FINAL DRAINAGE REPORT for

Veteran's Victory
Villages at Waterview North
Colorado Springs, CO

Prepared for:

Veterans Villa Operating, LLC
17332 Edna St.
Omaha, NE 68136
402-639-8855

Prepared by:

Kimley-Horn and Associates, Inc.
2 North Nevada Avenue, Suite 300
Colorado Springs, Colorado 80903
(719) 453-0180
Contact: Jared Roberts, P.E.

Project #: 096955000

Prepared: December 15, 2022

Kimley»Horn

CERTIFICATION

ENGINEERS STATEMENT

This report and plan for the drainage design of Veteran's Victory at Waterview North was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City of Colorado Springs Drainage Criteria Manual. I understand that the City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

SIGNATURE (Affix Seal): _____

Colorado P.E. No. 60470 Date

DEVELOPER'S STATEMENT

Veteran's Villa Operating, LLC. hereby certifies that the drainage facilities for Veteran's Victory at Waterview North shall be constructed according to the design presented in this report. I 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 are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of Veteran's Victory at Waterview North guarantee that final drainage design review will absolve Veterans Villa Operating, 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.

Veterans Villa Operating, LLC
Name of Developer

_____
Authorized Signature Date

Kim Kuhle
Printed Name

Manager
Title

17332 Edna St. Omaha, NE 68136
Address:

CITY OF COLORADO SPRINGS STATEMENT

Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

_____ _____
For City Engineer Date

Conditions:

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INTRODUCTION

PURPOSE AND SCOPE OF STUDY

The purpose of this report is to outline the required storm sewer and drainage improvements necessary to support the Veteran's Victory at Waterview North project (the "Property"), City of Colorado Springs, Colorado (the "City"). This Final Drainage Report identifies on-site and off-site drainage patterns, storm sewer and inlet locations, areas tributary to the Site and proposes to safely route developed storm water to adequate outfalls. The Property is 10.06 acres in size and is located in Jimmy Camp Creek Drainage Basin.

GENERAL PROJECT DESCRIPTION

The Property is located approximately 1200' to the northeast of the intersection of Powers Boulevard and Bradley Road. The proposed improvements involve the construction of 4 multi-family dwelling units, 1 amenity space, and associated parking, drive aisles, and landscape improvements.

The Property is situated in a portion of Section 9, Township 15 South, Range 65 West of the 6th P.M., City of Colorado Springs, County of El Paso, State of Colorado (see Vicinity Map). The Property is not currently platted. The Property is bounded by vacant land to the north owned by the City of Colorado Springs, vacant land to the east owned by WVN 96, LLC, vacant land to the west owned by CPR Entitlements, LLC, and vacant land to the south owned by Schulz Partnership, LLLP. The Property is currently undeveloped and consists of vacant land and existing vegetation. The Property generally slopes from west to east. The project site is not located in a streamside and thus not bound by streamside overlay guidelines and compliance.

PROJECT CHARACTERISTICS

The Project Site is 10.06 acres and will be disturbed in its entirety. The drainage area for the Project Site is 7.7 acres of onsite flows, 2.36 acres of onsite flows that exit the site, and 6.14 acres of offsite flows that enter the site. The Project involves the construction of 4 multi-family buildings, 1 amenity space, drive aisles, wet and dry utilities, and stormwater infrastructure. The proposed stormwater infrastructure includes the construction of private stormwater mains, private stormwater inlets, and private concrete cross pans. The site will discharge via offsite stormwater infrastructure and ultimately outfall into a regional detention pond to the southeast of the Site.

The proposed buildings, parking lot, paved drives, and other impervious surfaces comprise 58.6 percent (260,508 square feet) of the overall Project Site. Landscape areas internal and on the perimeter of the Site consist of parking islands and landscape zones within the landscape setback areas. The proposed landscaping areas make up 41.4 percent (184,144 square feet) of the Project Site. The weighted imperviousness of the entire drainage area totals to 57.0%

Generally, in the existing conditions the Site slopes approximately 1-33% from west to east. Hydraulic calculations were computed using Storm CAD using the Standard Method. Results of the hydraulic calculations are summarized in the **Appendix**.

VARIANCES FROM CRITERIA

There are no proposed variances from the City of Colorado Springs Drainage Criteria, dated May 2014 (Revised January 2021), for the proposed development.

EXISTING DRAINAGE CONDITIONS

MAJOR DRAINAGE BASIN DESCRIPTION

The Project is within the Jimmy Camp Creek Drainage Basin and part of the Villages at Waterview North Master Plan.

Villages at Waterview North Master Plan

- The Project Site lies within Villages at Waterview North Master Plan drainage study (the "MDDP").
- The proposed development is in compliance with Waterview North MDDP. No changes are proposed the Master Drainage Study.

Excerpts, and drainage map from MDDP for Waterview North prepared by Kimley-Horn and Associates, Inc. dated September 29, 2022, have been Provided in the **Appendix**.

EXISTING DRAINAGE BASIN

The existing Site has been divided into one on-site sub-basin, EX-1. There are also two off-site sub-basins OS-1 and OS-2. A description of each sub-basin is listed below. Calculations of the existing sub-basins on the Project Site have been completed using current stormwater criteria. Basin descriptions, hydraulic calculations, and a proposed sub-basin have been provided in the **Appendix**. An Existing Conditions Drainage Map is provided in the **Appendix** of this report. The weighted imperviousness of the entire drainage area under existing conditions is 2.0%.

Sub-Basin EX-1

Sub-basin EX-1 is 10.06 acres and consists of the entirety of the Site. This basin is mostly undeveloped native land. The runoff developed within this sub-basin sheet flows from west to east overland at slopes of approximately 6% toward DP 1. Flows are then conveyed offsite to the east through undeveloped native land. The weighted imperviousness of sub-basin EX-1 is 2%. The developed direct runoff from sub-basin EX-1 is 2.83 cfs for the 5-year event and 20.81 cfs for the 100-year event.

Offsite Sub-Basin OS-1

Sub-basin OS-1 is 2.77 acres and consists of the NW portion adjacent to the site. This basin is undeveloped native land. The runoff developed within this sub-basin sheet flows generally from northwest to southeast at slopes of approximately 5% where flows enter the Site at DP 2. The weighted imperviousness of sub-basin E1 is 2%. The developed direct runoff from sub-basin E2 is 0.81 cfs for the 5-year event and 5.93 cfs for the 100-year event.

Offsite Sub-Basin OS-2

Sub-basin OS-2 is 6.14 acres and consists of the western portion adjacent to the Site. This basin is undeveloped native land. The runoff developed within this sub-basin sheet flows from west to

east where it enters the Site at DP 3. The weighted imperviousness of sub-basin OS-2 is 2%. The developed direct runoff from sub-basin OS-2 is 1.82 cfs for the 5-year event and 13.36 cfs for the 100-year event.

PROPOSED DRAINAGE CONDITIONS

The developed runoff from Veteran's Victory at Waterview North will generally be collected by means of proposed storm inlets, concrete drainage pans, and curb and gutter. These flows are conveyed via proposed stormwater infrastructure into the storm system within the adjacent road, and to a private above ground full spectrum detention pond as referenced in the MDDP. The proposed site can be divided into twenty-five (25) sub-basins, P1-P23, OS-1 and OS-2. There are also six off-site sub-basins, OS-3 - OS-8. A description of each sub-basin is listed below. Calculations of the proposed sub-basins on the Project Site have been completed using current stormwater criteria. A drainage map referencing the MDDP for "Villages at Waterview North" will be included in the **Appendix**. Additionally, a proposed Conditions Drainage Map is provided in the **Appendix** of this report.

Sub-Basin P1

Sub-basin P1 is 0.19 acres and consists of the northwest garage entrance. The weighted imperviousness of sub-basin P1 is 78.1%. Runoff developed within the sub-basin sheet flows into a proposed trench drain at DP 1. Flow is then conveyed through a 6" storm pipe to proposed storm infrastructure and finally discharged to the offsite proposed private above ground full spectrum detention pond, per the MDDP for the Site. The developed direct runoff from sub-basin P1 is 0.69 cfs for the 5-year event and 1.33 cfs for the 100-year event.

Sub-Basin P2

Sub-basin P2 is 0.10 acres and consists of the northeast garage entrance. This sub-basin yields a weighted imperviousness of 61.8%. Runoff developed within the sub-basin sheet flows generally from west to east, where it is conveyed via proposed trench drain at DP 2. Flows which enter the drain are routed through proposed storm piping and discharged into the offsite private above ground full spectrum detention pond was described in the MDDP. The developed direct runoff from sub-basin P2 is 0.30 cfs for the 5-year event and 0.63 cfs for the 100-year event.

Sub-Basin P3

Sub-basin P3 is 0.85 acres and encompasses the northwest building and additional landscaping. The sub-basin yields a weighted imperviousness of 58.0%. Runoff developed within the sub-basin generally flows overland via roof drains and then landscaping and eventually into the proposed area inlet associated with DP 3. Flows are then conveyed through proposed storm piping and discharged into the detention pond southeast of the Site, as described in the MDDP for the Site. The developed direct runoff from sub-basin P3 is 1.82 cfs for the 5-year event and 3.97 cfs for the 100-year event.

Sub-Basin P4

Sub-basin P4 is 0.37 acres and consists of the parking adjacent to the northwest building. Runoff from this basin sheet flows across the parking lot and travels via an inverted crown crosspan within the roadway to DP 4. At this location, a CDOT Type C private on grade inlet will accept both 5-yr and 100-yr developed flows. Flow is then conveyed through a 12" storm pipe to proposed storm infrastructure and finally discharged to the offsite proposed private above ground full spectrum detention pond, per the MDDP for the Site. The weighted imperviousness of sub-basin

P4 is 87.4%. The developed direct runoff from sub-basin P4 is 1.50 cfs for the 5-year event and 2.79 cfs for the 100-year event.

Sub-Basin P5

Sub-basin P5 is 0.39 acres and consists of parking area adjacent to the northeast building. Runoff from this basin sheet flows and enters the inverted crown crosspan within the roadway to DP 5. At this location, a CDOT Type C private on grade area drain will accept both the 5-yr and 100-yr developed flows. A proposed 18" storm pipe connected into the inlet at DP 5 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P5 is 78.8%. The developed direct runoff from sub-basin P5 is 1.45 cfs for the 5-year event and 2.78 cfs for the 100-year event.

Sub-Basin P6

Sub-basin P6 is 1.18 acres and consists of the northeastern building and associated landscaping. Runoff from this basin sheet flows and enters a depressed CDOT type C inlet to DP 6. At this location, a private area drain will accept both the 5-yr and 100-yr developed flows. A proposed 18" storm pipe connected into the inlet at DP 6 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P6 is 44.5%. The developed direct runoff from sub-basin P6 is 1.77 cfs for the 5-year event and 4.31 cfs for the 100-year event.

Sub-Basin P7

Sub-basin P7 is 0.15 acres and consists of portion of landscaping behind the northwest building. Runoff from this basin sheet flows and enters a proposed area drain to DP 7. At this location, a private area drain will accept both the 5-yr and 100-yr developed flows. A proposed 21" storm pipe connected into the inlet at DP 7 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P7 is 67.5%. The developed direct runoff from sub-basin P7 is 0.38 cfs for the 5-year event and 0.78 cfs for the 100-year event.

Sub-Basin P8

Sub-basin P8 is 0.19 acres and consists of a parking area adjacent to the northwest building. Runoff from this basin sheet flows and enters an inverted crown crosspan within the roadway to DP 8. At this location, a private CDOT Type C on grade inlet will accept both the 5-yr and 100-yr developed flows. A proposed 18" storm pipe connected into the inlet at DP 8 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P8 is 84.0%. The developed direct runoff from sub-basin P8 is 0.74 cfs for the 5-year event and 1.40 cfs for the 100-year event.

Sub-Basin P9

Sub-basin P9 is 0.65 acres and consists of a central portion of the Site including parking, landscaping, and a portion of the proposed amenity space. Runoff from this basin sheet flows and enters an inverted crown crosspan within the roadway to DP 9. At this location, a CDOT Type C on-grade inlet will accept both the 5-yr and 100-yr developed flows. A proposed 21" storm pipe connected into the inlet at DP 9 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of

sub-basin P9 is 64.3%. The developed direct runoff from sub-basin P9 is 1.83 cfs for the 5-year event and 3.77 cfs for the 100-year event.

Sub-Basin P10

Sub-basin P10 is 0.05 acres and consists of a portion of roadway and landscaping along the western access to the Site. Runoff from this basin sheet flows and enters curb and cutter to DP 10. At this location, an 8' Colorado Springs D-10-R inlet will accept both the 5-yr and 100-yr developed flows and is designed to capture additional offsite flows from the future adjacent parcel. A proposed 27" storm pipe connected into the inlet at DP 10 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P10 is 39.6%. The developed direct runoff from sub-basin P10 is 0.09 cfs for the 5-year event and 0.23 cfs for the 100-year event.

Sub-Basin P11

Sub-basin P11 is 0.29 acres and consists of a roadway portion at the bottom of the western access road. Runoff from this basin sheet flows and enters an inverted crown crosspan within the roadway to DP 11. At this location, a private CDOT Type C on-grade inlet will accept both the 5-yr and 100-yr developed flows. A proposed 30" storm pipe connected into the inlet at DP 11 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P11 is 66.9%. The developed direct runoff from sub-basin P11 is 0.93 cfs for the 5-year event and 1.88 cfs for the 100-year event.

Sub-Basin P12

Sub-basin P12 is 0.32 acres and consists of the central portion of the Site. Runoff from this basin sheet flows and enters an inverted crown crosspan within the roadway to DP 12. At this location, a private CDOT Type C on grade inlet will accept both the 5-yr and 100-yr developed flows. A proposed 24" storm pipe connected into the inlet at DP 12 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P12 is 61.9%. The developed direct runoff from sub-basin P12 is 0.77 cfs for the 5-year event and 1.62 cfs for the 100-year event.

Sub-Basin P13

Sub-basin P13 is 0.07 acres and consists of a portion of roadway and landscaping along the eastern site access. Runoff from this basin sheet flows and enters curb and cutter to DP 13. At this location, a private 4' Colorado Springs D-10-R inlet will accept both the 5-yr and 100-yr developed flows. A proposed 18" storm pipe connected into the inlet at DP 13 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P13 is 60.1%. The developed direct runoff from sub-basin P13 is 0.19 cfs for the 5-year event and 0.40 cfs for the 100-year event.

Sub-Basin P14

Sub-basin P14 is 0.23 acres and consists of a portion of the southwest building and adjacent landscaping. Runoff from this basin sheet flows and enters curb and cutter to DP 14. At this

location, a private area drain will accept both the 5-yr and 100-yr developed flows. This drain is sized to adequately handle offsite flows in the future. A proposed 6" storm pipe connected into the area drain at DP 14 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P14 is 59.6%. The developed direct runoff from sub-basin P14 is 0.46 cfs for the 5-year event and 0.99 cfs for the 100-year event.

Sub-Basin P15

Sub-basin P15 is 0.34 acres and consists of a portion of the parking and landscape adjacent to the southwestern building. Runoff from this basin sheet flows and enters an inverted crown crosspan to DP 15. At this location, a private CDOT Type C on grade inlet will accept both the 5-yr and 100-yr developed flows. A proposed 30" storm pipe connected into the inlet at DP 15 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P15 is 85.0%. The developed direct runoff from sub-basin P15 is 1.34 cfs for the 5-year event and 2.52 cfs for the 100-year event.

Sub-Basin P16

Sub-basin P16 is 0.67 acres and consists of a portion of landscaping, roadway, and amenity space. Runoff from this basin sheet flows and enters an inverted crown crosspan within the roadway to DP 16. At this location, a private CDOT Type C on grade inlet will accept both the 5-yr and 100-yr developed flows. A proposed 24" storm pipe connected into the inlet at DP 16 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P16 is 50.8%. The developed direct runoff from sub-basin P16 is 1.27 cfs for the 5-year event and 2.86 cfs for the 100-year event.

Sub-Basin P17

Sub-basin P17 is 0.25 acres and consists of a portion of the southwest building and adjacent landscaping. Runoff from this basin sheet flows and enters the landscaping and is conveyed to DP 17. At this location, a private area drain will accept both the 5-yr and 100-yr developed flows. This drain is sized to adequately handle offsite flows in the future. A proposed 21" storm pipe connected into the inlet at DP 17 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P17 is 52.1%. The developed direct runoff from sub-basin P17 is 0.46 cfs for the 5-year event and 1.04 cfs for the 100-year event.

Sub-Basin P18

Sub-basin P18 is 0.28 acres and consists of a portion of the southwest building and adjacent landscaping. Runoff from this basin sheet flows and enters the landscaping and is conveyed to DP 18. At this location, a private area drain will accept both the 5-yr and 100-yr developed flows. This drain is sized to adequately handle offsite flows in the future. A proposed 24" storm pipe connected into the inlet at DP 18 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P18 is 47.2%. The developed direct runoff from sub-basin P18 is 0.47 cfs for the 5-year event and 1.11 cfs for the 100-year event.

Sub-Basin P19

Sub-basin P19 is 0.33 acres and consists of a portion of the southwest building and adjacent landscaping. Runoff from this basin sheet flows and enters the landscaping to DP 19. At this location, a private area drain will accept both the 5-yr and 100-yr developed flows. This drain is sized to adequately handle offsite flows in the future. A proposed 27" storm pipe connected into the area drain at DP 19 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P19 is 39.8%. The developed direct runoff from sub-basin P19 is 0.47 cfs for the 5-year event and 1.21 cfs for the 100-year event.

Sub-Basin P20

Sub-basin P20 is 0.26 acres and consists of a parking lot area adjacent to the southwest building. Runoff from this basin sheet flows and enters an inverted crown crosspan within the roadway to DP 20. At this location, a private depressed CDOT Type C inlet will accept both the 5-yr and 100-yr developed flows. A proposed 42" storm pipe connected into the inlet at DP 20 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P20 is 86.2%. The developed direct runoff from sub-basin P20 is 1.06 cfs for the 5-year event and 1.98 cfs for the 100-year event.

Sub-Basin P21

Sub-basin P21 is 0.39 acres and consists of the parking area adjacent to the southeast building. Runoff from this basin sheet flows and enters an inverted crown crosspan within the roadway to DP 21. At this location, a depressed CDOT Type C inlet will accept both the 5-yr and 100-yr developed flows. A proposed 27" storm pipe connected into the inlet at DP 21 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P21 is 73.0%. The developed direct runoff from sub-basin P21 is 1.22 cfs for the 5-year event and 2.41 cfs for the 100-year event.

Sub-Basin P22

Sub-basin P22 is 0.13 acres and consists of the southwest garage entrance. Runoff from this basin sheet flows and enters curb and cutter to DP 22. At this location, a trench drain will accept both the 5-yr and 100-yr developed flows. A proposed 6" storm pipe connected into the drain at DP 22 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P22 is 62.7%. The developed direct runoff from sub-basin P22 is 0.38 cfs for the 5-year event and 0.79 cfs for the 100-year event.

Sub-Basin P23

Sub-basin P23 is 0.20 acres and consists of the southeast garage entrance. Runoff from this basin sheet flows and enters curb and cutter to DP 23. At this location, a private trench drain will accept both the 5-yr and 100-yr developed flows. A proposed 6" storm pipe connected into the drain at DP 23 and is finally discharged to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin P23 is

49.0%. The developed direct runoff from sub-basin P23 is 0.41 cfs for the 5-year event and 0.93 cfs for the 100-year event.

Sub-Basin OS-1

Sub-basin OS-1 is 0.52 acres and consists of the north and eastern border of the Site. Runoff from this basin sheet flows offsite to DP 24. At this location, flows will follow native drainage patterns and ultimately flow into the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin OS-1 is 31.8%. The developed direct runoff from sub-basin OS-1 is 0.55 cfs for the 5-year event and 1.52 cfs for the 100-year event.

Sub-Basin OS-2

Sub-basin OS-2 is 1.84 acres and consists of the entirety of the southeast building as well as a portion of adjacent drive aisle and landscaping. Runoff from this basin sheet flows into the adjacent roadway at DP 25. At this location, the roadway storm infrastructure will accept both the 5-yr and 100-yr developed flows and finally discharge to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin OS-2 is 45.4%. The developed direct runoff from sub-basin OS-2 is 3.60 cfs for the 5-year event and 8.61 cfs for the 100-year event.

Sub-Basin OS-3

Sub-basin OS-3 is 0.08 acres and consists of a small landscape section at the central wester portion of the Site. Runoff from this basin sheet flows into the adjacent roadway at DP 26. At this location a private 4' Colorado Springs D-10-R inlet will accept both the 5-yr and 100-yr developed flows and finally discharge to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin OS-3 is 55.8%. The developed direct runoff from sub-basin OS-3 is 0.20 cfs for the 5-year event and 0.43 cfs for the 100-year event.

Sub-Basin OS-4

Sub-basin OS-4 is 0.01 acres and consists of a small landscape section at the central western portion of the Site. Runoff from this basin sheet flows into the adjacent landscaping at DP 27. At this location, the storm infrastructure will accept both the 5-yr and 100-yr developed flows and finally discharge to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin OS-4 is 2.0%. The developed direct runoff from sub-basin OS-4 is 0.00 cfs for the 5-year event and 0.02 cfs for the 100-year event.

This basin comes from a proposed future development and infrastructure has been sized accordingly to capture these flows.

Sub-Basin OS-5

Sub-basin OS-5 is 2.05 acres and consists of the northern half of the offsite storm infrastructure. Runoff from this basin sheet flows into the adjacent roadway at DP 28. At this location, the flows will directly enter the Site to meet green infrastructure criteria, accepting both the 5-yr and 100-yr developed flows and finally discharge to the offsite private above ground full spectrum detention

pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin OS-5 is 73.8%. The developed direct runoff from sub-basin OS-5 is 6.57 cfs for the 5-year event and 12.97 cfs for the 100-year event.
This basin comes from a proposed future development and infrastructure has been sized accordingly to capture these flows.

Sub-Basin OS-6

Sub-basin OS-6 is 1.60 acres and consists of the southern half of the offsite storm infrastructure. Runoff from this basin sheet flows into the adjacent roadway at DP 29. At this location, the private 12' Colorado Springs D-10-R inlet will accept both the 5-yr and 100-yr developed flows and finally discharge to the offsite private above ground full spectrum detention pond as described in the MDDP for the Site. The weighted imperviousness of sub-basin OS-6 is 57.5%. The developed direct runoff from sub-basin OS-6 is 4.00 cfs for the 5-year event and 8.64 cfs for the 100-year event.

This basin comes from a proposed future development and infrastructure has been sized accordingly to capture these flows.

Offsite Sub-Basin OS-7

Offsite sub-basin OS-7 is 1.46 acres and consists of native undeveloped land to the northwest of the Site. Runoff from this basin sheet flows from west to east, where it enters the Site at DP 30. The weighted imperviousness of sub-basin OS-7 is 3.6%. The developed direct runoff from sub-basin OS-7 is 0.56 cfs for the 5-year event and 3.65 cfs for the 100-year event.

Offsite Sub-Basin OS-8

Offsite sub-basin OS-8 is 0.80 acres and consist of native undeveloped land to the northwest of the Site, just south of OS-3. Runoff from this basin will sheet flow from west to east and enter the Site at DP 31. The weighted imperviousness of sub-basin OS-8 is 3.6%. The developed direct runoff from sub-basin OS-8 is 0.31 cfs for the 5-year event and 2.02 cfs for the 100-year event.

COMPLIANCE WITH VILLAGES AT WATERVIEW NORTH MDDP

As per MDDP for Villages at Waterview North prepared by Kimley-Horn and Associates, dated August 15, 2022, weighted impervious values shown for Basins 3 and 4 that were used in calculations for all tracts were 95% and 70%, respectively. The weighted impervious values for the Project Site are 57.0%. Flows as described in MDDP for Villages at Waterview North prepared by Kimley-Horn and Associates, dated August 15, 2022 will follow historic patterns and will be released at less than historic levels.

MAJOR DRAINAGEWAYS

The proposed private storm system will convey flows to existing public storm water infrastructure where flows outfall into the offsite regional detention pond, and ultimately discharges into Jimmy Camp Creek.

HYDRAULIC ANALYSIS METHODOLOGY

The proposed drainage facilities are designed in accordance with the CRITERIA and MANUAL. Floodplain identification was determined using FIRM panels by FEMA and information provided in the CRITERIA. Hydraulic calculations were computed using STORMCAD, which makes use of the Standard Step method to compute the hydraulic profile. Results of the hydraulic calculations

are provided in the **Appendix**. There are no additional provisions selected or deviations from the City of Colorado Springs Drainage Criteria, dated May 2014 (Revised January 2021), for the proposed development.

Four-Step Process

The four-step process per the MANUAL provides guidance and requirements for the selection of siting of structural Best Management Practices (BMPs) for new development and significant redevelopment.

Step 1: Employ Runoff Reduction Practices
Implementation of landscaping throughout the site will help slow runoff and encourage infiltration. The Site was designed to conserve as much of the existing vegetation as possible and to minimize the extent of paved areas. Wherever possible, impervious areas such as sidewalks and pavement, were designed to drain to pervious areas. Additionally, a runoff reduction spreadsheet has been added to the **Appendix** outlining areas of imperviousness draining through pervious areas in accordance with the Green Infrastructure Manual.

Step 2: Implement Control Measures That Provide a Water Quality Capture Volume with Slow Release
The water quality capture volume will be provided by the offsite regional detention facility. Reference the detention capacity calculations in the **Appendix**.

Step 3: Stabilize Drainageways
There are no open channels on or adjacent to this site, therefore no stabilization will be necessary. All new and re-development projects are required to construct or participate in the funding of channel stabilization measures. The downstream outlet has sufficient stabilization. Development site is 6500 ft from Jimmy Camp Creek.

Step 4: Implement Site Specific and Other Source Control Measures
The Site does not require "Covering of Storage/Handling Areas" or "Spill Containment and Control" (specialized BMPs) in the final constructed condition. There is no proposed material storage or other Site operations that would introduce contaminants to the City's MS4 that would require Site specific control or source control BMP for the proposed project.

All flows leaving the Site will be released at or below historic rates and will cause no impact to downstream facilities and additional off-site improvements are not required by this Project.

Water Quality Design

Please reference the MDDP for the proposed water quality design.

Outlet Requirements

Please reference the MDDP for the proposed outlet design.

Emergency Spillway Path

Please reference the MDDP for the proposed emergency spillway path.

EROSION CONTROL PLAN

Erosion Control Plans will be submitted separately as a standalone construction document.

FLOODPLAIN STATEMENT

The Flood Insurance Rate Maps (FIRM) 08041C0768G effective date December 7, 2018, by FEMA, indicates that the Site is located in Zone X (outside of the 500-year flood plain). This panel is included in the **Appendix**.

FEES DEVELOPMENT

DRAINAGE AND BRIDGE FEES

The Project Site is located in the Jimmy Camp Creek Basin. The fees associated with Jimmy Camp Creek will be paid prior to final plat recordation of the entire 10.06-acre Site. The total 2022 drainage, bridge, and pond fee amount for this Site is $122,511 as summarized below.

Fee Type	Fee/Acre	Total
Drainage	$9,185	$92,401
Bridge	--	--
Pond Land	--	--
Pond Facility	$2,993	$30,110
Surcharge	--	--
Total		**$122,511**

CONSTRUCTION COST OPINION

An opinion of probable construction cost for the construction of the private drainage facilities for the Project has been included in the **Appendix**.

MAINTENANCE AND OPERATIONS

Please reference the MDDP for the maintenance and operations of the offsite regional detention facility.

GROUNDWATER CONSIDERATIONS

A Geotechnical Engineering Report is currently being prepared. Groundwater is not anticipated to be encountered. A perimeter drain system is not anticipated to be provided for this Project.

SUMMARY

COMPLIANCE WITH STANDARDS

The drainage design presented within this report for Veterans Victory at Waterview North, conforms to the City of Colorado Springs Storm Drainage Criteria and the Urban Drainage and Flood Control District Manual. Additionally, the Site runoff and storm drain facilities will not adversely affect the water quality or peak flows downstream in Jimmy Camp Creek and surrounding developments.

REFERENCES

1. City of Colorado Springs Drainage Criteria Manual, May 2014 (Revised January 2021).

2. Mile High Flood District Urban Storm Drainage Criteria Manual (MHFDDCM), Vol. 1, prepared by Wright-McLaughlin Engineers, June 2001, with latest revisions.

3. Flood Insurance Rate Map, El Paso County, Colorado and Incorporated Areas, Map Number 08041C0768G, Effective Date December 7, 2018, prepared by the Federal Emergency Management Agency (FEMA).

4. Master Development Drainage Plan for Villages at Waterview North, prepared by Kimley-Horn and Associates, Prepared: September 29, 2022.

APPENDIX

APPENDIX A – VICINITY MAP

Veteran's Victory at Waterview North

Vicinity Map

APPENDIX B – FEMA FIRM PANEL AND SOILS MAP

National Flood Hazard Layer FIRMette

FEMA

104°41'2"W 38°46'7"N

104°40'24"W 38°45'39"N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

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

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

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

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

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/3/2022 at 9:17 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for El Paso County Area, Colorado

August 1, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

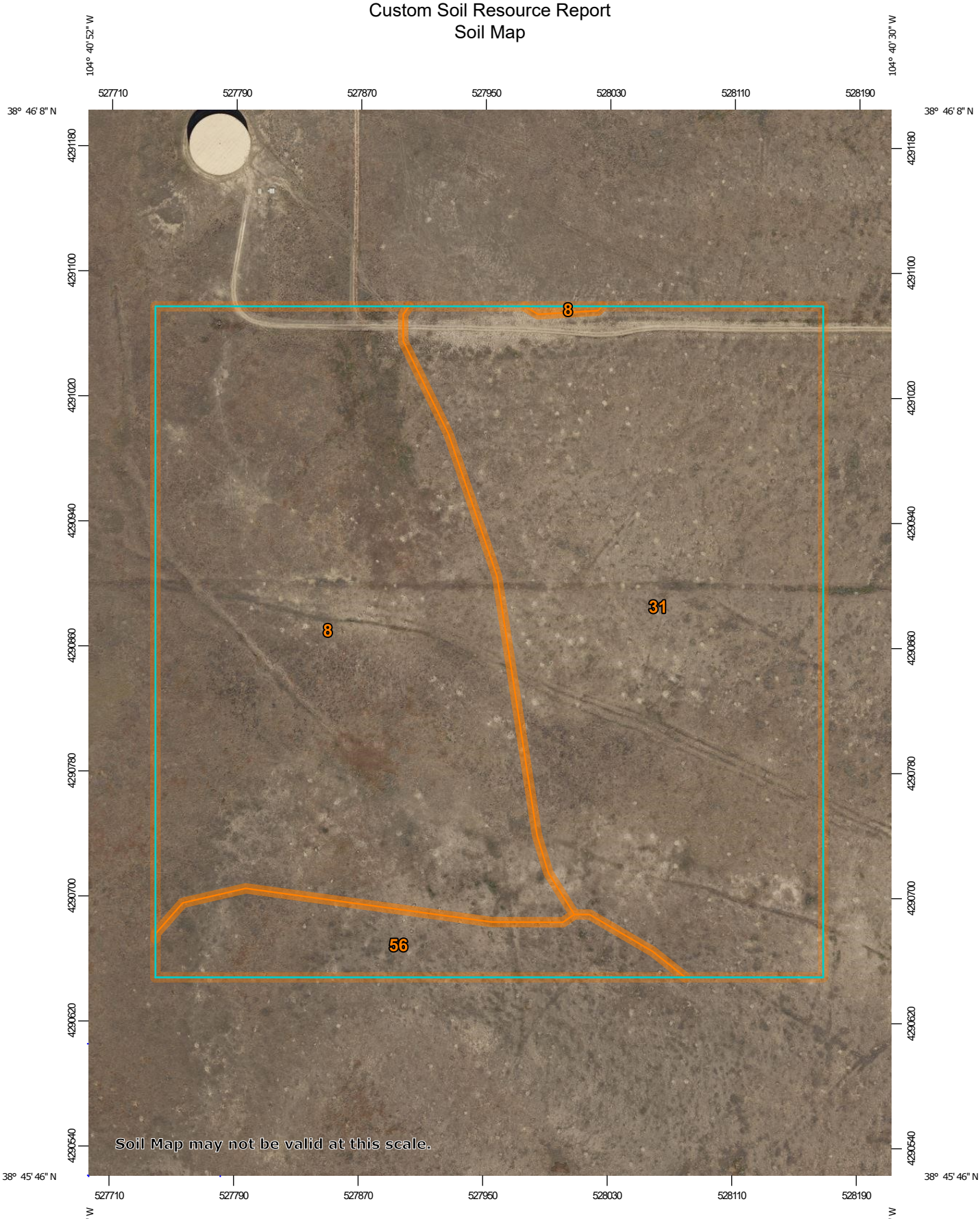
alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:3,320 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 150 300 600 900

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

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

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	20.6	45.0%
31	Fort Collins loam, 3 to 8 percent slopes	21.7	47.6%
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	3.4	7.4%
Totals for Area of Interest		**45.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent

Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

31—Fort Collins loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 3684
Elevation: 5,200 to 6,500 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 48 to 52 degrees F
Farmland classification: Not prime farmland

Map Unit Composition

Fort collins and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fort Collins

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

A - 0 to 9 inches: loam
Bt - 9 to 16 inches: clay loam
Bk - 16 to 21 inches: clay loam
Ck - 21 to 60 inches: loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R067BY002CO - Loamy Plains
Other vegetative classification: LOAMY PLAINS (069AY006CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

56—Nelson-Tassel fine sandy loams, 3 to 18 percent slopes

Map Unit Setting

National map unit symbol: 3690
Elevation: 5,600 to 6,400 feet
Mean annual precipitation: 12 to 14 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 135 to 155 days
Farmland classification: Not prime farmland

Map Unit Composition

Nelson and similar soils: 55 percent
Tassel and similar soils: 40 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Nelson

Setting

Landform: Hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous residuum weathered from interbedded sedimentary rock

Typical profile

A - 0 to 5 inches: fine sandy loam
Ck - 5 to 23 inches: fine sandy loam
Cr - 23 to 27 inches: weathered bedrock

Properties and qualities

Slope: 3 to 12 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R067BY045CO - Shaly Plains
Other vegetative classification: SHALY PLAINS (069AY046CO)
Hydric soil rating: No

Description of Tassel

Setting

Landform: Hills
Landform position (three-dimensional): Side slope, crest
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Calcareous slope alluvium over residuum weathered from sandstone

Typical profile

A - 0 to 4 inches: fine sandy loam
C - 4 to 10 inches: fine sandy loam
Cr - 10 to 14 inches: weathered bedrock

Properties and qualities

Slope: 3 to 18 percent
Depth to restrictive feature: 6 to 20 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Available water supply, 0 to 60 inches: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: R067BY045CO - Shaly Plains
Other vegetative classification: SHALY PLAINS (069AY046CO)

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 4 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

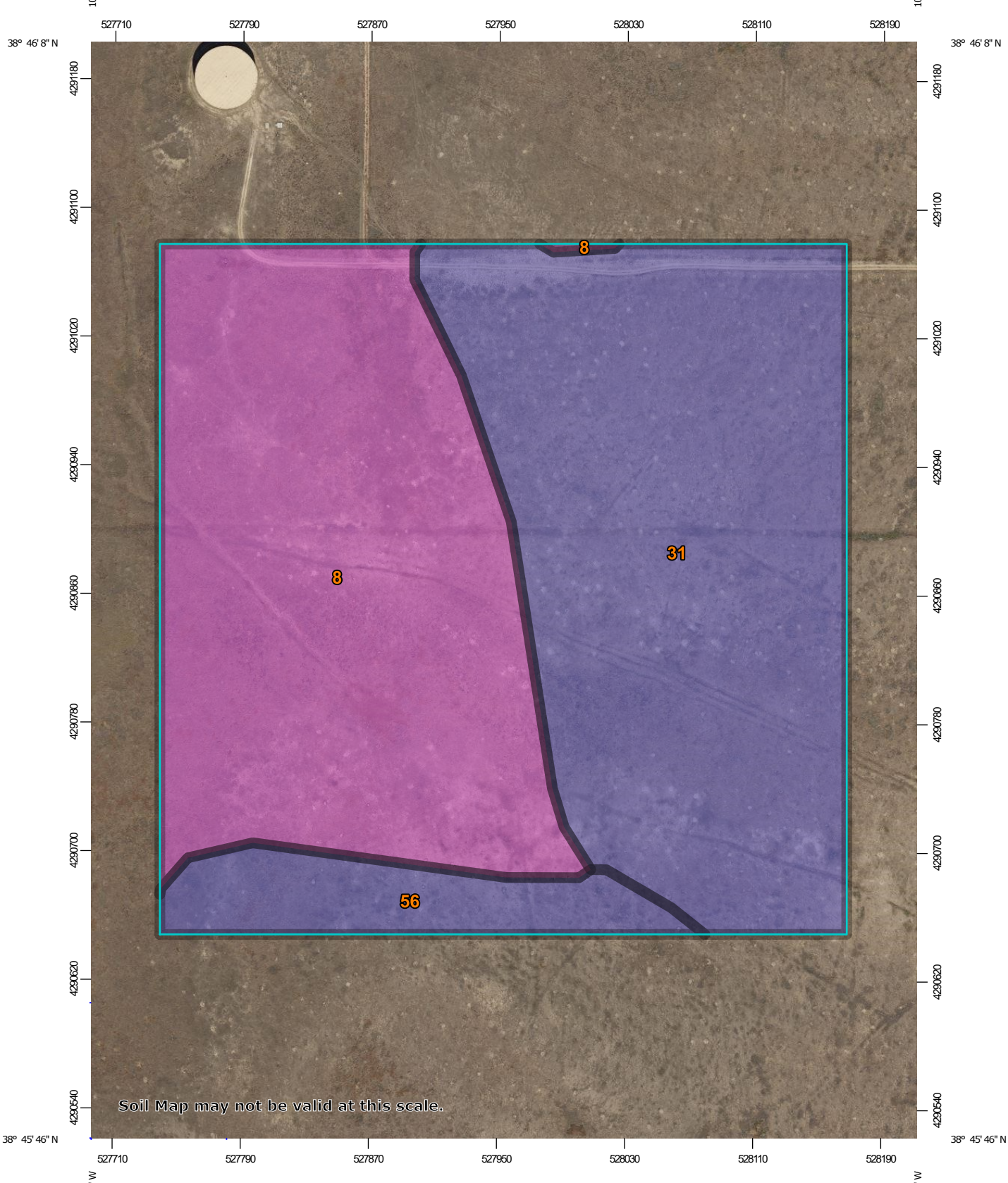
Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.



Map Scale: 1:3,320 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 45 90 180 270

Feet
0 150 300 600 900

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

MAP LEGEND

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

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

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

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	20.6	45.0%
31	Fort Collins loam, 3 to 8 percent slopes	B	21.7	47.6%
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	B	3.4	7.4%
Totals for Area of Interest			**45.7**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

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APPENDIX C – HYDROLOGIC CALCULATIONS

SUMMARY - EXISTING RUNOFF TABLE						
DESIGN POINT	**BASIN DESIGNATION**	**BASIN AREA (ACRES)**	**DIRECT 5-YR RUNOFF (CFS)**	**DIRECT 100-YR RUNOFF (CFS)**	**CUMULATIVE 5-YR RUNOFF (CFS)**	**CUMULATIVE 100-YR RUNOFF (CFS)**
1	EX-1	10.06	2.83	20.81	5.46	40.10
2	OS-1	2.77	0.81	5.93	0.81	5.93
3	OS-2	6.14	1.82	13.36	1.82	13.36

IDF Equations:

I_{100} = -2.52ln(D) + 12.735
I_{50} = -2.25ln(D) + 11.375
I_{25} -2.00ln(D) + 10.111
I_{10} -1.75ln(D) + 8.847
I_{5} -1.50ln(D) + 7.583
I_{2} -1.19ln(D) + 6.035

Where:
I = Rainfall Intensity (in/hr)
D= Duration (minutes)

	2-yr	5-yr	10-yr	100-yr
P_1 =	1.19	1.5	1.75	2.52

*The Design Point Rainfall Values and Time Intensity Frequency Tabulation are found in Table 6-2 and Figure 6-5 respectively, of the Colorado Springs Drainage Criteria Manual, Volume 1

Weighted Imperviousness Calculations (Existing)

SUB-BASIN	AREA (SF)	AREA (Acres)	ROOF AREA	ROOF IMPERVIOUSNESS	ROOF C2	ROOF C5	ROOF C10	ROOF C100	LANDSCAPE AREA	LANDSCAPE IMPERVIOUSNESS	LANDSCAPE C2	LANDSCAPE C5	LANDSCAPE C10	LANDSCAPE C100	PAVEMENT AREA	PAVEMENT IMPERVIOUSNESS	PAVEMENT C2	PAVEMENT C5	PAVEMENT C10	PAVEMENT C100	WEIGHTED IMPERVIOUSNESS	WEIGHTED COEFFICIENTS C2	WEIGHTED COEFFICIENTS C5	WEIGHTED COEFFICIENTS C10	WEIGHTED COEFFICIENTS C100
EXISTING BASINS ON PROPOSED SITE																									
EX-1	438,137	10.06	0	90%	0.71	0.73	0.75	0.81	438,137	2%	0.02	0.08	0.15	0.35	0	100%	0.89	0.90	0.92	0.96	2.0%	0.02	0.08	0.15	0.35
TOTAL	438,137	10.06	0	90%	0.71	0.73	0.75	0.81	438,137	2%	0.02	0.08	0.15	0.35	0	100%	0.89	0.90	0.92	0.96	2.0%	0.02	0.08	0.15	0.35
OFFSITE BASINS THAT ENTER THE SITE																									
OS-1	120,493	2.77	0	90%	0.71	0.73	0.75	0.81	120,493	2%	0.02	0.08	0.15	0.35	0	100%	0.89	0.90	0.92	0.96	2.0%	0.02	0.08	0.15	0.35
OS-2	267,625	6.14	0	90%	0.71	0.73	0.75	0.81	267,625	2%	0.02	0.08	0.15	0.35	0	100%	0.89	0.90	0.92	0.96	2.0%	0.02	0.08	0.15	0.35
TOTAL	388,118	8.91	0	90%	0.71	0.73	0.75	0.81	388,118	2%	0.02	0.08	0.15	0.35	0	100%	0.89	0.90	0.92	0.96	2.0%	0.02	0.08	0.15	0.35

Veteran's Villas - Drainage Report
Existing Runoff Calculations
Time of Concentration

Watercourse Coefficient

Forest & Meadow	2.50	Short Grass Pasture & Lawns	7.00	Grassed Waterway	15.00
Fallow or Cultivation	5.00	Nearly Bare Ground	10.00	Paved Area & Shallow Gutter	20.00

	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)					T(c) CHECK (URBANIZED BASINS)			FINAL T(c)
DESIGN POINT	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	TOTAL LENGTH	L/180+10	min.
1	EX-1	438,137	10.06	0.08	100	6.4%	10.1	798	6.1%	7.00	1.7	7.7	17.8	898	15.0	15.0
2	OS-1	120,493	2.77	0.08	100	9.0%	9.0	592	4.6%	7.00	1.5	6.6	15.6	692	13.8	13.8
3	OS-2	267,625	6.14	0.08	100	9.1%	9.0	487	5.0%	7.00	1.6	5.2	14.2	587	13.3	13.3

Veteran's Villas - Drainage Report
Existing Runoff Calculations ***Design Storm 5 Year***
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
1	EX-1	10.06	0.08	15.0	0.80	3.52	2.83				5.46	EX combined with OS basins
2	OS-1	2.77	0.08	13.8	0.22	3.65	0.81				0.81	
3	OS-2	6.14	0.08	13.3	0.49	3.70	1.82				1.82	

Veteran's Villas - Drainage Report
Existing Runoff Calculations ***Design Storm*** ***100 Year***
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
1	EX-1	10.06	0.35	15.0	3.52	5.91	20.81				40.10	EX combined with OS basins
2	OS-1	2.77	0.35	13.8	0.97	6.12	5.93				5.93	
3	OS-2	6.14	0.35	13.3	2.15	6.21	13.36				13.36	

SUMMARY - PROPOSED RUNOFF TABLE

DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)	Weighted Imperviousness
1	P-1	0.19	0.69	1.33	0.69	1.33	78.1%
2	P-2	0.10	0.30	0.63	0.30	0.63	61.8%
3	P-3	0.85	1.82	3.97	1.82	3.97	58.0%
4	P-4	0.37	1.50	2.79	1.50	2.79	87.4%
5	P-5	0.39	1.45	2.78	1.45	2.78	78.8%
6	P-6	1.18	1.77	4.31	1.77	4.31	44.5%
7	P-7	0.15	0.38	0.78	0.38	0.78	67.5%
8	P-8	0.19	0.74	1.40	0.74	1.40	84.0%
9	P-9	0.65	1.83	3.77	1.83	3.77	64.3%
10	P-10	0.05	0.09	0.23	0.09	0.23	39.6%
11	P-11	0.29	0.93	1.88	0.93	1.88	66.9%
12	P-12	0.32	0.77	1.62	0.77	1.62	61.9%
13	P-13	0.07	0.19	0.40	0.19	0.40	60.1%
14	P-14	0.23	0.46	0.99	0.46	0.99	59.6%
15	P-15	0.34	1.34	2.52	1.34	2.52	85.0%
16	P-16	0.67	1.27	2.86	1.27	2.86	50.8%
17	P-17	0.25	0.46	1.04	0.46	1.04	52.1%
18	P-18	0.28	0.47	1.11	0.47	1.11	47.2%
19	P-19	0.33	0.47	1.21	0.47	1.21	39.8%
20	P-20	0.26	1.06	1.98	1.06	1.98	86.2%

21	P-21	0.39	1.22	2.41	1.22	2.41	73.0%
22	P-22	0.13	0.38	0.79	0.38	0.79	62.7%
23	P-23	0.20	0.41	0.93	0.41	0.93	49.0%
24	OS-1	0.52	0.55	1.52	0.55	1.52	31.8%
25	OS-2	1.84	3.60	8.61	3.60	8.61	45.4%
26	OS-3	0.08	0.20	0.43	0.20	0.43	55.8%
27	OS-4	0.01	0.00	0.02	0.00	0.02	2.0%
28	OS-5	2.05	6.57	12.97	6.57	12.97	73.8%
29	OS-6	1.60	4.00	8.64	4.00	8.64	57.5%
30	OS-7	1.46	0.56	3.65	0.56	3.65	3.6%
31	OS-8	0.80	0.31	2.02	0.31	2.02	3.6%

Weighted Imperviousness Calculations (Proposed)

SUB-BASIN	AREA (SF)	AREA (Acres)	ROOF AREA	ROOF IMPERVIOUSNESS	ROOF C2	ROOF C5	ROOF C10	ROOF C100	LANDSCAPE AREA	LANDSCAPE IMPERVIOUSNESS	LANDSCAPE C2	LANDSCAPE C5	LANDSCAPE C10	LANDSCAPE C100	PAVEMENT AREA	PAVEMENT IMPERVIOUSNESS	PAVEMENT C2	PAVEMENT C5	PAVEMENT C10	PAVEMENT C100	WEIGHTED IMPERVIOUSNESS	WEIGHTED COEFFICIENTS C2	WEIGHTED COEFFICIENTS C5	WEIGHTED COEFFICIENTS C10	WEIGHTED COEFFICIENTS C100
EXISTING BASINS ON PROPOSED SITE																									
P-1	8,205	0.19	0	90%	0.71	0.73	0.75	0.81	1,832	2%	0.02	0.08	0.15	0.35	6,373	100%	0.89	0.90	0.92	0.96	78.1%	0.70	0.72	0.75	0.82
P-2	4,375	0.10	0	90%	0.71	0.73	0.75	0.81	1,706	2%	0.02	0.08	0.15	0.35	2,669	100%	0.89	0.90	0.92	0.96	61.8%	0.55	0.58	0.62	0.72
P-3	36,849	0.85	20,860	90%	0.71	0.73	0.75	0.81	13,677	2%	0.02	0.08	0.15	0.35	2,312	100%	0.89	0.90	0.92	0.96	58.0%	0.47	0.50	0.54	0.65
P-4	16,104	0.37	0	90%	0.71	0.73	0.75	0.81	2,063	2%	0.02	0.08	0.15	0.35	14,041	100%	0.89	0.90	0.92	0.96	87.4%	0.78	0.79	0.82	0.88
P-5	16,863	0.39	0	90%	0.71	0.73	0.75	0.81	3,652	2%	0.02	0.08	0.15	0.35	13,211	100%	0.89	0.90	0.92	0.96	78.8%	0.70	0.72	0.75	0.83
P-6	51,603	1.18	21,166	90%	0.71	0.73	0.75	0.81	27,090	2%	0.02	0.08	0.15	0.35	3,347	100%	0.89	0.90	0.92	0.96	44.5%	0.36	0.40	0.45	0.58
P-7	6,425	0.15	4,340	90%	0.71	0.73	0.75	0.81	1,690	2%	0.02	0.08	0.15	0.35	395	100%	0.89	0.90	0.92	0.96	67.5%	0.54	0.57	0.60	0.70
P-8	8,163	0.19	0	90%	0.71	0.73	0.75	0.81	1,334	2%	0.02	0.08	0.15	0.35	6,829	100%	0.89	0.90	0.92	0.96	84.0%	0.75	0.77	0.79	0.86
P-9	28,196	0.65	0	90%	0.71	0.73	0.75	0.81	10,271	2%	0.02	0.08	0.15	0.35	17,925	100%	0.89	0.90	0.92	0.96	64.3%	0.57	0.60	0.64	0.74
P-10	2,154	0.05	0	90%	0.71	0.73	0.75	0.81	1,327	2%	0.02	0.08	0.15	0.35	827	100%	0.89	0.90	0.92	0.96	39.6%	0.35	0.39	0.45	0.58
P-11	12,516	0.29	0	90%	0.71	0.73	0.75	0.81	4,221	2%	0.02	0.08	0.15	0.35	8,295	100%	0.89	0.90	0.92	0.96	66.9%	0.60	0.62	0.66	0.75
P-12	14,070	0.32	3,248	90%	0.71	0.73	0.75	0.81	5,145	2%	0.02	0.08	0.15	0.35	5,677	100%	0.89	0.90	0.92	0.96	61.9%	0.53	0.56	0.60	0.70
P-13	2,844	0.07	0	90%	0.71	0.73	0.75	0.81	1,159	2%	0.02	0.08	0.15	0.35	1,685	100%	0.89	0.90	0.92	0.96	60.1%	0.54	0.57	0.61	0.71
P-14	9,841	0.23	6,438	90%	0.71	0.73	0.75	0.81	3,401	2%	0.02	0.08	0.15	0.35	2	100%	0.89	0.90	0.92	0.96	59.6%	0.47	0.51	0.54	0.65
P-15	14,830	0.34	0	90%	0.71	0.73	0.75	0.81	2,264	2%	0.02	0.08	0.15	0.35	12,566	100%	0.89	0.90	0.92	0.96	85.0%	0.76	0.77	0.80	0.87
P-16	29,237	0.67	2,404	90%	0.71	0.73	0.75	0.81	14,420	2%	0.02	0.08	0.15	0.35	12,413	100%	0.89	0.90	0.92	0.96	50.8%	0.45	0.48	0.53	0.65
P-17	11,064	0.25	6,298	90%	0.71	0.73	0.75	0.81	4,766	2%	0.02	0.08	0.15	0.35	0	100%	0.89	0.90	0.92	0.96	52.1%	0.41	0.45	0.49	0.61
P-18	12,254	0.28	6,301	90%	0.71	0.73	0.75	0.81	5,953	2%	0.02	0.08	0.15	0.35	0	100%	0.89	0.90	0.92	0.96	47.2%	0.37	0.41	0.46	0.59
P-19	14,338	0.33	6,163	90%	0.71	0.73	0.75	0.81	8,175	2%	0.02	0.08	0.15	0.35	0	100%	0.89	0.90	0.92	0.96	39.8%	0.32	0.36	0.41	0.55
P-20	11,345	0.26	0	90%	0.71	0.73	0.75	0.81	1,598	2%	0.02	0.08	0.15	0.35	9,747	100%	0.89	0.90	0.92	0.96	86.2%	0.77	0.78	0.81	0.87
P-21	16,841	0.39	0	90%	0.71	0.73	0.75	0.81	4,636	2%	0.02	0.08	0.15	0.35	12,205	100%	0.89	0.90	0.92	0.96	73.0%	0.65	0.67	0.71	0.79
P-22	5,479	0.13	0	90%	0.71	0.73	0.75	0.81	2,085	2%	0.02	0.08	0.15	0.35	3,394	100%	0.89	0.90	0.92	0.96	62.7%	0.56	0.59	0.63	0.73
P-23	8,633	0.20	0	90%	0.71	0.73	0.75	0.81	4,490	2%	0.02	0.08	0.15	0.35	4,143	100%	0.89	0.90	0.92	0.96	49.0%	0.44	0.47	0.52	0.64
OS-1	22,476	0.52	4,034	90%	0.71	0.73	0.75	0.81	15,221	2%	0.02	0.08	0.15	0.35	3,221	100%	0.89	0.90	0.92	0.96	31.8%	0.27	0.31	0.37	0.52
OS-2	79,947	1.84	25,200	90%	0.71	0.73	0.75	0.81	41,968	2%	0.02	0.08	0.15	0.35	12,779	100%	0.89	0.90	0.92	0.96	45.4%	0.38	0.42	0.46	0.59
TOTAL	444,652	10.21	106,452	90%	0.71	0.73	0.75	0.81	184,144	2%	0.02	0.08	0.15	0.35	154,056	100%	0.89	0.90	0.92	0.96	57.0%	0.49	0.52	0.56	0.67
OFFSITE BASINS THAT ENTER THE SITE																									
OS-3	3,290	0.08	0	90%	0.71	0.73	0.75	0.81	1,485	2%	0.02	0.08	0.15	0.35	1,805	100%	0.89	0.90	0.92	0.96	55.8%	0.50	0.53	0.57	0.68
OS-4	312	0.01	0	90%	0.71	0.73	0.75	0.81	312	2%	0.02	0.08	0.15	0.35	0	100%	0.89	0.90	0.92	0.96	2.0%	0.02	0.08	0.15	0.35
OS-5	89,228	2.05	22,253	90%	0.71	0.73	0.75	0.81	21,576	2%	0.02	0.08	0.15	0.35	45,399	100%	0.89	0.90	0.92	0.96	73.8%	0.63	0.66	0.69	0.78
OS-6	69,623	1.60	14,747	90%	0.71	0.73	0.75	0.81	28,681	2%	0.02	0.08	0.15	0.35	26,195	100%	0.89	0.90	0.92	0.96	57.5%	0.49	0.53	0.57	0.68
OS-7	63,632	1.46	0	90%	0.71	0.73	0.75	0.81	62,609	2%	0.02	0.08	0.15	0.35	1,023	100%	0.89	0.90	0.92	0.96	3.6%	0.03	0.09	0.16	0.36
OS-8	34,905	0.80	0	90%	0.71	0.73	0.75	0.81	34,337	2%	0.02	0.08	0.15	0.35	568	100%	0.89	0.90	0.92	0.96	3.6%	0.03	0.09	0.16	0.36
TOTAL	260,990	5.99	37,000	90%	0.71	0.73	0.75	0.81	149,000	2%	0.02	0.08	0.15	0.35	74,990	100%	0.89	0.90	0.92	0.96	42.6%	0.37	0.41	0.46	0.59

Veteran's Villas - Drainage Report
Proposed Runoff Calculations
Time of Concentration

Watercourse Coefficient

Forest & Meadow	2.50	Short Grass Pasture & Lawns	7.00	Grassed Waterway	15.00
Fallow or Cultivation	5.00	Nearly Bare Ground	10.00	Paved Area & Shallow Gutter	20.00

	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)					T(c) CHECK (URBANIZED BASINS)			FINAL T(c)
DESIGN POINT	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	TOTAL LENGTH	L/180+10	min.
1	P-1	8,205	0.19	0.72	100	3.0%	4.9	72	2.9%	20.00	3.4	0.4	5.3	172	11.0	5.3
2	P-2	4,375	0.10	0.58	26	4.3%	3.0	88	3.1%	20.00	3.5	0.4	5.0	114	10.6	5.0
3	P-3	36,849	0.85	0.50	100	3.6%	7.2	136	3.7%	7.00	1.3	1.7	8.9	236	11.3	8.9
4	P-4	16,104	0.37	0.79	50	2.6%	2.9	199	0.5%	20.00	1.4	2.3	5.2	249	11.4	5.2
5	P-5	16,863	0.39	0.72	31	2.9%	2.7	163	0.5%	20.00	1.4	1.9	5.0	194	11.1	5.0
6	P-6	51,603	1.18	0.40	100	3.1%	8.8	423	0.4%	7.00	0.4	15.9	24.7	523	12.9	12.9
7	P-7	6,425	0.15	0.57	50	1.0%	6.9	83	4.0%	7.00	1.4	1.0	7.9	133	10.7	7.9
8	P-8	8,163	0.19	0.77	60	3.4%	3.2	83	0.5%	20.00	1.4	1.0	5.0	143	10.8	5.0
9	P-9	28,196	0.65	0.60	70	4.2%	4.7	181	0.5%	20.00	1.4	2.1	6.8	251	11.4	6.8
10	P-10	2,154	0.05	0.39	47	2.5%	6.5	25	1.3%	20.00	2.3	0.2	6.7	72	10.4	6.7
11	P-11	12,516	0.29	0.62	40	3.7%	3.6	100	1.3%	20.00	2.3	0.7	5.0	140	10.8	5.0
12	P-12	14,070	0.32	0.56	120	2.1%	8.4	70	0.6%	20.00	1.5	0.8	9.2	190	11.1	9.2
13	P-13	2,844	0.07	0.57	21	12.9%	1.9	58	1.3%	20.00	2.3	0.4	5.0	79	10.4	5.0
14	P-14	9,841	0.23	0.51	80	1.0%	9.7	82	0.1%	7.00	0.2	6.2	15.9	162	10.9	10.9

Veteran's Villas - Drainage Report
Proposed Runoff Calculations
Time of Concentration

Watercourse Coefficient

Forest & Meadow	2.50	Short Grass Pasture & Lawns	7.00	Grassed Waterway 15.00
Fallow or Cultivation	5.00	Nearly Bare Ground	10.00	Paved Area & Shallow Gutter 20.00

	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)					T(c) CHECK (URBANIZED BASINS)			FINAL T(c)
DESIGN POINT	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	TOTAL LENGTH	L/180+10	min.
15	P-15	14,830	0.34	0.77	51	2.1%	3.3	167	0.5%	20.00	1.4	2.0	5.3	218	11.2	5.3
16	P-16	29,237	0.67	0.48	100	1.3%	10.4	184	1.9%	20.00	2.8	1.1	11.5	284	11.6	11.5
17	P-17	11,064	0.25	0.45	80	1.0%	10.6	88	0.1%	7.00	0.2	6.6	17.2	168	10.9	10.9
18	P-18	12,254	0.28	0.41	80	1.0%	11.2	88	0.1%	7.00	0.2	6.6	17.8	168	10.9	10.9
19	P-19	14,338	0.33	0.36	80	1.0%	12.1	88	0.1%	7.00	0.2	6.6	18.7	168	10.9	10.9
20	P-20	11,345	0.26	0.78	52	2.6%	3.0	168	1.1%	20.00	2.1	1.3	5.0	220	11.2	5.0
21	P-21	16,841	0.39	0.67	85	3.0%	5.0	160	0.5%	20.00	1.4	1.9	6.9	245	11.4	6.9
22	P-22	5,479	0.13	0.59	50	4.8%	3.9	88	3.2%	20.00	3.6	0.4	5.0	138	10.8	5.0
23	P-23	8,633	0.20	0.47	100	2.6%	8.3	68	1.7%	20.00	2.6	0.4	8.7	168	10.9	8.7
24	OS-1	22,476	0.52	0.31	100	6.4%	7.8	1066	3.0%	7.00	1.2	14.7	22.5	1166	16.5	16.5
25	OS-2	79,947	1.84	0.42	24	4.9%	3.6	510	1.8%	20.00	2.7	3.2	6.8	534	13.0	6.8
26	OS-3	3,290	0.08	0.53	68	3.0%	6.0	0			0.0	0.0	6.0	68	10.4	6.0
27	OS-4	312	0.01	0.08	21	0.3%	12.8	0			0.0	0.0	12.8	21	10.1	10.1
28	OS-5	89,228	2.05	0.66	57	9.6%	2.9	547	2.0%	20.00	2.8	3.2	6.1	604	13.4	6.1

Veteran's Villas - Drainage Report
Proposed Runoff Calculations
Time of Concentration

Watercourse Coefficient

Forest & Meadow	2.50	Short Grass Pasture & Lawns	7.00	Grassed Waterway	15.00
Fallow or Cultivation	5.00	Nearly Bare Ground	10.00	Paved Area & Shallow Gutter	20.00

	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)					T(c) CHECK (URBANIZED BASINS)			FINAL T(c)
DESIGN POINT	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	TOTAL LENGTH	L/180+10	min.
29	OS-6	69,623	1.60	0.53	100	24.0%	3.6	506	2.0%	20.00	2.8	3.0	6.6	606	13.4	6.6
30	OS-7	63,632	1.46	0.09	100	10.3%	8.5	198	10.3%	7.00	2.2	1.5	10.0	298	11.7	10.0
31	OS-8	34,905	0.80	0.09	100	11.3%	8.2	197	10.0%	7.00	2.2	1.5	9.7	297	11.7	9.7

Veteran's Villas - Drainage Report
Proposed Runoff Calculations ***Design Storm 5 Year***
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
1	P-1	0.19	0.72	5.3	0.14	5.09	0.69				0.69	P-1 combined with OS-3
2	P-2	0.10	0.58	5.0	0.06	5.17	0.30				0.30	P-2 combined with OS-4
3	P-3	0.85	0.50	8.9	0.42	4.31	1.82				1.82	
4	P-4	0.37	0.79	5.2	0.29	5.10	1.50				1.50	
5	P-5	0.39	0.72	5.0	0.28	5.17	1.45				1.45	
6	P-6	1.18	0.40	12.9	0.47	3.75	1.77				1.77	
7	P-7	0.15	0.57	7.9	0.08	4.48	0.38				0.38	
8	P-8	0.19	0.77	5.0	0.14	5.17	0.74				0.74	
9	P-9	0.65	0.60	6.8	0.39	4.70	1.83				1.83	
10	P-10	0.05	0.39	6.7	0.02	4.73	0.09				0.09	
11	P-11	0.29	0.62	5.0	0.18	5.17	0.93				0.93	
12	P-12	0.32	0.56	9.2	0.18	4.26	0.77				0.77	
13	P-13	0.07	0.57	5.0	0.04	5.17	0.19				0.19	
14	P-14	0.23	0.51	10.9	0.11	4.00	0.46				0.46	

Veteran's Villas - Drainage Report
Proposed Runoff Calculations

Design Storm 5 Year

(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
15	P-15	0.34	0.77	5.3	0.26	5.09	1.34				1.34	
16	P-16	0.67	0.48	11.5	0.32	3.92	1.27				1.27	
17	P-17	0.25	0.45	10.9	0.11	4.00	0.46				0.46	
18	P-18	0.28	0.41	10.9	0.12	4.00	0.47				0.47	
19	P-19	0.33	0.36	10.9	0.12	4.00	0.47				0.47	
20	P-20	0.26	0.78	5.0	0.20	5.17	1.06				1.06	
21	P-21	0.39	0.67	6.9	0.26	4.69	1.22				1.22	
22	P-22	0.13	0.59	5.0	0.07	5.17	0.38				0.38	
23	P-23	0.20	0.47	8.7	0.09	4.33	0.41				0.41	
24	OS-1	0.52	0.31	16.5	0.16	3.38	0.55				0.55	
25	OS-2	1.84	0.42	6.8	0.76	4.71	3.60				3.60	
26	OS-3	0.08	0.53	6.0	0.04	4.90	0.20				0.20	
27	OS-4	0.01	0.08	10.1	0.00	4.11	0.00				0.00	
28	OS-5	2.05	0.66	6.1	1.35	4.86	6.57				6.57	

Veteran's Villas - Drainage Report
Proposed Runoff Calculations **Design Storm 5 Year**
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
29	OS-6	1.60	0.53	6.6	0.84	4.76	4.00				4.00	
30	OS-7	1.46	0.09	10.0	0.14	4.13	0.56				0.56	
31	OS-8	0.80	0.09	9.7	0.07	4.18	0.31				0.31	

Veteran's Villas - Drainage Report
Proposed Runoff Calculations ***Design Storm*** ***100 Year***
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
1	P-1	0.19	0.82	5.3	0.16	8.56	1.33				1.33	P-1 combined with OS-3
2	P-2	0.10	0.72	5.0	0.07	8.68	0.63				0.63	P-2 combined with OS-4
3	P-3	0.85	0.65	8.9	0.55	7.23	3.97				3.97	
4	P-4	0.37	0.88	5.2	0.33	8.56	2.79				2.79	
5	P-5	0.39	0.83	5.0	0.32	8.68	2.78				2.78	
6	P-6	1.18	0.58	12.9	0.69	6.29	4.31				4.31	
7	P-7	0.15	0.70	7.9	0.10	7.53	0.78				0.78	
8	P-8	0.19	0.86	5.0	0.16	8.68	1.40				1.40	
9	P-9	0.65	0.74	6.8	0.48	7.89	3.77				3.77	
10	P-10	0.05	0.58	6.7	0.03	7.95	0.23				0.23	
11	P-11	0.29	0.75	5.0	0.22	8.68	1.88				1.88	
12	P-12	0.32	0.70	9.2	0.23	7.16	1.62				1.62	
13	P-13	0.07	0.71	5.0	0.05	8.68	0.40				0.40	
14	P-14	0.23	0.65	10.9	0.15	6.72	0.99				0.99	

Veteran's Villas - Drainage Report
Proposed Runoff Calculations **Design Storm** **100 Year**
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
15	P-15	0.34	0.87	5.3	0.30	8.55	2.52				2.52	
16	P-16	0.67	0.65	11.5	0.43	6.58	2.86				2.86	
17	P-17	0.25	0.61	10.9	0.16	6.72	1.04				1.04	
18	P-18	0.28	0.59	10.9	0.16	6.72	1.11				1.11	
19	P-19	0.33	0.55	10.9	0.18	6.72	1.21				1.21	
20	P-20	0.26	0.87	5.0	0.23	8.68	1.98				1.98	
21	P-21	0.39	0.79	6.9	0.31	7.87	2.41				2.41	
22	P-22	0.13	0.73	5.0	0.09	8.68	0.79				0.79	
23	P-23	0.20	0.64	8.7	0.13	7.27	0.93				0.93	
24	OS-1	0.52	0.52	16.5	0.27	5.67	1.52				1.52	
25	OS-2	1.84	0.59	6.8	1.09	7.92	8.61				8.61	
26	OS-3	0.08	0.68	6.0	0.05	8.22	0.43				0.43	
27	OS-4	0.01	0.35	10.1	0.00	6.91	0.02				0.02	
28	OS-5	2.05	0.78	6.1	1.59	8.17	12.97				12.97	

Veteran's Villas - Drainage Report
Proposed Runoff Calculations **Design Storm** **100 Year**
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
29	OS-6	1.60	0.68	6.6	1.08	7.99	8.64				8.64	
30	OS-7	1.46	0.36	10.0	0.53	6.94	3.65				3.65	
31	OS-8	0.80	0.36	9.7	0.29	7.01	2.02				2.02	

APPENDIX D – HYDRAULIC CALCULATIONS

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	P3	P4	P5
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	AREA	AREA	AREA
Hydraulic Condition	Swale	Swale	Swale
Inlet Type	CDOT Type C	CDOT Type C	CDOT Type C

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.8	1.5	1.5
Major Q_{Known} (cfs)	4.0	2.8	2.8

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	User-Defined	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.6	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	3.7	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**2.4**	**1.5**	**1.5**
Major Total Design Peak Flow, Q (cfs)	**7.6**	**2.8**	**2.8**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.3	0.3
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	1.2	1.1

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	P6	P7	P8
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	AREA	AREA	AREA
Hydraulic Condition	Swale	Swale	Swale
Inlet Type	CDOT Type C (Depressed)	CDOT Type C	CDOT Type C

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.8	0.4	0.7
Major Q_{Known} (cfs)	4.3	0.8	1.4

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	P4
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.3
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	1.2

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.8**	**0.4**	**1.1**
Major Total Design Peak Flow, Q (cfs)	**4.3**	**0.8**	**2.6**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.1
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	0.2	1.0

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	P9	P10	P11
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	AREA	STREET	AREA
Hydraulic Condition	Swale	On Grade	Swale
Inlet Type	CDOT Type C	Colorado Springs D-10-R	CDOT Type C

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.8	0.1	0.9
Major Q_{Known} (cfs)	3.8	0.2	1.9

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	P5	User-Defined	User-Defined
Minor Bypass Flow Received, Q_b (cfs)	0.3	0.0	0.1
Major Bypass Flow Received, Q_b (cfs)	1.1	2.1	3.1

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**2.1**	**0.1**	**1.0**
Major Total Design Peak Flow, Q (cfs)	**4.9**	**2.3**	**5.0**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.7	0.0	0.1
Major Flow Bypassed Downstream, Q_b (cfs)	2.7	0.0	2.7

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	P12	P13	P14
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	AREA	STREET	AREA
Hydraulic Condition	Swale	On Grade	Swale
Inlet Type	CDOT Type C	Colorado Springs D-10-R	CDOT Type C

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.8	0.2	0.5
Major Q_{Known} (cfs)	1.6	0.4	1.0

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	P9	No Bypass Flow Received	User-Defined
Minor Bypass Flow Received, Q_b (cfs)	0.7	0.0	2.2
Major Bypass Flow Received, Q_b (cfs)	2.7	0.0	4.3

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.5**	**0.2**	**2.7**
Major Total Design Peak Flow, Q (cfs)	**4.3**	**0.4**	**5.3**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.3	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	2.2	0.0	0.0

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	P15	P16	P17
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	AREA	AREA	AREA
Hydraulic Condition	Swale	Swale	Swale
Inlet Type	CDOT Type C	CDOT Type C	CDOT Type C

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.3	1.3	0.5
Major Q_{Known} (cfs)	2.5	2.9	1.0

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	P11	P12	User-Defined
Minor Bypass Flow Received, Q_b (cfs)	0.1	0.3	2.2
Major Bypass Flow Received, Q_b (cfs)	2.7	2.2	4.3

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.4**	**1.6**	**2.7**
Major Total Design Peak Flow, Q (cfs)	**5.2**	**5.1**	**5.4**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.3	0.4	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	2.9	2.8	0.0

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	P18	P19	P20
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	AREA	AREA	AREA
Hydraulic Condition	Swale	Swale	Swale
Inlet Type	CDOT Type C	CDOT Type C	CDOT Type C (Depressed)

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	0.5	0.5	1.1
Major Q_{Known} (cfs)	1.1	1.2	2.0

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	User-Defined	P18	P15
Minor Bypass Flow Received, Q_b (cfs)	2.2	0.0	0.3
Major Bypass Flow Received, Q_b (cfs)	4.3	0.0	2.9

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**2.7**	**0.5**	**1.4**
Major Total Design Peak Flow, Q (cfs)	**5.4**	**1.2**	**4.9**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	P21	OS3	OS4
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	AREA	STREET	AREA
Hydraulic Condition	Swale	On Grade	Swale
Inlet Type	CDOT Type C (Depressed)	Colorado Springs D-10-R	CDOT Type C

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	1.2	0.2	0.0
Major Q_{Known} (cfs)	2.4	0.4	0.0

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	P16	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.4	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	2.8	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)			
Percent Impervious			
NRCS Soil Type			

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**1.6**	**0.2**	**0.0**
Major Total Design Peak Flow, Q (cfs)	**5.2**	**0.4**	**0.0**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	OS6
Site Type (Urban or Rural)	URBAN
Inlet Application (Street or Area)	STREET
Hydraulic Condition	On Grade
Inlet Type	Colorado Springs D-10-R

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	4.0
Major Q_{Known} (cfs)	8.6

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	User-Defined
Minor Bypass Flow Received, Q_b (cfs)	0.3
Major Bypass Flow Received, Q_b (cfs)	2.0

Watershed Characteristics

Subcatchment Area (acres)	
Percent Impervious	
NRCS Soil Type	

Watershed Profile

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

Minor Storm Rainfall Input

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

Major Storm Rainfall Input

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

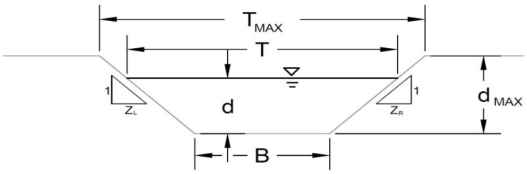
CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**4.3**
Major Total Design Peak Flow, Q (cfs)	**10.7**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	1.9

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P3



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	10.00	ft/ft
Right Side Sloe	Z2 =	5.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**58.00**	**58.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**4.00**	**4.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**607.2**	**607.2**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**3.87**	**3.87**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**2.4**	**7.6**	**cfs**
Water Depth	**d** =	**0.48**	**0.75**	**ft**

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

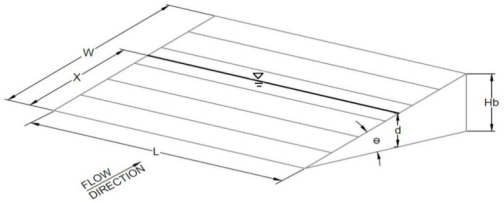
AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P3

Inlet Design Information (Input)

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



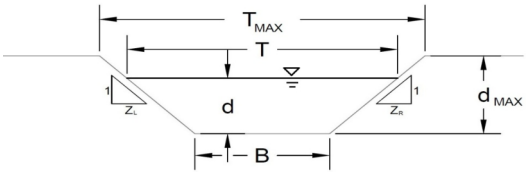
		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.48	0.75	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**6.2**	**12.0**	**cfs**
Bypassed Flow	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**100**	**100**	**%**

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

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P4



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.016	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	50.00	ft/ft
Right Side Sloe	Z2 =	50.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**60.00**	**60.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**1.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**53.1**	**53.1**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.60**	**0.60**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**1.5**	**2.8**	**cfs**
Water Depth	**d** =	**0.16**	**0.20**	**ft**

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

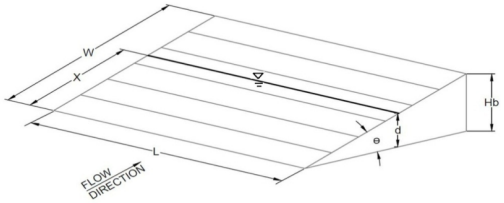
AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P4

Inlet Design Information (Input)

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

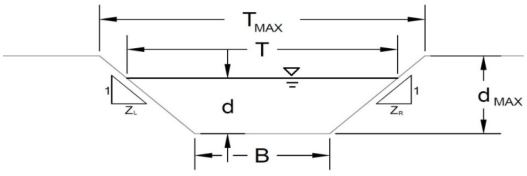


		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.16	0.20	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.2**	**1.6**	**cfs**
Bypassed Flow	**Q_b =**	**0.3**	**1.2**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**77**	**59**	**%**

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P5



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.016	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	50.00	ft/ft
Right Side Sloe	Z2 =	50.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**60.00**	**60.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**1.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**53.1**	**53.1**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.60**	**0.60**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**1.5**	**2.8**	**cfs**
Water Depth	d =	**0.16**	**0.20**	**ft**

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

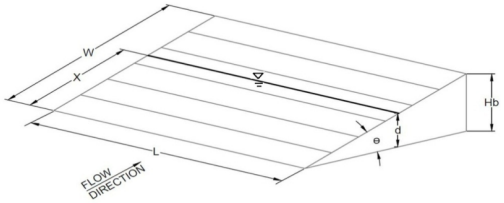
AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P5

Inlet Design Information (Input)

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

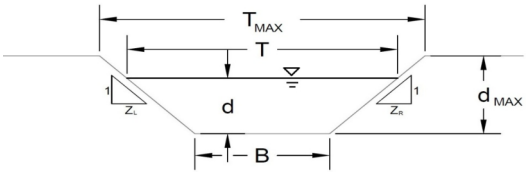


		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.16	0.20	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.1**	**1.6**	**cfs**
Bypassed Flow	**Q_b =**	**0.3**	**1.1**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**78**	**59**	**%**

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P6



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0030	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	25.00	ft/ft
Right Side Sloe	Z2 =	200.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**20.00**	**20.00**	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**0.10**	**0.10**	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**0.3**	**0.3**	cfs
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.09**	**0.09**	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**1.8**	**4.3**	cfs
Warning 05 Water Depth	d =	**0.17**	**0.24**	ft

WARNING: MINOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'
WARNING: MAJOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

AREA INLET IN A SWALE

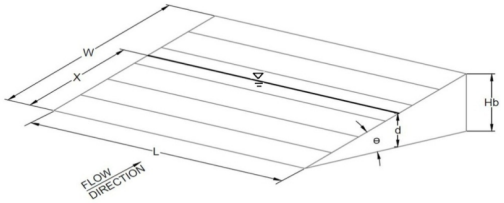
Veteran's Villas - Waterview North

P6

Inlet Design Information (Input)

Type of Inlet	CDOT Type C (Depressed)	Inlet Type =	CDOT Type C (Depressed)

Angle of Inclined Grate (must be <= 30 degrees)	θ =	30.00	degrees
Width of Grate	W =	3.00	ft
Length of Grate	L =	3.00	ft
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	1.50	ft
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.77	
Orifice Coefficient	C_o =	0.52	
Weir Coefficient	C_w =	1.65	



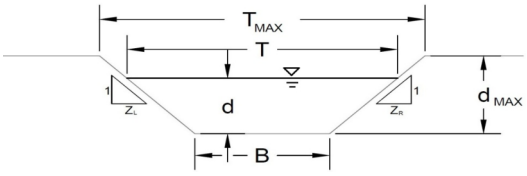
		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	1.17	1.24	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**9.5**	**10.4**	**cfs**
Bypassed Flow	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**100**	**100**	**%**

Warning 05: Depth (d) exceeds max allowable depth (dmax).
Warning 06: Top Width (T) exceeds max allowable top width (Tmax).

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P7



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0330	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	100.00	ft/ft
Right Side Sloe	Z2 =	20.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**13.00**	**13.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**0.50**	**0.50**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**0.9**	**0.9**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.11**	**0.11**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**0.4**	**0.8**	**cfs**
Water Depth	d =	**0.08**	**0.10**	**ft**

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

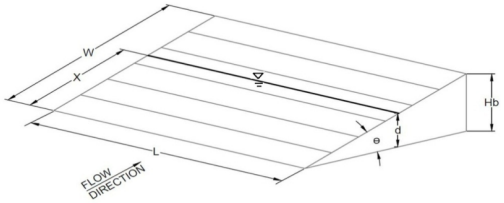
AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P7

Inlet Design Information (Input)

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



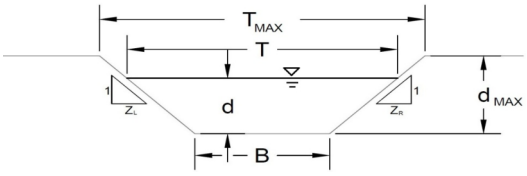
		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.08	0.10	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**0.4**	**0.6**	**cfs**
Bypassed Flow	**Q_b =**	**0.0**	**0.2**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**100**	**77**	**%**

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

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P8



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.016	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	50.00	ft/ft
Right Side Sloe	Z2 =	50.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**60.00**	**60.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**1.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**53.1**	**53.1**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.60**	**0.60**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**1.1**	**2.6**	**cfs**
Water Depth	d =	**0.14**	**0.19**	**ft**

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

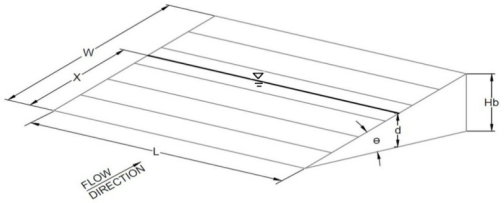
AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P8

Inlet Design Information (Input)

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



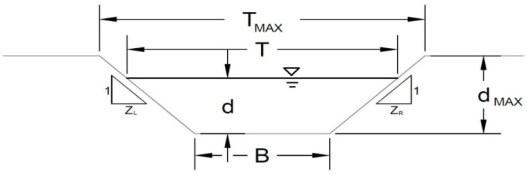
Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	3.00	ft
Length of Grate	L =	3.00	ft
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	ft
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.96	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient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

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.14	0.19	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.0**	**1.6**	**cfs**
Bypassed Flow	**Q_b =**	**0.1**	**1.0**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**89**	**61**	**%**

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P9



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.016	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	50.00	ft/ft
Right Side Sloe	Z2 =	50.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**60.00**	**60.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**1.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**53.1**	**53.1**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.60**	**0.60**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**2.1**	**4.9**	**cfs**
Water Depth	d =	**0.18**	**0.25**	**ft**

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

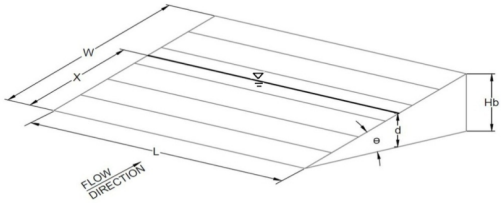
AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P9

Inlet Design Information (Input)

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



		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.18	0.25	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.4**	**2.3**	**cfs**
Bypassed Flow	**Q_b =**	**0.7**	**2.7**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**66**	**46**	**%**

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

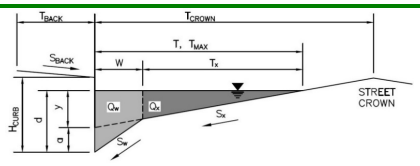
MHFD-Inlet, Version 5.01 (April 2021)

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

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

Project: **Veteran's Villas - Waterview North**

Inlet ID: **P10**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	30.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.060	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	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 =	0.013	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 (check box for yes, leave blank for no)		☐	☐	

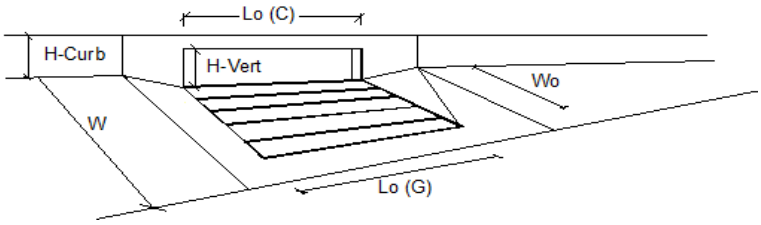
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**5.4**	**5.4**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

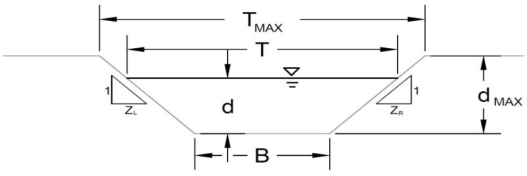


Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	8.00	8.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		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 < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**0.1**	**2.3**	**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**	**%**

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P11



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.016	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	50.00	ft/ft
Right Side Sloe	Z2 =	50.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**60.00**	**60.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**1.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**53.1**	**53.1**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.60**	**0.60**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**1.0**	**5.0**	**cfs**
Water Depth	**d** =	**0.14**	**0.25**	**ft**

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

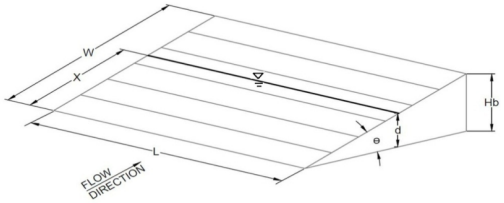
AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P11

Inlet Design Information (Input)

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

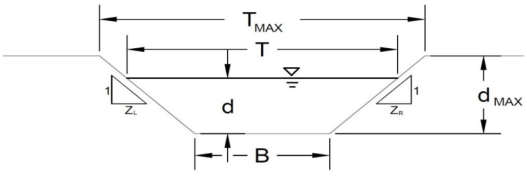


		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.14	0.25	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**0.9**	**2.3**	**cfs**
Bypassed Flow	**Q_b =**	**0.1**	**2.7**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**91**	**46**	**%**

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P12



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.016	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	50.00	ft/ft
Right Side Sloe	Z2 =	50.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**60.00**	**60.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**1.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**53.1**	**53.1**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.60**	**0.60**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**1.5**	**4.3**	**cfs**
Water Depth	d =	**0.16**	**0.23**	**ft**

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

AREA INLET IN A SWALE

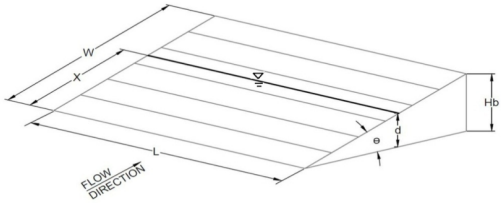
Veteran's Villas - Waterview North

P12

Inlet Design Information (Input)

Type of Inlet	CDOT Type C	Inlet Type =	CDOT Type C

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



		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.16	0.23	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.2**	**2.1**	**cfs**
Bypassed Flow	**Q_b =**	**0.3**	**2.2**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**77**	**49**	**%**

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

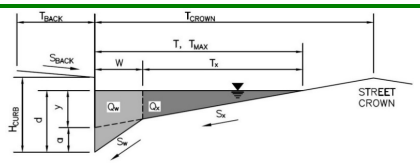
MHFD-Inlet, Version 5.01 (April 2021)

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

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

Project: **Veteran's Villas - Waterview North**

Inlet ID: **P13**



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	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 =	0.015	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 (check box for yes, leave blank for no)		☐	☐	

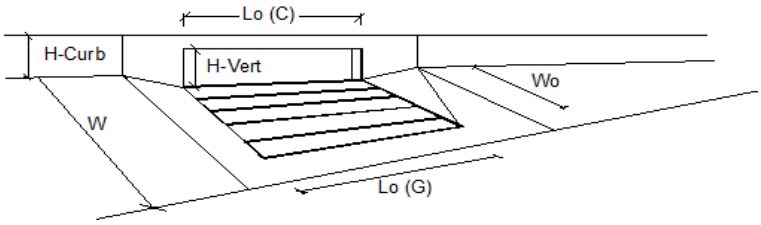
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**5.8**	**5.8**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

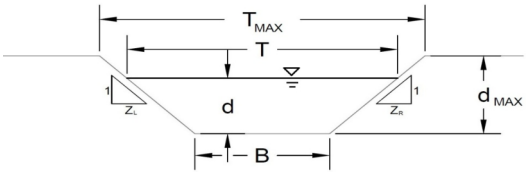


Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	4.00	4.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		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 < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**0.2**	**0.4**	**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**	**%**

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P14



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0020	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	20.00	ft/ft
Right Side Sloe	Z2 =	10.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**40.00**	**40.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**1.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**21.0**	**21.0**	**cfs**
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	**1.00**	**1.00**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**2.7**	**5.3**	**cfs**
Water Depth	d =	**0.46**	**0.60**	**ft**

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

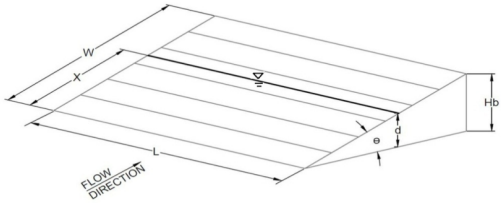
AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P14

Inlet Design Information (Input)

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

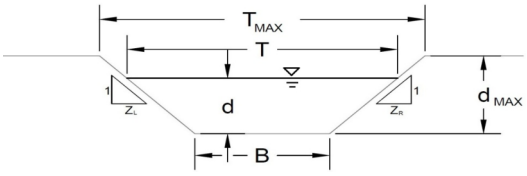


		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.46	0.60	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**5.8**	**8.5**	**cfs**
Bypassed Flow	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**100**	**100**	**%**

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P15



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.016	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	50.00	ft/ft
Right Side Sloe	Z2 =	50.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**60.00**	**60.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**1.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**53.1**	**53.1**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.60**	**0.60**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**1.4**	**5.2**	**cfs**
Water Depth	**d** =	**0.15**	**0.25**	**ft**

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

AREA INLET IN A SWALE

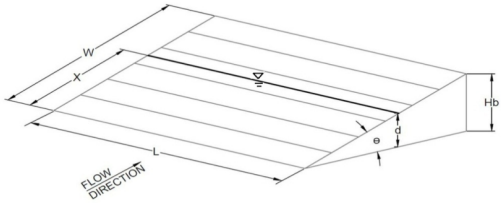
Veteran's Villas - Waterview North

P15

Inlet Design Information (Input)

Type of Inlet: CDOT Type C

Inlet Type = CDOT Type C



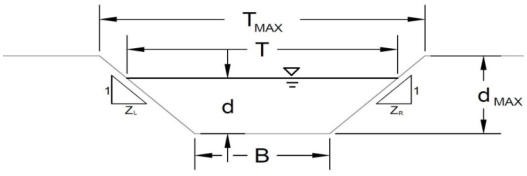
Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	3.00	ft
Length of Grate	L =	3.00	ft
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	ft
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.96	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient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

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.15	0.25	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.1**	**2.3**	**cfs**
Bypassed Flow	**Q_b =**	**0.3**	**2.9**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**78**	**45**	**%**

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P16



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.016	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	50.00	ft/ft
Right Side Sloe	Z2 =	50.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**60.00**	**60.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**1.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**53.1**	**53.1**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.60**	**0.60**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**1.6**	**5.1**	**cfs**
Water Depth	d =	**0.16**	**0.25**	**ft**

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

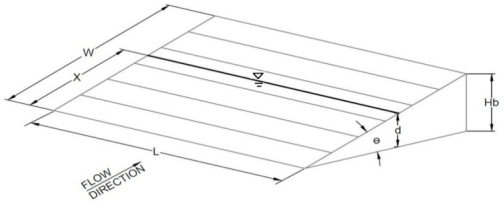
AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P16

Inlet Design Information (Input)

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



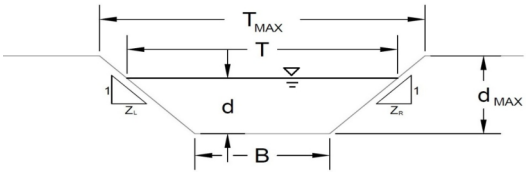
Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	3.00	ft
Length of Grate	L =	3.00	ft
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	ft
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.96	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient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

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.16	0.25	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**1.2**	**2.3**	**cfs**
Bypassed Flow	**Q_b =**	**0.4**	**2.8**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**74**	**45**	**%**

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P17



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0020	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	10.00	ft/ft
Right Side Sloe	Z2 =	15.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**60.00**	**60.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**1.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**17.5**	**17.5**	**cfs**
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	**1.00**	**1.00**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**2.7**	**5.4**	**cfs**
Water Depth	d =	**0.49**	**0.64**	**ft**

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

AREA INLET IN A SWALE

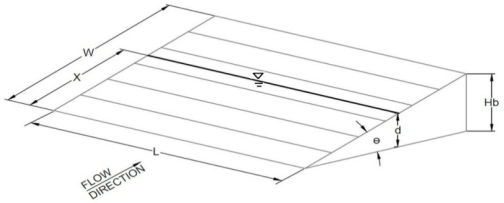
Veteran's Villas - Waterview North

P17

Inlet Design Information (Input)

Type of Inlet: CDOT Type C

Inlet Type = CDOT Type C



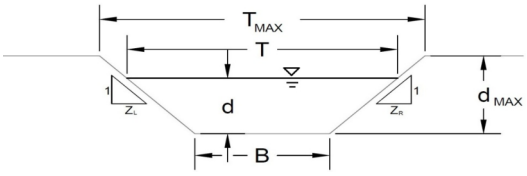
Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	3.00	ft
Length of Grate	L =	3.00	ft
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	ft
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.96	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient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

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.49	0.64	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**6.4**	**9.5**	**cfs**
Bypassed Flow	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**100**	**100**	**%**

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P18



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0020	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	10.00	ft/ft
Right Side Sloe	Z2 =	15.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**60.00**	**60.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**1.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**17.5**	**17.5**	**cfs**
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	**1.00**	**1.00**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**2.7**	**5.4**	**cfs**
Water Depth	d =	**0.49**	**0.65**	**ft**

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

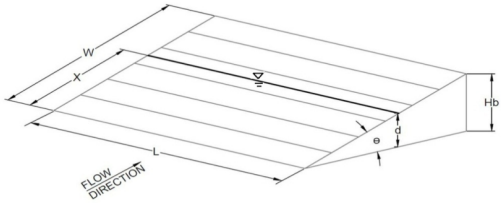
AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P18

Inlet Design Information (Input)

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

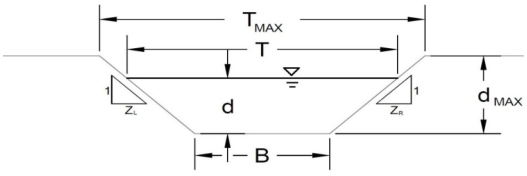


		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.49	0.65	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**6.4**	**9.6**	**cfs**
Bypassed Flow	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**100**	**100**	**%**

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P19



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0020	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	10.00	ft/ft
Right Side Sloe	Z2 =	15.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	100.00	100.00	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.00	1.00	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	17.5	17.5	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	1.00	1.00	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	0.5	1.2	cfs
Water Depth	d =	0.26	0.37	ft

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

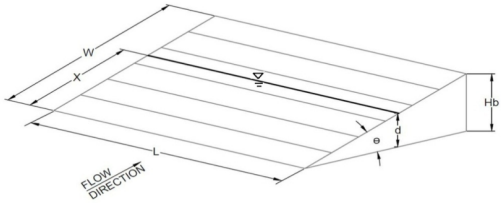
AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P19

Inlet Design Information (Input)

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

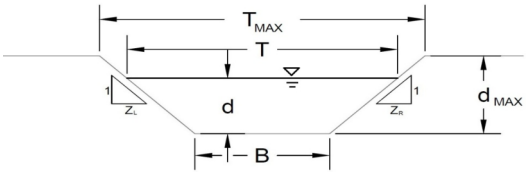


		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.26	0.37	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.4**	**4.1**	**cfs**
Bypassed Flow	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**100**	**100**	**%**

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P20



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.016	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	50.00	ft/ft
Right Side Sloe	Z2 =	50.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**60.00**	**60.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**1.00**	**1.00**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**53.1**	**53.1**	**cfs**
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	**0.60**	**0.60**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**1.4**	**4.9**	**cfs**
Water Depth	d =	**0.15**	**0.25**	**ft**

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

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

AREA INLET IN A SWALE

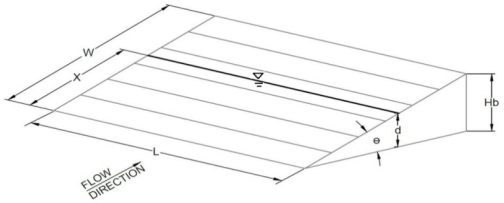
Veteran's Villas - Waterview North

P20

Inlet Design Information (Input)

Type of Inlet	CDOT Type C (Depressed)	Inlet Type =	CDOT Type C (Depressed)

Angle of Inclined Grade (must be <= 30 degrees)	θ =	8.33	degrees
Width of Grate	W =	3.00	ft
Length of Grate	L =	3.00	ft
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.43	ft
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.59	
Orifice Coefficient	C_o =	0.39	
Weir Coefficient	C_w =	1.26	



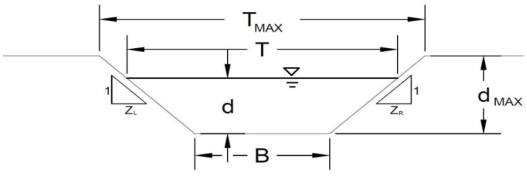
		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	1.15	1.25	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**11.8**	**13.4**	**cfs**
Bypassed Flow	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**100**	**100**	**%**

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

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P21



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.016	
Channel Invert Slope	S_O =	0.0050	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	50.00	ft/ft
Right Side Sloe	Z2 =	50.00	ft/ft

Check one of the following soil types:

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

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

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	60.00	60.00	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.00	1.00	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	53.1	53.1	cfs
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	0.60	0.60	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	1.6	5.2	cfs
Water Depth	d =	0.16	0.25	ft

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

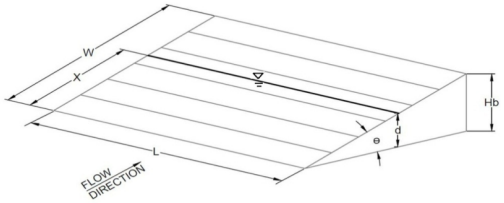
AREA INLET IN A SWALE

Veteran's Villas - Waterview North

P21

Inlet Design Information (Input)

Type of Inlet: CDOT Type C (Depressed) — Inlet Type = CDOT Type C (Depressed)



Angle of Inclined Grade (must be <= 30 degrees)	θ =	8.33	degrees
Width of Grate	W =	3.00	ft
Length of Grate	L =	3.00	ft
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.43	ft
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.59	
Orifice Coefficient	C_o =	0.39	
Weir Coefficient	C_w =	1.26	

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	1.16	1.25	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**12.0**	**13.5**	**cfs**
Bypassed Flow	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**100**	**100**	**%**

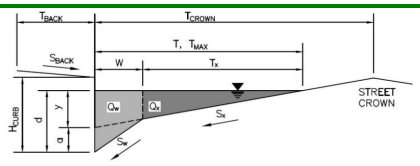
MHFD-Inlet, Version 5.01 (April 2021)

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

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

Project: **Veteran's Villas - Waterview North**

Inlet ID: **OS3**



Gutter Geometry:			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	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 =	0.015	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 (check box for yes, leave blank for no)		☐	☐	

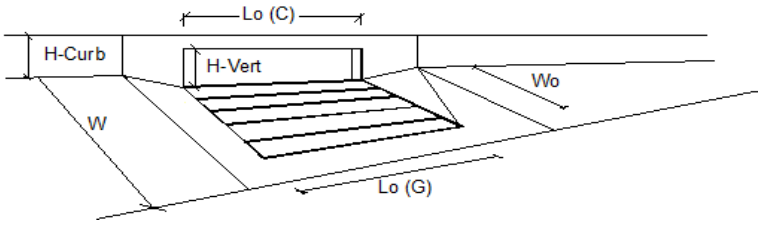
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**5.8**	**5.8**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

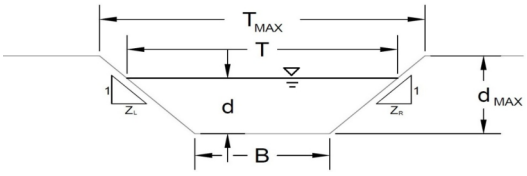


Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	4.0	4.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	4.00	4.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		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 < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**0.2**	**0.4**	**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**	**%**

AREA INLET IN A SWALE

Veteran's Villas - Waterview North

OS4



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.030	
Channel Invert Slope	S_O =	0.0200	ft/ft
Bottom Width	B =	0.00	ft
Left Side Slope	Z1 =	10.00	ft/ft
Right Side Sloe	Z2 =	50.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**30.00**	**30.00**	**ft**
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**0.50**	**0.50**	**ft**

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**20.9**	**20.9**	**cfs**
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	**0.50**	**0.50**	**ft**

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**0.0**	**0.0**	**cfs**
Water Depth	d =	**0.02**	**0.04**	**ft**

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

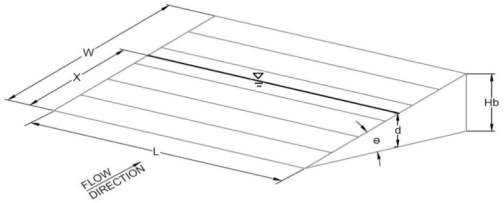
AREA INLET IN A SWALE

Veteran's Villas - Waterview North

OS4

Inlet Design Information (Input)

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



		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.02	0.04	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**0.1**	**0.1**	**cfs**
Bypassed Flow	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**100**	**100**	**%**

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

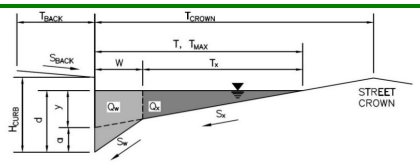
MHFD-Inlet, Version 5.01 (April 2021)

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

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

Project: **Veteran's Villas - Waterview North**

Inlet ID: **OS6**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	40.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.030	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 =	0.013	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 (check box for yes, leave blank for no)		☐	☐	

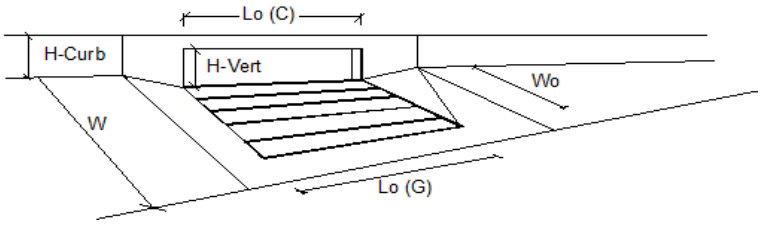
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**5.4**	**29.9**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)	Colorado Springs D-10-R		MINOR	MAJOR	
Type of Inlet		Type =	Colorado Springs D-10-R		
Local Depression (additional to continuous gutter depression 'a')		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, Gutter Width)		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 < Allowable Street Capacity'			MINOR	MAJOR	
Total Inlet Interception Capacity		**Q =**	**4.3**	**8.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)		**Q_b =**	**0.0**	**1.9**	**cfs**
Capture Percentage = Q_a/Q_o =		**C% =**	**100**	**82**	**%**

Circular Pipe (Pipe Sizings.fm8)

Label	Solve For	Friction Method	Roughness Coefficient	Channel Slope (ft/ft)	Normal Depth (in)	Diameter (in)	Discharge (cfs)	Flow Area (ft²)	Wetted Perimeter (ft)	Hydraulic Radius (in)	Top Width (ft)	Critical Depth (in)	Percent Full (%)	Critical Slope (ft/ft)
P1-MH	Normal Depth	Manning Formula	0.013	0.005	6.2	12.0	1.33	0.4	1.6	3.1	1.00	5.8	51.6	0.006
P2-MH	Normal Depth	Manning Formula	0.013	0.005	4.1	12.0	0.63	0.2	1.2	2.3	0.95	4.0	34.1	0.006
MH-P5	Normal Depth	Manning Formula	0.013	0.005	8.0	12.0	1.96	0.6	1.9	3.5	0.95	7.2	66.3	0.007
P5-P9	Normal Depth	Manning Formula	0.013	0.005	8.8	18.0	3.56	0.9	2.3	4.4	1.50	8.6	48.8	0.005
P6-P13	Normal Depth	Manning Formula	0.013	0.005	9.8	18.0	4.30	1.0	2.5	4.7	1.49	9.5	54.6	0.006
P13-TEE	Normal Depth	Manning Formula	0.013	0.005	10.4	18.0	4.70	1.1	2.6	4.9	1.48	10.0	57.7	0.006
P9-P12	Normal Depth	Manning Formula	0.013	0.005	16.2	21.0	10.56	2.0	3.8	6.4	1.47	14.5	77.2	0.007
P12-P16	Normal Depth	Manning Formula	0.013	0.005	16.1	24.0	12.66	2.2	3.8	7.0	1.88	15.4	67.1	0.006
P16-P21	Normal Depth	Manning Formula	0.013	0.005	18.4	24.0	14.96	2.6	4.3	7.3	1.69	16.7	76.7	0.006
P23-P21	Normal Depth	Manning Formula	0.013	0.005	5.0	12.0	0.93	0.3	1.4	2.7	0.99	4.9	42.1	0.006
P21-P20	Normal Depth	Manning Formula	0.013	0.005	8.3	18.0	3.20	0.8	2.2	4.3	1.49	8.2	45.9	0.005
P4-P8	Normal Depth	Manning Formula	0.013	0.005	21.3	27.0	21.09	3.4	4.9	8.2	1.84	19.3	78.8	0.006
P8-P11	Normal Depth	Manning Formula	0.013	0.005	21.3	27.0	21.09	3.4	4.9	8.2	1.84	19.3	78.8	0.006
P3-P7	Normal Depth	Manning Formula	0.013	0.005	15.2	18.0	7.60	1.6	3.5	5.5	1.09	12.8	84.2	0.007
P7-OS5	Normal Depth	Manning Formula	0.013	0.005	13.3	21.0	8.20	1.6	3.2	6.0	1.68	12.8	63.5	0.006
OS3-OS5	Normal Depth	Manning Formula	0.013	0.005	5.0	6.0	0.40	0.2	1.1	1.8	0.38	3.9	82.7	0.009
OS5-P10	Normal Depth	Manning Formula	0.013	0.005	18.2	27.0	17.40	2.8	4.3	7.9	2.11	17.5	67.3	0.006
P10-MH	Normal Depth	Manning Formula	0.013	0.005	20.0	27.0	19.70	3.2	4.7	8.1	1.97	18.6	74.1	0.006
MH-P11	Normal Depth	Manning Formula	0.013	0.005	23.4	27.0	22.90	3.7	5.4	8.2	1.52	20.1	86.8	0.007
P11-P15	Normal Depth	Manning Formula	0.013	0.005	21.6	30.0	25.20	3.8	5.1	9.0	2.24	20.5	72.1	0.006
P15-P20	Normal Depth	Manning Formula	0.013	0.005	23.3	30.0	27.50	4.1	5.4	9.1	2.08	21.5	77.7	0.006
P20-MH	Normal Depth	Manning Formula	0.013	0.005	27.5	42.0	54.28	6.7	6.6	12.1	3.33	27.7	65.4	0.005
OS4-P14	Normal Depth	Manning Formula	0.013	0.005	2.1	6.0	0.10	0.1	0.6	1.1	0.47	1.9	34.2	0.007
P14-P17	Normal Depth	Manning Formula	0.013	0.005	11.4	18.0	5.40	1.2	2.8	5.1	1.45	10.7	63.2	0.006
P17-P18	Normal Depth	Manning Formula	0.013	0.005	16.6	21.0	10.80	2.0	3.8	6.4	1.43	14.7	78.9	0.007
P18-P19	Normal Depth	Manning Formula	0.013	0.005	20.0	24.0	16.20	2.8	4.6	7.3	1.50	17.4	83.2	0.007
P19-MH	Normal Depth	Manning Formula	0.013	0.005	18.2	27.0	17.40	2.8	4.3	7.9	2.11	17.5	67.3	0.006
MH-OUT	Normal Depth	Manning Formula	0.013	0.005	34.7	42.0	71.68	8.5	8.0	12.8	2.65	31.8	82.7	0.006

Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Maximum Discharge (cfs)	Discharge Full (cfs)	Slope Full (ft/ft)	Flow Type	Notes	Messages
3.25	0.16	0.68	0.896	2.71	2.52	0.001	Subcritical		
2.67	0.11	0.45	0.941	2.71	2.52	0.000	Subcritical		
3.54	0.20	0.86	0.817	2.71	2.52	0.003	Subcritical		
4.16	0.27	1.00	0.971	7.99	7.43	0.001	Subcritical		
4.36	0.29	1.11	0.945	7.99	7.43	0.002	Subcritical		
4.45	0.31	1.17	0.928	7.99	7.43	0.002	Subcritical		
5.30	0.44	1.79	0.801	12.05	11.20	0.004	Subcritical		
5.65	0.50	1.84	0.911	17.21	16.00	0.003	Subcritical		
5.79	0.52	2.05	0.825	17.21	16.00	0.004	Subcritical		
2.97	0.14	0.56	0.928	2.71	2.52	0.001	Subcritical		
4.04	0.25	0.94	0.980	7.99	7.43	0.001	Subcritical		
6.27	0.61	2.39	0.818	23.56	21.90	0.005	Subcritical		
6.27	0.61	2.39	0.818	23.56	21.90	0.005	Subcritical		
4.79	0.36	1.62	0.700	7.99	7.43	0.005	Subcritical		
5.09	0.40	1.51	0.917	12.05	11.20	0.003	Subcritical		
2.30	0.08	0.50	0.599	0.43	0.40	0.005	Subcritical		
6.11	0.58	2.10	0.928	23.56	21.90	0.003	Subcritical		
6.23	0.60	2.27	0.868	23.56	21.90	0.004	Subcritical		

Circular Pipe (Pipe Sizings.fm8)

Velocity (ft/s)	Velocity Head (ft)	Specific Energy (ft)	Froude Number	Maximum Discharge (cfs)	Discharge Full (cfs)	Slope Full (ft/ft)	Flow Type	Notes	Messages
6.25	0.61	2.56	0.710	23.56	21.90	0.005	Subcritical		
6.65	0.69	2.49	0.903	31.20	29.00	0.004	Subcritical		
6.72	0.70	2.64	0.846	31.20	29.00	0.004	Subcritical		
8.14	1.03	3.32	1.014	76.52	71.14	0.003	Supercritical		
1.69	0.04	0.22	0.841	0.43	0.40	0.000	Subcritical		
4.58	0.33	1.28	0.896	7.99	7.43	0.003	Subcritical		
5.31	0.44	1.82	0.783	12.05	11.20	0.005	Subcritical		
5.80	0.52	2.19	0.749	17.21	16.00	0.005	Subcritical		
6.11	0.58	2.10	0.928	23.56	21.90	0.003	Subcritical		
8.43	1.10	4.00	0.829	76.52	71.14	0.005	Subcritical		

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018) **Sheet 1 of 1**

Designer:	**Jared Roberts**
Company:	**Kimley-Horn and Associates**
Date:	**December 13, 2022**
Project:	**WVN 9.6 at Waterview North**
Location:	**NEC of Powers Blvd and Bradley Rd**

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth = 0.60 inches

Depth of Average Runoff Producing Storm, d_6 = 0.43 inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3)

Area Type	DCIA	DCIA	DCIA	SPA	SPA	SPA	SPA	UIA:RPA				
Area ID	1	2	3		5	6	7	8				
Downstream Design Point ID	1	2	3		1	2	3	4				
Downstream BMP Type	EDB	EDB	EDB	None	EDB	EDB	EDB	EDB				
DCIA (ft^2)	25,184	25,184	25,184	--	--	--	--	--				
UIA (ft^2)	--	--	--	--	--	--	--	25,184				
RPA (ft^2)	--	--	--	--	--	--	--	19,377				
SPA (ft^2)	--	--	--		5,238	19,026	3,081	--				
HSG A (%)	--	--	--		45%	45%	45%	45%				
HSG B (%)	--	--	--		55%	55%	55%	55%				
HSG C/D (%)	--	--	--		0%	0%	0%	0%				
Average Slope of RPA (ft/ft)	--	--	--	--	--	--	--	0.100				
UIA:RPA Interface Width (ft)	--	--	--	--	--	--	--	360.00				

CALCULATED RUNOFF RESULTS

Area ID	1	2	3		5	6	7	8				
UIA:RPA Area (ft^2)	--	--	--	--	--	--	--	44,561				
L / W Ratio	--	--	--	--	--	--	--	0.34				
UIA / Area	--	--	--	--	--	--	--	0.5652				
Runoff (in)	0.50	0.50	0.50	0.00	0.00	0.00	0.00	0.00				
Runoff (ft^3)	1049	1049	1049	0	0	0	0	0				
Runoff Reduction (ft^3)	0	0	0		262	951	154	1049				

CALCULATED WQCV RESULTS

Area ID	1	2	3		5	6	7	8				
WQCV (ft^3)	1049	1049	1049	0	0	0	0	1049				
WQCV Reduction (ft^3)	0	0	0	0	0	0	0	1049				
WQCV Reduction (%)	0%	0%	0%	0%	0%	0%	0%	100%				
Untreated WQCV (ft^3)	1049	1049	1049	0	0	0	0	0				

CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

Downstream Design Point ID	1	2	3	1	2	3	4					
DCIA (ft^2)	25,184	25,184	25,184	25,184	25,184	25,184	0					
UIA (ft^2)	0	0	0	0	0	0	25,184					
RPA (ft^2)	0	0	0	0	0	0	19,377					
SPA (ft^2)	5,238	19,026	3,081	5,238	19,026	3,081	0					
Total Area (ft^2)	30,422	44,210	28,265	30,422	44,210	28,265	44,561					
Total Impervious Area (ft^2)	25,184	25,184	25,184	25,184	25,184	25,184	25,184					
WQCV (ft^3)	1,049	1,049	1,049	1,049	1,049	1,049	1,049					
WQCV Reduction (ft^3)	0	0	0	0	0	0	1,049					
WQCV Reduction (%)	0%	0%	0%	0%	0%	0%	100%					
Untreated WQCV (ft^3)	1,049	1,049	1,049	1,049	1,049	1,049	0					

CALCULATED SITE RESULTS (sums results from all columns in worksheet)

Total Area (ft^2)	250,355
Total Impervious Area (ft^2)	176,288
WQCV (ft^3)	4,197
WQCV Reduction (ft^3)	1,049
WQCV Reduction (%)	25%
Untreated WQCV (ft^3)	3,148

APPENDIX E - DRAINAGE EXHIBITS

LEGEND

A = BASIN DESIGNATION
B = AREA (ACRES)
C = BASIN IMPERVIOUSNESS
D = 100YR DESIGN STORM RUNOFF (CFS)

= DESIGN POINT

FLOW DIRECTION

PROPERTY BOUNDARY

EASEMENT

EXISTING STORM SEWER

EXISTING STORM MANHOLE

EXISTING STORM INLET

DRAINAGE BASIN BOUNDARY

XXXX EXISTING MAJOR CONTOUR

XXXX EXISTING MINOR CONTOUR

NOTES

1. ALL EXISTING CURB AND GUTTER COS STD TYPE–1 8" UNLESS OTHERWISE NOTED IN PLAN.

SUMMARY - EXISTING RUNOFF TABLE

DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
1	EX-1	13.96	3.83	28.16	5.38	39.51
2	OS-1	2.77	0.81	5.93	0.81	5.93
3	OS-2	2.24	0.74	5.42	0.74	5.42

OS–1
1.26 | 2% | 5.93

OS–2
1.26 | 2% | 5.42

EX–1
13.96 | 2% | 39.51

OWNER: CITY OF COLORADO SPRINGS
PARCEL: 5500000488

OWNER: CPR ENTITLEMENTS, LLC.
PARCEL: 5500000452

OWNER: WVN 96, LLC
PARCEL: 5500000454

OWNER: CPR ENTITLEMENTS, LLC
PARCEL: TBD

NORTH

GRAPHIC SCALE IN FEET
0 30 60 120

NO.	REVISION	BY	DATE	APPR.

Kimley»Horn
2022 KIMLEY-HORN AND ASSOCIATES, INC.
2 North Nevada Avenue, Suite 300
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: JAR
DRAWN BY: JAR
CHECKED BY: JRH
DATE: 12/20/22

VETERANS VICTORY
CONSTRUCTION DOCUMENTS
EXISTING DRAINAGE MAP

PROJECT NO. 096955000

SHEET

LEGEND

A = BASIN DESIGNATION
B = AREA (ACRES)
C = BASIN IMPERVIOUSNESS
D = 100YR DESIGN STORM RUNOFF (CFS)

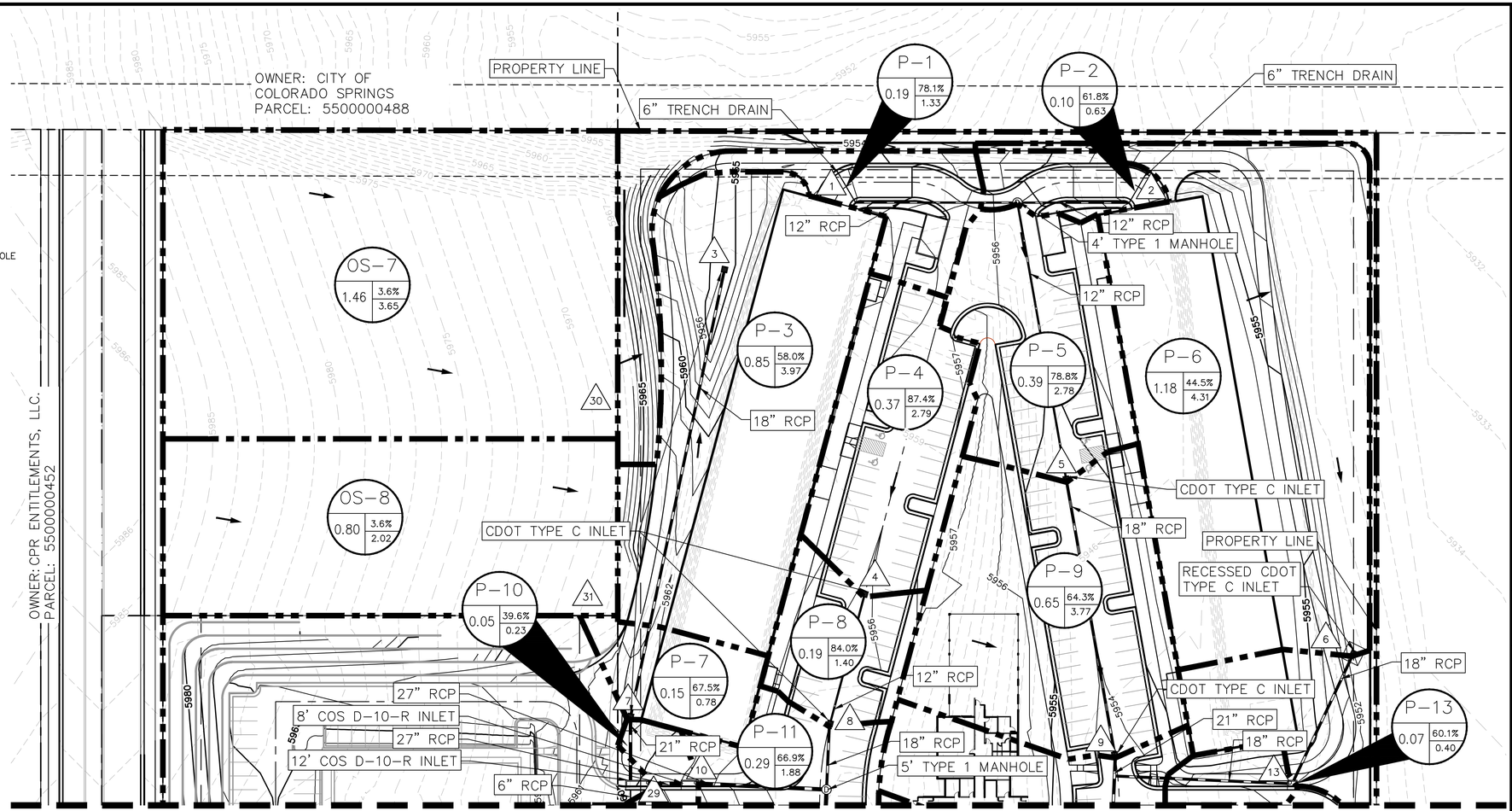
= DESIGN POINT

FLOW DIRECTION
EMERGENCY OVERFLOW PATH

PROPERTY BOUNDARY
EASEMENT
EXISTING STORM SEWER
PROPOSED STORM SEWER
EXISTING/PROPOSED STORM MANHOLE
EXISTING/PROPOSED STORM INLET
DRAINAGE BASIN BOUNDARY
PROPOSED MAJOR CONTOUR
PROPOSED MINOR CONTOUR
EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR

NOTES

1. ALL EXISTING CURB AND GUTTER COS STD TYPE-1 6" UNLESS OTHERWISE NOTED IN PLAN.



SUMMARY - PROPOSED RUNOFF TABLE

DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)	Weighted Imperviousness
1	P-1	0.19	0.69	1.33	0.69	1.33	78.1%
2	P-2	0.10	0.30	0.63	0.30	0.63	61.8%
3	P-3	0.85	1.82	3.97	1.82	3.97	58.0%
4	P-4	0.37	1.50	2.79	1.50	2.79	87.4%
5	P-5	0.39	1.45	2.78	1.45	2.78	78.8%
6	P-6	1.18	1.77	4.31	1.77	4.31	44.5%
7	P-7	0.15	0.38	0.78	0.38	0.78	67.5%
8	P-8	0.19	0.74	1.40	0.74	1.40	84.0%
9	P-9	0.65	1.83	3.77	1.83	3.77	64.3%
10	P-10	0.05	0.09	0.23	0.09	0.23	39.6%
11	P-11	0.29	0.93	1.88	0.93	1.88	66.9%
12	P-12	0.32	0.77	1.62	0.77	1.62	61.9%
13	P-13	0.07	0.19	0.40	0.19	0.40	60.1%
14	P-14	0.23	0.46	0.99	0.46	0.99	59.6%
15	P-15	0.34	1.34	2.52	1.34	2.52	85.0%
16	P-16	0.67	1.27	2.86	1.27	2.86	50.8%
17	P-17	0.25	0.46	1.04	0.46	1.04	52.1%
18	P-18	0.28	0.47	1.11	0.47	1.11	47.2%
19	P-19	0.33	0.47	1.21	0.47	1.21	39.8%
20	P-20	0.26	1.06	1.98	1.06	1.98	86.2%
21	P-21	0.39	1.22	2.41	1.22	2.41	73.0%
22	P-22	0.13	0.38	0.79	0.38	0.79	62.7%
23	P-23	0.20	0.41	0.93	0.41	0.93	49.0%
24	OS-1	0.52	0.55	1.52	0.55	1.52	31.8%
25	OS-2	1.84	3.60	8.61	3.60	8.61	45.4%
26	OS-3	0.08	0.20	0.43	0.20	0.43	55.8%
27	OS-4	0.01	0.00	0.02	0.00	0.02	2.0%
28	OS-5	2.05	6.57	12.97	6.57	12.97	73.8%
29	OS-6	1.60	4.00	8.64	4.00	8.64	57.5%
30	OS-7	1.46	0.56	3.65	0.56	3.65	3.6%
31	OS-8	0.80	0.31	2.02	0.31	2.02	3.6%

NORTH

GRAPHIC SCALE IN FEET
0 20 40 80

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NO.	REVISION	BY	DATE	APPR.

Kimley»Horn
2022 KIMLEY-HORN AND ASSOCIATES, INC.
2 North Nevada Avenue, Suite 300
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: JAR
DRAWN BY: JAR
CHECKED BY: JRH
DATE: 12/20/22

VETERANS VICTORY
CONSTRUCTION DOCUMENTS
PROPOSED DRAINAGE MAP (1 OF 2)

PROJECT NO. 096955000
SHEET

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LEGEND

A = BASIN DESIGNATION
B = AREA (ACRES)
C = BASIN IMPERVIOUSNESS
D = 100YR DESIGN STORM RUNOFF (CFS)

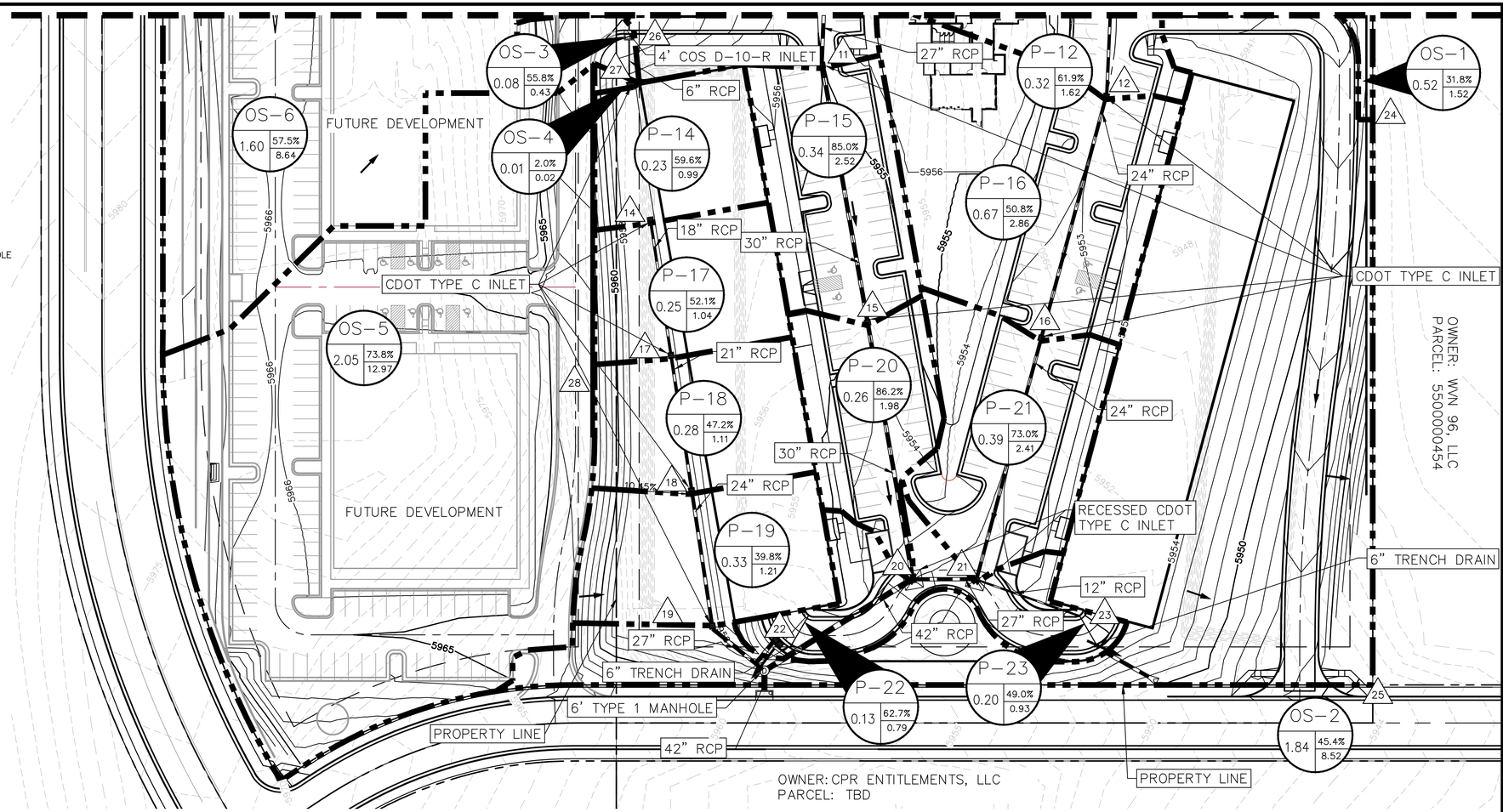
= DESIGN POINT

FLOW DIRECTION
EMERGENCY OVERFLOW PATH

PROPERTY BOUNDARY
EASEMENT
EXISTING STORM SEWER
PROPOSED STORM SEWER
EXISTING/PROPOSED STORM MANHOLE
EXISTING/PROPOSED STORM INLET
DRAINAGE BASIN BOUNDARY
XXXX PROPOSED MAJOR CONTOUR
XXXX PROPOSED MINOR CONTOUR
XXXX EXISTING MAJOR CONTOUR
XXXX EXISTING MINOR CONTOUR

NOTES

1. ALL EXISTING CURB AND GUTTER COS STD TYPE-1 6" UNLESS OTHERWISE NOTED IN PLAN.



SUMMARY - PROPOSED RUNOFF TABLE

DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)	Weighted Imperviousness
1	P-1	0.19	0.69	1.33	0.69	1.33	78.1%
2	P-2	0.10	0.30	0.63	0.30	0.63	61.8%
3	P-3	0.85	1.82	3.97	1.82	3.97	58.0%
4	P-4	0.37	1.50	2.79	1.50	2.79	87.4%
5	P-5	0.39	1.45	2.78	1.45	2.78	78.8%
6	P-6	1.18	1.77	4.31	1.77	4.31	44.5%
7	P-7	0.15	0.38	0.78	0.38	0.78	67.5%
8	P-8	0.19	0.74	1.40	0.74	1.40	84.0%
9	P-9	0.65	1.83	3.77	1.83	3.77	64.3%
10	P-10	0.05	0.09	0.23	0.09	0.23	39.6%
11	P-11	0.29	0.93	1.88	0.93	1.88	66.9%
12	P-12	0.32	0.77	1.62	0.77	1.62	61.9%
13	P-13	0.07	0.19	0.40	0.19	0.40	60.1%
14	P-14	0.23	0.46	0.99	0.46	0.99	59.6%
15	P-15	0.34	1.34	2.52	1.34	2.52	85.0%
16	P-16	0.67	1.27	2.86	1.27	2.86	50.8%
17	P-17	0.25	0.46	1.04	0.46	1.04	52.1%
18	P-18	0.28	0.47	1.11	0.47	1.11	47.2%
19	P-19	0.33	0.47	1.21	0.47	1.21	39.8%
20	P-20	0.26	1.06	1.98	1.06	1.98	86.2%
21	P-21	0.39	1.22	2.41	1.22	2.41	73.0%
22	P-22	0.13	0.38	0.79	0.38	0.79	62.7%
23	P-23	0.20	0.41	0.93	0.41	0.93	49.0%
24	OS-1	0.52	0.55	1.52	0.55	1.52	31.8%
25	OS-2	1.84	3.60	8.61	3.60	8.61	45.4%
26	OS-3	0.08	0.20	0.43	0.20	0.43	55.8%
27	OS-4	0.01	0.00	0.02	0.00	0.02	2.0%
28	OS-5	2.05	6.57	12.97	6.57	12.97	73.8%
29	OS-6	1.60	4.00	8.64	4.00	8.64	57.5%
30	OS-7	1.46	0.56	3.65	0.56	3.65	3.6%
31	OS-8	0.80	0.31	2.02	0.31	2.02	3.6%

NORTH

GRAPHIC SCALE IN FEET
0 20 40 80

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2 North Nevada Avenue, Suite 300
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: JAR
DRAWN BY: JAR
CHECKED BY: JRH
DATE: 12/20/22

VETERANS VICTORY
CONSTRUCTION DOCUMENTS
PROPOSED DRAINAGE MAP (2 OF 2)

PROJECT NO. 096955000
SHEET

LEGEND

- PROPERTY BOUNDARY
- DISCONNECTED IMPERVIOUS AREA (DCIA)
- RECEIVING PERVIOUS AREA (RPA)
- XXXX — PROPOSED MAJOR CONTOUR
- XXXX — PROPOSED MINOR CONTOUR
- XXXX — PROPOSED MAJOR CONTOUR
- XXXX — PROPOSED MINOR CONTOUR

ID
TYPE | AC

OWNER: CITY OF COLORADO SPRINGS
PARCEL: 5500000488

OWNER: CPR ENTITLEMENTS, LLC.
PARCEL: 5500000452

OWNER: WAN 96, LLC
PARCEL: 5360000454

OWNER: CPR ENTITLEMENTS, LLC
PARCEL: TBD

FUTURE DEVELOPMENT

FUTURE DEVELOPMENT

5 SPA 0.12

1 DCIA 0.58

2 DCIA 0.58

6 SPA 0.44

3 DCIA 0.58

4 DCIA 0.58

7 SPA 0.07

8 UIA 0.44

IMPERVIOUS AREAS		
Area	SF	ACRES
Roof area	106452	2.44
Pavement Area	154056	3.54
TOTAL	260508	5.98

CALCULATIONS		
0.20x = DCIA = y =	1.20	AC
0.10y = RPA	0.12	AC

CURRENT AREAS		
DCIA	2.31	AC
RPA	1.07	AC

Total Area (ft²)	250,355
Total Impervious Area (ft²)	176,288
WQCV (ft³)	4,197
WQCV Reduction (ft³)	1,049
WQCV Reduction (%)	25%
Untreated WQCV (ft³)	3,148

NORTH

GRAPHIC SCALE IN FEET
0 30 60 120

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NO.	REVISION	BY	DATE	APPR.

Kimley»Horn
2022 KIMLEY-HORN AND ASSOCIATES, INC.
2 North Nevada Avenue, Suite 300
Colorado Springs, Colorado 80903 (719) 453-0180

DESIGNED BY: JAR
DRAWN BY: JAR
CHECKED BY: JRH
DATE: 12/20/22

VETERANS VICTORY
CONSTRUCTION DOCUMENTS
GREEN INFRASTRUCTURE PIA PLAN

PROJECT NO.
096955000

SHEET

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APPENDIX F – MASTER DEVELOPMENT DRAINAGE PLANS

MASTER DEVELOPMENT DRAINAGE PLAN

Villages at Waterview North
Colorado Springs, CO

Prepared for:

CPR Entitlements, LLC
31 N. Tejon Street, Suite 500
Colorado Springs, CO 80903
Contact: P. A. Koscielski, Manager
719-377-0244

Prepared by:

Kimley-Horn and Associates, Inc.
2 North Nevada Avenue, Suite 300
Colorado Springs, Colorado 80903
(719) 453-0180
Contact: Jessica McCallum, P.E.

Project #: 096955000

Submitted: August 15, 2022
Resubmitted: September 29, 2022
Resubmitted: November 1, 2022

Kimley»Horn

TABLE OF CONTENTS

CERTIFICATION

ENGINEERS STATEMENT

"This report and plan for the drainage design of the Villages at Waterview North project was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the provisions of the City of Colorado Springs Drainage Criteria Manual and is in conformity with the master plan of the drainage basin. I understand that City of Colorado Springs does not and will not assume liability for drainage facilities designed by others. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report."

SIGNATURE: _____

Jessica J. McCallum, P.E. Colorado P.E. No. 59054 Date

DEVELOPER'S STATEMENT

CPR Entitlements, LLC. hereby certifies that the drainage facilities for the Villages at Waterview North development shall be constructed according to the design presented in this report. I 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 are submitted to the City of Colorado Springs pursuant to section 7.7.906 of the City Code; and cannot, on behalf of the Villages at Waterview North development guarantee that final drainage design review will absolve CPR Entitlements, 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.

_____
Name of Developer

_____
Authorized Signature Date

_____
Printed Name

_____
Title

_____
Address:

CITY OF COLORADO SPRINGS STATEMENT

Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

_____ _____
For City Engineer Date

Conditions:

INTRODUCTION

PURPOSE AND SCOPE OF STUDY

The purpose of this report is to outline the Master Development Drainage Plan (the "MDDP") associated with the Villages at Waterview North Concept Plan (the "Concept Plan") and annexation/ zone change into the City of Colorado Springs (the "City"). The Project is located on three parcels at the northeast corner of S. Powers Blvd and Bradley Rd (the "Site"), City of Colorado Springs, Colorado.

This MDDP identifies on-site and offsite drainage patterns, areas tributary to the site and proposes to safely route developed storm water to adequate outfalls at or less than historic flow rates. A Final Drainage Report for the master development roadways and infrastructure and for each individual lot and use containing detailed proposed site stormwater infrastructure design will be submitted at a later date and prior to construction of the individual lots and roadways. The Project will be processed through the City of Colorado Springs and is currently going through the annexation process with the City. Additional outside agency review or processing is not anticipated as part of the Project.

DBPS INVESTIGATIONS

This Site is located within West Fork Jimmy Camp Creek and Jimmy Camp Creek Drainage Basins per the "West Fork Jimmy Camp Creek Drainage Basin Planning Study" prepared by Kiowa Engineering Corporation, dated October 2003, and "Jimmy Camp Creek Drainage Basin Planning Study" prepared by Wilson & Company, dated 1987. The Site is also located in the Big Johnson Drainage Basin per the "Big Johnson Reservoir/Crews Gulch Drainage Basin Planning Study" prepared by Kiowa Engineering Corporation, dated September 1991. These reports serve as the current, approved DBPS for these basins. The proposed development will comply with the standards and required improvements set by the DBPS's.

GENERAL PROJECT DESCRIPTION

The Project is located on three parcels at the northeast corner of S. Powers Blvd and Bradley Rd within a portion of Section 8 and Section 9, both in Township 15 South, Range 65 West of the 6th P.M. El Paso County, Colorado. The Site is located within the Jimmy Camp Creek and Big Johnson Drainage Basins which are mostly vacant land. The Site is surrounded by:

North: Peak Innovation Parkway, Lot 7 Colorado Springs Airport Filing No. 1D

South: Bradley Road

East: Colorado Centre Metro District, Lot 4 Colorado Centre Foreign Trade Zone & Business Park Filing No. 1

West: S. Powers Boulevard

DESCRIPTION OF PROPERTY

The proposed improvements consist of community commercial, regional commercial, and medium and high to very high residential uses within the Site. The Project will also include construction of internal roadways and utility infrastructure which will be detailed in the infrastructure Final Drainage Report submitted at a later date.

The total Site is approximately 116.5 acres and consists of vacant land with native vegetation

within the Jimmy Camp Creek Basin and Big Johnson Basin. There is a ridge located in the western portion of the Site that splits the site into the two basins. The Jimmy Camp Creek Basin portion of the Site drains approximately west to east at grades that vary from 3% to 9%. The Big Johnson Basin portion of the Site drains approximately northeast to southwest at grades that vary from 3% to 10%.

There are no major irrigation facilities within the Site. The Site does not currently provide on-site water quality or detention for the Project area. There is no regional detention pond for the Project Site.

There is an existing gas main that runs along the east side of the property.

PROJECT CHARACTERISTICS

The Project Site is 116.5 acres and the proposed improvements consist of community commercial, regional commercial, and medium and high to very high residential uses within the Site.

The proposed project will route stormwater to the private temporary sediment basins ("TSB's") via the proposed temporary drainage swales. It is intended that the temporary sediment basins in the northwest corner, southwest corner, and southeast corner of the Site will be upgraded to full spectrum detention basins. The Full Spectrum Detention Basins will be designed and further discussed in the infrastructure Final Drainage Report.

There are no major irrigation facilities within the Site. The Site does not currently provide on-site water quality or detention for the Project area. There is no regional detention pond for the Project Site. The existing land use is vacant land.

DBPS COMPLIANCE

The proposed development will comply with the requirements, recommendations, and design intent set forth by West Fork Jimmy Camp Creek, Jimmy Camp Creek, and Big Johnson Reservoir DBPS's. The Project is not adjacent to any major drainage ways located within West Fork Jimmy Camp Creek, Jimmy Camp Creek or Big Johnson Reservoir.

SOIL CONDITIONS

NRCS soil data is available for this Site and it has been noted that soils onsite are generally USCS Type A and B. The NRSC Soils map is provided in **Appendix A**.

MAJOR DRAINAGEWAYS & STRUCTURES

Jimmy Camp Creek is located approximately 3,000 feet east of the Site. The Big Johnson Reservoir is located approximately 3,700 feet southwest of the Site.

EXISTING AND PROPOSED LAND USES

The existing use of the Site is vacant land. The proposed uses will consist of community commercial, regional commercial, and medium and high to very high residential uses within the Site.

HYDROLOGIC ANALYSIS

REGULATIONS

Water quality and detention are required for this Project per the City of Colorado Springs Drainage Criteria Manual (the "DCM"), dated May 2014, and revised January 2021. The Site proposes private temporary sediment basins to accompany the initial erosion control measures, concept plan, zone change, and annexation into the City of Colorado Springs. The infrastructure Drainage Report will provided detailed information and design for the permanent full spectrum detention ponds proposed on Site.

DESIGN CRITERIA REFERENCE AND CONSTRAINTS

The Project follows the City of Colorado Springs Storm Drainage Criteria Manual, Volumes 1 and 2 (the "DCM") and the MHFD Urban Storm Drainage Criteria Manual Volumes 1, 2, and 3 (the "MANUAL"). Project area drainage is not significantly impacted by such constraints as utilities or existing development. Further detail regarding on-site drainage patterns is provided in the Proposed Drainage Conditions Section.

HYDROLOGIC CRITERIA

The 5-year and 100-year design storm events were used in determining rainfall and runoff for the proposed drainage system per Section 6 of the DCM. Table 6-2 of the DCM is the source for rainfall data for the 5-year and 100-year design storm events. Design runoff was calculated using the Rational Method for developed conditions as established in the DCM and the USDCM. Runoff coefficients for the proposed development were determined using Table 6-6 of the DCM by calculating weighted impervious values for each specific site basin.

Temporary sediment basins were provided for the Site for the overlot grading construction associated with the initial erosion control permit. Temporary sediment basins were sized per the MANUAL fact sheet on sediment basins which is provided in **Appendix C**.

EXISTING DRAINAGE BASIN

The Project Site is a part of the *Amendment to the Master Drainage Development Plan for Waterview, Waterview North* prepared by Dakota Springs Engineering, dated February 2021 (the "MDDP Amendment"). The MDDP Amendment defines 9 basins on the Pre-Development Basin Map provided in **Appendix F.** The Site consists of the MDDP Amendment existing basins BJD-12c, BJDEX14, JCDEX3.1, JCDEX3.2, and JCDEX3.3.

MAJOR DRAINAGE BASIN DESCRIPTION

The Site is located in the Jimmy Camp Creek and Big Johnson Drainage Basins. Currently, the site consists of natural vegetation. The existing runoff from the Site is captured by existing storm sewer within S. Powers Boulevard and Bradley Road. The runoff eventually outfalls to either Jimmy Camp Creek or the Big Johnson Reservoir. The Pre-Development Basin Map from the MDDP Amendment with respective runoffs and calculations is provided in **Appendix F**.

The Project Site is split between the Big Johnson Drainage Basin and the Jimmy Camp Creek Drainage Basin. The release rate from the future full spectrum detention ponds will release flows

at or below the historic runoff values for each major drainage basin. The platted lots will pay fees to the respective drainage basins. A Major Basin Exhibit with calculations was provided in **Appendix G.**

PROPOSED BASIN DESCRIPTIONS

The proposed Site was divided into eleven sub-basins. Each of these sub-basins sheet flows to a temporary sediment basin in the overlot graded condition. Hydrologic calculations are provided in **Appendix B**. A Drainage Exhibit is provided in **Appendix F.**

SPECIFIC DETAILS

Sub-Basin 1

Sub-basin 1 is 19.06 acres and is anticipated to be developed primarily into a regional commercial use with a portion to be community commercial use per the Villages at Waterview North Master Plan. The runoff within this sub-basin will be captured by the basin 1 temporary swale and routed to the private temporary sediment basin 1. The 5-year and 100-year storm event runoffs are 66.15 cfs and 120.65 cfs, respectively. The runoff developed within this sub-basin ultimately discharges into the Big Johnson Drainage Basin.

Sub-Basin 2

Sub-basin 2 is 20.77 acres and is anticipated to be developed into a community commercial use per the Villages at Waterview North Master Plan. The runoff within this sub-basin will be captured by the basin 2 east and 2 south temporary swales and routed to the private temporary sediment basin 2. The 5-year and 100-year storm event runoffs are 72.34 cfs and 131.96 cfs, respectively. The runoff within this sub-basin is split with ultimate outfalls to Big Johnson and Jimmy Camp Creek.

Sub-Basin 3

Sub-basin 3 is 8.16 acres and is anticipated to be developed into a regional commercial use and residential high and very high use. The runoff within this sub-basin will be captured by the basin 3 temporary swale and routed to the private temporary sediment basin 3A. The 5-year and 100-year storm event runoffs are 33.27 cfs and 60.69 cfs, respectively. The runoff developed within this sub-basin ultimately discharges into the Jimmy Camp Creek Drainage Basin.

Sub-Basin 4

Sub-basin 3 is 8.16 acres and is anticipated to be developed into a regional commercial use and residential high and very high use. The runoff within this sub-basin will be captured by the basin 4 temporary swale and routed to the private temporary sediment basin 4A. The 5-year and 100-year storm event runoffs are 16.46 cfs and 34.97 cfs, respectively. The runoff developed within this sub-basin ultimately discharges into the Jimmy Camp Creek Drainage Basin.

Sub-Basin 5

Sub-basin 5 is 9.73 acres and is anticipated to be developed into a residential high and very high use. The runoff within this sub-basin will be captured by the basin 5 temporary swale and routed to the private temporary sediment basin 5. The 5-year and 100-year storm event runoffs are 21.15 cfs and 44.93 cfs, respectively. The runoff developed within this sub-basin ultimately discharges into the Jimmy Camp Creek Drainage Basin.

Sub-Basin 6

Sub-basin 6 is 26.44 acres and is anticipated to be developed into a residential high and very high use. The runoff within this sub-basin will be captured by the basin 6 north, 6 south, and 6 east temporary swales and routed to the private temporary sediment basin 6. The 5-year and 100-year storm event runoffs are 49.21 cfs and 104.53 cfs, respectively. The runoff developed within this sub-basin ultimately discharges into the Jimmy Camp Creek Drainage Basin.

Sub-Basin 7

Sub-basin 7 is 22.41 acres and is anticipated to be developed into a residential medium use. The runoff within this sub-basin will be captured by the basin 7 temporary swale and routed to the private temporary sediment basin 6. The 5-year and 100-year storm event runoffs are 41.88 cfs and 88.96 cfs, respectively. The runoff developed within this sub-basin ultimately discharges into the Jimmy Camp Creek Drainage Basin.

Sub-Basin RW-1 through RW-5

Sub-Basins RW-1 through RW-5 consist of the main shared access roads that connect each phase of the development. The roads traverse from Bradley Road to the north adjacent parcel and east to tie back into Bradley Road. Sub-Basins RW-1 through RW-5 are 1.61 acres, 1.33 acres, 0.60 acres, 0.65 acres, and 0.47 acres respectively. The 5-year storm event runoffs are 6.02 cfs, 5.72 cfs, 2.69 cfs, 2.79 cfs, and 2.16 cfs respectively. The 100-year storm event runoffs are 10.77 cfs, 10.25 cfs, 4.83 cfs, 5.01 cfs, and 3.87 cfs respectively.

HYDRAULIC ANALYSIS

The proposed private temporary sediment basins are designed in accordance with the MANUAL and the fact sheet provided in **Appendix C**.

The proposed temporary sediment basins are designed to capture and slow runoff during construction to allow time for the settling of sediment prior to discharge downstream. The temporary sediment basins were sized with at least 3,600 cubic feet per acre of drainage area upstream of the basin. The orifice plate or riser pipes were designed to accommodate an emptying time of approximately 72 hours.

Hydraulic calculations for the temporary drainage swales were computed using Flowmaster. Hydraulic calculations are included in **Appendix D**.

The inlet, storm sewer sizing, and full spectrum detention designs will be complete with the infrastructure Drainage Report.

OUTLET REQUIREMENTS

The water quality standards established by the CRITERIA will be met by the proposed full spectrum extended detention basins designed by the infrastructure Final Drainage Report. The orifice plates will allow the WQCV to be drained from the structure in at least 40 hours and the EURV in 68-72 hours.

FEMA INFORMATION

The Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map (FIRM) No. 80841C0768G, effective date December 7, 2018, indicated the Site is located in Zone X (Areas determined outside the 500-year floodplain).

ENVIRONMENTAL EVALUATIONS

FOUR-STEP PROCESS

The four-step process per the MANUAL provides guidance and requirements for the selection of siting of structural Best Management Practices (BMPs) for new development and significant redevelopment.

Step 1: Employ Runoff Reduction Practices
Temporary drainage swales and temporary sediment basins are provided to help reduce runoff and promote infiltration. The Colorado Springs Green Infrastructure Guidance Manual, dated March 2022, will be implemented with individual lot Final Drainage Reports.

Step 2: Implement BMPs That Provide a Water Quality Capture Volume with Slow Release
This MDDP is associated with the initial erosion control permit, Concept Plan, Master Plan, zone change, and annexation process which does not require the capture and treatment of the water quality capture volume at this time. Erosion control techniques are implemented throughout the development in the form of temporary drainage swales and temporary sediment basins. The temporary sediment basins provide risers pipes that provide an emptying time of approximately 72 hours. Permanent extended detention basins will be designed and constructed with the infrastructure Final Drainage Report for the infrastructure improvements for the development.

Step 3: Stabilize Drainageways
The Project Site is located more than 500’ away from any major drainageways and there are no open channels located on or adjacent to the Site. The Project outfall is ultimately to Jimmy Camp Creek and Big Johnson.

Step 4: Implement Site Specific and Other Source Control BMPs
The Site does not require “Covering of Storage/Handling Areas” or “Spill Containment and Control” (specialized BMPs) in the final constructed condition. There is no proposed material storage or other site operations that would introduce contaminants to the County’s MS4 that would require site specific control or source control BMP for the proposed project.

All flows leaving the Site will be released at the historic rates and are not anticipated to cause adverse impact to downstream facilities and additional off-site improvements are not required by this Project at this time.

OUTLET REQUIREMENTS

The water quality standards established by the CRITERIA will be met by the proposed full spectrum extended detention basins. The water quality outlet structures will be designed per the specifications in the CRITERIA. The outlet structure for the extended detention basin will meet the micro-pool requirement that it be integrated into the design of the structure with an additional surcharge volume. The orifice plates of the structures will be designed based on the CRITERIA. The orifice plates will allow the WQCV to be drained from the structure in at least 40 hours and the EURC in 72 hours.

GRADING AND EROSION CONTROL PLAN

Erosion Control Plans will be submitted separately as a standalone construction document.

OFFSITE DRAINAGE ANALYSIS

Per the MDDP Amendment, sub-basins BJD-12a, BJD-12b, JCD OS-1.A, and JCD OS-1.B on the offsite northern property surface flow south towards the Project Site. In the Final Drainage Report a 20' wide berm with a height of 2' will be designed spanning the portion of the northern property where the offsite drainage sheet flows south to the Project Site. This berm will then direct flow east following historical drainage patterns. In the event that the north adjacent parcel is in construction for their proposed project, the berm will not be required as it is the responsibility of the north adjacent owner to capture and treat their on-site storm runoff.

Temporary sediment basin 3 discharges east to the east property line and eventually discharges to an existing drainage channel along Bradley Road. A proposed riprap pad was provided at the outfall of this discharge pipe. The riprap sizing will be re-evaluated during final design of the extended detention basin and these calculations will be provided in that Final Drainage Report.

DEVELOPMENT FEES

DRAINAGE AND BRIDGE FEES

The Project Site is located in the Big Johnson, West Fork Jimmy Camp Creek, and Jimmy Camp Creek Basins. Fees are not applicable with the Concept Plan. Fees will be calculated with each subsequent subdivision plat's final drainage report and the drainage fees will be paid at the time of final plat recordation.

CONSTRUCTION COST OPINION

An opinion of probable construction cost for the construction of the private and public drainage facilities for the Project will be included in the infrastructure Final Drainage Report. Each individual lot will provide their own construction cost opinion in the Final Drainage Report for their specific development.

SUMMARY

COMPLIANCE WITH STANDARDS

The drainage design presented within this report for Villages at Waterview North conforms to the CRITERIA and MANUAL. Site runoff and storm drain facilities are not anticipated to adversely affect the downstream and surrounding developments.

This report and findings are in general conformance with all previously approved reports and/or studies which include this Site. The proposed Project does not adversely impact the peak flows downstream within Jimmy Camp Creek or Big Johnson.

REFERENCES

1. City of Colorado Springs Drainage Criteria Manual, January 2021.

2. Mile High Flood District Drainage Criteria Manual Vol. 1, prepared by Wright-McLaughlin Engineers, June 2001, with latest revisions.

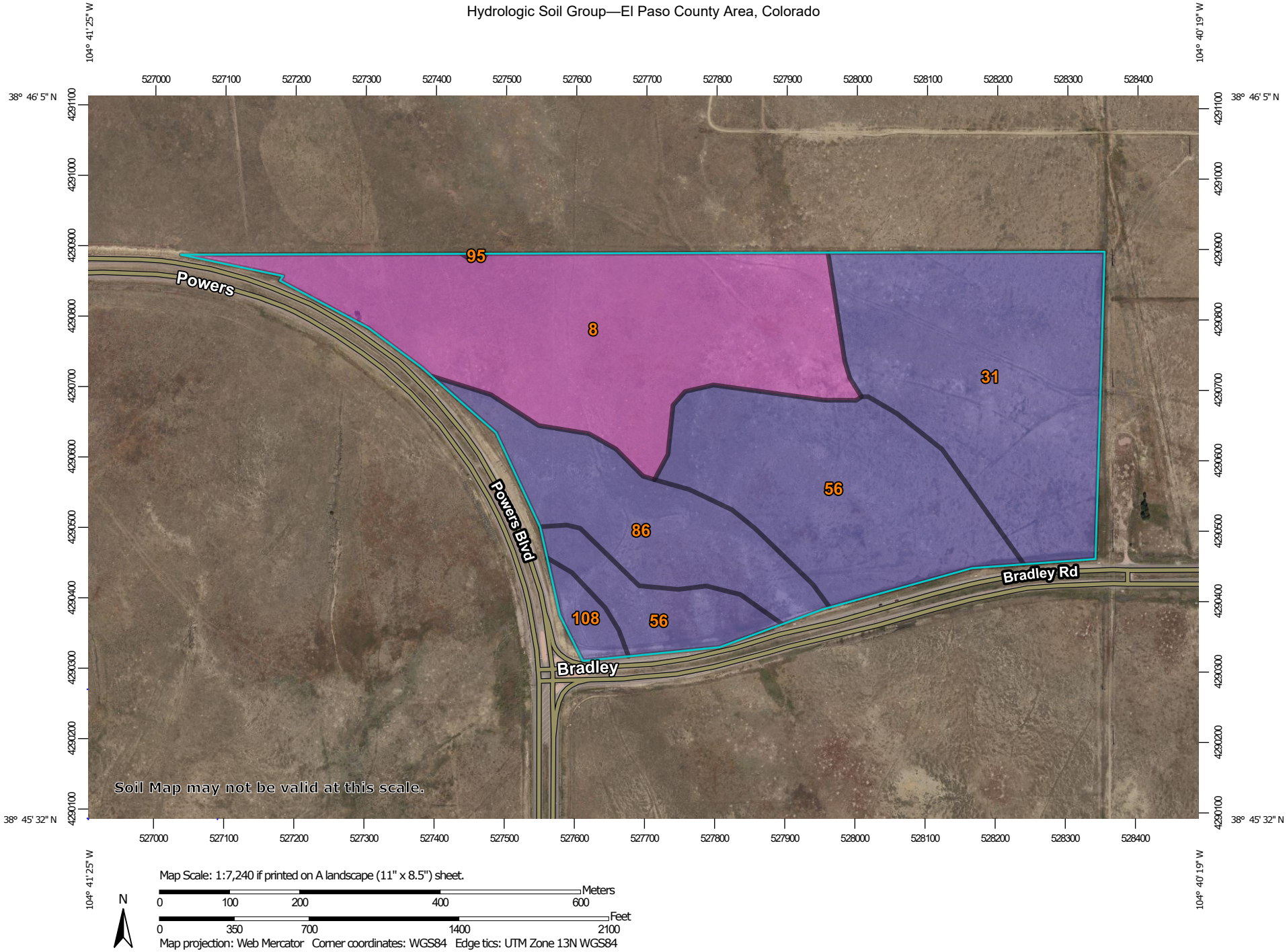
3. Flood Insurance Rate Map, El Paso County, Colorado and Incorporated Areas, Map Number 08041C0768G, Effective Date December 7, 2018, prepared by the Federal Emergency Management Agency (FEMA).

4. Amendment to Master Drainage Development Plan for Waterview, Waterview North, prepared by Dakota Springs Engineering, February 2021.

5. Big Johnson Reservoir/Crews Gulch Drainage Basin Planning Study, prepared by Kiowa Engineering Corporation, September 1991.

6. Jimmy Camp Creek Drainage Basin Planning Study, prepared by Kiowa Engineering Corporation, dated March 9, 2015.

APPENDIX A – SOILS MAP AND FEMA FIRM PANEL



Map Scale: 1:7,240 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 350 700 1400 2100

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 18, Jun 5, 2020

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

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	38.3	33.1%
31	Fort Collins loam, 3 to 8 percent slopes	B	30.6	26.5%
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	B	30.0	26.0%
86	Stoneham sandy loam, 3 to 8 percent slopes	B	14.6	12.6%
95	Truckton loamy sand, 1 to 9 percent slopes	A	0.0	0.0%
108	Wiley silt loam, 3 to 9 percent slopes	B	2.0	1.7%
Totals for Area of Interest			**115.6**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

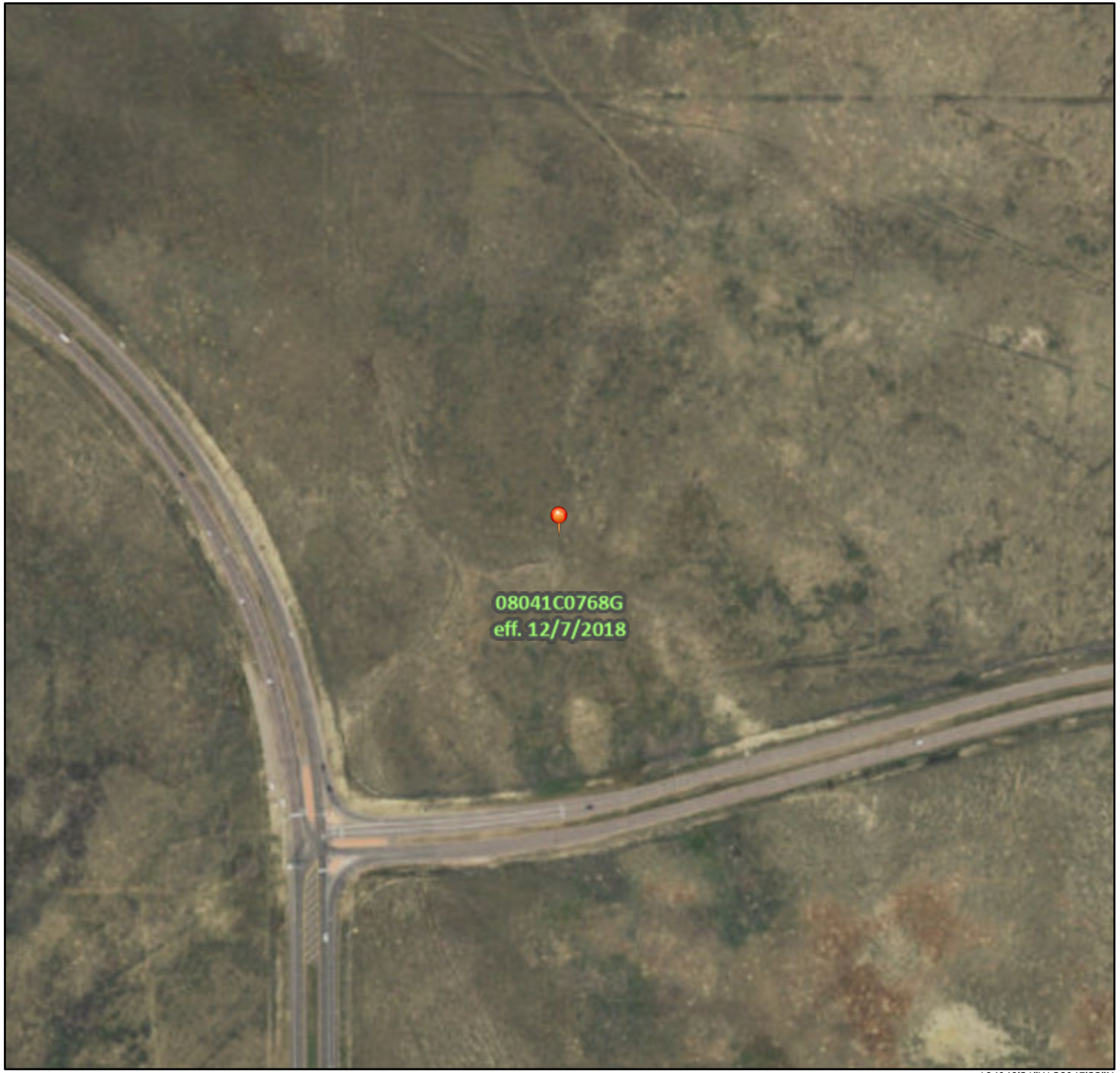
Component Percent Cutoff: None Specified

Tie-break Rule: Higher

National Flood Hazard Layer FIRMette

FEMA

104°41'8"W 38°46'1"N



104°40'31"W 38°45'33"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

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

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

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN — Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

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

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

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

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

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

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/7/2021 at 3:45 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

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

APPENDIX B – HYDROLOGIC CALCULATIONS

IDF Equations:

$I_{100} = -2.52\ln(D) + 12.735$
$I_{50} = -2.25\ln(D) + 11.375$
$I_{25}\ -2.00\ln(D) + 10.111$
$I_{10}\ -1.75\ln(D) + 8.847$
$I_{5}\ -1.50\ln(D) + 7.583$
$I_{2}\ -1.19\ln(D) + 6.035$

Where:
I = Rainfall Intensity (in/hr)
D= Duration (minutes)

	2-yr	5-yr	10-yr	100-yr
P_1 =	1.19	1.5	1.75	2.52

*The Design Point Rainfall Values and Time Intensity Frequency Tabulation are found in Table 6-2 and Figure 6-5, respectively of the Colorado Springs Drainage Criteria Manual, Volume1

Weighted Imperviousness Calculations

SUB-BASIN	AREA (SF)	AREA (Acres)	BASIN DESIGNATION	SOIL GROUP DESIGNATION	WEIGHTED IMPERVIOUSNESS	WEIGHTED COEFFICIENTS			
						C2	C5	C10	C100
1	830,188	19.06	COMMERCIAL	A	95.0%	0.79	0.81	0.83	0.88
2	904,811	20.77	COMMERCIAL	B	95.0%	0.79	0.81	0.83	0.88
3	355,415	8.16	COMMERCIAL	A	95.0%	0.79	0.81	0.83	0.88
4	342,309	7.86	RESIDENTIAL	A	70.0%	0.45	0.49	0.53	0.62
5	423,625	9.73	RESIDENTIAL	A	70.0%	0.45	0.49	0.53	0.62
6	1,151,520	26.44	RESIDENTIAL	B	70.0%	0.45	0.49	0.53	0.62
7	976,336	22.41	RESIDENTIAL	B	70.0%	0.45	0.49	0.53	0.62
TOTAL	4,984,204	114.42							

ROADWAYS

SUB-BASIN	AREA (SF)	AREA (Acres)	BASIN DESIGNATION	WEIGHTED IMPERVIOUSNESS	WEIGHTED COEFFICIENTS			
					C2	C5	C10	C100
RW-1	70025	1.60755	ROADWAY	100.0%	0.89	0.9	0.92	0.96
RW-2	57797	1.32684	ROADWAY	100.0%	0.89	0.9	0.92	0.96
RW-3	26088	0.5989	ROADWAY	100.0%	0.89	0.9	0.92	0.96
RW-4	28224	0.64793	ROADWAY	100.0%	0.89	0.9	0.92	0.96
RW-5	20293	0.46586	ROADWAY	100.0%	0.89	0.9	0.92	0.96
TOTAL	202,427	4.65			0.89	0.9	0.92	0.96

Waterview North - Drainage Report
Proposed Runoff Calculations
Time of Concentration

Watercourse Coefficient

Forest & Meadow	2.50	Short Grass Pasture & Lawns	7.00	Grassed Waterway	15.00
Fallow or Cultivation	5.00	Nearly Bare Ground	10.00	Paved Area & Shallow Gutter	20.00

	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)					T(c) CHECK (URBANIZED BASINS)			FINAL T(c)
DESIGN POINT	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	TOTAL LENGTH	L/180+10	min.
1	1	830,188	19.06	0.81	100	2.0%	4.2	817	2.0%	20.00	2.8	4.8	9.0	917	15.1	9.0
2	2	904,811	20.77	0.81	100	4.0%	3.3	1350	4.0%	20.00	4.0	5.6	8.9	1450	18.1	8.9
3	3	355,415	8.16	0.81	100	6.0%	2.9	690	5.0%	20.00	4.5	2.6	5.5	790	14.4	5.5
4	4	342,309	7.86	0.49	100	5.0%	6.5	690	5.0%	20.00	4.5	2.6	9.1	790	14.4	9.1
5	5	423,625	9.73	0.49	100	5.0%	6.5	440	5.0%	20.00	4.5	1.6	8.1	540	13.0	8.1
6	6	1,151,520	26.44	0.49	100	5.0%	6.5	1600	5.0%	20.00	4.5	6.0	12.5	1700	19.4	12.5
7	7	976,336	22.41	0.49	100	3.9%	7.1	1700	7.3%	20.00	5.4	5.2	12.3	1800	20.0	12.3
RW-1	RW-1	70,025	1.61	0.90	50	1.0%	2.6	1368	2.5%	20.00	3.2	7.2	9.8	1418	17.9	9.8
RW-2	RW-2	57,797	1.33	0.90	50	1.0%	2.6	920	4.0%	20.00	4.0	3.8	6.4	970	15.4	6.4
RW-3	RW-3	26,088	0.60	0.90	50	1.0%	2.6	720	4.0%	20.00	4.0	3.0	5.6	770	14.3	5.6
RW-4	RW-4	28,224	0.65	0.90	50	1.0%	2.6	795	3.0%	20.00	3.5	3.8	6.4	845	14.7	6.4
RW-5	RW-5	20,293	0.47	0.90	50	1.0%	2.6	550	3.5%	20.00	3.7	2.4	5.0	600	13.3	5.0

Waterview North - Drainage Report
Proposed Runoff Calculations *Design Storm 5 Year*
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
1	1	19.06	0.81	9.0	15.44	4.28	66.15					
2	2	20.77	0.81	8.9	16.82	4.30	72.34					
3	3	8.16	0.81	5.5	6.61	5.03	33.27					
4	4	7.86	0.49	9.1	3.85	4.28	16.46					
5	5	9.73	0.49	8.1	4.77	4.44	21.15					
6	6	26.44	0.49	12.5	12.95	3.80	49.21					
7	7	22.41	0.49	12.3	10.98	3.81	41.88					
RW-1	RW-1	1.61	0.90	9.8	1.45	4.16	6.02					
RW-2	RW-2	1.33	0.90	6.4	1.19	4.79	5.72					
RW-3	RW-3	0.60	0.90	5.6	0.54	5.00	2.69					
RW-4	RW-4	0.65	0.90	6.4	0.58	4.79	2.79					
RW-5	RW-5	0.47	0.90	5.0	0.42	5.15	2.16					

Waterview North - Drainage Report
Proposed Runoff Calculations
(Rational Method Procedure)

Design Storm *100 Year*

BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
1	1	19.06	0.88	9.0	16.77	7.19	120.65					
2	2	20.77	0.88	8.9	18.28	7.22	131.96					
3	3	8.16	0.88	5.5	7.18	8.45	60.69					
4	4	7.86	0.62	9.1	4.87	7.18	34.97					
5	5	9.73	0.62	8.1	6.03	7.45	44.93					
6	6	26.44	0.62	12.5	16.39	6.38	104.53					
7	7	22.41	0.62	12.3	13.90	6.40	88.96					
RW-1	RW-1	1.61	0.96	9.8	1.54	6.98	10.77					
RW-2	RW-2	1.33	0.96	6.4	1.27	8.04	10.25					
RW-3	RW-3	0.60	0.96	5.6	0.57	8.39	4.83					
RW-4	RW-4	0.65	0.96	6.4	0.62	8.05	5.01					
RW-5	RW-5	0.47	0.96	5.0	0.45	8.65	3.87					

SUMMARY - PROPOSED RUNOFF TABLE					
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	IMPERVIOUSNESS (%)
1	1	19.06	66.15	120.65	0.95
2	2	20.77	72.34	131.96	0.95
3	3	8.16	33.27	60.69	0.95
4	4	7.86	16.46	34.97	0.70
5	5	9.73	21.15	44.93	0.70
6	6	26.44	49.21	104.53	0.70
7	7	22.41	41.88	88.96	0.70
RW-1	RW-1	1.61	6.02	10.77	100.00
RW-2	RW-2	1.33	5.72	10.25	100.00
RW-3	RW-3	0.60	2.69	4.83	100.00
RW-4	RW-4	0.65	2.79	5.01	100.00
RW-5	RW-5	0.47	2.16	3.87	100.00

APPENDIX C – SEDIMENT BASIN FACT SHEET

Sediment Basin (SB) SC-7

Description

A sediment basin is a temporary pond built on a construction site to capture eroded or disturbed soil transported in storm runoff prior to discharge from the site. Sediment basins are designed to capture site runoff and slowly release it to allow time for settling of sediment prior to discharge. Sediment basins are often constructed in locations that will later be modified to serve as post-construction stormwater basins.

Photograph SB-1. Sediment basin at the toe of a slope. Photo courtesy of WWE.

Appropriate Uses

Most large construction sites (typically greater than 2 acres) will require one or more sediment basins for effective management of construction site runoff. On linear construction projects, sediment basins may be impractical; instead, sediment traps or other combinations of BMPs may be more appropriate.

Sediment basins should not be used as stand-alone sediment controls. Erosion and other sediment controls should also be implemented upstream.

When feasible, the sediment basin should be installed in the same location where a permanent post-construction detention pond will be located.

Design and Installation

The design procedure for a sediment basin includes these steps:

- **Basin Storage Volume**: Provide a storage volume of at least 3,600 cubic feet per acre of drainage area. To the extent practical, undisturbed and/or off-site areas should be diverted around sediment basins to prevent "clean" runoff from mixing with runoff from disturbed areas. For undisturbed areas (both on-site and off-site) that cannot be diverted around the sediment basin, provide a minimum of 500 ft^3/acre of storage for undeveloped (but stable) off-site areas in addition to the 3,600 ft^3/acre for disturbed areas. For stable, developed areas that cannot be diverted around the sediment basin, storage volume requirements are summarized in Table SB-1.

- **Basin Geometry:** Design basin with a minimum length-to-width ratio of 2:1 (L:W). If this cannot be achieved because of site space constraints, baffling may be required to extend the effective distance between the inflow point(s) and the outlet to minimize short-circuiting.

- **Dam Embankment**: It is recommended that embankment slopes be 4:1 (H:V) or flatter and no steeper than 3:1 (H:V) in any location.

Sediment Basins	
Functions	
Erosion Control	No
Sediment Control	Yes
Site/Material Management	No

- **Inflow Structure**: For concentrated flow entering the basin, provide energy dissipation at the point of inflow.

Table SB-1. Additional Volume Requirements for Undisturbed and Developed Tributary Areas Draining through Sediment Basins

Imperviousness (%)	Additional Storage Volume (ft^3) Per Acre of Tributary Area
Undeveloped	500
10	800
20	1230
30	1600
40	2030
50	2470
60	2980
70	3560
80	4360
90	5300
100	6460

- **Outlet Works**: The outlet pipe shall extend through the embankment at a minimum slope of 0.5 percent. Outlet works can be designed using one of the following approaches:

  - **Riser Pipe (Simplified Detail):** Detail SB-1 provides a simplified design for basins treating no more than 15 acres.

  - **Orifice Plate or Riser Pipe**: Follow the design criteria for Full Spectrum Detention outlets in the EDB Fact Sheet provided in Chapter 4 of this manual for sizing of outlet perforations with an emptying time of approximately 72 hours. In lieu of the trash rack, pack uniformly sized 1½ - to 2-inch gravel in front of the plate or surrounding the riser pipe. This gravel will need to be cleaned out frequently during the construction period as sediment accumulates within it. The gravel pack will need to be removed and disposed of following construction to reclaim the basin for use as a permanent detention facility. If the basin will be used as a permanent extended detention basin for the site, a trash rack will need to be installed once contributing drainage areas have been stabilized and the gravel pack and accumulated sediment have been removed.

  - **Floating Skimmer**: If a floating skimmer is used, install it using manufacturer's recommendations. Illustration SB-1 provides an illustration of a Faircloth Skimmer Floating Outlet™, one of the more commonly used floating skimmer outlets. A skimmer should be designed to release the design volume in no less than 48 hours. The use of a floating skimmer outlet can increase the sediment capture efficiency of a basin significantly. A floating outlet continually decants cleanest water off the surface of the pond and releases cleaner water than would discharge from a perforated riser pipe or plate.

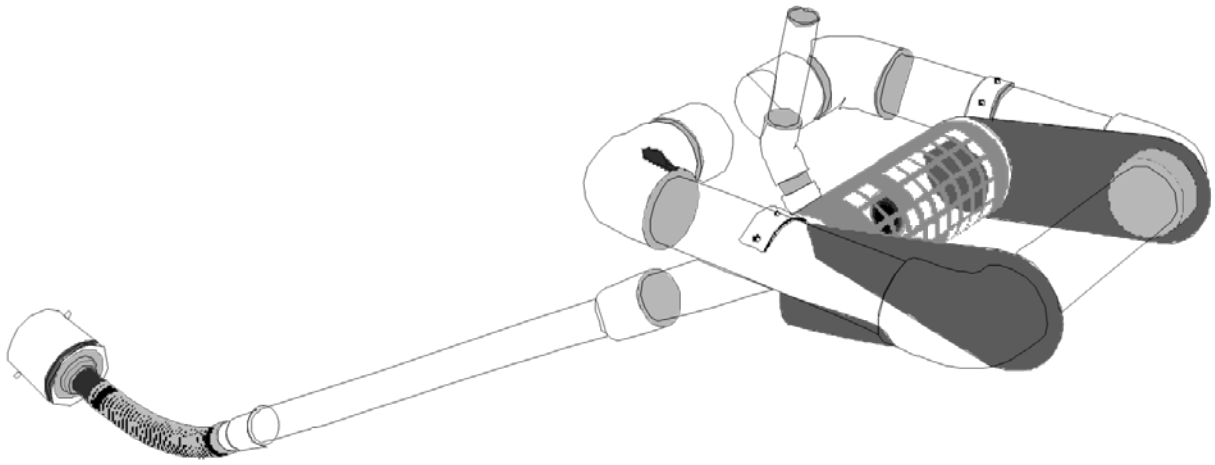


Illustration SB-1. Outlet structure for a temporary sediment basin - Faircloth Skimmer Floating Outlet. Illustration courtesy of J. W. Faircloth & Sons, Inc., FairclothSkimmer.com.

- **Outlet Protection and Spillway:** Consider all flow paths for runoff leaving the basin, including protection at the typical point of discharge as well as overtopping.
  - **Outlet Protection:** Outlet protection should be provided where the velocity of flow will exceed the maximum permissible velocity of the material of the waterway into which discharge occurs. This may require the use of a riprap apron at the outlet location and/or other measures to keep the waterway from eroding.
  - **Emergency Spillway:** Provide a stabilized emergency overflow spillway for rainstorms that exceed the capacity of the sediment basin volume and its outlet. Protect basin embankments from erosion and overtopping. If the sediment basin will be converted to a permanent detention basin, design and construct the emergency spillway(s) as required for the permanent facility. If the sediment basin will not become a permanent detention basin, it may be possible to substitute a heavy polyvinyl membrane or properly bedded rock cover to line the spillway and downstream embankment, depending on the height, slope, and width of the embankments.

Maintenance and Removal

Maintenance activities include the following:

- Dredge sediment from the basin, as needed to maintain BMP effectiveness, typically when the design storage volume is no more than one-third filled with sediment.
- Inspect the sediment basin embankments for stability and seepage.
- Inspect the inlet and outlet of the basin, repair damage, and remove debris. Remove, clean and replace the gravel around the outlet on a regular basis to remove the accumulated sediment within it and keep the outlet functioning.
- Be aware that removal of a sediment basin may require dewatering and associated permit requirements.
- Do not remove a sediment basin until the upstream area has been stabilized with vegetation.

Final disposition of the sediment basin depends on whether the basin will be converted to a permanent post-construction stormwater basin or whether the basin area will be returned to grade. For basins being converted to permanent detention basins, remove accumulated sediment and reconfigure the basin and outlet to meet the requirements of the final design for the detention facility. If the sediment basin is not to be used as a permanent detention facility, fill the excavated area with soil and stabilize with vegetation.

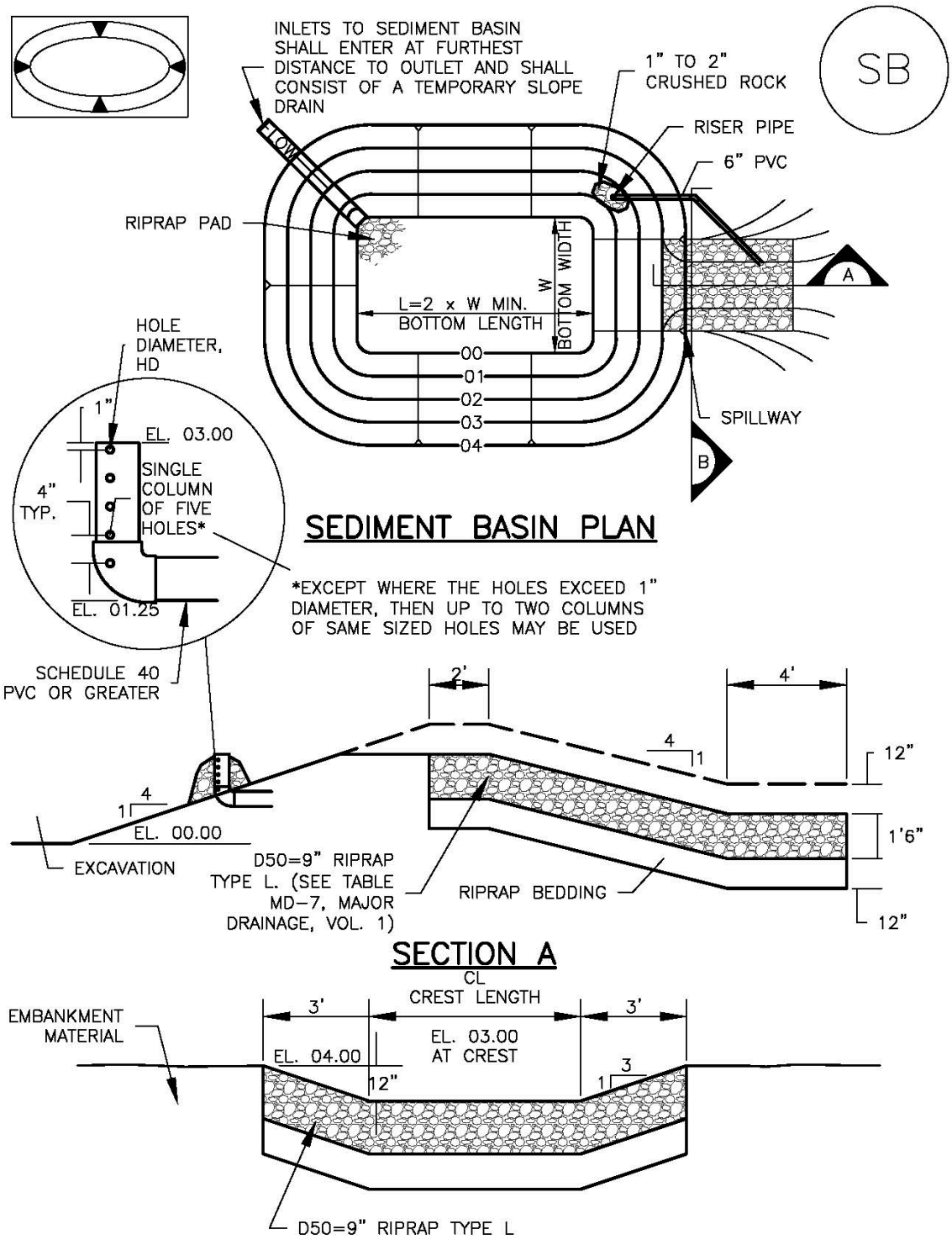

SB
INLETS TO SEDIMENT BASIN SHALL ENTER AT FURTHEST DISTANCE TO OUTLET AND SHALL CONSIST OF A TEMPORARY SLOPE DRAIN
FLOW
1" TO 2" CRUSHED ROCK
RISER PIPE
6" PVC
RIPRAP PAD
W BOTTOM WIDTH
L=2 x W MIN. BOTTOM LENGTH
00
01
02
03
04
A
B
SPILLWAY
HOLE DIAMETER, HD
1"
EL. 03.00
4" TYP.
SINGLE COLUMN OF FIVE HOLES*
EL. 01.25
SCHEDULE 40 PVC OR GREATER
SEDIMENT BASIN PLAN
*EXCEPT WHERE THE HOLES EXCEED 1" DIAMETER, THEN UP TO TWO COLUMNS OF SAME SIZED HOLES MAY BE USED
2'
4'
4
1
12"
4
1
EL. 00.00
1'6"
EXCAVATION
D50=9" RIPRAP TYPE L. (SEE TABLE MD-7, MAJOR DRAINAGE, VOL. 1)
RIPRAP BEDDING
12"
SECTION A
CL
CREST LENGTH
3'
3'
EMBANKMENT MATERIAL
EL. 04.00
EL. 03.00 AT CREST
12"
3
1
D50=9" RIPRAP TYPE L

TABLE SB–1. SIZING INFORMATION FOR STANDARD SEDIMENT BASIN			
Upstream Drainage Area (rounded to nearest acre), (ac)	Basin Bottom Width (W), (ft)	Spillway Crest Length (CL), (ft)	Hole Diameter (HD), (in)
1	12 ½	2	9/32
2	21	3	13/16
3	28	5	½
4	33 ½	6	9/16
5	38 ½	8	21/32
6	43	9	21/32
7	47 ¼	11	25/32
8	51	12	27/32
9	55	13	⅞
10	58 ¼	15	15/16
11	61	16	31/32
12	64	18	1
13	67 ½	19	1 1/16
14	70 ½	21	1 ⅛
15	73 ¼	22	1 3/16

SEDIMENT BASIN INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - –LOCATION OF SEDIMENT BASIN.
   - –TYPE OF BASIN (STANDARD BASIN OR NONSTANDARD BASIN).
   - –FOR STANDARD BASIN, BOTTOM WIDTH W, CREST LENGTH CL, AND HOLE DIAMETER, HD.
   - –FOR NONSTANDARD BASIN, SEE CONSTRUCTION DRAWINGS FOR DESIGN OF BASIN INCLUDING RISER HEIGHT H, NUMBER OF COLUMNS N, HOLE DIAMETER HD AND PIPE DIAMETER D.

2. FOR STANDARD BASIN, BOTTOM DIMENSION MAY BE MODIFIED AS LONG AS BOTTOM AREA IS NOT REDUCED.

3. SEDIMENT BASINS SHALL BE INSTALLED PRIOR TO ANY OTHER LAND–DISTURBING ACTIVITY THAT RELIES ON ON BASINS AS AS A STORMWATER CONTROL.

4. EMBANKMENT MATERIAL SHALL CONSIST OF SOIL FREE OF DEBRIS, ORGANIC MATERIAL, AND ROCKS OR CONCRETE GREATER THAN 3 INCHES AND SHALL HAVE A MINIMUM OF 15 PERCENT BY WEIGHT PASSING THE NO. 200 SIEVE.

5. EMBANKMENT MATERIAL SHALL BE COMPACTED TO AT LEAST 95 PERCENT OF MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D698.

6. PIPE SCH 40 OR GREATER SHALL BE USED.

7. THE DETAILS SHOWN ON THESE SHEETS PERTAIN TO STANDARD SEDIMENT BASIN(S) FOR DRAINAGE AREAS LESS THAN 15 ACRES. SEE CONSTRUCTION DRAWINGS FOR EMBANKMENT, STORAGE VOLUME, SPILLWAY, OUTLET, AND OUTLET PROTECTION DETAILS FOR ANY SEDIMENT BASIN(S) THAT HAVE BEEN INDIVIDUALLY DESIGNED FOR DRAINAGE AREAS LARGER THAN 15 ACRES.

SEDIMENT BASIN MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED IN BASIN SHALL BE REMOVED AS NEEDED TO MAINTAIN BMP EFFECTIVENESS, TYPICALLY WHEN SEDIMENT DEPTH REACHES ONE FOOT (I.E., TWO FEET BELOW THE SPILLWAY CREST).

5. SEDIMENT BASINS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS ACCEPTED BY THE LOCAL JURISDICTION.

6. WHEN SEDIMENT BASINS ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

APPENDIX D – TEMPORARY SWALE SIZING

Earth Dikes and Drainage Swales (ED/DS) EC-10

Description

Earth dikes and drainage swales are temporary storm conveyance channels constructed either to divert runoff around slopes or to convey runoff to additional sediment control BMPs prior to discharge of runoff from a site. Drainage swales may be lined or unlined, but if an unlined swale is used, it must be well compacted and capable of resisting erosive velocities.

Photograph ED/DS-1. Example of an earth dike used to divert flows at a construction site. Photo courtesy of CDOT.

Appropriate Uses

Earth dikes and drainage swales are typically used to control the flow path of runoff at a construction site by diverting runoff around areas prone to erosion, such as steep slopes. Earth dikes and drainage swales may also be constructed as temporary conveyance features. This will direct runoff to additional sediment control treatment BMPs, such as sediment traps or basins.

Design and Installation

When earth dikes are used to divert water for slope protection, the earth dike typically consists of a horizontal ridge of soil placed perpendicular to the slope and angled slightly to provide drainage along the contour. The dike is used in conjunction with a swale or a small channel upslope of the berm to convey the diverted water. Temporary diversion dikes can be constructed by excavation of a V-shaped trench or ditch and placement of the fill on the downslope side of the cut. There are two types of placement for temporary slope diversion dikes:

- A dike located at the top of a slope to divert upland runoff away from the disturbed area and convey it in a temporary or permanent channel.
- A diversion dike located at the base or mid-slope of a disturbed area to intercept runoff and reduce the effective slope length.

Depending on the project, either an earth dike or drainage swale may be more appropriate. If there is a need for cut on the project, then an excavated drainage swale may be better suited. When the project is primarily fill, then a conveyance constructed using a berm may be the better option.

All dikes or swales receiving runoff from a disturbed area should direct stormwater to a sediment control BMP such as a sediment trap or basin.

Earth Dikes and Drainage Swales	
Functions	
Erosion Control	Yes
Sediment Control	Moderate
Site/Material Management	No

EC-10 Earth Dikes and Drainage Swales (ED/DS)

Unlined dikes or swales should only be used for intercepting sheet flow runoff and are not intended for diversion of concentrated flows.

Details with notes are provided for several design variations, including:

ED-1. Unlined Earth Dike formed by Berm

DS-1. Unlined Excavated Swale

DS-2. Unlined Swale Formed by Cut and Fill

DS-3. ECB-lined Swale

DS-4. Synthetic-lined Swale

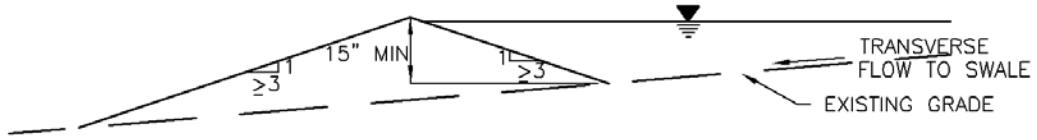
DS-5. Riprap-lined Swale

The details also include guidance on permissible velocities for cohesive channels if unlined approaches will be used.

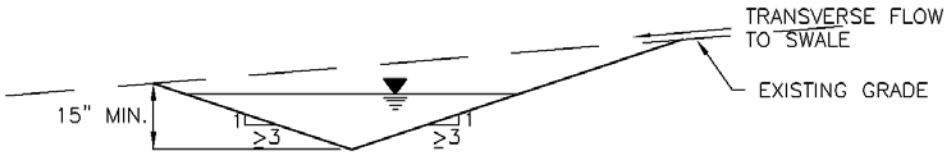
Maintenance and Removal

Inspect earth dikes for stability, compaction, and signs of erosion and repair. Inspect side slopes for erosion and damage to erosion control fabric. Stabilize slopes and repair fabric as necessary. If there is reoccurring extensive damage, consider installing rock check dams or lining the channel with riprap.

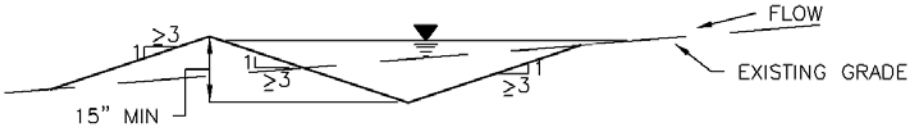
If drainage swales are not permanent, remove dikes and fill channels when the upstream area is stabilized. Stabilize the fill or disturbed area immediately following removal by revegetation or other permanent stabilization method approved by the local jurisdiction.



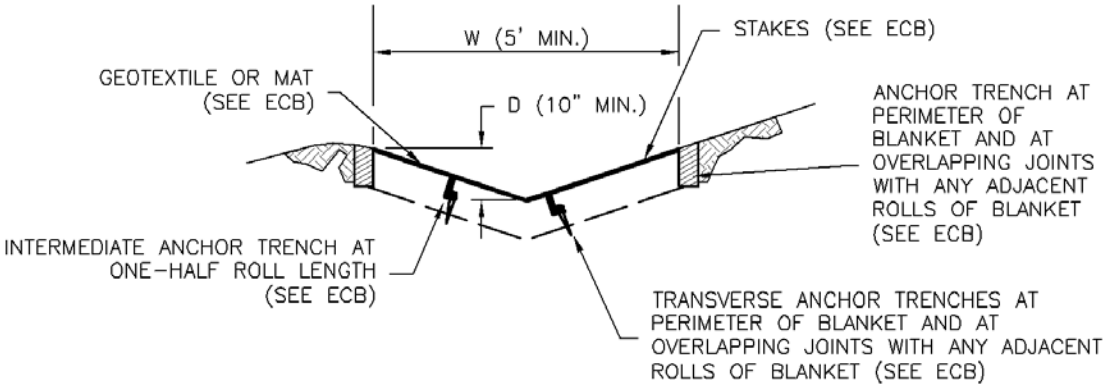
ED–1. COMPACTED UNLINED EARTH DIKE FORMED BY BERM



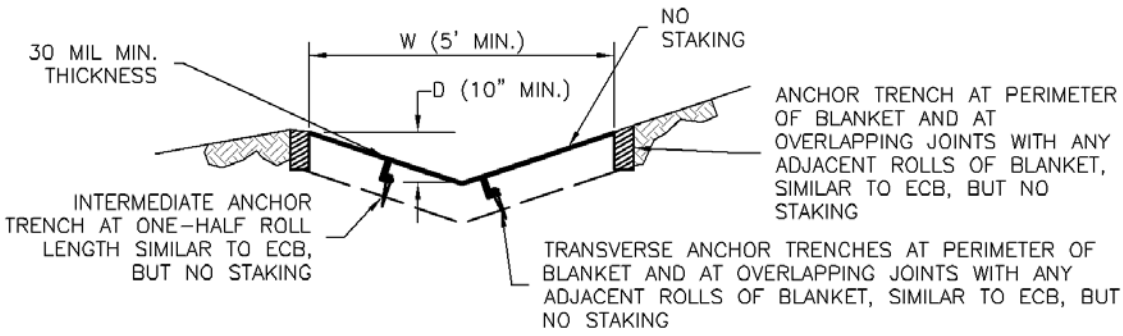
DS–1. COMPACTED UNLINED EXCAVATED SWALE



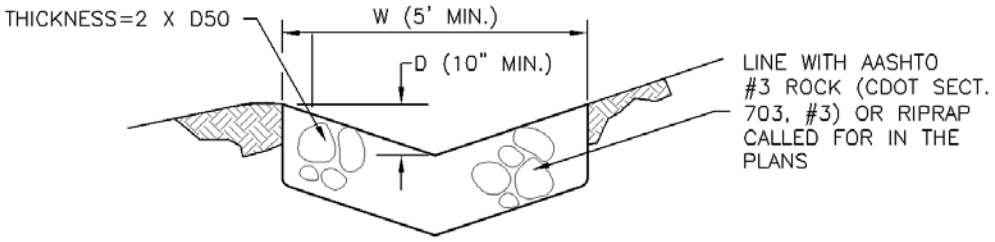
DS–2. COMPACTED UNLINED SWALE FORMED BY CUT AND FILL



DS–3. ECB LINED SWALE (CUT AND FILL OR BERM)



DS-4. SYNTHETIC LINED SWALE



DS-5. RIPRAP LINED SWALE

EARTH DIKE AND DRAINAGE SWALE INSTALLATION NOTES

1. SEE SITE PLAN FOR:
   - LOCATION OF DIVERSION SWALE
   - TYPE OF SWALE (UNLINED, COMPACTED AND/OR LINED).
   - LENGTH OF EACH SWALE.
   - DEPTH, D, AND WIDTH, W DIMENSIONS.
   - FOR ECB/TRM LINED DITCH, SEE ECB DETAIL.
   - FOR RIPRAP LINED DITCH, SIZE OF RIPRAP, D50.

2. SEE DRAINAGE PLANS FOR DETAILS OF PERMANENT CONVEYANCE FACILITIES AND/OR DIVERSION SWALES EXCEEDING 2-YEAR FLOW RATE OR 10 CFS.

3. EARTH DIKES AND SWALES INDICATED ON SWMP PLAN SHALL BE INSTALLED PRIOR TO LAND-DISTURBING ACTIVITIES IN PROXIMITY.

4. EMBANKMENT IS TO BE COMPACTED TO 90% OF MAXIMUM DENSITY AND WITHIN 2% OF OPTIMUM MOISTURE CONTENT ACCORDING TO ASTM D698.

5. SWALES ARE TO DRAIN TO A SEDIMENT CONTROL BMP.

6. FOR LINED DITCHES, INSTALLATION OF ECB/TRM SHALL CONFORM TO THE REQUIREMENTS OF THE ECB DETAIL.

7. WHEN CONSTRUCTION TRAFFIC MUST CROSS A DIVERSION SWALE, INSTALL A TEMPORARY CULVERT WITH A MINIMUM DIAMETER OF 12 INCHES.

EARTH DIKE AND DRAINAGE SWALE MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SWALES SHALL REMAIN IN PLACE UNTIL THE END OF CONSTRUCTION; IF APPROVED BY LOCAL JURISDICTION, SWALES MAY BE LEFT IN PLACE.

5. WHEN A SWALE IS REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY LOCAL JURISDICTION.

(DETAIL ADAPTED FROM DOUGLAS COUNTY, COLORADO AND THE CITY OF COLORADO SPRINGS, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Worksheet for Basin 1 Temp Drainage Swale

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.030	
Channel Slope	0.020	ft/ft
Normal Depth	28.0	in
Left Side Slope	3.000	H:V
Right Side Slope	3.000	H:V

Results		
Discharge	122.42	cfs
Flow Area	16.3	ft²
Wetted Perimeter	14.8	ft
Hydraulic Radius	13.3	in
Top Width	14.00	ft
Critical Depth	30.4	in
Critical Slope	0.013	ft/ft
Velocity	7.49	ft/s
Velocity Head	0.87	ft
Specific Energy	3.21	ft
Froude Number	1.223	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	28.0	in
Critical Depth	30.4	in
Channel Slope	0.020	ft/ft
Critical Slope	0.013	ft/ft

Worksheet for Basin 2 Temp Drainage Swale

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.030	
Channel Slope	0.030	ft/ft
Normal Depth	27.0	in
Left Side Slope	3.000	H:V
Right Side Slope	3.000	H:V

Results		
Discharge	136.07	cfs
Flow Area	15.2	ft²
Wetted Perimeter	14.2	ft
Hydraulic Radius	12.8	in
Top Width	13.50	ft
Critical Depth	31.7	in
Critical Slope	0.013	ft/ft
Velocity	8.96	ft/s
Velocity Head	1.25	ft
Specific Energy	3.50	ft
Froude Number	1.489	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	27.0	in
Critical Depth	31.7	in
Channel Slope	0.030	ft/ft
Critical Slope	0.013	ft/ft

Worksheet for Basin 3 Temp Drainage Swale

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.030	
Channel Slope	0.020	ft/ft
Normal Depth	22.0	in
Left Side Slope	3.000	H:V
Right Side Slope	3.000	H:V

Results		
Discharge	64.35	cfs
Flow Area	10.1	ft²
Wetted Perimeter	11.6	ft
Hydraulic Radius	10.4	in
Top Width	11.00	ft
Critical Depth	23.5	in
Critical Slope	0.014	ft/ft
Velocity	6.38	ft/s
Velocity Head	0.63	ft
Specific Energy	2.47	ft
Froude Number	1.175	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	22.0	in
Critical Depth	23.5	in
Channel Slope	0.020	ft/ft
Critical Slope	0.014	ft/ft

Worksheet for Basin 4 Temp Drainage Swale

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.030	
Channel Slope	0.020	ft/ft
Normal Depth	18.0	in
Left Side Slope	3.000	H:V
Right Side Slope	3.000	H:V

Results		
Discharge	37.68	cfs
Flow Area	6.8	ft²
Wetted Perimeter	9.5	ft
Hydraulic Radius	8.5	in
Top Width	9.00	ft
Critical Depth	18.9	in
Critical Slope	0.015	ft/ft
Velocity	5.58	ft/s
Velocity Head	0.48	ft
Specific Energy	1.98	ft
Froude Number	1.136	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	18.0	in
Critical Depth	18.9	in
Channel Slope	0.020	ft/ft
Critical Slope	0.015	ft/ft

Worksheet for Basin 5 Temp Drainage Swale

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.030	
Channel Slope	0.008	ft/ft
Normal Depth	24.0	in
Left Side Slope	3.000	H:V
Right Side Slope	3.000	H:V

Results		
Discharge	49.70	cfs
Flow Area	12.0	ft²
Wetted Perimeter	12.6	ft
Hydraulic Radius	11.4	in
Top Width	12.00	ft
Critical Depth	21.2	in
Critical Slope	0.015	ft/ft
Velocity	4.14	ft/s
Velocity Head	0.27	ft
Specific Energy	2.27	ft
Froude Number	0.730	
Flow Type	Subcritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	24.0	in
Critical Depth	21.2	in
Channel Slope	0.008	ft/ft
Critical Slope	0.015	ft/ft

Worksheet for Basin 6 North Temp Drainage Swale

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.030	
Channel Slope	0.020	ft/ft
Normal Depth	27.0	in
Left Side Slope	3.000	H:V
Right Side Slope	3.000	H:V

Results		
Discharge	111.10	cfs
Flow Area	15.2	ft²
Wetted Perimeter	14.2	ft
Hydraulic Radius	12.8	in
Top Width	13.50	ft
Critical Depth	29.2	in
Critical Slope	0.013	ft/ft
Velocity	7.32	ft/s
Velocity Head	0.83	ft
Specific Energy	3.08	ft
Froude Number	1.216	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	27.0	in
Critical Depth	29.2	in
Channel Slope	0.020	ft/ft
Critical Slope	0.013	ft/ft

Worksheet for Basin 7 Temp Drainage Swale

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.030	
Channel Slope	0.035	ft/ft
Normal Depth	23.0	in
Left Side Slope	3.000	H:V
Right Side Slope	3.000	H:V

Results		
Discharge	95.84	cfs
Flow Area	11.0	ft²
Wetted Perimeter	12.1	ft
Hydraulic Radius	10.9	in
Top Width	11.50	ft
Critical Depth	27.5	in
Critical Slope	0.013	ft/ft
Velocity	8.70	ft/s
Velocity Head	1.18	ft
Specific Energy	3.09	ft
Froude Number	1.566	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	23.0	in
Critical Depth	27.5	in
Channel Slope	0.035	ft/ft
Critical Slope	0.013	ft/ft

Worksheet for Basin 6 East Temp Drainage Swale

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.030	
Channel Slope	0.013	ft/ft
Normal Depth	29.0	in
Left Side Slope	3.000	H:V
Right Side Slope	3.000	H:V

Results		
Discharge	108.38	cfs
Flow Area	17.5	ft²
Wetted Perimeter	15.3	ft
Hydraulic Radius	13.8	in
Top Width	14.50	ft
Critical Depth	28.9	in
Critical Slope	0.013	ft/ft
Velocity	6.19	ft/s
Velocity Head	0.59	ft
Specific Energy	3.01	ft
Froude Number	0.992	
Flow Type	Subcritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	29.0	in
Critical Depth	28.9	in
Channel Slope	0.013	ft/ft
Critical Slope	0.013	ft/ft

Worksheet for Basin 6 South Temp Drainage Swale

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.030	
Channel Slope	0.013	ft/ft
Normal Depth	29.0	in
Left Side Slope	3.000	H:V
Right Side Slope	3.000	H:V

Results		
Discharge	108.38	cfs
Flow Area	17.5	ft²
Wetted Perimeter	15.3	ft
Hydraulic Radius	13.8	in
Top Width	14.50	ft
Critical Depth	28.9	in
Critical Slope	0.013	ft/ft
Velocity	6.19	ft/s
Velocity Head	0.59	ft
Specific Energy	3.01	ft
Froude Number	0.992	
Flow Type	Subcritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	29.0	in
Critical Depth	28.9	in
Channel Slope	0.013	ft/ft
Critical Slope	0.013	ft/ft

APPENDIX E – OFFSITE DRAINAGE ANALYSIS

Worksheet for North Offsite Drainage Berm

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.019 ft/ft
Normal Depth	12.0 in

Section Definitions

Station (ft)	Elevation (ft)
-0+85	1.00
0+00	0.00
0+20	0.00
0+26	2.00
0+46	2.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+85, 1.00)	(0+46, 2.00)	0.030

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	306.33 cfs
Roughness Coefficient	0.030
Elevation Range	0.0 to 2.0 ft
Flow Area	64.0 ft²
Wetted Perimeter	108.2 ft
Hydraulic Radius	7.1 in
Top Width	108.00 ft
Normal Depth	12.0 in
Critical Depth	12.5 in
Critical Slope	0.015 ft/ft
Velocity	4.79 ft/s
Velocity Head	0.36 ft
Specific Energy	1.36 ft
Froude Number	1.096
Flow Type	Supercritical

GVF Input Data

Worksheet for North Offsite Drainage Berm

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	12.0 in
Critical Depth	12.5 in
Channel Slope	0.019 ft/ft
Critical Slope	0.015 ft/ft

Worksheet for North Offsite Drainage Berm

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.019 ft/ft
Normal Depth	12.0 in

Section Definitions

Station (ft)	Elevation (ft)
-0+85	1.00
0+00	0.00
0+20	0.00
0+26	2.00
0+46	2.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(-0+85, 1.00)	(0+46, 2.00)	0.030

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	306.33 cfs
Roughness Coefficient	0.030
Elevation Range	0.0 to 2.0 ft
Flow Area	64.0 ft²
Wetted Perimeter	108.2 ft
Hydraulic Radius	7.1 in
Top Width	108.00 ft
Normal Depth	12.0 in
Critical Depth	12.5 in
Critical Slope	0.015 ft/ft
Velocity	4.79 ft/s
Velocity Head	0.36 ft
Specific Energy	1.36 ft
Froude Number	1.096
Flow Type	Supercritical

GVF Input Data

Worksheet for North Offsite Drainage Berm

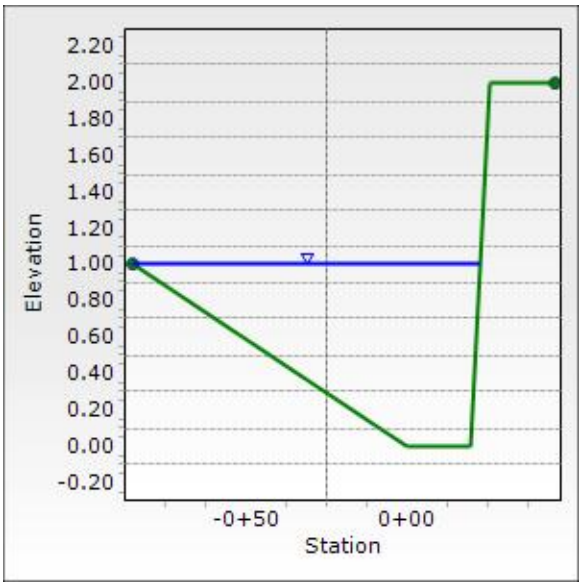
GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	12.0 in
Critical Depth	12.5 in
Channel Slope	0.019 ft/ft
Critical Slope	0.015 ft/ft

Cross Section for North Offsite Drainage Berm

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data	
Channel Slope	0.019 ft/ft
Normal Depth	12.0 in
Discharge	306.33 cfs



Worksheet for Outfall 6" PVC Riser Pipe for Southeast temporary sediment basin

Project Description	
Friction Method	Manning Formula
Solve For	Discharge

Input Data		
Roughness Coefficient	0.010	
Channel Slope	0.020	ft/ft
Normal Depth	5.8	in
Diameter	6.0	in

Results		
Discharge	1.11	cfs
Flow Area	0.2	ft²
Wetted Perimeter	1.4	ft
Hydraulic Radius	1.7	in
Top Width	0.20	ft
Critical Depth	5.8	in
Percent Full	95.8	%
Critical Slope	0.020	ft/ft
Velocity	5.71	ft/s
Velocity Head	0.51	ft
Specific Energy	0.99	ft
Froude Number	1.023	
Maximum Discharge	1.11	cfs
Discharge Full	1.03	cfs
Slope Full	0.023	ft/ft
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.0	%
Normal Depth Over Rise	96.7	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	5.8	in
Critical Depth	5.8	in
Channel Slope	0.020	ft/ft
Critical Slope	0.020	ft/ft

Rip-Rap Calculation
TEMPORARY SEDIMENT BASIN 5

.

Applicable Equations:

$L_p = (1/2\tan\Theta)(A_t/Y_t-D)$	Equation 9-11 per USCDM
$A_t = Q/V$	Equation 9-12 per USDCM
$\Theta = \tan^{-1}(1/(2*\text{ExpansionFactor}))$	Equation 9-13 per USDCM
$W = 2(L_p\tan\Theta)+D$	Equation 9-14 per USDCM
$T = 2D_{50}$	Equation 9-15 per USDCM

Assumptions

Maximum Major Event Velocity is 5fps for FES outletting into grass channel

Input parameters:

Description		Variable	Input	Unit
Width of the conduit (use diameter for circular conduits),		D:	0.50	ft
HGL Elevation			0.48	ft
Invert Elevation			0.00	ft
Tailwater depth (ft),		Y_t:	0.48	ft
Expansion angle of the culvert flow		Θ:	0.12	radians
Design discharge (cfs)*		Q:	1.11	cfs
Froude Number		F_r	1.43	Supercritical
Unitless Variables for Tables:				
	For Figure 9-35	$Q/D^{2.5}$	6.28	
	For Figure 9-35	Y_t/D	0.97	
	For Figure 9-38	$Q/D^{1.5}$	3.14	
	For Figure 9-38	Y_t/D	0.97	
Allowable non-eroding velocity in the downstream channel (ft/sec)		V:	5	ft/sec
Expansion Factor (Figure 9-35), 1/(2tan(θ))			4.2	

Solve for:

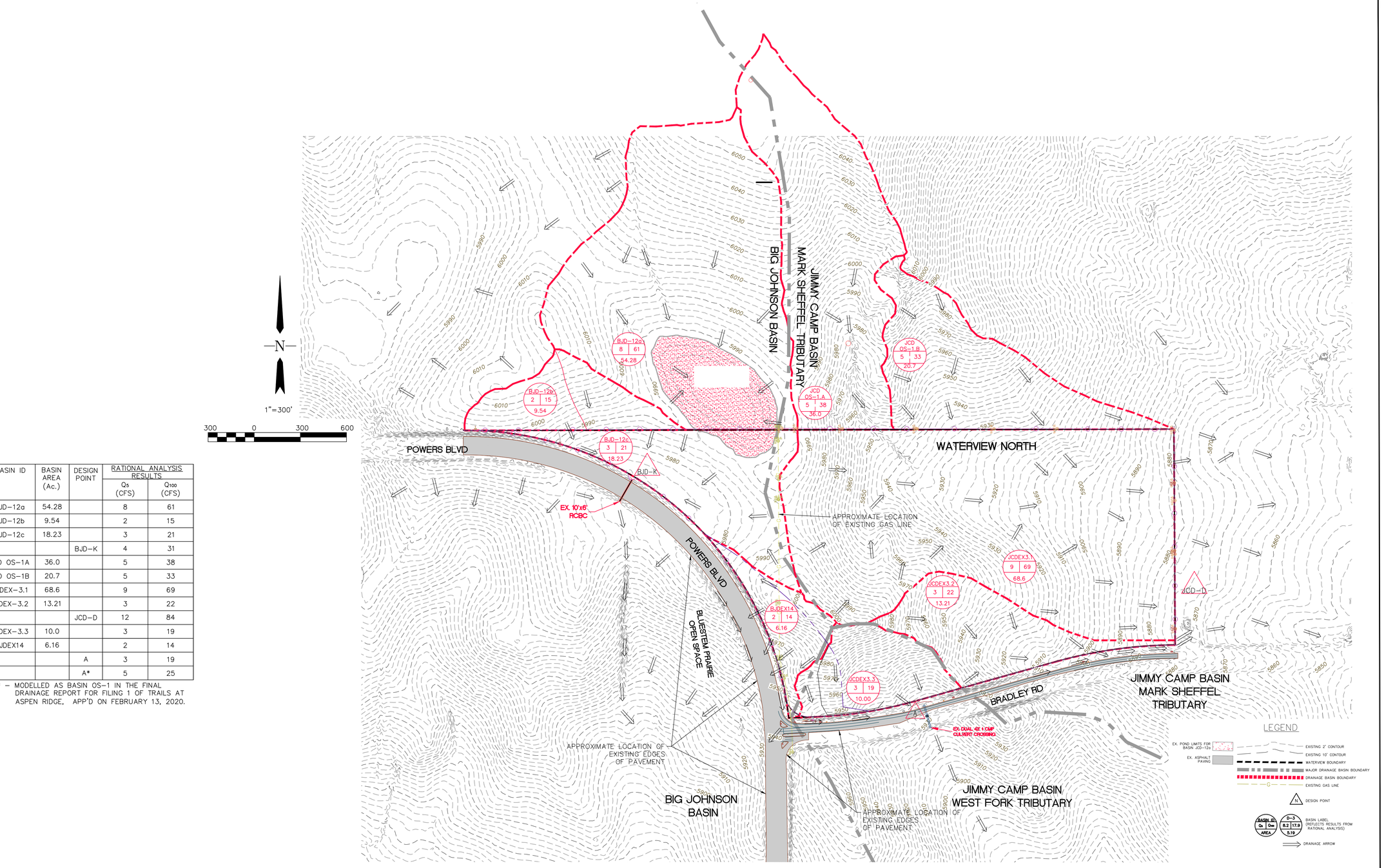
Description	Variable	Output	Unit
1. Required area of flow at allowable velocity (ft^2)	A_t:	0.22	ft^2
2. Length of Protection	L_p:	-0.17	ft
	$L_p < 3D$?	Yes	
	L_{pmin}:	1.50	ft
3. Width of downstream riprap protection	W:	1.00	ft
4. Rip Rap Type (Figure 9-38)	-	VL	
5. Rip Rap Size (Figure 8-34)	D_{50}:	6	inches

Rip Rap Summary

Length	L_p	2.00	ft
Width	W	1.00	ft
Size	D_{50}	6	inches
Type	-	VL	-
Thickness	T	12	inches

APPENDIX F – DRAINAGE EXHIBITS

PRE-DEVELOPMENT BASIN MAP



BASIN ID	BASIN AREA (Ac.)	DESIGN POINT	RATIONAL ANALYSIS RESULTS	
			Q_5 (CFS)	Q_{100} (CFS)
BJD-12a	54.28		8	61
BJD-12b	9.54		2	15
BJD-12c	18.23		3	21
		BJD-K	4	31
JCD OS-1A	36.0		5	38
JCD OS-1B	20.7		5	33
JCDEX-3.1	68.6		9	69
JCDEX-3.2	13.21		3	22
		JCD-D	12	84
JCDEX-3.3	10.0		3	19
BJDEX14	6.16		2	14
		A	3	19
		A*	5	25

A* - MODELLED AS BASIN OS-1 IN THE FINAL DRAINAGE REPORT FOR FILING 1 OF TRAILS AT ASPEN RIDGE, APP'D ON FEBRUARY 13, 2020.

REVISIONS:

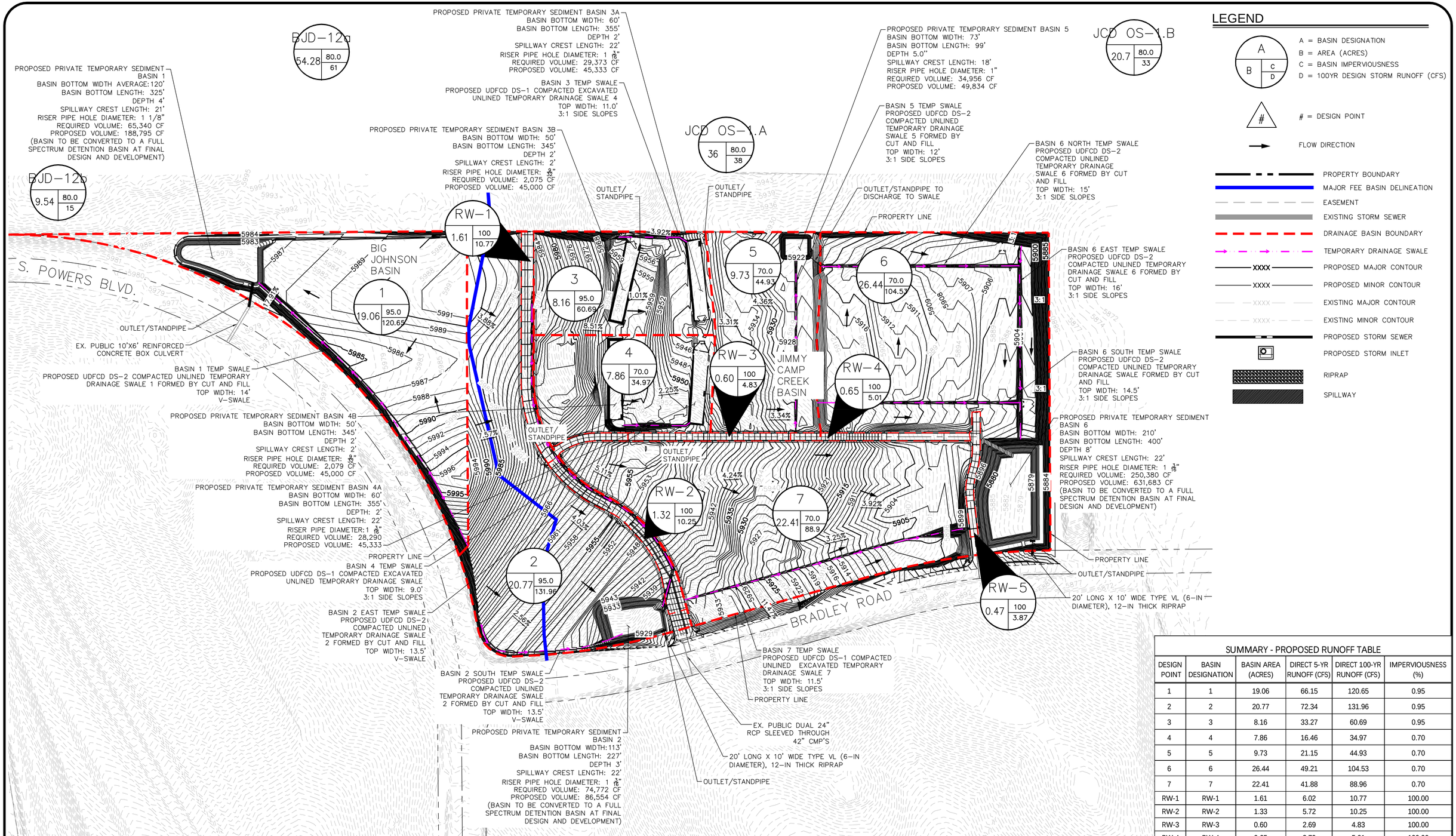
NO.	DESCRIPTION	DATE

ENGINEER:
DESIGNED BY: CEB DATE: 11-05-20
DRAWN BY: CEB DATE: 11-05-20
CHECKED BY: CKC DATE: 11-05-20

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATORS
1-800-922-1987
CITY OF COLORADO SPRINGS DEPT. OF UTILITIES GAS, ELECTRIC, WATER AND WASTEWATER

DSE Dakota Springs Engineering
31 N. TEJON, SUITE 518
COLORADO SPRINGS, CO 80903
P: (719) 227-7388
F: (719) 227-7392

PROJECT WATERVIEW NORTH
SHEET TITLE PRE-DEVELOPMENT BASIN MAP
FROM n/a TO n/a
JOB NO. 02-19-05 SHEET 2 OF 3



SUMMARY - PROPOSED RUNOFF TABLE

DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	IMPERVIOUSNESS (%)
1	1	19.06	66.15	120.65	0.95
2	2	20.77	72.34	131.96	0.95
3	3	8.16	33.27	60.69	0.95
4	4	7.86	16.46	34.97	0.70
5	5	9.73	21.15	44.93	0.70
6	6	26.44	49.21	104.53	0.70
7	7	22.41	41.88	88.96	0.70
RW-1	RW-1	1.61	6.02	10.77	100.00
RW-2	RW-2	1.33	5.72	10.25	100.00
RW-3	RW-3	0.60	2.69	4.83	100.00
RW-4	RW-4	0.65	2.79	5.01	100.00
RW-5	RW-5	0.47	2.16	3.87	100.00

NORTH

GRAPHIC SCALE IN FEET
0 100 200 400

DRAINAGE EXHIBIT – WATERVIEW NORTH COLORADO SPRINGS, CO

Kimley»Horn

APPENDIX G –MASTER DRAINAGE BASIN EXHIBIT AND CALCULATIONS

LEGEND

A = BASIN DESIGNATION
B = AREA (ACRES)
C = BASIN IMPERVIOUSNESS
D = 100YR DESIGN STORM RUNOFF (CFS)

PROPERTY BOUNDARY

BASIN DELINEATION

XXXX EXISTING MAJOR CONTOUR

XXXX EXISTING MINOR CONTOUR

PROPERTY LINE

BIG JOHNSON BASIN

BJB
26.2 | 2.0 | 48.2

JIMMY CAMP CREEK BASIN

JCCB
90.4 | 2.0 | 152.7

EX. 10'X6' REINFORCED CONCRETE BOX CULVERT

PROPERTY LINE

S. POWERS BLVD.

PROPERTY LINE

BRADLEY ROAD

PROPERTY LINE

EX. DUAL 24" RCP SLEEVED THROUGH 42" CMP'S

SUMMARY - PROPOSED RUNOFF TABLE

DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	IMPERVIOUSNESS (%)
BJB	BJB	26.20	7.18	48.21	0.02
JCCB	JCCB	90.34	22.74	152.69	0.02

BJB BIG JOHNSON BASIN

JCCB JIMMY CAMP CREEK BASIN

NORTH

GRAPHIC SCALE IN FEET
0 100 200 400

MAJOR BASIN EXHIBIT – WATERVIEW NORTH COLORADO SPRINGS, CO

Kimley»Horn

IDF Equations:

I_{100} = -2.52ln(D) + 12.735
I_{50} = -2.25ln(D) + 11.375
I_{25} -2.00ln(D) + 10.111
I_{10} -1.75ln(D) + 8.847
I_{5} -1.50ln(D) + 7.583
I_{2} -1.19ln(D) + 6.035

Where:
I = Rainfall Intensity (in/hr)
D= Duration (minutes)

	2-yr	5-yr	10-yr	100-yr
P_1 =	1.19	1.5	1.75	2.52

*The Design Point Rainfall Values and Time Intensity Frequency Tabulation are found in Table 6-2 and Figure 6-5, respectively of the Colorado Springs Drainage Criteria Manual, Volume1

Weighted Imperviousness Calculations

SUB-BASIN	AREA (SF)	AREA (Acres)	SOIL GROUP DESIGNATION	WEIGHTED IMPERVIOUSNESS	WEIGHTED COEFFICIENTS			
					C2	C5	C10	C100
BJB	1,141,190	26.20	A/B	2.0%	0.03	0.09	0.17	0.36
JCCB	3,935,162	90.34	A/B	2.0%	0.03	0.09	0.17	0.36
TOTAL	5,076,352	116.54						

Waterview North - Drainage Report
Proposed Runoff Calculations
Time of Concentration

Watercourse Coefficient

Forest & Meadow	2.50	Short Grass Pasture & Lawns	7.00			Grassed Waterway	15.00
Fallow or Cultivation	5.00		Nearly Bare Ground	10.00		Paved Area & Shallow Gutter	20.00

	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)					T(c) CHECK (URBANIZED BASINS)			FINAL T(c)
DESIGN POINT	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	TOTAL LENGTH	L/180+10	min.
BJB	BJB	1,141,190	26.20	0.09	100	3.0%	12.8	1811	10.0%	2.50	0.8	38.2	51.0	1911	20.6	20.6
JCCB	JCCB	3,935,162	90.34	0.09	100	5.0%	10.8	2466	9.5%	2.50	0.8	53.3	64.1	2566	24.3	24.3

Waterview North - Drainage Report
Proposed Runoff Calculations *Design Storm 5 Year*
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
BJB	BJB	26.20	0.09	20.6	2.36	3.05	7.18					
JCCB	JCCB	90.34	0.09	24.3	8.13	2.80	22.74					

Waterview North - Drainage Report
Proposed Runoff Calculations
(Rational Method Procedure)

Design Storm *100 Year*

BASIN INFORMATION				DIRECT RUNOFF				CUMMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
BJB	BJB	26.20	0.36	20.6	9.43	5.11	48.21					
JCCB	JCCB	90.34	0.36	24.3	32.52	4.69	152.69					

SUMMARY - PROPOSED RUNOFF TABLE					
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	IMPERVIOUSNESS (%)
BJB	BJB	26.20	7.18	48.21	0.02
JCCB	JCCB	90.34	22.74	152.69	0.02