Master Development Drainage Plan (MDDP) and Final Drainage Report
for
The Ridge at Garden of the Gods Collection
Filing No. 1

December 2016

Prepared for:

Winds of the Spirit, LLC
3320 Mesa Road
Colorado Springs, CO 80904

Prepared by:

Rockwell Consulting, Inc.
1955 N. Union, Suite 200
Colorado Springs, CO 80909
475-2575

Project #14-001

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DRAINAGE PLAN STATEMENTS

ENGINEER'S STATEMENT

The attached drainage plan and report for The Ridge at Garden of the Gods Collection Filing No. 1 were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the City of Colorado Springs Drainage Design and Technical Criteria for the owners of said project. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others.

KD Rockwell PE

Kent D. Rockwell, P.E.

COLORADO REGISTERED KENT D. ROCKWELL 25086 1/4/17 PROFESSIONAL ENGINEER

CERTIFICATION STATEMENT

I, the developer, Winds of the Spirit, LLC have read and hereby certifies that the drainage facility for The Ridge at Garden of the Gods Collection Filing No. 1 shall be constructed according to the design presented in this report. I, as the developer, understand that the City of Colorado Springs does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that the City of Colorado Springs reviews drainage plans pursuant to Colorado Revised Statutes, Title 30, Article 28; but cannot, on behalf of The Ridge at Garden of the Gods Collection No. 1, guarantee that final drainage design review will absolve Winds of the Spirit, LLC and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the final plat does not imply approval of my engineer's drainage design.

Winds of the Spirit, ~~LLC~~

BY: _____ 1/4/17
AUTHORIZED SIGNATURE DATE

TITLE: BRENDA J. SMITH CO-MANAGING MEMBER

ADDRESS: 3314 MESA RD COLORADO SPRINGS, CO. 80904

CITY OF COLORADO SPRINGS

Filed in accordance with Section 7-7-906 of the code of the City of Colorado Springs, 2001, as amended.

_____ 1/4/2017
CITY ENGINEER DATE

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GENERAL LOCATION AND DESCRIPTION

The Ridge at Garden of the Gods Collection Filing No. 1 is located west of Mesa Road and east of 30th street, at the intersection of Mesa Road and Kissing Camels Drive. The overall plat consists of approximately 29.5 acres. Filing No. 1 is a replat of Garden of the Gods Filing No. 2 and an additional 4.455 acres located to the south of existing Filing No. 2. The additional area to the south includes the 1.148 acre, Lot 1 Gateway Vista Filing No. 10, and 3.327 aces of the adjacent subdivision which is currently included within the Cathedral Ridge at Garden of the Gods development. Lot 1, Gateway Vista Filing No. 10 will be replatted with the proposed The Ridge at Garden of the Gods Collection Filing No. 1.

The site lies within Sections 34 and 35, Township 13 South, Range 67 West of the 6th P.M., El Paso County, Colorado (see Figure 1). The site is bound on the north by an existing single family residential lot on the east by Mesa Road, on the south by Cathedral Ridge at Garden of the Gods Subdivision and on the west by open space, Garden of the Gods visitor center and 30th Street.

The entire site lies within the Camp Creek Drainage Basin. Existing ground cover consists of native grasses and vegetation.

The Ridge at Garden of the Gods Collection Filing No. 1 contains 29.54 acres of which 27.03 acres was previously platted. The proposed redevelopment of the site consists of redeveloping the southerly 13 acres of the existing club property along with approximately 3 acres of additional property.

The northern half of the site consists of the existing Garden of the Gods Club and will be contained within Lot 34 of Filing No. 1. This area will remain in its current condition. Currently, the Garden of the Gods Spa/Salon, Event and Rental Space building (spa building) is under construction and is also within Lot 34 of Filing No. 1. The spa building is in the middle of the overall development at the south end of Lot 34. The southerly approximately 13.0 acres will be redeveloped into 37 residential units and proposed tennis courts. The area to be redeveloped currently consists of an existing tennis building, a building wing of hotel rooms, commercial offices, and an existing indoor tennis building.

A proposed Extended Detention Basin (EDB) will be constructed just south of the subject site within the adjacent Cathedral Ridge at Garden of the Gods Development. This EDB will provide water quality capture volume for the southern 18 acres of The Ridge at Garden of the Gods Collection Filing No. 1 area to be redeveloped, for the spa building area, for approximately 3.5 acres on the east side of Mesa Road and approximately 6.1 acres of future Cathedral Ridge residential lots.

The spa building area has 2 existing rain gardens that will be abandoned and the required water quality capture volume will be provided in the downstream EDB. A maintenance/ownership agreement for the storm sewer and pond facility will be entered into between the Cathedral Ridge owner and the Garden of the Gods Club ownership. The agreement will address maintenance and ownership of the proposed pond.

REFERENCES

1. Camp Creek Drainage Study (October, 1964), prepared by United Western Engineers, Colorado Springs, CO.

2. Preliminary and Final Drainage Report and Plan, La Mesa Vista (June, 1994), Addenda (December, 1994); prepared by Leigh Whitehead and Associates, Colorado Springs, CO.

3. Drainage Report for La Posada Del Sol Subdivision (February, 1984), prepared by URS/NES, Colorado Springs, CO.

4. Amendment to the Drainage Report for Garden of the Gods Club Subdivision No. 1 Replat (December, 1994), prepared by Rockwell-Minchow Consultants, Inc., Colorado Springs, CO.

5. Master Development Drainage Plan (MDDP) for Gateway Vista and Final Drainage Report for Gateway Vista Filing No. 10, prepared by Rockwell Minchow Consultants, Inc., February 2002.

6. Master Development Drainage Plan (MDDP) for Cathedral Ridge at Garden of the Gods Club, Final Drainage Report Cathedral Ridge at Garden of the Gods Club, Filing No. 3A.

7. Final Drainage for Lot 1, Garden of the Gods Club Filing No. 2, Proposed Club/Resort Expansion (Spa, Salon, Event and Rental Space), prepared by Rockwell Consulting, January, 2016.

8. Amendment to the Drainage Report for Garden of the Gods Club Subdivisioin No. 1 Replat, by Rockwell-Minchow Consultants, Inc., dated December, 1994.

The Camp Creek Drainage Basin Planning Study is from 1964, so provides little up to date information. The Gateway Vista Drainage Report (Ref. 5) and the Cathedral Ridge Drainage Report (Ref. 6) provide some more recent runoff data to compare with the runoff information generated as part of this study. A comparison of the flows are presented below.

SOILS

According to the US Department of Agriculture Soil Conservation Services Soil Survey of El Paso County, The Ridge at Garden of the Gods Collection Filing No. 1 is underlain by the Ascalon Series (Soil 3) which is classified as a Hydrologic Group "B" soil and by the Chaseville/Midway Series (Soil 18) which is classified as a Hydrologic Group "A/D" soil, respectively (see Figure 1). Hydrologic Group "B" was used for runoff calculation purposes.

FLOOD PLAIN STATEMENT

According to the Federal Emergency Management Agency (FEMA), as depicted on Flood Insurance Rate Map (FIRM) 08041CO513 F & 08041CO726 F (March 1997), no portion of this site lies within a designated Flood Plain. See map in Appendix.

DRAINAGE DESIGN CRITERIA

The current City of Colorado Springs Drainage Criteria was used in the preparation of this report. The Rational Method was used to determine the runoff quantities as required for basins containing less than 100 acres. The tributary area for this development is less than 100 acres. Peak runoff was determined for both the 5 year and 100 year frequency storms.

FOUR STEP PROCESS TO MINIMIZE ADVERSE IMPACTS OF URBANIZATION

Step 1: The Garden of the Gods Filing No. 3 development is a redevelopment of an existing site. Constraints, such as existing storm sewers, utilities, slopes and roadway connection points, limit the ability to minimize directly connected impervious areas. However, several "common" spaces are included in the plan which allow for grass lined swales to convey runoff between the various residential units.

Step 2: An Extended Detention Basin (EDB) will be installed to provide Water Quality Capture Volume (WQCV). In addition, the proposed detention/water quality pond will be expanded to also provide additional full spectrum detention for the undeveloped acreage reaching the pond.

As stated above, this is a redevelopment project where most of the internal and outfall storm sewer have previously been installed. Several off-site areas that have been existing for decades are tributary to this site and the downstream EDB facilities. These areas were not subject to the requirement of providing WQCV when they were developed. However, since these areas are tributary to the proposed EDB and the collected flows are conveyed within existing systems that reach the EDB, the EDB will be sized to provide WQCV for 27 acres of redeveloped and new development area and Full Spectrum Detention for the 13 acres of new development. (See Water Quality Section of this report).

Step 3: The downstream drainage ways consists of existing storm sewer pipes and further downstream existing concrete channels. All of these systems are public facilities and in stable condition.

Step 4: Site specific measures will be taken during construction to protect the receiving waters from contaminants. Concrete washout areas, silt fence, inlet protection and two temporary sedimentation ponds will all be used to limit contaminants from leaving the site. In addition, the future EDB area will be used as a temporary sediment basin during construction.

HISTORIC DRAINAGE ANALYSIS

This portion of the report analyzes the historic runoff quantities and patterns for the site. The area has been depicted on the Historic Drainage Plan by twenty seven (27) basins including several off-site basins. Since the northern half of the site will remain in its current conditions, the northerly historic basins (Basins A through P will also be used for the analysis of the developed flows generated from the proposed redevelopment area. Following is a description of each of the historic basin, the historic runoff patterns and historic flow rates.

Basin A encompasses 3.35 off-site acres along the east side of Mesa Road. Runoff rates of 5.5 cubic feet per second (cfs) are generated from this basin during the 5 year storm and 13.3 cfs during the 100 year storm. These flows are conveyed southerly within the east side of Mesa Road reaching an existing on-grade public 12' inlet. Mesa Road with a street classification of a Collector has the capacity to convey these flows. This inlet will collect runoff rates of 5.5 cfs during the 5 year storm and 10.1 cfs during the 100 year storm. A flow rate of 3.2 cfs during the 100 year storm will bypass this inlet and enter Basin B. The collected flows will be piped across Mesa Road in an existing public 18" pipe.

Basin B, consisting of 1.99 acres also along the east side of Mesa Road, generates runoff rates of 2.5 cfs and 7.4 cfs during the 5 and 100 year storms, respectively. Including the 3.2 cfs entering Basin B during the 100 year storm from Basin A, total street flow rates of Q_5 = 2.5 cfs and Q_{100} = 10.6 cfs reach the south end of Basin B. An existing 10' public sump inlet located at the northeast corner of Mesa Road and Kissing Camels Drive intersection collects these flows. The runoff rates collected by this inlet are conveyed southeasterly within an existing public 24" storm sewer pipe.

Runoff rates of Q_5 = 7.0 cfs and Q_{100} = 17.9 cfs collected from Basin A and B reach Design Point #H1. These flows are conveyed southwesterly within an existing 18" storm sewer pipe.

Basin C comprises a portion (1.05 acres) of an existing residential lot located just north of the Garden of the Gods Club site. Runoff rates of 1.0 cfs during the 5 year storm and 3.3 cfs during the 100 year storm are generated from this basin. These flows surface flows onto the Garden of the Gods Club site (Ref. 8) and enter on-site Basin F.

Basin D is located along the west side of Mesa Road. Runoff rates of 1.7 cfs and 3.9 cfs are generated from this 0.73 acre basin during the 5 and 100 year storms, respectively. These flows reach an existing public 10' on-grade inlet. This inlet will collect all these flows which are conveyed southerly within an existing 19" x 30" public storm sewer pipe.

An additional 0.28 acres, also along the east side of Mesa Road, comprises Basin E. The flow rates of 0.9 cfs and 1.9 cfs generated from this basin during the 5 and 100 year storms, respectively reach an existing 6' on-grade public inlet. This inlet collects all these flows. An existing 19" x 30" public storm sewer pipe conveys these flows southerly.

Basin F consists of 1.47 acres toward the north end of the club property. Runoff rates of Q_5 = 2.8 cfs and Q_{100} = 6.7 cfs are generated from this basin. Including the runoff entering this site from Basin C, total runoff rates of 3.8 cfs during the 5 year storm and 10.0 cfs reach the south end of Basin F. An existing 4' private sump inlet collects these flows at the south end of Basin F.

Approximately 0.46 acres at the northeast corner of the Garden of the Gods Club site comprises Basin G. This basin generates runoff rates of 1.2 cfs during the 5 year storm and 2.5 cfs during the 100 year storm. These flows are collected within an existing private grated sump inlet at the south end of this basin.

Total flow rates of 4.2 cfs and 10.5 cfs reach Historic Design Point #2 from Basins C, F and G. These flows are conveyed southerly within an existing private 15" pipe.

Basin H contains an additional 1.61 acres at the north end of the site. Runoff rates of 3.1 cfs and 7.5 cfs are generated from this basin. These flows are also collected within an existing 4' private sump inlet at the south end of Basin H.

Basin I, consisting of 0.28 acres, generates flow rates of Q_5 = 0.8 cfs and Q_{100} = 1.7 cfs that are collected within an existing 2'x2' private grated sump inlet.

The 0.19 acre Basin J, located just north of the main entrance to the Garden of the Gods Club main building, generates an additional 0.5 cfs and 1.2 cfs during the 5 and 100 year storms, respectively. These flows are collected by a sump area inlet within the landscape area.

Basin K, consisting of 0.19 acres, generates additional flow rates of 0.8 cfs during the 5 year storm and 1.5 cfs during the 100 year storm. Total runoff rates of Q_5 = 7.6 cfs and Q_{100} = 18.3 cfs reach Design Point #H3 from Basins, C, F, G, H, I, J and K. An existing private 18" RCP conveys these collected flows southerly through the existing parking lot.

The existing main parking area for the club comprises Basin L. This 1.90 acre basin generates runoff rates of 5.5 cfs during the 5 year storm and 11.3 cfs during the 100 year storm. The flows are collected within an existing 5' private sump inlet at the south end of Basin L.

Basin M consists of an existing 0.65 acre parking lot. Runoff rates of 2.5 cfs and 4.7 cfs generated from this basin during the 5 and 100 year storms, respectively, are collected by an existing 4' sump inlet (private) at the southwest corner of this parking lot.

Total runoff rates of Q_5 = 12.7 cfs and Q_{100} = 28.6 cfs reach Design Point #H4. These flows are conveyed southerly within an existing private 24" storm sewer.

Basin N consists of the newly renovated parking lot north of the new spa building (currently under construction). This 0.74 acre parking lot generates runoff rates of 2.5 cfs and 4.8 cfs during the 5 and 100 year storms, respectively. These flows reach an existing 4' private sump inlet at the southeast corner of Basin N. These flows discharge into a rain garden located just south of the parking lot. Upon construction of the downstream Extended Detention Basin (EDB), this rain garden will be removed since additional Water Quality Capture Volume is being provided in the EDB for Basin N.

Basin O, consists of approximately 4.31 acres of the west portion of the existing Garden of the Gods Club area. This basin generates flow rates of Q_5 = 5.9 cfs and Q_{100} = 13.0 cfs. These flows currently sheet flow to the west into the adjacent open space. This area will not be modified with the current site renovations.

The Wellness and Spa building and adjacent area currently under construction comprises Basin P. This 1.41 acre basin generates additional runoff rates of 3.7 cfs during the 5 year storm and 8.3 cfs during the 100 year storm. These flows are directed toward a second rain garden at the southwest corner of this basin. This rain garden will also be removed upon construction of the downstream EDB.

The, runoff rates of Q_5 = 14.8 cfs and Q_{100} = 33.3 cfs reaching Design Point #H5 are piped to the westerly line of the subject parcel within an existing 30" private pipe and then conveyed within a swale to the southwest corner of the site where the flows are collected within an existing open ended 30" RCP. The 30" RCP continues southerly through the existing Gateway and Cathedral Ridge developments.

Basin Q comprises existing parking lots and tennis courts toward the south central portion of the Garden of the Gods Club. This 4.70 acre basin generates runoff rates of 8.2 cfs and 18.9 cfs during the 5 and 100 year storms, respectively. These flow also reach the existing open ended private 30" RCP.

An additional 0.99 acres of parking area, roadways and landscape southeast of the new spa building comprises Basin R. The runoff rates of 2.2 cfs generated during the 5 year storm and 4.9 cfs generated during the 100 year storm are conveyed within the existing streets and combine with flows generated from Basin Q.

Flow rates of Q_5 = 10.2 cfs and Q_{100} = 22.8 cfs reach Design Point #H6 from Basins N, Q and R. These flows reach the south end of the existing Garden of the Gods Club property as surface flows ultimately reaching the aforementioned 30" RCP.

Approximately 0.40 acres of Mesa Road comprises Basin S-1. Runoff rates of 1.0 cfs and 2.3 cfs generated from this basin during the 5 and 100 year storms, respectively, are collected within an existing 6' on-grade private inlet along the east side of Mesa Road. These collected flows are conveyed southerly within the existing public 19" x 30" pipe.

Basin S-2 comprises approximately 1.38 acres which drains into Mesa Road. The runoff rates of 1.8 cfs and 5.6 cfs generated from this basin during the 5 and 100 year storms, respectively, continue southerly as street flows and enter Basin T.

Basin T consists of an additional 1.18 acres of land at the southeast corner of the Garden of the Gods Club property along with approximately 400 feet of Mesa Road. The runoff rates of 0.5 cfs during the 5 year storm and 2.9 cfs during the 100 year storm generated from this basin continue southerly as street flows within Mesa Road.

Total runoff rates of 12.0 cfs during the 5 year storm and 32.0 cfs during the 100 year storm reach Design Point #H7 as either pipe flow or street flows from Basins A, B, D, E, S-1, S-2, T and Y. Flow rates of Q_5 = 2.1 cfs and Q_{100} = 8.2 cfs will bypass this point and continue southerly as street flows. The pipe flows entering the Garden of the Gods Club and Cathedral Ridge developments within the existing 30" public storm sewer pipe are 9.9 cfs during the 5 year storm and 23.8 cfs during the 100 year storm.

Basin U consists of the east half of the existing indoor tennis building and the surrounding area. Runoff rates of Q_5 =1.5 cfs and Q_{100} = 4.7 cfs generated from this basin are collected and piped within an existing 15" pipe to the existing 30" public storm sewer pipe extending westerly from Mesa Road. This public 30" pipe extends southwesterly to the Treeline View cul-de-sac.

The open area west of the southerly wing of the existing hotel rooms comprise Basin V. This 3.25 acre basin generates runoff rates of 2.2 cfs during the 5 year storm and 7.8 cfs during the 100 year storm. These flows reach an existing swale along the westerly property line of the club and are conveyed southerly to the open end of the existing private 30" RCP.

Flows from Historic Design Point #H5 and Developed Basin V reach Design Point #H8 within an existing swale along the easterly property line of the Garden of the Gods Club. The runoff rates of 16.8 cfs and 41.0 cfs reaching this point during the 5 and 100 year storms, respectively, also are collected within the open end of the existing private 30" RCP.

Basin W comprises the northerly portion of the adjacent Cathedral Ridge development. (This area is being conveyed to the Garden of the Gods ownership for future tennis courts). This 2.88 acre basin generates runoff rates of Q_5 = 1.4 cfs and Q_{100} = 8.1 cfs. Currently, these flows sheet flow to the southwest and enter Treeline View.

Approximately 2.31 acres along the westerly property line of the club property comprises Basin X. The runoff rates of Q_5 = 1.2 cfs and Q_{100} = 6.5 cfs generated from this basin sheet flow to the west.

Basin Y consists of approximately 0.54 acres along the east side of Mesa Road south of Kissing Camels Drive. The flow rates of 1.5 cfs during the 5 year storm and 3.0 cfs during the 100 year storm approach an existing 6' public on-grade inlet. This inlet collects runoff rates of 1.5 cfs and 3.0 cfs during the 5 and 100 year storms, respectively.

Total flow rates 26.5 cfs during the 5 year storm and 62.7 cfs during the 100 year storm reach Design Point #H9 from Design Points #6 and #8. Additional flow rates of 9.9 cfs during the 5 year storm and 23.8 cfs are piped to this same point from Mesa Road. Total flow rates of 39.0 cfs during the 5 year storm and 97.4 cfs during the 100 year storm reach the Treeline cul-de-sac as piped flows.

Basin Z is a portion of the Cathedral Ridge at Garden of the Gods Club development that is tributary to the proposed EDB that will be installed as part of this development. This 5.5 acre basin generates runoff rates of 2.4 cfs during the 5 year storm and 13.6 cfs during the 100 year storm.

These flows currently enter Treeline View and continue southerly within Treeline View as street flows.

Total runoff rates of 42.0 cfs and 114.5 cfs reach Historic Design Point #10 during the 5 and 100 year storms, respectively.

DEVELOPED DRAINAGE ANALYSIS

This portion of the report analyzes the developed runoff quantities and patterns for the site. The northerly portion of the Garden of the Gods Club property will remain in its current condition. Only the southerly 18 acres are being redeveloped. Only Historic Basins Q, R, S, T, U, V, W and Z are being redeveloped; Therefore, the other historic basin flows rates generated from the northerly portion of the site will be used in conjunction with the developed basins describing the renovated portions of the site.

The other change to the historic basins involves replacing the WQCV required for the spa building area in the 2 existing rain gardens with additional WQCV in the proposed EDB.

Basin 1 consists of 1.20 acres along the east side of the project adjacent to Mesa Road. Runoff rates of 3.1 cubic feet per second (cfs) during the 5-year storm event and 6.5 cfs during the 100-year storm event will enter Mesa Road.

Basin 2 covers 0.96 acres directly south of the spa building. The runoff rates of 2.2 cfs and 4.6 cfs generated from this basin during the 5 and 100 year storms, respectively, will be directed to an 8' private sump inlet on the north side Spirit Wind Heights.

These flows along with the flows from Historic Basin N will be piped southerly within a proposed private 18" RCP storm sewer. (Q_5 =4.7 cfs and Q_{100} = 9.4).

Basin 3 is located along the west side of Mesa Road at the southeast corner of the Garden of the Gods Club property. Runoff rates of 2.6 cfs during the 5 year storm and 5.1 cfs during the 100 year storm are generated from this 0.92 acre basin. These runoff rates continue southerly as street flows within Lone Mountain View to the south end of the basin.

Basin 4 covers 1.33 acres along the north side of Lone Mountain View. The runoff rates generated from this basin of 3.0 cfs and 6.7 cfs during the 5 and 100 year storms, respectively, flow southerly as street flow along the west side of Lone Mountain View. The combined flow rates of Q_5 = 5.6 cfs and Q_{100} = 11.8 cfs reaching the south end of these two basins will be collected by 2 proposed private 8' sump inlets.

Flow rates of Q_5 = 8.8 cfs and Q_{100} = 18.2 cfs reach Developed Design Point #2 from Historic Basin N and Developed Basins 2, 3 and 4. These flows are collected and discharged into the existing public 30" RCP extending westerly from Mesa Road. (The easement for this public system is attached).

Basin 5 encompasses 0.65 acres along the west side of Mesa Road. Runoff rates of 1.7 cfs during the 5 year storm and 3.9 during the 100 year storm travel south as street flow along the west side of Mesa Road.

Basin OS-1 consists of an additional 3.45 acres of vacant land along the east side of Mesa Road. Since the area adjacent to Basin OS_1 has previously been developed and existing adjacent systems do not allow for water quality or full spectrum detention in that area, measures will be taken to direct runoff from this basin to the system within Mesa Road.

Runoff rates of 3.7 cfs during the 5 year storm and 12.4 cfs during the 100 year storm are generated from this basin. Water quality capture volume and full spectrum detention for this area will be provided in the proposed EDB to be constructed with this project.

Combined runoff rates of Q_5 = 17.2 cfs and Q_{100} = 43.8 cfs from Historic Basins A, B, D, E and Y along with Developed Basin 1, 5 and OS-1 reach Developed Design Point #1. Of that total, flow rates of 15.1 cfs during the 5 year storm and 37.2 cfs are piped westerly from Mesa Road. The remaining flow rates of 2.1 cfs during the 5 year storm and 6. 6 cfs during the 100 year storm continue southerly as street flows, as they do historically. These flows are less than the flows historically flowing southerly within Mesa Road historically (See Historic Design Point #7).

The flows from Design Points 1 and 2 reach Design Point #2A. Total flow rates of 25.1 cfs during the 5 year storm and 60.0 cfs during the 100 year storm reach Design Point #2A as pipe flows.

Basin 6 comprises 0.96 acres in the north central portion of the redevelopment area. Runoff rates of 2.8 cfs during the 5 year storm and 5.4 cfs during the 100 year storm flow southerly into Basin 7.

Basin 7, located at the northwest corner of the redevelopment area, consists of 0.63 acres and generates runoff rates of 2.4 cfs during the 5 year storm and 4.7 cfs during the 100 year storm. These runoff rates continue southerly as street flow combining with flows from Basin 6. Combined flow rates of 5.2 cfs during the 5 year storm and 10.1 cfs during the 100 year storm flows southerly within the east side of the Majestic View Point entering Basin 8 as street flows.

Approximate flow rates of Q_5 = 18.0 cfs and Q_{100} = 39.4 cfs reach Developed Design Point #3 from Historic Design Point #H5 and Developed Basins 6 and 7. Flow rates of 15.4 cfs during the 5 year storm and 33.6 cfs during the 100 year storm are within the storm sewer pipe at this location and flow rates of Q_5 = 2.6 cfs and Q_{100} = 5.8 cfs are street flows.

Basin 8 consists of an additional 1.81 acres along the east side of Majestic View Point. Flow rates of Q_5 = 4.1 cfs and Q_{100} = 8.8 cfs are generated from Basin 8. The total street flows reaching the south end of Basin 8 are 9.3 cfs during the 5 year storm and 18.9 cfs during the 100 year storm from Basins 6, 7 and 8. These flows reach a proposed 12' private sump inlet at the south end of this basin.

Basin 9 comprises the lots along the westerly side of the Majestic View Point. This 2.31 acre basin generates runoff rates of 5.7 cfs during the 5 year storm and 12.0 cfs during the 100 year storm. These flows reach a proposed private 12' sump inlet at the south end of Basin 9.

Total flow rates of 24.9 cfs and 54.2 cfs reach Design Point #4 during the 5 and 100 year storms, respectively. These flows will be piped southerly within the existing private 30" RCP.

Developed drainage Basin 10 is located toward the southerly central portion of the site along the east side of Spirit Wind Heights. This 2.40 acre Basin generates runoff rates of 6.0 cfs during the 5 year storm and 13.1 cfs during the 100 year storm. It is anticipated several area inlets will be installed in the middle of these residential units to collect flows between the units. The flow rates collected internally will be piped to the west to the south end of Basin 10. A proposed private 10' sump inlet will be constructed at the south end of this basin to collect these flows.

Basin 11 is situated in the southerly central portion of the site along the west side of Spirit Wind Heights. The flow rates of Q_5 = 2.5 cfs and Q_{100} = 4.8 cfs generated from this basin flow southerly to a proposed private 6' sump inlet.

The combined runoff rates of Q_5 = 8.5 cfs and Q_{100} = 17.8 cfs from Basins 10 and 11 reach Developed Design Point #5. These flows collected within the 2 proposed 10' private inlets will be piped to the public 36" RCP that conveys flows from Mesa Road and Developed Design#2A. The proposed public 36" RCP conveys these flows to the proposed EDB.

Developed Design Point #6 is located just downstream of Basin 10 and 11. The total pipe flows at this point are 26.7 cfs during the 5 year storm and 62.3 cfs during the 100 year storm. This pipe will discharge directly into the water quality pond.

Basin 12 comprises the southwesterly corner of the site. This 2.22 acre basin generates runoff rates of 1.2 cfs during the 5 year storm and 6.6 cfs during the 100 year storm. These runoff rates sheet flow to the west onto the adjacent property as they have historically. These flows compare with Historic Basin X. This basin consists of the existing steep slope located along the westerly boundary line of the project. This area will not be developed and remains in its existing condition.

Basin 13 comprises the proposed tennis courts at the southeast corner of the site. The tennis court area, consisting of 1.28 acres, generates runoff rates of 5.5 cfs and 10.0 cfs during the 5 and 100 year storms. It is anticipated that several area inlets will be installed around the tennis courts and the flows collected will be conveyed westerly to the proposed pipe conveying flows to the EDB.

Total flows reaching Design Point #7 are 29.6 cfs during the 5 year storm and 67.5 cfs during the 100 year storm. These flows will be conveyed to the EDB in a 36" RCP.

Two additional off-site basins located south of The Ridge at Garden of the Gods Collection Filing No. 1 also contribute flows to the proposed EDB. This basins are within the future Cathedral Ridge at Garden of the Gods development.

Basin CR East consists of 2.5 acres of future single family residential development within the Cathedral Ridge Development. Runoff rates of 4.0 cfs during the 5 year storm and 11.2 cfs during the 100 year storm are generated from this basin. These flows will be collected within 2 existing private sump inlets within Cathedral Park View. Currently, these inlets are connected to an existing storm sewer pipe that conveys the flows southerly. Instead, the inlets will be disconnected from the existing storm sewer pipe and connected to a new private 18" RCP storm pipe that will convey the collected flows from Basin CR East to the proposed EDB.

Design Point #8 accounts for the total pipe flows entering the EDB at the two inlet locations. The total pipe flow rates entering the pond are Q_5 = 55.6 cfs and Q_{100} = 125.5 cfs.

Basin CR West consists of an additional 3.6 acres within the Cathedral Ridge at Garden of the Gods development. This 3.6 acre basin consists of 1.0 acres of the proposed EDB and 2.6 acres of single family residential development. Runoff rates of 4.0 cfs and 13.7 cfs generated from this basin will be directed into the proposed EDB via sheet flow and inlets.

Design Point #9 represents all the tributary areas to the pond. Total flow rates of Q_5 = 56.2 cfs and Q_{100} = 127.8 cfs reach the pond from the tributary areas. The pond detains approximately 50 cfs during the 100 year storm, resulting in a release rate of approximately 82 cfs during the 100 year storm. The flows at this point in the Gateway Drainage Report and the CR Drainage Report were 144 cfs during the 100 year storm.

DRAINAGE FEES

Drainage and Bridge Fees are required per the City of Colorado Springs Drainage Basin Fee Program. The Ridge at Garden of the Gods Collection Filing No. 1 development is within the Camp Creek basin. The majority of the proposed Filing No. 1 has previously been platted. Exhibit 3 provides a depiction of the area that has not yet been platted consisting of 2.508 acres.

2016 Drainage Fees for Camp Creek are $1,944 per acre. The Ridge at Garden of the Gods Collection Filing No. 1 consists of a total of 29.490 acres, all of which have been previously platted except for the 2.508 acres listed above. Drainage fees will be paid on the unplatted 2.508 acres.

Camp Creek Fee

2.508 Acres	Drainage Fee:	$ 1,944.00/ac.x 2.508 acres=	$ 4,875.52

WATER QUALITY

The overall Ridge at Garden of the Gods Collection Filing No. 1 plat consists of 29.49 acres. The recorded Garden of the Gods Club Filing No. 2 plat consists of 25.025 acres. The balance of the 4.475 acres being added to the Ridge at Garden of the Gods Collection Filing No. 1 plat consists of the 1.148 acres Lot 1, Gateway Filing No. 10 and 3.327 acres vacant land.

Of that area, approximately 11.072 acres tributary to the pond will remain in the current condition. There are 13.5 acres being redeveloped as part of the new development.

Garden of the Gods Club Filing No. 2	25.025 acres
Lot 1, Gateway Filing No. 10	1.148 acres
Vacant Land Addition	3.317 acres
Total The Ridge at Garden of the Gods Collection Filing No. 1	29.490 acres

Overall Plat Acreage	29.490 acres
Area to Remain Unchanged	11.072 acres
Area to Be Redeveloped Including Spa	13.553 acres
Area of Undeveloped Land Being Added to Filing No. 1	3.317 acres
Area of Lot 1, Grandview Filing No. 10	1.148 acres
New Tributary Area East of Mesa Road	3.45 acres
New Cathedral Ridge Lots and Pond	6.10 acres

Based on conversations with City Engineering, water quality capture volume is required for all redeveloped areas and all proposed vacant land to be developed for the first time (13.953 ac. + 3.45 ac. + 6.10 ac + 3.317 ac. = 26.82 ac.).

Full Spectrum Detention (FSD) is required for the proposed vacant land to be developed for the first time. (3.317 ac. + 6.10 ac. + 3.45 ac. = 12.86 ac.). FSD is not required for the redevelopment area as downstream drainage systems are adequate to convey storm runoff from these sites.

Based on these areas of WQCV and FSD, Urban Drainage spreadsheets were prepared depicting the acreage for the FSD and the WQCV. The FSD spreadsheet indicates that the Zone 3 (above EURV) volume requirement is 0.563 acre feet of detention is required for the 12.86 acres of vacant land for the 100 year storm. This volume of 0.563 acre feet was then plugged into the spreadsheet for the 26.82 acres of WQCV required for the redevelopment area and the undeveloped areas. This resulted in a total pond volume of 2.152 acre feet. The 100 year maximum volume stored in the pond during the 100 year storm is 2.270 acre feet.

The anticipated release rate from the pond is 67.6 cfs. This compares to the flow rate of 114 cfs presented in the Gateway Filing No. 10 drainage report at this same location.

DRAINAGE FACILITY ESTIMATE

Following is an estimate of the storm sewer estimated costs for The Ridge at Garden of the Gods Collection Filing No. 1. These costs are not exact bids and may vary.

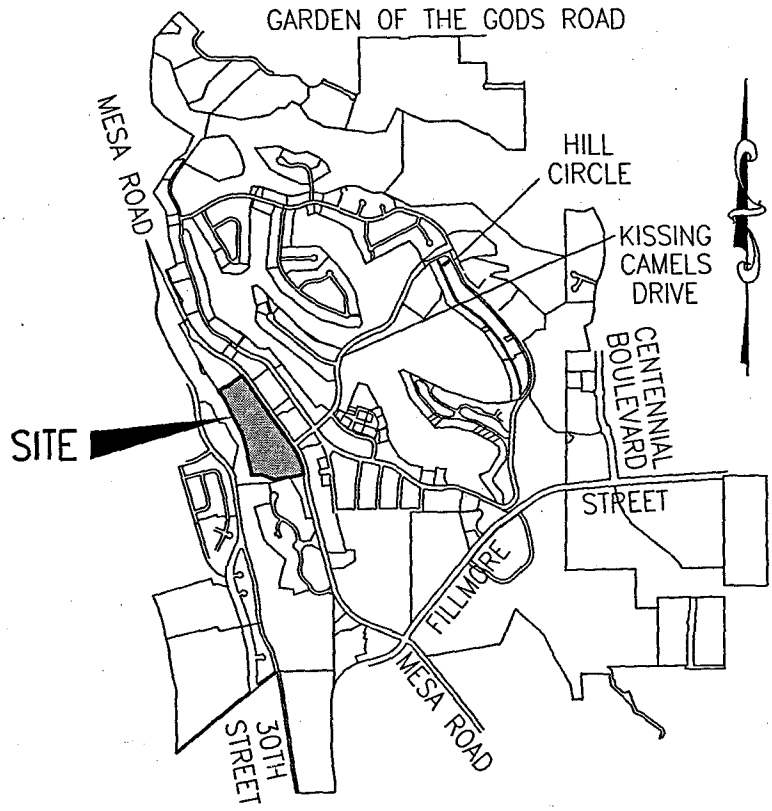
The Ridge at Garden of the Gods Filing No. 1 (Private, Non-Reimbursable)

ITEM	QUANTITY		UNIT PRICE	EXTENDED COST
18" RCP	478	L.F.	$ 45.00	$ 21,510.00
24" RCP	581	L.F.	$ 60.00	$ 34,860.00
30" RCP	927	L.F.	$ 75.00	$ 69,525.00
36" RCP	90	L.F.	$ 85.00	$ 7,650.00
42" RCP	84	L.F.	$ 110.00	$ 9,240.00
TYPE II MANHOLE	3	Ea.	$ 3,500.00	$ 10,500.00
TYPE 1 MANHOLE	0	Ea.	$ 7,500.00	$ 0.00
POND OUTFALL STRCT	1	Ea.	$25,000.00	$ 25,000.00
POND SPILLWAY, TRICKLE CHANNEL, ACCESS ROAD	1	L.S.	$20,000.00	$20,000.00
INLET FOREBAYS	2	Ea.	$ 8,500.00	$ 17,000.00
6' D-10-R Inlets	1	Ea.	$ 4,750.00	$ 4,750.00
8' D-10-R Inlets	5	Ea.	$ 5,500.00	$ 27,500.00
10' D-10-R Inlets	2	Ea.	$ 6,200.00	$ 12,400.00
			Sub-Total	$259,935.00
10% Engineering and Contingency				$ 25,993.50
			Grand Total	$ 285,928.50

The Ridge at Garden of the Gods Filing No. 1 (Public, Non-Reimbursable)

ITEM	QUANTITY		UNIT PRICE	EXTENDED COST
36" RCP	908	L.F.	$ 85.00	$ 77,180.00
42" RCP	0	L.F.	$ 110.00	$ 0.00
TYPE II MANHOLE	0	Ea.	$ 3,500.00	$ 0.00
TYPE 1 MANHOLE	3	Ea.	$ 7,500.00	$ 22,500.00
POND OUTFALL STRCT	0	Ea.	$25,000.00	$ 0.00
INLET FOREBAYS	0	Ea.	$ 8,500.00	$ 0.00
6' D-10-R Inlets	0	Ea.	$ 4,750.00	$ 0.00
8' D-10-R Inlets	0	Ea.	$ 5,500.00	$ 0.00
10' D-10-R Inlets	0	Ea.	$ 6,200.00	$ 0.00
			Sub-Total	$ 99,680.00
10% Engineering and Contingency				$ 9,968.00
			Grand Total	$ 109,648.00

APPENDIX



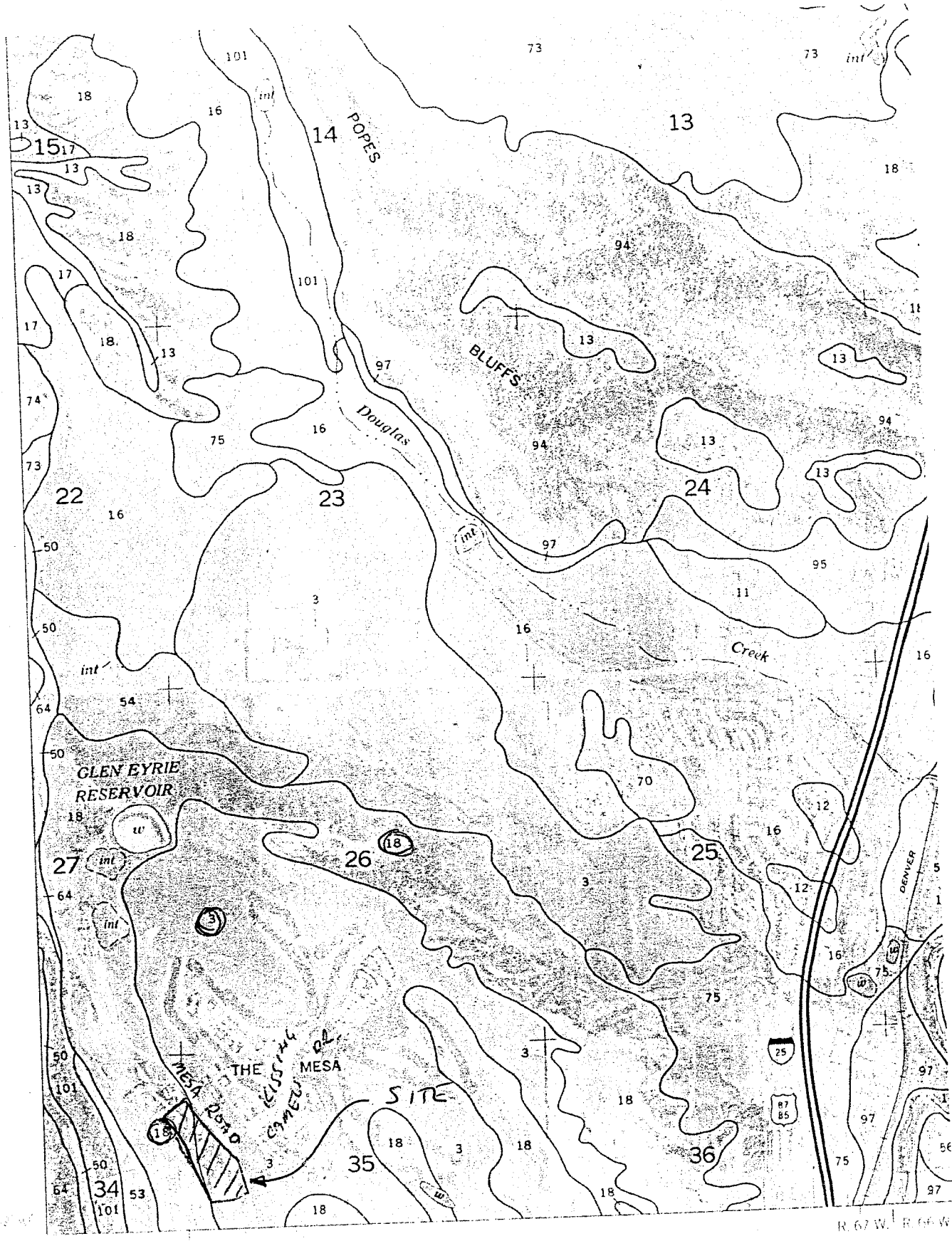
Vicinity Map

NOT TO SCALE

JOB NO. 14-001

FILE: 14001fp.DWG
DATE: 5/24/14

ROCKWELL CONSULTING, Inc.
ENGINEERING • SURVEYING
1955 N. UNION BLVD., SUITE 200
COLORADO SPRINGS, CO 80909
(719) 475-2575 • FAX (719) 475-9223



Soil 3 - Ascalon Series

Soil 18 - Chaseville/Midway Series

NORTH

SOILS MAP
FIGURE 2
1" = 2000'

5000 4000 3000

J. Patrick Kelly El Paso Cty,CO 202021835
02/07/2002 01:02
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Rec $15.00 1 of 3

GRANT OF DRAINAGE EASEMENT

The undersigned, being the owner(s) of the hereinafter described real property located in the County of El Paso and the State of Colorado, for and in consideration of One ($1.00) Dollar and other good and valuable consideration, do(es) hereby grant to the City of Colorado Springs, Colorado, a Municipal Corporation, a permanent easement for drainage purposes over, under, and across the following property:

SEE EXHIBITS A & B, ATTACHED HERETO

Together with rights of ingress and egress for the installation, maintenance, repair, and replacement of drainage facilities.

The undersigned shall not erect or construct any building or other permanent structure or drill or operate any well, within the above described property.

The provisions herein shall inure to the benefit of and ~~bind~~ bind the heirs, successors, and assigns of the respective parties hereto.

Signed, sealed and delivered this 22nd day of January, 2002.

Danny R. Bowlin

Hunt Petroleum Corporation
By: Danny R. Bowlin, Senior Vice President

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

STATE OF TEXAS)
)ss
COUNTY OF DALLAS)

Subscribed and sworn to before me this 22nd day of January 2002,

By: Danny R. Bowlin, Senior Vice President of Hunt Petroleum Corporation

WITNESS MY HAND AND OFFICIAL SEAL:

My Commission Expires

DEANNA L. WHITE
NOTARY PUBLIC
STATE OF TEXAS
MY COMMISSION EXPIRES
OCTOBER 28, 2003

Deanna L. White
Notary Public

C# SCS5012770-4

06-046

J. Patrick Kelly El Paso Cty,CO 202021835
02/07/2002 01:02
Dod $0.00 Page
Rec $15.00 2 of 3

EXHIBIT "A"

A Public Drainage Easement located in the West Half of Section 35, Township 13 South, Range 67 West of the 6th P.M., El Paso County, Colorado more particularly described as follows:

BEGINNING at the northeast corner of a parcel as described at Reception No. 201159268 of the records of said El Paso County, thence S76°56'19"W on the north boundary of said parcel a distance of 219.25 feet; thence N31°56'19"E a distance of 28.28 feet; thence N76°56'19"E a distance of 202.02 feet to a point on the west right-of-way line of Mesa Road as described in Book 1816 at Page 496 of the records of said El Paso County; thence southerly on said west right-of way line on a non-tangent curve to the right having a central angle of 01°15'49", a radius of 915.40 feet for an arc distance of 20.19 feet, the chord of which bears S05°09'27"E to the Point of Beginning, containing 0.097 acres of land more or less.

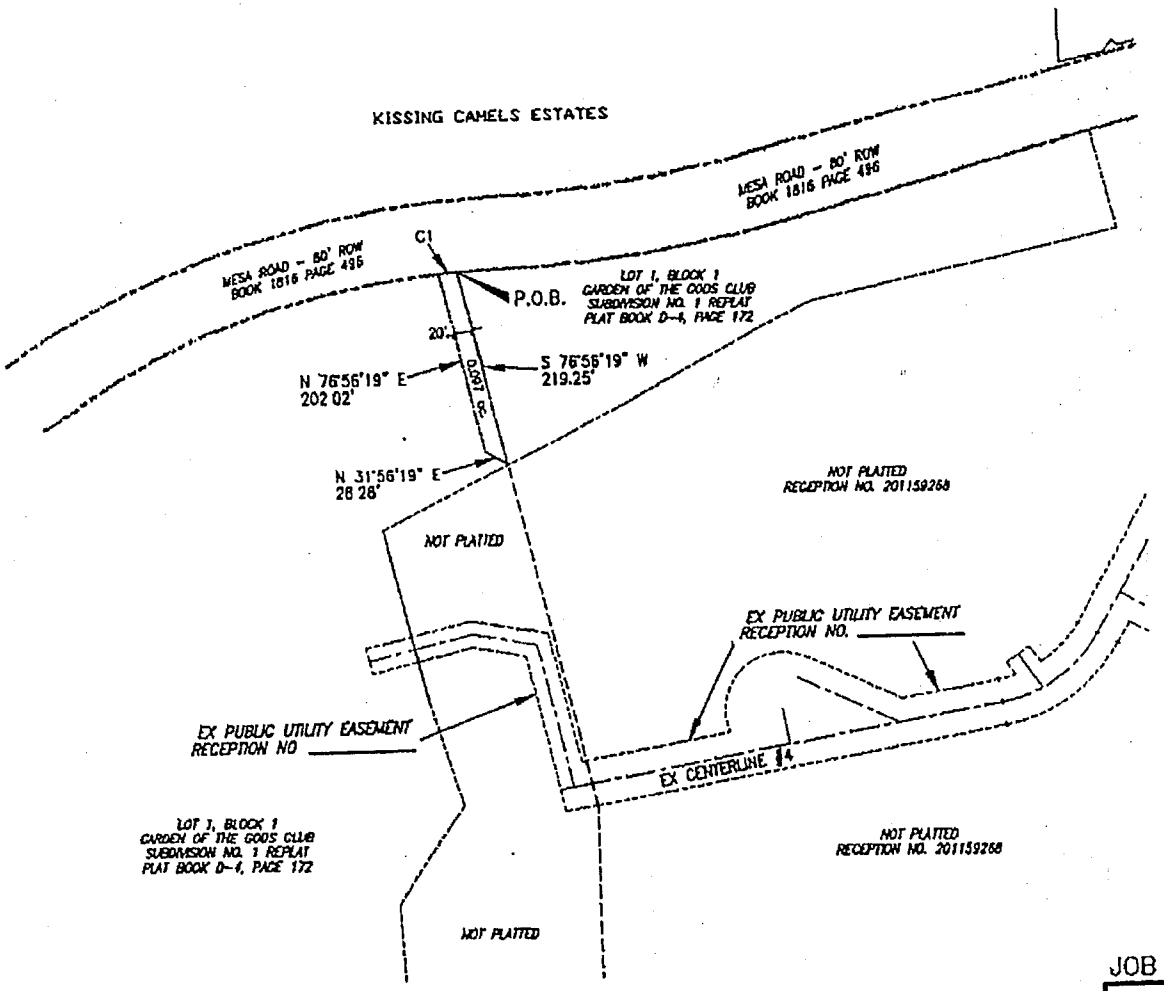
See Exhibit "B" Attached

Prepared by: Rockwell-Minchow Consultants, Inc.
1873 Austin Bluffs Parkway
Colorado Springs, CO 80918

Job #99-069
1/9/02
99069EXD.doc

EXHIBIT "B"

A PORTION OF THE WEST HALF OF SECTION 35
TOWNSHIP 13 SOUTH, RANGE 67 WEST OF THE 6TH P.M.,
CITY OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO



SCALE: 1"=200'

SHEET 1 OF 1

JOB NO. 99-069 FILE: 99069EXD.DWG 1/24/02

ROCKWELL MINCHOW CONSULTANTS, INC.
ENGINEERING • SURVEYING
1673 AUSTIN BLUFFS PARKWAY
COLORADO SPRINGS, CO 80918
(719) 475-2575 • FAX (719) 475-9223

J. Patrick Kelly El Paso Cty,CO 202021835
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Doc $0.00 Page
Rec $15.00 3 of 3

Garden of the Gods Club
Storm Drainage System Design (Rational Method Procedure)
Historic Condition Basin Flow
Calculated By: KDR
Date: 8/16/16

Basin	DP	Area (Acres)	C5	C100	Overland Length (Ft)	Overland Height (Ft)	Slope (%)	tc (min)	Street Length (Ft)	Street Height (Ft)	(%)	tc (min)	Pipe Length (Ft)	Pipe Height (Ft)	(%)	tc (min)	Total Tc (min)
A		3.35	0.49	0.70	100	4	4.0%	10.86	1200	36	3.0%	5.77	0	0	0.0%	0	16.63
B		1.99	0.34	0.61	60	2	3.0%	9.25	1100	44	4.0%	4.58	0	0	0.0%	0	13.83
C		1.05	0.31	0.59	240	7	3.0%	18.49	0	0	0.0%	0.00	0	0	0.0%	0	18.49
D		0.73	0.57	0.75	10	0	3.0%	3.77	1200	36	3.0%	5.77	0	0	0.0%	0	9.54
E		0.28	0.66	0.81	10	0	3.0%	3.77	360	11	3.0%	1.73	0	0	0.0%	0	5.50
F		1.47	0.50	0.71	160	14	9.0%	10.51	240	4	1.5%	1.63	0	0	0.0%	0	12.14
G		0.46	0.66	0.80	160	14	9.0%	10.51	105	7	6.5%	0.34	0	0	0.0%	0	10.85
H		1.61	0.48	0.70	160	14	9.0%	10.51	105	7	6.5%	0.34	0	0	0.0%	0	10.85
I		0.28	0.55	0.74	20	1	3.0%	5.34	120	6	5.0%	0.45	0	0	0.0%	0	5.79
J		0.19	0.54	0.74	25	1	5.0%	5.04	0	0	0.0%	0.45	0	0	0.0%	0	5.04
K		0.19	0.82	0.90	10	0	3.0%	3.77	120	4	3.3%	0.55	0	0	0.0%	0	4.32
L		1.90	0.66	0.80	30	1	3.0%	6.54	375	12	3.2%	1.75	0	0	0.0%	0	8.29
M		0.65	0.77	0.87	20	1	3.0%	5.34	85	3	3.5%	0.38	0	0	0.0%	0	5.72
N		0.74	0.73	0.85	40	2	5.0%	6.38	200	4	2.0%	1.18	0	0	0.0%	0	7.56
O		4.31	0.56	0.74	300	3	1.0%	29.71	300	12	4.0%	1.25	0	0	0.0%	0	30.96
P		1.41	0.55	0.74	80	12	15.0%	6.28	85	3	2.9%	0.41	0	0	0.0%	0	6.69
Q		4.70	0.53	0.73	240	17	7.0%	13.98	440	4	1.0%	3.67	0	0	0.0%	0	17.65
R		0.99	0.58	0.76	120	10	8.0%	9.46	400	8	2.0%	2.36	0	0	0.0%	0	11.82
S-1		0.40	0.49	0.70	20	2	8.0%	3.86	440	11	2.5%	2.31	0	0	0.0%	0	6.17
S-2		1.38	0.32	0.6	120	10	8.0%	9.46	220	7	3.0%	1.06	0	0	0.0%	0	10.52
T		1.18	0.15	0.5	300	9	3.0%	20.45	150	5	3.0%	1.44	0	0	0.0%	0	21.89
U		1.47	0.33	0.61	300	10	3.3%	19.97	0	0	0.0%	0.00	0	0	0.0%	0	19.97
V		3.25	0.27	0.57	300	3	1.0%	29.71	0	0	0.0%	0.00	0	0	0.0%	0	29.71
W		2.88	0.15	0.5	210	7	3.3%	16.78	0	0	0.0%	0.00	0	0	0.0%	0	16.78
X		2.31	0.15	0.5	210	6.3	3.0%	16.76	0	0	0	0	0	0	0	0	16.76
Y		0.54	0.64	0.79	20	0.6	3.0%	5.34	450	15	3.3%	4.13	0	0	0	0	9.47
Z		5.5	0.15	0.5	650	52	8.0%	22	0	0	0.0%	0	0	0	0	0	22.00

Garden of the Gods Club
Storm Drainage System Design (Rational Method Procedure)
Historic Basin Flow
Calculated By: KDR
Date: 11/16/16

Basin	DP	Area (Acres)	C5	C100	CA5	CA100	Total Tc (min)	I5	I100	Q5 (cfs)	Q100 (cfs)
A		3.35	0.49	0.70	1.64	2.35	16.63	3.4	5.7	5.5	13.3
B		1.99	0.34	0.61	0.68	1.21	13.83	3.6	6.1	2.5	7.4
C		1.05	0.31	0.59	0.33	0.62	18.49	3.2	5.4	1.0	3.3
D		0.73	0.57	0.75	0.42	0.55	9.54	4.2	7.1	1.7	3.9
E		0.28	0.66	0.81	0.18	0.23	5.50	5.0	8.4	0.9	1.9
F		1.47	0.50	0.71	0.74	1.04	12.14	3.8	6.4	2.8	6.7
G		0.46	0.66	0.80	0.30	0.37	10.85	4.0	6.7	1.2	2.5
H		1.61	0.48	0.70	0.77	1.13	10.85	4.0	6.7	3.1	7.6
I		0.28	0.55	0.74	0.15	0.21	5.79	4.9	8.3	0.8	1.7
J		0.19	0.54	0.74	0.10	0.14	5.04	5.2	8.7	0.5	1.2
K		0.19	0.82	0.90	0.16	0.17	4.32	5.2	8.7	0.8	1.5
L		1.90	0.66	0.80	1.25	1.52	8.29	4.4	7.4	5.5	11.3
M		0.65	0.77	0.87	0.50	0.57	5.72	5.0	8.3	2.5	4.7
N		0.74	0.73	0.85	0.54	0.63	7.56	4.5	7.6	2.5	4.8
O		4.31	0.56	0.74	2.41	3.19	30.96	2.4	4.1	5.9	13.0
P		1.41	0.55	0.74	0.78	1.04	6.69	4.7	7.9	3.7	8.3
Q		4.70	0.53	0.73	2.49	3.43	17.65	3.3	5.5	8.2	18.9
R		0.99	0.58	0.76	0.57	0.75	11.82	3.9	6.5	2.2	4.9
S-1		0.40	0.49	0.70	0.20	0.28	6.17	4.9	8.1	1.0	2.3
S-2		1.38	0.32	0.60	0.44	0.83	10.52	4.1	6.8	1.8	5.6
T		1.18	0.15	0.50	0.18	0.59	21.89	3.0	5.0	0.5	2.9
U		1.47	0.33	0.61	0.49	0.90	19.97	3.1	5.2	1.5	4.7
V		3.25	0.27	0.57	0.88	1.85	29.71	2.5	4.2	2.2	7.8
W		2.88	0.15	0.50	0.43	1.44	16.78	3.4	5.6	1.4	8.1
X		2.31	0.15	0.5	0.35	1.16	16.76	3.4	5.6	1.2	6.5
Y		0.54	0.64	0.79	0.35	0.43	9.47	4.2	7.1	1.5	3.0
Z		5.5	0.15	0.5	0.83	2.75	22.00	2.9	4.9	2.4	13.6

Garden of the Gods Club
Storm Drainage System Design (Rational Method Procedure)
Historic Condition Design Points
Calculated By: KDR
Date: 11/16/16

Design Point	Contributing Basins	Area (Acres)	∑CA5	∑CA100	Max. Basin Tc (min)	Add'l Length (Ft)	Height (Ft)	(%)	Add'l tc (min)	Total Tc (min)	I5	i100	Q5 (cfs)	Q100 (cfs)
H1	Basin A, B	5.34	2.32	3.56	16.63	1100	44	4.0%	4.58	21.21	3.0	5.0	7.0	17.9
H2	Basins C, F, G	2.98	1.36	2.03	18.49	330	9	2.7%	1.68	20.17	3.1	5.2	4.2	10.5
H3	DP#H2, Basins H,I,J & K	5.25	2.55	3.68	20.16	300	6	2.0%	1.5	21.66	3.0	5.0	7.6	18.3
H4	DP#3, Basins L & M	7.80	4.30	5.76	21.7	400	14	3.5%	0.2	21.86	3.0	5.0	12.7	28.6
H5	DP#4, P	9.21	5.08	6.81	21.86	700	18	2.6%	0.6	22.46	2.9	4.9	14.8	33.3
H6	Basins N, Q, & R	6.43	3.61	4.81	22.46	800	13	1.6%	1.4	23.86	2.8	4.7	10.2	22.8
H7	DP#H1, Basins D, E, S-1, S-2 & T, Y	9.85	4.08	6.46	21.9	0	0	0.0%	0	21.9	3.0	5.0	12.0	32.0
H8	DP#5. Basin V	12.46	5.96	8.66	23.86	0	0	0.0%	0	23.86	2.8	4.7	16.8	41.0
H9	DP#6, & 8	18.89	9.56	13.47	23.86	300	6	2.0%	0.8	24.66	2.8	4.7	26.5	62.7
H10	DP#7 and DP#9, U, W & Z	38.59	15.38	25.02	24.66	300	6	2.0%	0.8	25.46	2.7	4.6	42.0	114.5

Garden of the Gods Club
Storm Drainage System Design (Rational Method Procedure)
Developed Conditions Time of Concentration
Calculated By: KDR
Date: 11/16/16

Basin	Area (Acres)	C5	C100	Overland Length (Ft)	Overland Height (Ft)	Slope (%)	tc (min)	Street Length (Ft)	Street Height (Ft)	(%)	tc (min)	Pipe Length (Ft)	Pipe Height (Ft)	(%)	tc (min)	Total Tc (min)
1	1.20	0.65	0.80	120	9	7.5%	9.66	250	8	3.0%	1.20	0	0	0.0%	0	10.86
2	0.96	0.63	0.79	200	12	6.0%	13.43	100	2	1.5%	0.68	0	0	0.0%	0	14.11
3	0.92	0.70	0.83	60	2	3.3%	8.96	440	15	3.4%	1.99	0	0	0.0%	0	10.95
4	1.33	0.57	0.75	60	2	3.3%	8.96	420	14	3.4%	1.90	0	0	0.0%	0	10.86
5	0.65	0.55	0.74	60	20	33.3%	4.19	440	13	3.0%	2.12	0	0	0.0%	0	6.31
6	0.96	0.74	0.85	100	1	0.5%	10.08	280	7	2.5%	1.48	0	0	0.0%	0	11.56
7	0.63	0.73	0.85	10	1	5.0%	3.19	230	5	2.0%	1.36	0	0	0.0%	0	4.55
8	1.81	0.59	0.76	50	1	2.0%	9.65	500	12	2.4%	2.69	0	0	0.0%	0	12.34
9	2.31	0.63	0.79	30	1	3.0%	6.54	900	20	2.2%	5.06	0	0	0.0%	0	11.60
10	2.40	0.59	0.76	30	1	3.0%	6.54	500	13	2.6%	2.58	0	0	0.0%	0	9.12
11	0.76	0.77	0.87	30	1	3.0%	6.54	500	16	3.2%	2.33	0	0	0.0%	0	8.87
12	2.22	0.15	0.50	120	2	2.0%	14.95	0	0	0.0%	0.00	0	0	0.0%	0	14.95
13	1.28	0.82	0.90	50	1	1.0%	5.00	0	0	0.0%	0.00	0	0	0.0%	0	5.00
OS-1	3.45	0.28	0.56	300	6	2.0%	12.44	0	0	0.0%	0.00	0	0	0.0%	0	12.44
CR-East	2.50	0.35	0.58	100	4	4.0%	5.71	300	12	4.0%	1.56	0	0	0.0%	0	7.27
CR-West	3.60	0.28	0.55	300	12	4.0%	9.90	150	6	4.0%	0.67	0	0	0.0%	0	10.57

Garden of the Gods Club
Storm Drainage System Design (Rational Method Procedure)
Developed Conditions Total Flows
Calculated By: KDR
Date: 11/16/16

Basin	Area (Acres)	C5	C100	CA5	CA100	Total Tc (min)	I5	I100	Q5 (cfs)	Q100 (cfs)
1	1.20	0.65	0.80	0.78	0.96	10.86	4.0	6.7	3.1	6.5
2	0.96	0.63	0.79	0.60	0.76	14.11	3.6	6.1	2.2	4.6
3	0.92	0.70	0.83	0.64	0.76	10.95	4.0	6.7	2.6	5.1
4	1.33	0.57	0.75	0.76	1.00	10.86	4.0	6.7	3.0	6.7
5	0.65	0.55	0.74	0.36	0.48	6.31	4.8	8.1	1.7	3.9
6	0.96	0.74	0.85	0.71	0.82	11.56	3.9	6.6	2.8	5.4
7	0.63	0.73	0.85	0.46	0.54	4.55	5.2	8.7	2.4	4.7
8	1.81	0.59	0.76	1.07	1.38	12.34	3.8	6.4	4.1	8.8
9	2.31	0.63	0.79	1.46	1.83	11.60	3.9	6.6	5.7	12.0
10	2.40	0.59	0.76	1.42	1.82	9.12	4.3	7.2	6.0	13.1
11	0.76	0.77	0.87	0.59	0.66	8.87	4.3	7.2	2.5	4.8
12	2.22	0.15	0.50	0.33	1.11	14.95	3.5	5.9	1.2	6.6
13	1.28	0.82	0.90	1.05	1.15	5.00	5.2	8.7	5.5	10.0
OS-1	3.45	0.28	0.56	0.97	1.93	12.44	3.8	6.4	3.7	12.4
CR-East	2.50	0.35	0.58	0.88	1.45	7.27	4.6	7.7	4.0	11.2
CR-West	3.60	0.28	0.56	1.01	2.02	10.56	4.0	6.8	4.0	13.7

Garden of the Gods Club
Storm Drainage System Design (Rational Method Procedure)
Developed Condition Design Points
Calculated By: KDR
Date: 11/16/16

Design Point	Contributing Basins	Area (Acres)	∑CA5	∑CA100	Max. Basin Tc (min)	Add'l Length (Ft)	Height (Ft)	(%)	Add'l tc (min)	Total Tc (min)	I5	i100	Q5 (cfs)	Q100 (cfs)
1	Hist. A, B, D, E, Y- Dev. Basins 1, 5, OS-1	12.19	5.37	8.13	16.65	440	13	3.0%	1.85	18.50	3.2	5.4	17.2	43.8
2	Hist. N plus Basins 2, 3, 4	3.95	2.55	3.15	14.11	440	16	3.6%	1.67	15.78	3.4	5.8	8.8	18.2
2A	DP#1, DP#2	16.14	7.92	11.28	18.50	200	2	1.0%	0.5	19.00	3.2	5.3	25.1	60.0
3	Hist. DP#5 plus Basins 6, 7	10.80	6.25	8.16	22.46	300	9	3.0%	0.6	23.06	2.9	4.8	18.0	39.4
4	DP#3, Basins 8 & 9	14.92	8.77	11.36	23.06	650	18	2.8%	0.5	23.56	2.8	4.8	24.9	54.2
5	Basins 10 & 11	3.16	2.00	2.49	9.12	0	0	0.0%	0	9.12	4.3	7.2	8.5	17.8
6	DP#2A, DP#5	19.30	9.92	13.77	26	0	0	0.0%	0	26.00	2.7	4.5	26.7	62.3
7	DP#6, Basins 13	20.58	10.97	14.92	26.00	0	0	0.0%	0	26.00	2.7	4.5	29.6	67.5
8	DP#4 & DP #7, CR-East	38.00	20.61	27.73	26.00	0	0	0.0%	0	26.00	2.7	4.5	55.6	125.5
9	DP#8, CR-West	41.60	21.62	29.74	26	400	10	2.5%	1.7	27.70	2.6	4.4	56.2	129.8

RIDGE AT CCC
EDB
11/1/16

FOREBAY

EAST TRIB. AREA = 19.64 72.4%
WEST TRIB. AREA = 7.47 27.6%
27.11

TOTAL WQCV REQ'D = 0.498 AC FT
TOTAL EURV = 1.606 AC FT

FOREBAY VOLUME = 3% OF WQCV
= (0.03)(0.499)
= 0.015 AC FT

EAST FOREBAY VOLUME = (0.724)(0.015)
= 0.0109 AC FT
= .473 ft^3

WEST FOREBAY VOLUME = (0.276)(0.015)
= 0.004 AC-FT
= .180 ft^3

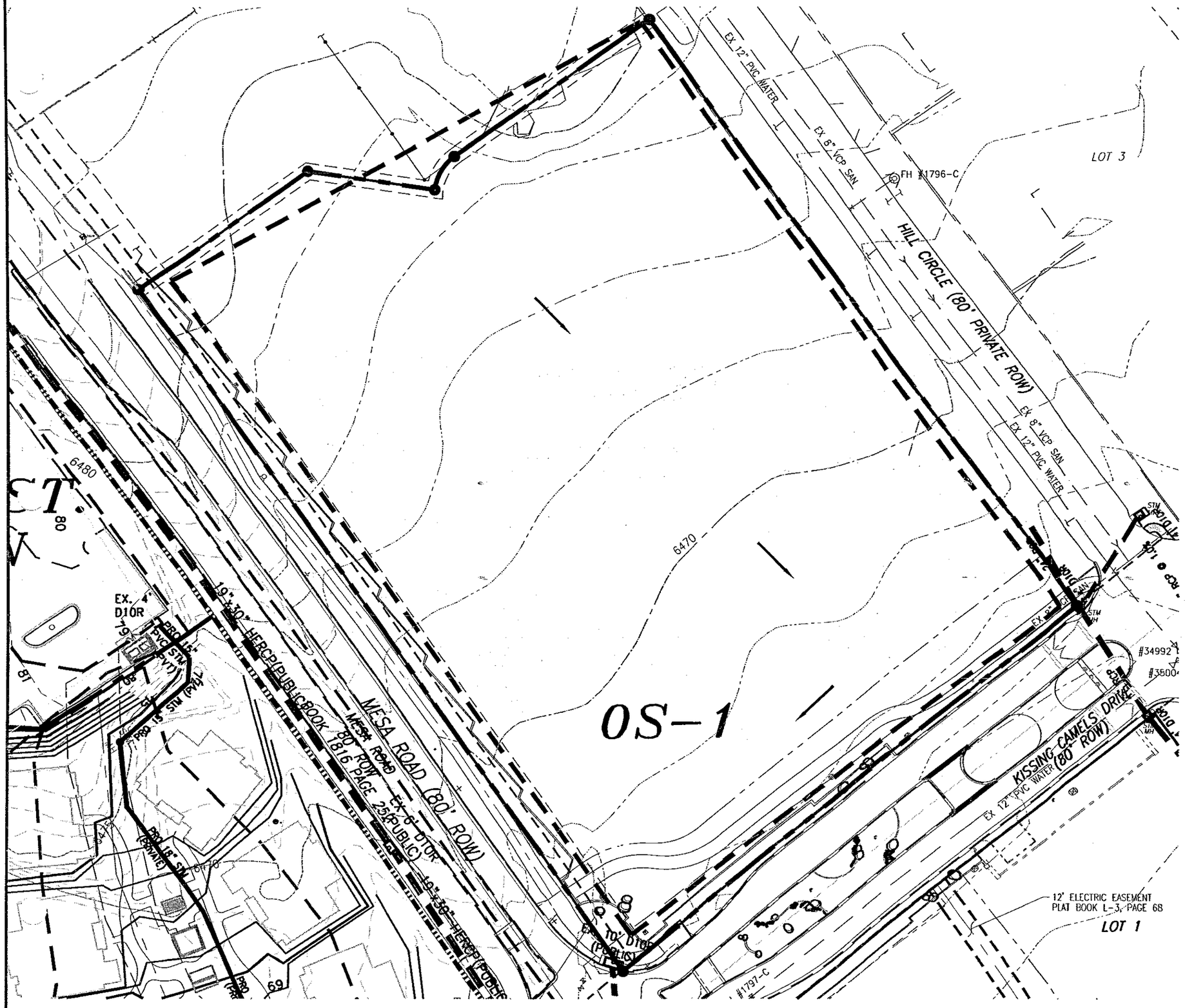
WEIR SIZING

RELEASE 2% OF 100 yr STORM
EAST Q_{100} = 81.4
WEST Q_{100} = 54.2

EAST WEIR (81.4)(0.02) = 1.62 cfs
WEST WEIR (54.2)(0.02) = 1.08 cfs H = 1.0

EAST $Q = CLH^{0.5}$
$1.62 = 3(L)(1)^{0.5}$
$0.54 = L$

WEST $Q = CLH^{0.5}$
$1.08 = 3(L)(4)^{0.5}$
$0.36 = L$



1" = 60'

0 15 30 60 120

Scale in Feet

JOB NO. 14-001

FILE: 14001dev8-15-16.DWG
DATE: 12/29/16

ROCKWELL CONSULTING, Inc.
ENGINEERING • SURVEYING
1955 N. UNION BLVD., SUITE 200
COLORADO SPRINGS, CO 80909
(719) 475-2575 • FAX (719) 475-9223

Manning's Pipe Flow (Normal Flow)

Project The Ridge at Garden of the Gods Collection

Date

Basins N and 2

5 Year

Pipe Diameter (inches)	18	**Inches**	1.50 ft
Manning's Coeff (n)	0.013		
Depth of Flow (d)	6.9	**Inches**	0.58 ft
Pipe Slope (ft/ft)	0.02	**ft/ft**	
Pipe radius	0.75	**ft**	
d/D	0.38		
Q (cfs)	**4.63**	**cfs**	
Area of Flow (ft^2)	0.62	**ft^2**	
Velocity	**7.42**	**fps**	
Pipe Total Circumference	4.71	**ft**	
Angle of Flow	2.67	**Radians**	
Hydraulic Radius (A/P)	0.31		
Wetted Perimeter	2.00		
Velocity head, hv	0.86		
T, Top Width	1.46	**feet**	
Froude Number	2.00		

Manning's Pipe Flow (Normal Flow)

Project The Ridge at Garden of the Gods Collection

Date

Basins N and 2

100 Year

Pipe Diameter (inches)	18	**Inches**	1.50 ft
Manning's Coeff (n)	0.013		
Depth of Flow (d)	10.4	**Inches**	0.87 ft
Pipe Slope (ft/ft)	0.02	**ft/ft**	
Pipe radius	0.75	**ft**	
d/D	0.58		
Q (cfs)	**9.41**	**cfs**	
Area of Flow (ft^2)	1.06	**ft^2**	
Velocity	**8.89**	**fps**	
Pipe Total Circumference	4.71	**ft**	
Angle of Flow	3.45	**Radians**	
Hydraulic Radius (A/P)	0.41		
Wetted Perimeter	2.59		
Velocity head, hv	1.23		
T, Top Width	1.48	**feet**	
Froude Number	1.86		

Manning's Pipe Flow (Normal Flow)

Project The Ridge at Garden of the Gods Collection
Date
Design Point #2
5 Year

Pipe Diameter (inches)	24	**Inches**	2.00 ft
Manning's Coeff (n)	0.013		
Depth of Flow (d)	8.6	**Inches**	0.72 ft
Pipe Slope (ft/ft)	0.02	**ft/ft**	
Pipe radius	1.00	**ft**	
d/D	0.36		
Q (cfs)	**8.79**	**cfs**	
Area of Flow (ft^2)	1.01	**ft^2**	
Velocity	**8.69**	**fps**	
Pipe Total Circumference	6.28	**ft**	
Angle of Flow	2.57	**Radians**	
Hydraulic Radius (A/P)	0.39		
Wetted Perimeter	2.57		
Velocity head, hv	1.17		
T, Top Width	1.92	**feet**	
Froude Number	2.11		

Manning's Pipe Flow (Normal Flow)

Project The Ridge at Garden of the Gods Collection
Date
Design Point #2
100 Year

Pipe Diameter (inches)	24	**Inches**	2.00 ft
Manning's Coeff (n)	0.013		
Depth of Flow (d)	13	**Inches**	1.08 ft
Pipe Slope (ft/ft)	0.02	**ft/ft**	
Pipe radius	1.00	**ft**	
d/D	0.54		
Q (cfs)	**18.27**	**cfs**	
Area of Flow (ft^2)	1.74	**ft^2**	
Velocity	**10.52**	**fps**	
Pipe Total Circumference	6.28	**ft**	
Angle of Flow	3.31	**Radians**	
Hydraulic Radius (A/P)	0.53		
Wetted Perimeter	3.31		
Velocity head, hv	1.72		
T, Top Width	1.99	**feet**	
Froude Number	1.99		

Manning's Pipe Flow (Normal Flow)

Project The Ridge at Garden of the Gods Collection

Date

Design Point #2A

5 Year

Pipe Diameter (inches)	30	**Inches**	2.50 ft
Manning's Coeff (n)	0.013		
Depth of Flow (d)	12.3	**Inches**	1.03 ft
Pipe Slope (ft/ft)	0.03	**ft/ft**	
Pipe radius	1.25	**ft**	
d/D	0.41		
Q (cfs)	**25.03**	**cfs**	
Area of Flow (ft^2)	1.89	**ft^2**	
Velocity	**13.21**	**fps**	
Pipe Total Circumference	7.85	**ft**	
Angle of Flow	2.78	**Radians**	
Hydraulic Radius (A/P)	0.55		
Wetted Perimeter	3.47		
Velocity head, hv	2.71		
T, Top Width	2.46	**feet**	
Froude Number	2.65		

Manning's Pipe Flow (Normal Flow)

Project The Ridge at Garden of the Gods Collection

Date

Design Point #2A

100 Year

Pipe Diameter (inches)	30	**Inches**	2.50 ft
Manning's Coeff (n)	0.013		
Depth of Flow (d)	21.2	**Inches**	1.77 ft
Pipe Slope (ft/ft)	0.03	**ft/ft**	
Pipe radius	1.25	**ft**	
d/D	0.71		
Q (cfs)	**60.20**	**cfs**	
Area of Flow (ft^2)	3.71	**ft^2**	
Velocity	**16.23**	**fps**	
Pipe Total Circumference	7.85	**ft**	
Angle of Flow	3.99	**Radians**	
Hydraulic Radius (A/P)	0.74		
Wetted Perimeter	4.99		
Velocity head, hv	4.09		
T, Top Width	2.28	**feet**	
Froude Number	2.24		

Manning's Pipe Flow (Normal Flow)

Project The Ridge at Garden of the Gods Collection

Date

Design Point #6

5 Year

Pipe Diameter (inches)	36	**Inches**	3.00 ft
Manning's Coeff (n)	0.013		
Depth of Flow (d)	15.9	**Inches**	1.33 ft
Pipe Slope (ft/ft)	0.01	**ft/ft**	
Pipe radius	1.50	**ft**	
d/D	0.44		
Q (cfs)	**26.87**	**cfs**	
Area of Flow (ft^2)	3.01	**ft^2**	
Velocity	**8.92**	**fps**	
Pipe Total Circumference	9.42	**ft**	
Angle of Flow	2.91	**Radians**	
Hydraulic Radius (A/P)	0.69		
Wetted Perimeter	4.36		
Velocity head, hv	1.24		
T, Top Width	2.98	**feet**	
Froude Number	1.56		

Manning's Pipe Flow (Normal Flow)

Project The Ridge at Garden of the Gods Collection
Date
Design Point #6
100 Year

Pipe Diameter (inches)	36	**Inches**	3.00 ft
Manning's Coeff (n)	0.013		
Depth of Flow (d)	27.6	**Inches**	2.30 ft
Pipe Slope (ft/ft)	0.01	**ft/ft**	
Pipe radius	1.50	**ft**	
d/D	0.77		
Q (cfs)	**62.34**	**cfs**	
Area of Flow (ft^2)	5.82	**ft^2**	
Velocity	**10.72**	**fps**	
Pipe Total Circumference	9.42	**ft**	
Angle of Flow	4.27	**Radians**	
Hydraulic Radius (A/P)	0.91		
Wetted Perimeter	6.40		
Velocity head, hv	1.78		
T, Top Width	2.54	**feet**	
Froude Number	1.25		

Manning's Pipe Flow (Normal Flow)

Project The Ridge at Garden of the Gods Collection

Date

Design Point #7

5 Year

Pipe Diameter (inches)	36	**Inches**	3.00 ft
Manning's Coeff (n)	0.013		
Depth of Flow (d)	16.8	**Inches**	1.40 ft
Pipe Slope (ft/ft)	0.01	**ft/ft**	
Pipe radius	1.50	**ft**	
d/D	0.47		
Q (cfs)	**29.60**	**cfs**	
Area of Flow (ft^2)	3.23	**ft^2**	
Velocity	**9.15**	**fps**	
Pipe Total Circumference	9.42	**ft**	
Angle of Flow	3.01	**Radians**	
Hydraulic Radius (A/P)	0.72		
Wetted Perimeter	4.51		
Velocity head, hv	1.30		
T, Top Width	2.99	**feet**	
Froude Number	1.55		

Manning's Pipe Flow (Normal Flow)

Project The Ridge at Garden of the Gods Collection

Date

Design Point #7

100 Year

Pipe Diameter (inches)	36	**Inches**	3.00 ft
Manning's Coeff (n)	0.013		
Depth of Flow (d)	29.9	**Inches**	2.49 ft
Pipe Slope (ft/ft)	0.01	**ft/ft**	
Pipe radius	1.50	**ft**	
d/D	0.83		
Q (cfs)	**67.45**	**cfs**	
Area of Flow (ft^2)	6.28	**ft^2**	
Velocity	**10.75**	**fps**	
Pipe Total Circumference	9.42	**ft**	
Angle of Flow	4.59	**Radians**	
Hydraulic Radius (A/P)	0.91		
Wetted Perimeter	6.88		
Velocity head, hv	1.79		
T, Top Width	2.25	**feet**	
Froude Number	1.13		

Manning's Pipe Flow (Normal Flow)

Project The Ridge at Garden of the Gods Collection

Date

Design Point #4

5 Year

Pipe Diameter (inches)	36	**Inches**	3.00 ft
Manning's Coeff (n)	0.013		
Depth of Flow (d)	15.2	**Inches**	1.27 ft
Pipe Slope (ft/ft)	0.01	**ft/ft**	
Pipe radius	1.50	**ft**	
d/D	0.42		
Q (cfs)	**24.79**	**cfs**	
Area of Flow (ft^2)	2.84	**ft^2**	
Velocity	**8.74**	**fps**	
Pipe Total Circumference	9.42	**ft**	
Angle of Flow	2.83	**Radians**	
Hydraulic Radius (A/P)	0.67		
Wetted Perimeter	4.24		
Velocity head, hv	1.19		
T, Top Width	2.96	**feet**	
Froude Number	1.57		

Manning's Pipe Flow (Normal Flow)

Project The Ridge at Garden of the Gods Collection

Date

Design Point #4

100 Year

Pipe Diameter (inches)	36	**Inches**	3.00 ft
Manning's Coeff (n)	0.013		
Depth of Flow (d)	24.7	**Inches**	2.06 ft
Pipe Slope (ft/ft)	0.01	**ft/ft**	
Pipe radius	1.50	**ft**	
d/D	0.69		
Q (cfs)	**54.36**	**cfs**	
Area of Flow (ft^2)	5.17	**ft^2**	
Velocity	**10.52**	**fps**	
Pipe Total Circumference	9.42	**ft**	
Angle of Flow	3.90	**Radians**	
Hydraulic Radius (A/P)	0.88		
Wetted Perimeter	5.86		
Velocity head, hv	1.72		
T, Top Width	2.78	**feet**	
Froude Number	1.36		

Manning's Pipe Flow (Normal Flow)

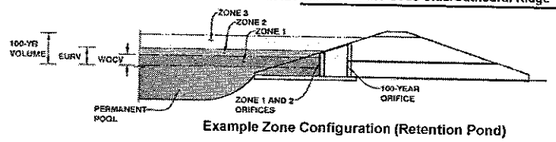
Project The Ridge at Garden of the Gods Collection
Date
Basins N and 2
5 Year

Pipe Diameter (inches)	18	**Inches**	1.50 ft
Manning's Coeff (n)	0.013		
Depth of Flow (d)	6.9	**Inches**	0.58 ft
Pipe Slope (ft/ft)	0.02	**ft/ft**	
Pipe radius	0.75	**ft**	
d/D	0.38		
Q (cfs)	**4.63**	**cfs**	
Area of Flow (ft^2)	0.62	**ft^2**	
Velocity	**7.42**	**fps**	
Pipe Total Circumference	4.71	**ft**	
Angle of Flow	2.67	**Radians**	
Hydraulic Radius (A/P)	0.31		
Wetted Perimeter	2.00		
Velocity head, hv	0.86		
T, Top Width	1.46	**feet**	
Froude Number	2.00		

Detention Basin Outlet Structure Design

Project: Garden of the Gods Club

Basin ID: Garden of the Gods Club/Cathedral Ridge



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.63	0.493	Orifice Plate
Zone 2 (EURV)	3.67	1.096	Orifice Plate
Zone 3 (User)	4.63	0.587	Weir&Pipe (Restrict)
		2.176	Total

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

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

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)

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	3.67	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	18.00	inches
Orifice Plate: Orifice Area per Row =	4.51	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	3.132E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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	1.50	3.00					
Orifice Area (sq. inches)	4.51	4.51	4.51					

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =	N/A	N/A	ft^2
Vertical Orifice Centroid =	N/A	N/A	feet

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.00		ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	12.00		feet
Overflow Weir Slope =	0.00		H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	5.00		feet
Overflow Grate Open Area % =	70%		%, grate open area/total area
Debris Clogging % =	50%		%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.00		feet
Over Flow Weir Slope Length =	5.00		feet
Grate Open Area / 100-yr Orifice Area =	4.37		should be ≥ 4
Overflow Grate Open Area w/o Debris =	42.00		ft^2
Overflow Grate Open Area w/ Debris =	21.00		ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00		ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	42.00		inches
Restrictor Plate Height Above Pipe Invert =	42.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	9.62		ft^2
Outlet Orifice Centroid =	1.75		feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.10	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	50.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.80	feet
Stage at Top of Freeboard =	6.90	feet
Basin Area at Top of Freeboard =	0.71	acres

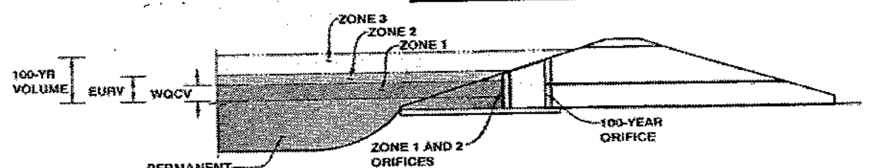
Routed Hydrograph Results

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	3.29
Calculated Runoff Volume (acre-ft) =	0.493	1.589	1.330	1.985	2.532	3.285	3.919	4.640	6.424
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.492	1.588	1.328	1.983	2.530	3.282	3.916	4.635	6.417
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.22	0.43	0.97	1.25	1.59	2.25
Predevelopment Peak Q (cfs) =	0.0	0.0	0.4	5.9	11.6	26.0	33.6	42.7	60.2
Peak Inflow Q (cfs) =	11.7	37.7	31.5	47.0	60.1	78.2	93.5	110.9	153.7
Peak Outflow Q (cfs) =	0.2	0.6	0.5	2.0	14.4	31.3	46.6	65.4	103.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.3	1.2	1.2	1.4	1.5	1.7
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Overflow Grate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.3	0.7	1.1	1.5	2.1
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	68	63	72	70	68	66	64	60
Time to Drain 99% of Inflow Volume (hours) =	40	71	66	76	76	75	74	73	72
Maximum Ponding Depth (ft) =	1.56	3.53	3.10	4.07	4.33	4.56	4.73	4.92	5.32
Area at Maximum Ponding Depth (acres) =	0.49	0.58	0.56	0.60	0.62	0.63	0.64	0.65	0.67
Maximum Volume Stored (acre-ft) =	0.461	1.512	1.261	1.825	1.984	2.127	2.241	2.356	2.625

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: Garden of the Gods Club-12.86 Acres Requiring Full Spectrum Detention

Basin ID: This spreadsheet is for intermediate determination of FSD for Zone 3 Volume for Tributary Vacant Land



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**	
Watershed Area =	12.86	acres
Watershed Length =	800	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	64.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	UDFCD Default	
Water Quality Capture Volume (WQCV) =	0.268	acre-feet
Excess Urban Runoff Volume (EURV) =	0.897	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.762	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	1.086	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	1.354	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	1.703	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	2.007	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	2.350	acre-feet
500-yr Runoff Volume (P1 = 3.29 in.) =	3.217	acre-feet
Approximate 2-yr Detention Volume =	0.722	acre-feet
Approximate 5-yr Detention Volume =	1.016	acre-feet
Approximate 10-yr Detention Volume =	1.112	acre-feet
Approximate 25-yr Detention Volume =	1.153	acre-feet
Approximate 50-yr Detention Volume =	1.253	acre-feet
Approximate 100-yr Detention Volume =	1.460	acre-feet

Optional User Input
1-hr Precipitation

1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
3.29	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.268	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.629	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	0.563	acre-feet
Total Detention Basin Volume =	1.460	acre-feet
Initial Surcharge Volume (ISV) =		ft^3
Initial Surcharge Depth (ISD) =		ft
Total Available Detention Depth (H_{total}) =		ft
Depth of Trickle Channel (H_{TC}) =		ft
Slope of Trickle Channel (S_{TC}) =		ft/ft
Slopes of Main Basin Sides (S_{main}) =		H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =		

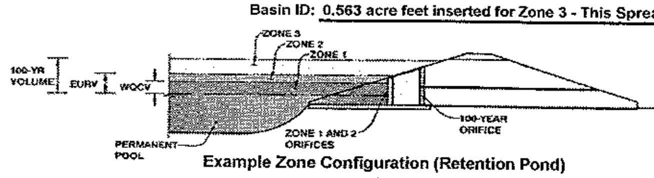
Depth Increment = ___ ft

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)
Micropool									

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

Project: Garden of the Gods Club-26.82 Acres of Water Quality - 14.30 FSD (Vacant Land)

Basin ID: 0.563 acre feet inserted for Zone 3 - This Spreadsheet is to determine total pond volume



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	EDB	
Watershed Area =	26.82	acres
Watershed Length =	1,500	ft
Watershed Slope =	0.030	ft/ft
Watershed Imperviousness =	55.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Desired WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	UDFCD Default	
Water Quality Capture Volume (WQCV) =	0.493	acre-feet
Excess Urban Runoff Volume (EURV) =	1.589	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.330	acre-feet
5-yr Runoff Volume (P1 = 1.5 in.) =	1.985	acre-feet
10-yr Runoff Volume (P1 = 1.75 in.) =	2.532	acre-feet
25-yr Runoff Volume (P1 = 2 in.) =	3.285	acre-feet
50-yr Runoff Volume (P1 = 2.25 in.) =	3.919	acre-feet
100-yr Runoff Volume (P1 = 2.52 in.) =	4.640	acre-feet
500-yr Runoff Volume (P1 = 3.29 in.) =	6.424	acre-feet
Approximate 2-yr Detention Volume =	1.259	acre-feet
Approximate 5-yr Detention Volume =	1.831	acre-feet
Approximate 10-yr Detention Volume =	2.002	acre-feet
Approximate 25-yr Detention Volume =	2.090	acre-feet
Approximate 50-yr Detention Volume =	2.315	acre-feet
Approximate 100-yr Detention Volume =	2.763	acre-feet

Optional User Input 1-hr Precipitation

1.19	inches
1.50	inches
1.75	inches
2.00	inches
2.25	inches
2.52	inches
3.29	inches

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.493	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.096	acre-feet
Zone 3 Volume (User Defined - Zones 1 & 2) =	0.563	acre-feet
Total Detention Basin Volume =	2.152	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

Total detention volume is less than 100-year volume.

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

Depth Increment = 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)
Micropool	--	0.00	--	--	--	20	0.000		
24.8	--	0.30	--	--	--	50	0.001	10	0.000
25	--	0.50	--	--	--	13,719	0.315	1,252	0.029
26	--	1.50	--	--	--	21,154	0.486	18,611	0.427
27	--	2.50	--	--	--	23,114	0.531	40,956	0.940
28	--	3.50	--	--	--	25,146	0.577	65,086	1.494
29	--	4.50	--	--	--	27,251	0.626	91,285	2.096
29.5	--	5.00	--	--	--	28,340	0.651	105,183	2.415
30	--	5.50	--	--	--	29,429	0.676	119,625	2.746
30.5	--	6.00	--	--	--	29,979	0.688	134,477	3.087
31	--	6.50	--	--	--	30,500	0.700	149,597	3.434
31.5	--	7.00	--	--	--	31,000	0.712	164,972	3.787
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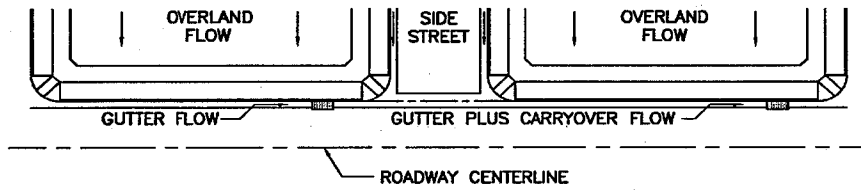
Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Garden of the Gods Club
Inlet ID: Basin A



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	5.5	13.3	cfs

<— FILL IN THIS SECTION OR...

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <—

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ {C_3}$

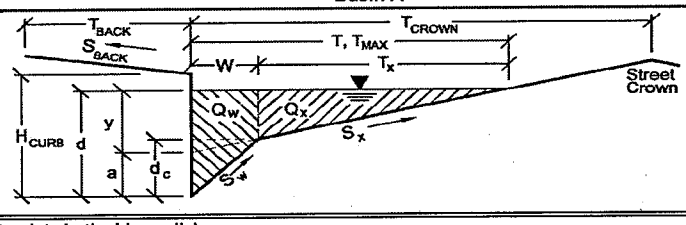
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	5.5	13.3	cfs

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

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

Project: Garden of the Gods Club

Inlet ID: Basin A



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.050	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

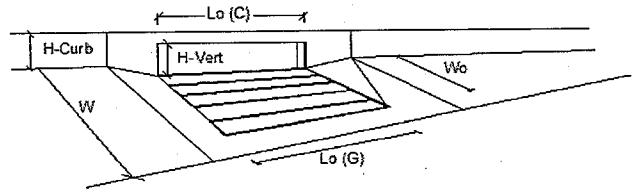
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	10.5	15.2	cfs

Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Garden of the Gods Club
Inlet ID: Basin A



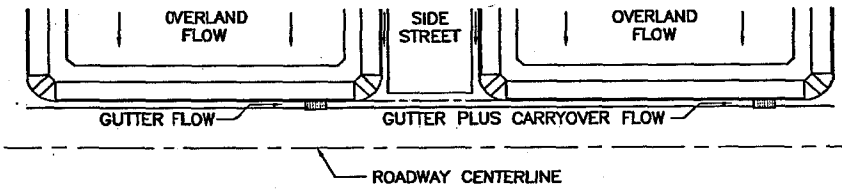
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	12.00	12.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	5.50	10.10	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	3.2	cfs
Capture Percentage = Q_a/Q_o =	C% =	100	76	%

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Garden of the Gods Club
Inlet ID: Basins A-B



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.5	10.6	cfs

<--- FILL IN THIS SECTION OR...

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

<--- FILL IN THE SECTIONS BELOW.

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c)^{C_3}$

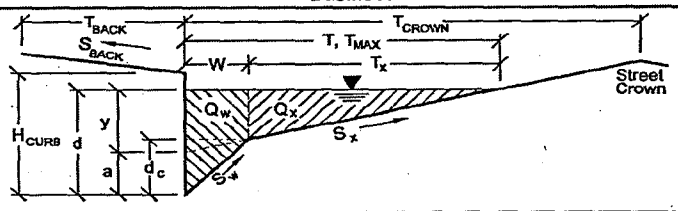
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	2.5	10.6	cfs

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

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

Project: Garden of the Gods Club

Inlet ID: Basins A-B



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	ft
Gutter Width	W =	1.00	ft
Street Transverse Slope	S_X =	0.010	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.018	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	24.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	1.9	214.4	cfs

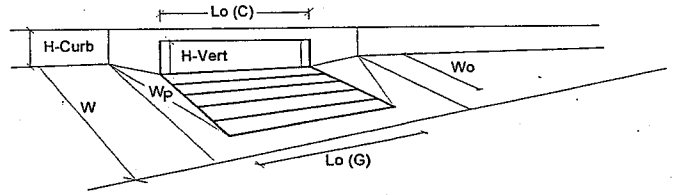
WARNING: MINOR STORM max. allowable capacity is less than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = Garden of the Gods Club

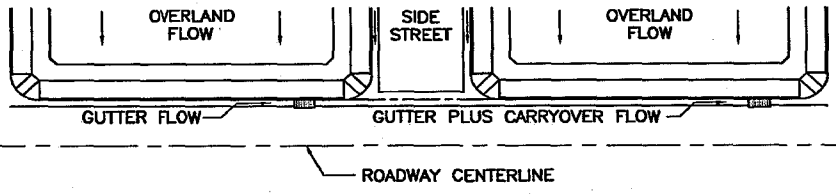
Inlet ID = Basins A-B



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.2	12.0	inches ☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	81.00	81.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	1.00	1.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	10.8	0.0	cfs
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	2.5	10.6	cfs

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Garden of the Gods Club
Inlet ID: Basin D



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	1.7	3.9	cfs

<-- FILL IN THIS SECTION OR...

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

<-- FILL IN THE SECTIONS BELOW.

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

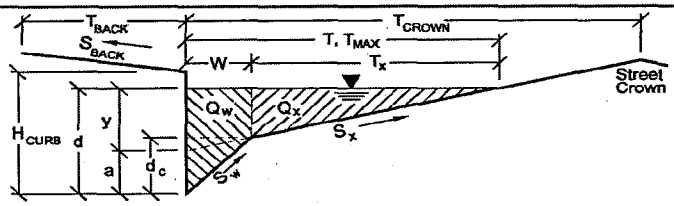
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	1.7	3.9	cfs

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

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

Project: Garden of the Gods Club

Inlet ID: Basin D



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	9.4	16.2	cfs

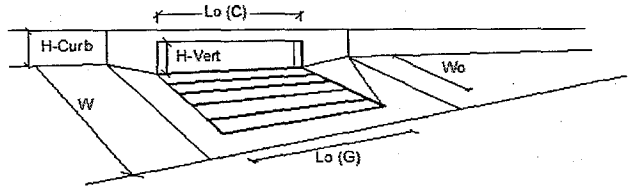
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Garden of the Gods Club

Inlet ID: Basin D

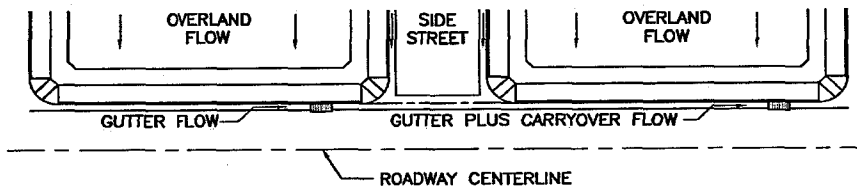


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	1.70	3.90	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	0.0	cfs
Capture Percentage = Q_a/Q_o =	C% =	100	100	%

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Garden of the Gods Club
Inlet ID: Basin E



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	1.0	2.3	cfs

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

<-- FILL IN THIS SECTION OR...

FILL IN THE SECTIONS BELOW. <--

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c)^{C_3}$

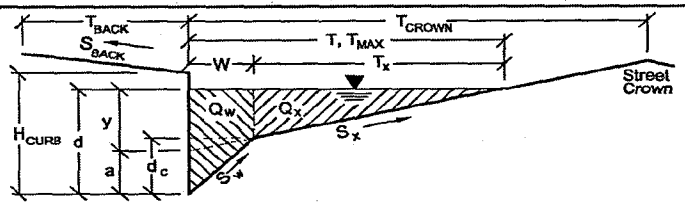
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	1.0	2.3	cfs

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

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

Project: Garden of the Gods Club

Inlet ID: Basin E



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.031	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

MINOR STORM Allowable Capacity is based on Spread Criterion

MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q_{allow} =	8.3	17.5	cfs

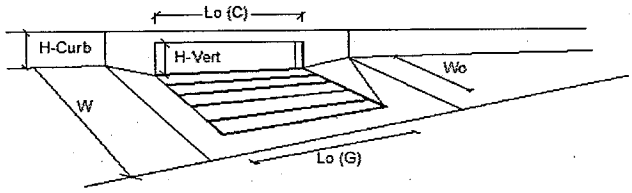
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Garden of the Gods Club

Inlet ID: Basin E



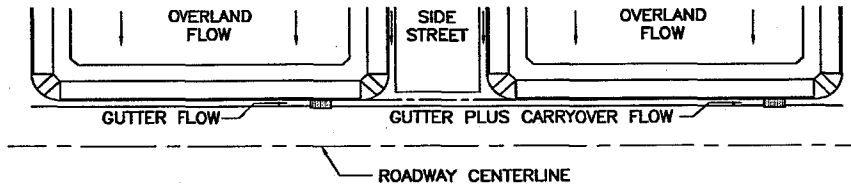
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	6.00	6.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	**1.00**	**2.20**	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	**0.0**	**0.1**	cfs
Capture Percentage = Q_a/Q_o =	C% =	**100**	**96**	%

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Garden of the Gods Club
Inlet ID: Basin S-1



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	1.0	2.3	cfs

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

<-- FILL IN THIS SECTION OR...

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <--

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

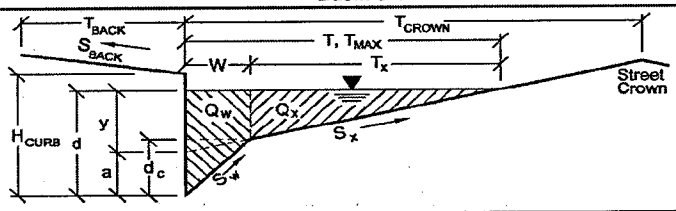
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	1.0	2.3	cfs

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

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

Project: Garden of the Gods Club

Inlet ID: Basin S-1



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.031	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

=

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	8.3	16.5	cfs

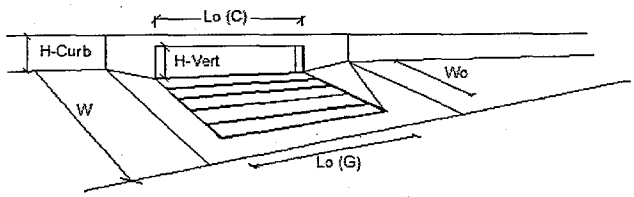
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET ON A CONTINUOUS GRADE

Project: Garden of the Gods Club

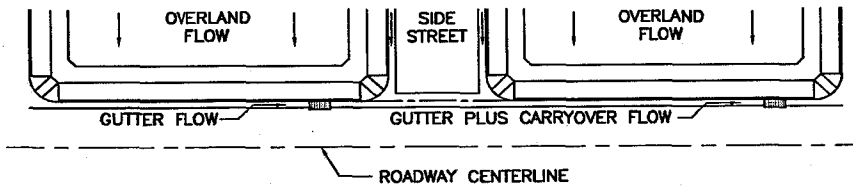
Inlet ID: Basin S-1



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	6.00	6.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.00**	**2.20**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.1**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**96**	**%**

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Garden of the Gods Club
Inlet ID: Basin Y



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	1.5	3.0	cfs

<-- FILL IN THIS SECTION OR...

*** If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.**

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <--

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

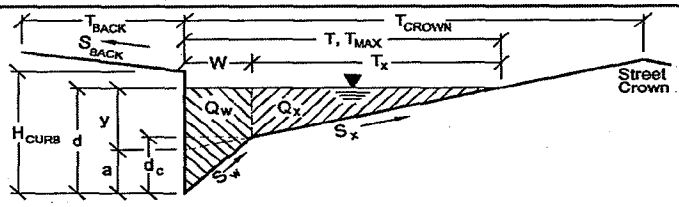
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	1.5	3.0	cfs

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

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

Project: Garden of the Gods Club

Inlet ID: Basin Y

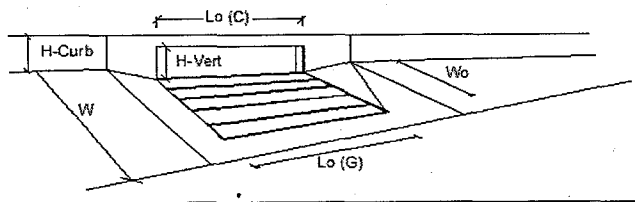


Gutter Geometry (Enter data in the blue cells)				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.040		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	16.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	9.4	18.7	cfs
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'				
Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'				

INLET ON A CONTINUOUS GRADE

Project: Garden of the Gods Club

Inlet ID: Basin Y



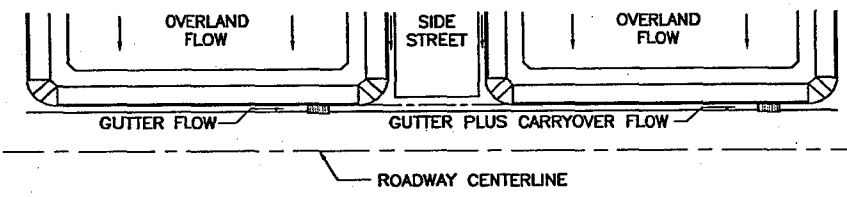
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	6.00	6.00	ft
Width of a Unit Grate (cannot be greater than W from Q-Allow)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < maximum allowable from sheet 'Q-Allow'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.50**	**2.65**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**88**	**%**

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Garden of the Gods Club
Inlet ID: Basins 2



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.2	4.6	cfs
		10.6	

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

<-- FILL IN THIS SECTION OR...

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

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

FILL IN THE SECTIONS BELOW. <--

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c)^{C_3}$

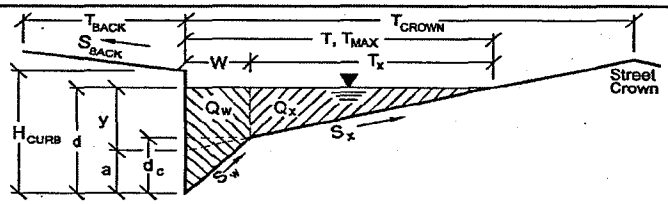
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	2.2	4.6	cfs

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

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

Project: Garden of the Gods Club

Inlet ID: Basins 2



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	3.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.0	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	SUMP	SUMP	cfs

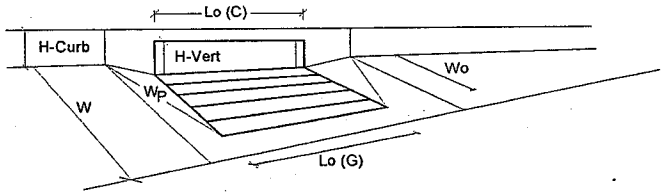
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = Garden of the Gods Club

Inlet ID = Basins 2

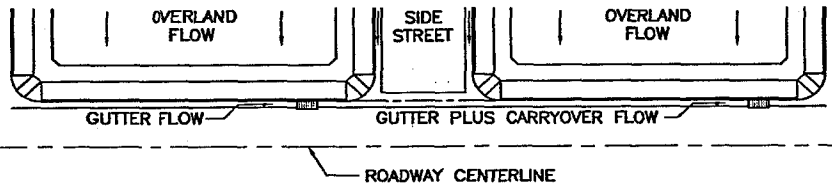


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	12.0	inches ☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	8.00	8.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	81.00	81.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	3.00	3.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	5.7	0.0	**cfs**
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	2.2	4.6	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Garden of the Gods Club
Inlet ID: Basins 3



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.6	5.1	cfs
		10.6	

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

<-- FILL IN THIS SECTION OR...

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <--

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c)^{C_3}$

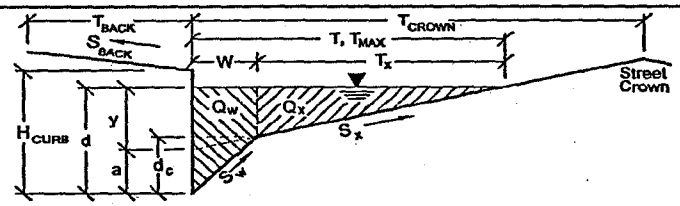
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	2.6	5.1	cfs

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

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

Project: Garden of the Gods Club

Inlet ID: Basins 3



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	3.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

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

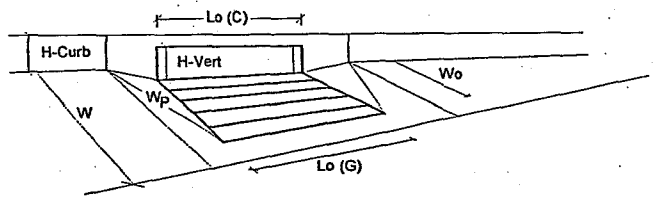
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = Garden of the Gods Club

Inlet ID = Basins 3

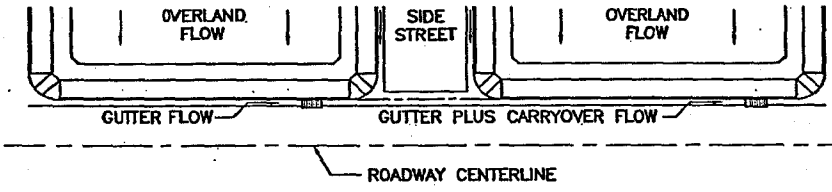


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	8.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	8.00	8.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	81.00	81.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	3.00	3.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	5.7	0.0	cfs
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	2.6	5.1	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Garden of the Gods Club
Inlet ID: Basins 4



Show Details

Design Flow: ONLY if already determined through other methods:

	Minor Storm	Major Storm	
(local peak flow for 1/2 of street OR grass-lined channel): $*Q_{Known}$ =	3.0	6.7	cfs
		10.6	

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

← FILL IN THIS SECTION OR...

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. ←

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c)^{C_3}$

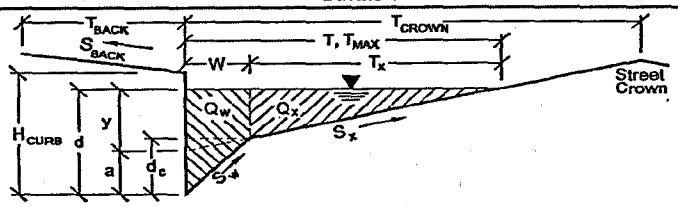
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	3.0	6.7	cfs

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

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

Project: Garden of the Gods Club

Inlet ID: Basins 4



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	3.00	ft
Street Transverse Slope	S_X =	0.010	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

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

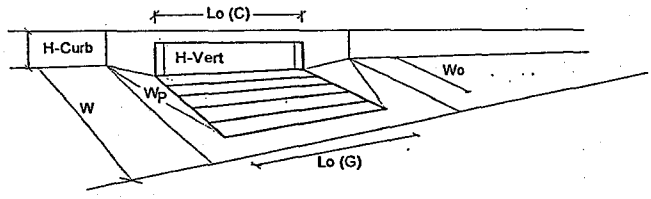
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = Garden of the Gods Club

Inlet ID = Basins 4



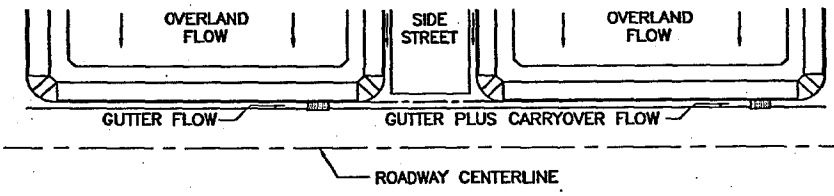
	Design Information (Input)		MINOR	MAJOR	
	Type of Inlet	Inlet Type =	Colorado Springs D-10-R		
	Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	4.00	4.00	inches
	Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
	Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.4	7.0	inches ☑ Override Depths
	Grate Information		MINOR	MAJOR	
	Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
	Width of a Unit Grate	W_o =	N/A	N/A	feet
	Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
	Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
	Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
	Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
	Curb Opening Information		MINOR	MAJOR	
	Length of a Unit Curb Opening	L_o (C) =	8.00	8.00	feet
Warning 1	Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
	Height of Curb Orifice Throat in Inches	H_{throat} =	8.00	8.00	inches
	Angle of Throat (see USDCM Figure ST-5)	Theta =	81.00	81.00	degrees
	Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	3.00	3.00	feet
	Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
	Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
	Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
			MINOR	MAJOR	
	Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	6.9	0.0	cfs
	WARNING: Inlet Capacity is less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	3.0	6.7	cfs

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Garden of the Gods Club
Inlet ID: Basin 8



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	9.3	18.9	cfs

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

<-- FILL IN THIS SECTION OR...

Geographic Information: (Enter data in the blue cells):

<-- FILL IN THE SECTIONS BELOW.

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c)^{C_3}$

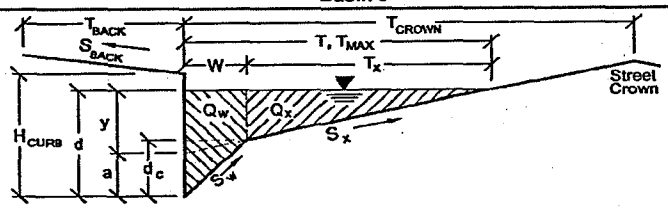
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	9.3	18.9	cfs

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

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

Project: Garden of the Gods Club

Inlet ID: Basin 8



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_x =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_w =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_o =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	24.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	SUMP	SUMP	cfs

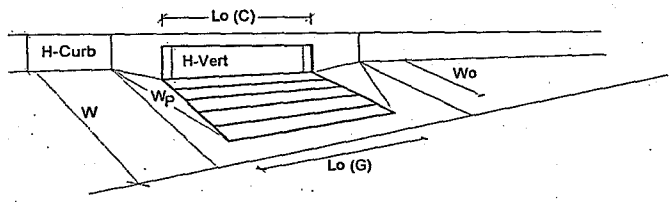
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = Garden of the Gods Club

Inlet ID = Basin 8

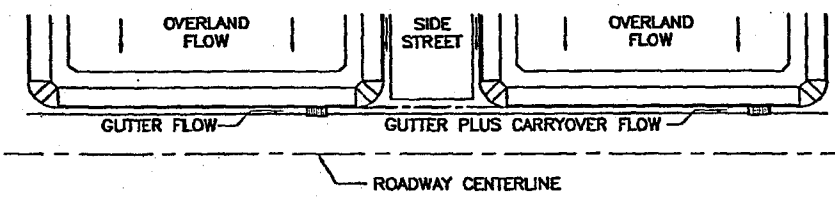


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	8.1	0.0	inches ☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	12.00	12.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	81.00	81.00	degrees
Warning 1 Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	80.00	80.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.70	0.70	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	19.4	0.0	cfs
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	9.3	18.9	cfs

Warning 1: Dimension entered is not a typical dimension for inlet type specified.

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Garden of the Gods Club
Inlet ID: Basins 9



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	7.7	17.0	cfs
		10.6	

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

<-- FILL IN THIS SECTION OR...

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. <--

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c)^{C_3}$

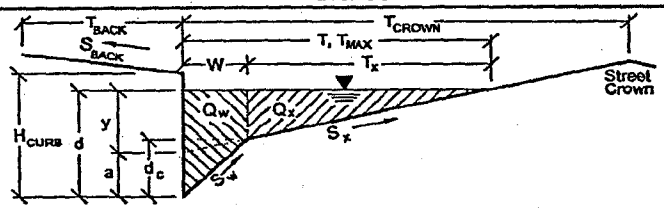
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	7.7	17.0	cfs

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

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

Project: Garden of the Gods Club

Inlet ID: Basins 9



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	12.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	3.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	SUMP	SUMP	cfs

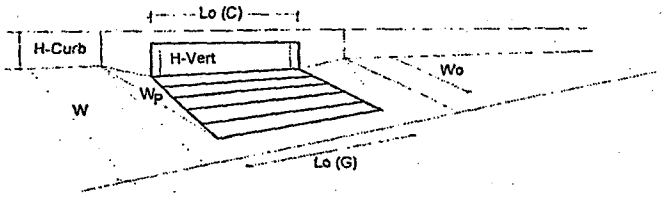
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = Garden of the Gods Club

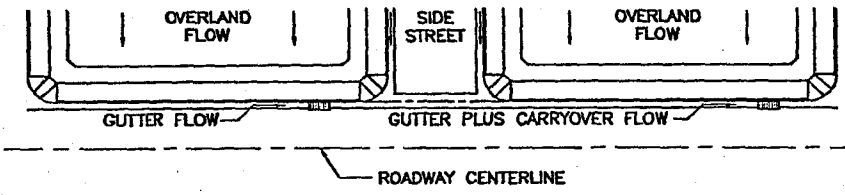
Inlet ID = Basins 9



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	8.5	12.0	inches ☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	12.00	12.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	81.00	81.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	3.00	3.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	18.3	0.0	cfs
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	7.3	17.0	cfs

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Garden of the Gods Club
Inlet ID: Basins 10



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	6.0	13.1	cfs
		10.6	

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

← FILL IN THIS SECTION OR...

Geographic Information: (Enter data in the blue cells):

FILL IN THE SECTIONS BELOW. ←

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

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

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c)^{C_3}$

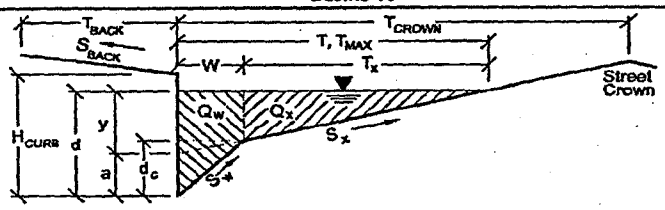
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	6.0	13.1	cfs

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

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

Project: Garden of the Gods Club

Inlet ID: Basins 10



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	12.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	3.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	SUMP	SUMP	cfs

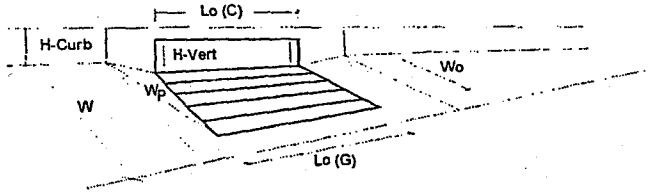
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = Garden of the Gods Club

Inlet ID = Basins 10

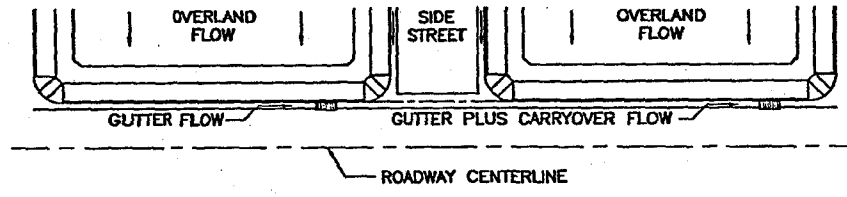


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	8.0	12.0	inches
				☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	81.00	81.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	14.0	0.0	cfs
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	6.0	13.1	cfs

Worksheet Protected

DESIGN PEAK FLOW FOR ONE-HALF OF STREET OR GRASS-LINED CHANNEL BY THE RATIONAL METHOD

Project: Garden of the Gods Club
Inlet ID: Basins 11



Show Details

Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street OR grass-lined channel):

	Minor Storm	Major Storm	
$*Q_{Known}$ =	2.5	4.8	cfs
		10.6	

* If you enter values in Row 14, skip the rest of this sheet and proceed to sheet Q-Allow or Area Inlet.

<-- FILL IN THIS SECTION OR...

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site Type:
- ○ Site is Urban
- ○ Site is Non-Urban

Flows Developed For:
- ○ Street Inlets
- ○ Area Inlets in a Median

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

FILL IN THE SECTIONS BELOW. <--

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c)^{C_3}$

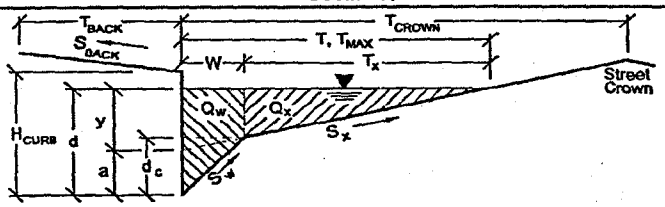
	Minor Storm	Major Storm	
Design Storm Return Period, T_r =			years
Return Period One-Hour Precipitation, P_1 =			inches
C_1 =			
C_2 =			
C_3 =			
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.0	0.0	cfs
Total Design Peak Flow, Q =	2.5	4.8	cfs

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

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

Project: Garden of the Gods Club

Inlet ID: Basins 11



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	12.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	12.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	3.00	ft
Street Transverse Slope	S_x =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_w =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_o =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	12.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	SUMP	SUMP	cfs

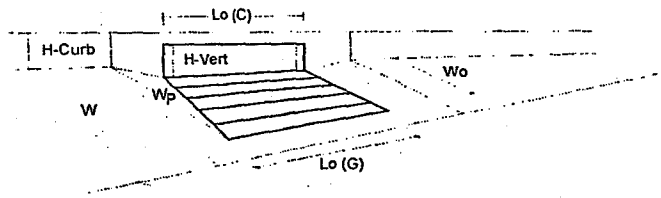
Minor storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

Major storm max. allowable capacity GOOD - greater than flow given on sheet 'Q-Peak'

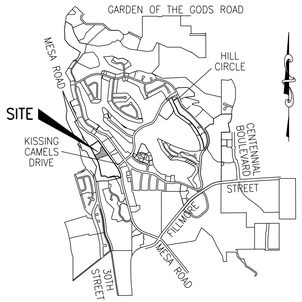
INLET IN A SUMP OR SAG LOCATION

Project = Garden of the Gods Club

Inlet ID = Basins 11

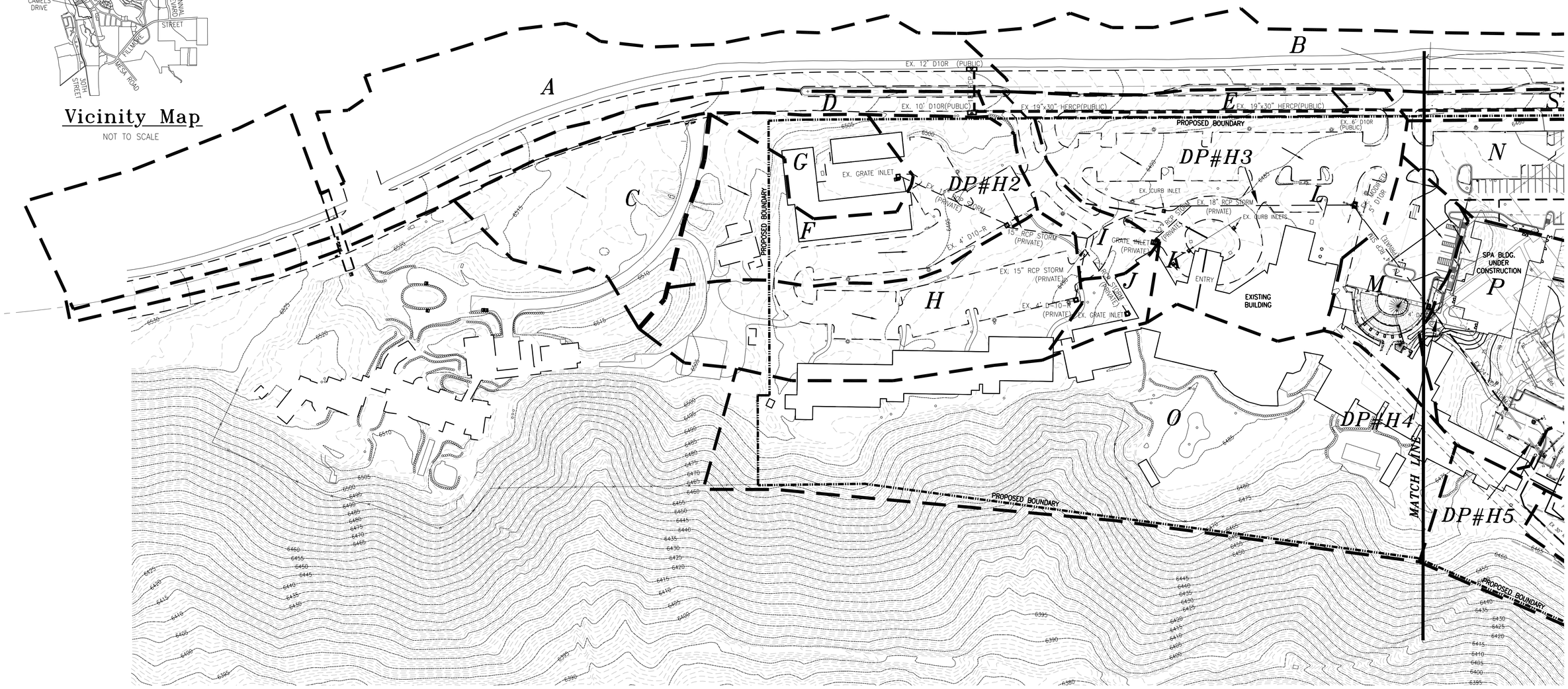


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Inlet Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	4.00	4.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.1	12.0	inches ☑ Override Depths
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	6.00	6.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	8.00	8.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	8.00	8.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	81.00	81.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	3.00	3.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	5.0	0.0	cfs
WARNING: Inlet Capacity less than Q Peak for MAJOR Storm	$Q_{PEAK\ REQUIRED}$ =	2.5	4.8	cfs



Vicinity Map

NOT TO SCALE



LEGEND

- 6100 — EXISTING CONTOURS
- BASIN BOUNDARIES
- A — BASIN DESIGNATOR
- DP #1 — DESIGN POINT
- 30 — PROPOSED 2' CONTOURS
- DIRECTION OF FLOW
- BOUNDARY LINE

HISTORIC DRAINAGE BASIN TABLE

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
A	3.35	5.5	13.3
B	1.99	2.5	7.4
C	1.05	1.0	3.3
D	0.73	1.7	3.9
E	0.28	0.9	1.9
F	1.47	2.8	6.7
G	0.46	1.2	2.5
H	1.61	3.1	7.6
I	0.28	0.8	1.7
J	0.19	0.5	1.2
K	0.19	0.8	1.5
L	1.90	5.5	11.3
M	0.65	2.5	4.7
N	0.74	2.5	4.8
O	4.31	5.9	13.0
P	1.41	3.7	8.3
Q	4.70	8.2	18.9
R	0.99	2.2	4.9
S-1	0.40	1.0	2.3
S-2	1.38	1.8	5.6
T	1.18	0.5	2.9
U	1.47	1.5	4.7
V	3.26	2.2	7.8
W	2.88	1.4	8.1
X	2.31	1.2	6.5
Y	0.54	1.5	3.0
Z	5.50	2.4	13.6

HISTORIC DESIGN POINT TABLE

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)	CONTRIBUTING BASINS
DP#H1	5.34	7.0	17.9	BASINS A,B
DP#H2	2.98	4.2	10.5	BASINS C,F,G
DP#H3	5.25	7.6	18.3	DP#H2, BASINS H,I,J,K
DP#H4	7.80	12.7	28.6	DP#H3, BASINS L,M
DP#H5	9.21	14.8	33.3	DP#H4, BASIN P
DP#H6	6.43	10.2	22.8	BASINS N, Q & R
DP#H7	9.85	12.0	32.0	DP#H1,BASINS D,E, S-1, S-2, T & Y
DP#H8	12.46	16.8	41.0	DP#H5, BASIN V
DP#H9	18.89	26.5	62.7	DP#H6 & H8
DP#H10	38.59	42.0	114.5	DP#H9, U, W, & Z

1" = 60'

0 30 60' 120

Scale in Feet

FILE: 14001dev8-15-16rec000..DWG 12/29/16

ROCKWELL CONSULTING, Inc.
ENGINEERING • SURVEYING
1955 N. UNION BLVD., SUITE 200
COLORADO SPRINGS, CO 80909
(719) 475-2575 • FAX (719) 475-9223

THE RIDGE AT GARDEN OF THE GODS COLLECTION

TITLE : HISTORIC DRAINAGE PLAN – NORTH

SCALE :	1"=60'	DRAWN BY:	KDR
DATE :	12/29/16	CHECKED BY :	KDR

14-001 JOB NO.

HISTORIC DRAINAGE BASIN TABLE

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
A	3.35	5.5	13.3
B	1.99	2.5	7.4
C	1.05	1.0	3.3
D	0.73	1.7	3.9
E	0.28	0.9	1.9
F	1.47	2.8	6.7
G	0.46	1.2	2.5
H	1.61	3.1	7.6
I	0.28	0.8	1.7
J	0.19	0.5	1.2
K	0.19	0.8	1.5
L	1.90	5.5	11.3
M	0.65	2.5	4.7
N	0.74	2.5	4.8
O	4.31	5.9	13.0
P	1.41	3.7	8.3
Q	4.70	8.2	18.9
R	0.99	2.2	4.9
S-1	0.40	1.0	2.3
S-2	1.38	1.8	5.6
T	1.18	0.5	2.9
U	1.47	1.5	4.7
V	3.25	2.2	7.8
W	2.88	1.4	8.1
X	2.31	1.2	6.5
Y	0.54	1.5	3.0
Z	5.50	2.4	13.6

HISTORIC DESIGN POINT TABLE

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)	CONTRIBUTING BASINS
DP#H1	5.34	7.0	17.9	BASINS A,B
DP#H2	2.98	4.2	10.5	BASINS C,F,G
DP#H3	5.25	7.6	18.3	DP#H2, BASINS H,I,J,K
DP#H4	7.80	12.7	28.6	DP#H3, BASINS L,M
DP#H5	9.21	14.8	33.3	DP#H4, BASIN P
DP#H6	6.43	10.2	22.8	BASINS N, Q & R
DP#H7	9.85	12.0	32.0	DP#H1,BASINS D,E, S-1, S-2, T & Y
DP#H8	12.46	16.8	41.0	DP#H5, BASIN V
DP#H9	18.89	26.5	62.7	DP#H6 & H8
DP#H10	38.59	42.0	114.5	DP#H9, U, W, & Z

1" = 60'

0 30 60' 120
Scale in Feet

FILE: 14001dev8-15-16rec000.DWG 12/29/16

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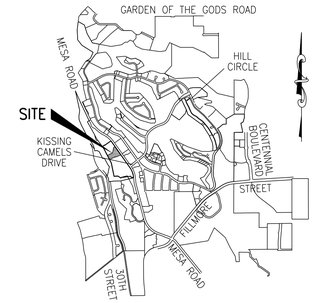
COLORADO SPRINGS, CO 80909
(719) 475-2575 • FAX (719) 475-9223

THE RIDGE AT GARDEN OF THE GODS COLLECTION
TITLE : HISTORIC DRAINAGE PLAN – SOUTH

SCALE :	1"=60'	CHECKED BY :	KDR	14-001
DATE :	12/29/16	CHECKED BY :	KDR	JOB NO.



Vicinity Map

NOT TO SCALE

1" = 40'

0 10 20 40 80

Scale in Feet

LEGEND

- 6100 — EXISTING CONTOURS
- BASIN BOUNDARIES
- A — BASIN DESIGNATOR
- DP #1 — DESIGN POINT
- 30 — PROPOSED 2' CONTOURS
- DIRECTION OF FLOW
- BOUNDARY LINE

DEVELOPED DRAINAGE BASIN TABLE

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
1	1.20	3.1	6.5
2	0.96	2.2	4.6
3	0.92	2.6	5.1
4	1.33	3.0	6.7
5	0.65	1.7	3.9
6	0.96	2.8	5.4
7	0.63	2.4	4.7
8	1.81	4.1	8.8
9	2.31	5.7	12.0
10	2.40	6.0	13.1
11	0.76	2.5	4.8
12	2.22	1.2	6.6
13	1.28	5.5	10.0
CR-E	2.50	4.0	11.2
CR-W	3.60	4.0	13.7
OS-1	3.45	3.7	12.4

DEVELOPED DESIGN POINTS TABLE

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)	CONTRIBUTING BASINS
DP#1	12.19	17.2	43.8	HIST. A,B,D,E,Y PLUS DEV. 1,5, OS-1
DP#2	3.95	8.8	18.2	HIST. N PLUS BASINS 2,3,4
DP#2A	16.14	25.1	60.0	DP#1, DP#2
DP#3	10.80	18.0	39.4	HIST. DP#5 PLUS BASINS 6,7
DP#4	14.92	24.9	54.2	DP#3, BASINS 8&9
DP#5	3.16	8.5	17.8	BASINS 10&11
DP#6	19.30	26.7	62.3	DP#2A, DP#5
DP#7	20.58	29.6	67.5	DP#6, BASIN 13
DP#8	38.00	55.6	125.5	DP#4, DP#7, CR-EAST
DP#9	41.60	56.2	129.8	DP#8, CR-WEST

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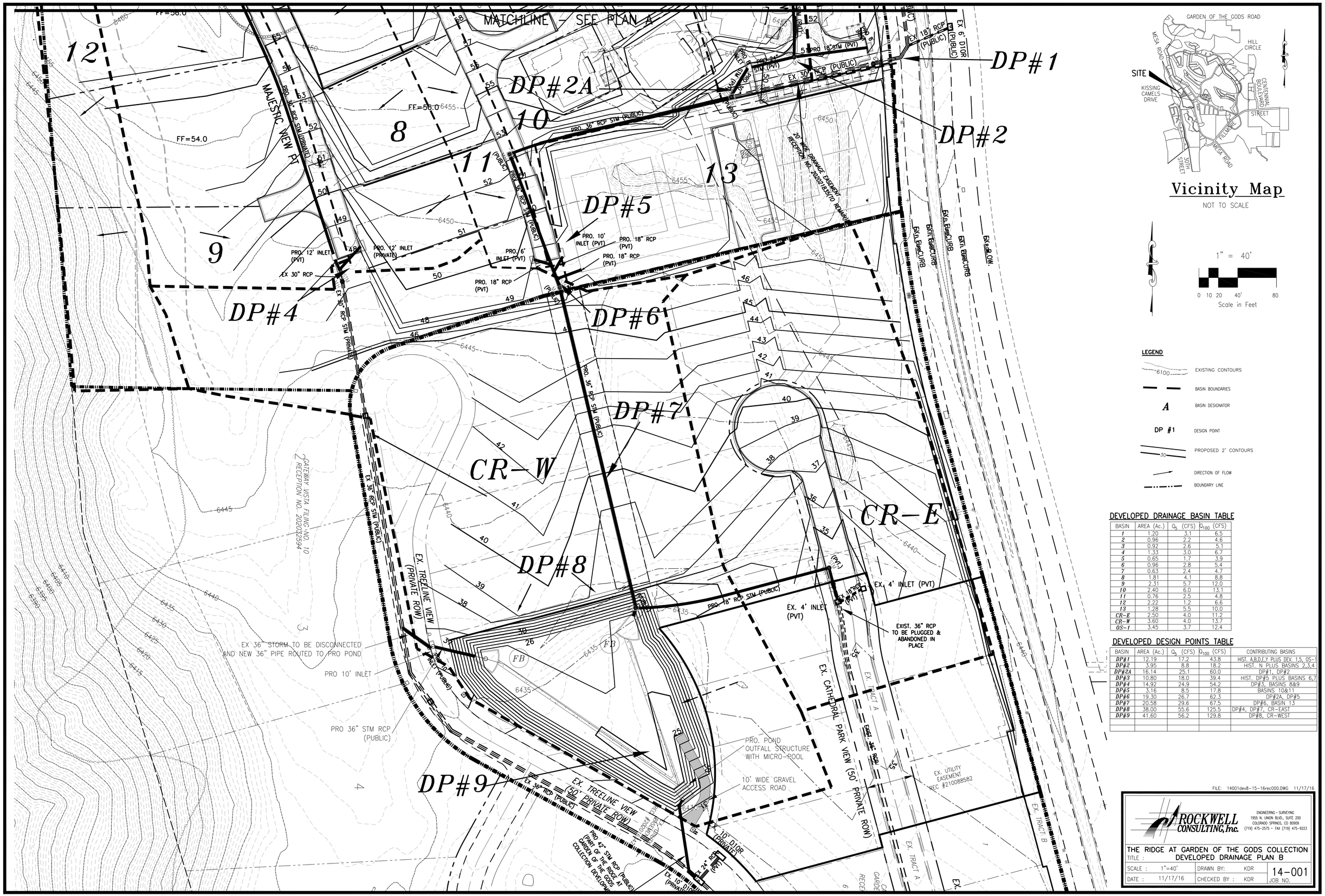
1955 N. UNION BLVD., SUITE 200
COLORADO SPRINGS, CO 80909
(719) 475-2575 • FAX (719) 475-9223

THE RIDGE AT GARDEN OF THE GODS COLLECTION
TITLE : DEVELOPED DRAINAGE PLAN A

SCALE : 1"=40'	DRAWN BY: KDR	14-001
DATE : 11/17/16	CHECKED BY : KDR	JOB NO.



Vicinity Map

NOT TO SCALE

LEGEND

- 6100 — EXISTING CONTOURS
- BASIN BOUNDARIES
- *A* — BASIN DESIGNATOR
- DP #1 — DESIGN POINT
- 30 — PROPOSED 2' CONTOURS
- DIRECTION OF FLOW
- BOUNDARY LINE

DEVELOPED DRAINAGE BASIN TABLE

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)
1	1.20	3.1	6.5
2	0.96	2.2	4.6
3	0.92	2.6	5.1
4	1.33	3.0	6.7
5	0.65	1.7	3.9
6	0.96	2.8	5.4
7	0.63	2.4	4.7
8	1.81	4.1	8.8
9	2.31	5.7	12.0
10	2.40	6.0	13.1
11	0.76	2.5	4.8
12	2.22	1.2	6.6
13	1.28	5.5	10.0
CR-E	2.50	4.0	11.2
CR-W	3.60	4.0	13.7
OS-1	3.45	3.7	12.4

DEVELOPED DESIGN POINTS TABLE

BASIN	AREA (Ac.)	Q_5 (CFS)	Q_{100} (CFS)	CONTRIBUTING BASINS
DP#1	12.19	17.2	43.8	HIST. A,B,D,E,Y PLUS DEV. 1,5, OS-1
DP#2	3.95	8.8	18.2	HIST. N PLUS BASINS 2,3,4
DP#2A	16.14	25.1	60.0	DP#1, DP#2
DP#3	10.80	18.0	39.4	HIST. DP#5 PLUS BASINS 6,7
DP#4	14.92	24.9	54.2	DP#3, BASINS 8&9
DP#5	3.16	8.5	17.8	BASINS 10&11
DP#6	19.30	26.7	62.3	DP#2A, DP#5
DP#7	20.58	29.6	67.5	DP#6, BASIN 13
DP#8	38.00	55.6	125.5	DP#4, DP#7, CR-EAST
DP#9	41.60	56.2	129.8	DP#8, CR-WEST

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THE RIDGE AT GARDEN OF THE GODS COLLECTION

TITLE : DEVELOPED DRAINAGE PLAN B

SCALE :	1"=40'	DRAWN BY: KDR	14-001
DATE :	11/17/16	CHECKED BY : KDR	JOB NO.