FINAL DRAINAGE REPORT
FOR
HOMESTEAD NORTH AT STERLING RANCH FILING NO. 3

Prepared For:

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October 2022
Project No. 25188.12

Prepared By:
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PCD Filing No.:
SF-22-29

J·R ENGINEERING

ENGINEER'S STATEMENT:
The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by El Paso County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors, or omissions on my part in preparing this report.

Mike Bramlett, Colorado P.E. 32314
For and On Behalf of JR Engineering, LLC

COLORADO LICENSED MIKE BRAMLETT MB 32314 10/25/22 PROFESSIONAL ENGINEER

DEVELOPER'S STATEMENT:
I, the developer, have read and will comply with all of the requirements specified in this drainage report and plan.

Business Name: SR Land, LLC

By:

Title: MANAGER

Address: 20 Boulder Crescent, Suite 200
Colorado Springs, CO 80903

El Paso County:
Filed in accordance with the requirements of the El Paso County Land Development Code, Drainage Criteria Manual, Volumes 1 and 2 and Engineering Criteria Manual, as amended.

Joshua Palmer, P.E. Date
County Engineer/ ECM Administrator

Conditions:

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APPENDIX

PURPOSE

This document is the Final Drainage Report for Homestead North at Sterling Ranch Filing No. 3. The purpose of this report is to identify on-site and off-site drainage patterns, storm sewer, culvert and inlet locations, areas tributary to the site, and to safely route developed storm water to adequate outfall facilities.

This report also finalizes and provides design details for the concepts previously studied within the "Preliminary Drainage Report and MDDP Addendum for Homestead North At Sterling Ranch Preliminary Plan" by JR Engineering, Dated January 2022.

GENERAL SITE DESCRIPTION

GENERAL LOCATION

Homestead North at Sterling Ranch Filing No. 3 (hereby referred to as the "site") is a proposed Single-Family SF residential, urban (RS-6000) development with a total area of approximately 40.83 acres.

The site is located in a portion of the SE ¼ of Section 28, Township 12 South, Range 65 West of the Sixth Principal Meridian in the County of El Paso, State of Colorado. The site is located immediately east of Vollmer Road and South of Poco Road. Beyond Poco Road to the north lies "the Retreat at Timberridge Filing No. 1" and beyond Vollmer Road to the west lies a parcel owned by John R. Jaynes (Rec No. 211001958). The site is bounded by Homestead North at Sterling Ranch Filing No. 2 to the south, and Sand Creek borders the site to east. Beyond the Creek to the east is another portion of "The Retreat At Timberridge Filing No. 1". Refer to the vicinity map in Appendix A for additional information.

The site is completely within the "Sand Creek Major Drainage Basin". There are no known irrigation facilities located within the project site.

DESCRIPTION OF PROPERTY

The site totals 40.83 acres in area and will be platted to contain 77 single-family residential lots, public, urban residential streets with 50' Right-of-Way's, and Tracts. The site ground cover is comprised of variable sloping grasslands that generally slope(s) downward to the south and east at 1 to 30+% towards Sand Creek. On the eastern side of the site, between the proposed lots, and the Creek, is an existing 15' wide concrete maintenance and access trail centered within an existing 25' public easement. The western edge of this easement is the anticipated limits of disturbance for the entire eastern boundary of this project/site. The total area anticipated to be disturbed with this project is 36.49 acres.

Soil characteristics are comprised of Type B hydrologic Soil groups. Refer to the soil survey map in Appendix A for additional information.

The Sand Creek borders the eastern portion of the site. Currently, JR Engineering is performing studies and plans to address Sand Creek stabilization directly adjacent to the site. This project corresponds to PCD Project Number CDR-20-004.

Pre-Development grading and early utility plans have been submitted to El Paso County for this project site (El Paso County Proj. # SP-22-007). The existing conditions for this site reflect the grading proposed on the "Pre-Development Grading Plans" and the Water and Sanitary infrastructure proposed within those plans sets can be considered existing for the purposes of this report. No other utilities are known to be located within the project site.

FLOODPLAIN STATEMENT

Based on the FEMA Firm Maps Number 08041C0535G revised December 7, 2018, the vast majority of the development is located within Zone X, or areas area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. The eastern property boundary will be platted to the center of Sand creek, placing a portion of the site within Zone AE. The area of disturbance for site grading is located outside of the delineated floodway within Zone X. The FEMA map containing the site has been presented in Appendix A. The plat for Homestead North at Sterling Ranch Filing No. 3 is anticipated to be recorded prior to a LOMR for channel improvement. It is anticipated that the floodplain improvements will result in a no-rise condition and will not adversely impact the Homestead Filing No. 3 development and surrounding developments. See Appendix A for a copy of the FEMA Firm Map.

EXISTING DRAINAGE CONDITIONS

MAJOR BASIN DESCRIPTIONS

The site lies within the Sand Creek Drainage Basin based **o**n the "Sand Creek Drainage Basin Planning Study" (DBPS) completed by Kiowa Engineering Corporation in January 1993, revised March 1996. The Sand Creek Drainage Basin covers approximately 54 square miles and is divided into major sub-basins. The site is within the respective sub-basin is shown in Appendix D.

The site generally drains from north to south consisting of rolling hills. Currently, the site is used as pasture land for cattle. Sand Creek is located adjacent to the east portion of the site running north to south. This reach of drainage conveyance is not currently improved. Currently, JR engineering is performing studies and plans to address Sand Creek stabilization adjacent to the site. It is anticipated that the channel improvements will be in place prior to the development of the site. The design presented herein is coordinated with the proposed channel improvements presented in the "Sand Creek Restoration Public Improvement Plans" by JR Engineering. This project corresponds to PCD Project Number CDR-20-004.

The proposed drainage on the site closely follows the approved "Master Development Drainage Plan for Sterling Ranch", (MMDP) prepared by M&S Civil Consultants, Inc., dated October 24, 2018 and the “Preliminary Drainage Report And MDDP Addendum For Homestead North At Sterling Ranch Preliminary Plan”, prepared by JR Engineering, dated January 2022. The Homestead North Filing No. 3 detention facility closely follows the drainage patterns of pond A and B in the preliminary drainage report as well as the Final Drainage Report for Homestead At Sterling Ranch Filing No. 2, prepared by JR Engineering, dated July 2022. The Homestead North preliminary drainage report map and WQ map is shown within Appendix D of this report.

EXISTING SUB-BASIN DRAINAGE

The total platted area for the site is 40.83 acres. The existing site drainage conditions were analyzed as 7 basins totaling 36.60 acres. These existing basins outfall to Sand Creek at the two locations shown and to Homestead North Filing No. 2 to the south at the four locations shown. Basins draining to Homestead North Filing No. 2 have been accounted and accommodated for in the design of the Filing No. 2 infrastructure, as presented in the Final Drainage Report for Homestead North at Sterling Ranch Filing No. 2.

The Sand Creek borders and is partially within the eastern limits of the site for a total onsite area of 4.23 acres. The portion of the Sand Creek running through and along the project site was not basinized for the purposes of this report, as the basis of design for this site was to not disturb or modify the Creek in any way, and to limit developed flows leaving the project site to pre-development/historic rates. The Creek is being studied and improved with the "Sand Creek Restoration Public Improvement Plans" by JR Engineering. This project corresponds to PCD Project Number CDR-20-004.

Basin EX1 (Q5 = 0.9 cfs, Q100 = 5.8 Cfs) is 3.82 acres, and consists of undeveloped land, covered with sparse native vegetation. Runoff generated generally sheet flows south per existing drainage patterns until it reaches the Site’s southern border at DP E1 (the northern curb of Perry Owens Drive, El Paso County Type C). Once flows reach the curb and gutter, they continue per the drainage patterns identified in the Final Drainage Report for Homestead North at Sterling Ranch Filing No. 2, by JR Engineering.

Basin EX2 (Q5 = 1.8 cfs, Q100 = 12.0 cfs) is 9.74 acres, and consists of undeveloped land covered with sparse native vegetation. Runoff generated in this basin generally flows southeast towards the Site’s southern border. Flows are intercepted by the existing grass-lined swale and carried east to DP E2, flows continue through Basin EX3 to DP 3.1.

Basin EX3 (Q5 = 3.8 cfs, Q100 = 25.4 cfs) is 21.47 acres, and consists of undeveloped land covered with sparse native vegetation. Runoff generated in this basin generally flows southeast towards the Site's southern border. Flows are intercepted by the existing grass-lined swale and carried east to Sand Creek at DP E3.1. Combined flows in the grass swale from DP2 and Basin EX3 that reach DP3.1 are Q5 = 5.0 cfs, Q100 = 33.6 cfs.

Basin EX4 (Q5 = 1.6 cfs, Q100 = 3.7 cfs) is 0.84 acres in area and consists mainly of undeveloped land bordering the western side of the Regional Trail that serves as a pedestrian and bike corridor as well as maintenance access road that allows for vehicular access to Sand Creek and other drainage infrastructure. In general this basin slopes to the east, directly into Sand Creek. Slopes range from flat to 33%. Runoff generated flows east, over the existing 15' concrete regional trail and into Sand Creek at DP E4.

Basin EX1.2 (Q5 = 0.1 cfs, Q100 = 0.4 cfs) is 0.17 acres, and consists of undeveloped land with sparse, native vegetation. Runoff generated flows southeast to the Site's southern border with Filing No. 2 at DP 1.2. Flows continue per the drainage patterns identified in the Final Drainage Report for Homestead North at Sterling Ranch Filing No. 2, by JR Engineering. The flows identified in this report that are tributary to the Filing No. 2 development have remained consistent with what was planned for.

Basin EXB6 (Q5 = 0.0 cfs, Q100 = 0.3 cfs) is 0.13 acres, and consists of undeveloped land with sparse, native vegetation. Runoff generated flows southeast to the Site's southern border with Filing No. 2 at DP B6. Flows continue per the drainage patterns identified in the Final Drainage Report for Homestead North at Sterling Ranch Filing No. 2, by JR Engineering. The flows identified in this report that are tributary to the Filing No. 2 development have remained consistent with what was planned for.

Basin EXB4 (Q5 = 0.2 cfs, Q100 = 1.0 cfs) is 0.43 acres, and consists of undeveloped land with sparse, native vegetation. Runoff generated flows southeast to the Site's southern border with Filing No. 2 at DP B4. Flows continue per the drainage patterns identified in the Final Drainage Report for Homestead North at Sterling Ranch Filing No. 2, by JR Engineering. The flows identified in this report that are tributary to the Filing No. 2 development have remained consistent with what was planned for.

PROPOSED DRAINAGE CONDITIONS

The proposed site consists of 77 single family detached residential lots ranging in size from ¼ acre to over ½ acre, public urban local streets, and intermixed open space. The site has been designed to collect, detain, and treat all developed flows prior to their discharge from the project site or their basins respective ultimate outfall. Developed basins that leave the site to the south, are all treated in either Pond B or Pond C. Basins have been named to be consistent with the Preliminary Drainage Report And MDDP Addendum For Homestead North At Sterling Ranch Preliminary Plan and subsequent Filing No. 1 and Filing No.2 FDR's. Basins designated with the prefix B, go to Pond B within the Filing 2 development and are consistent with what was planned for in the Filing No. 2 FDR. Basins designated with the Prefix D, go to Pond C, part of the Filing No. 1 development and are consistent with what was planned for in the Final Drainage Report for the Homestead North at Sterling Ranch Filing No. 1 by JR Engineering. All developed basins identified with the prefix A, are treated and detained on-site in the proposed Full-Spectrum detention and Water Quality Pond A. Basins OS-1 and OS-2 are undeveloped basins that flow directly to the Sand Creek. These basins are infeasible to capture onsite due to the existing topography and proximity to the Creek.

In general, this site utilizes a system of grass swales and lot grading to direct developed flows to the proposed streets and curb and gutter system. The proposed streets and curb and gutter, direct water to inlets and the proposed storm sewer system that carries flows to the proposed on-site, full-spectrum detention and water quality Pond A.

PROPOSED SUB-BASIN DRAINAGE

All basins include a numbered design point indicating where all flows will outfall/leave that basin. Basins that include a design point suffix of (i) or (B) in the rational calculations indicate that a portion of the flows are either captured in an inlet or continue as "by-pass" flow per overland flow patterns. Captured flows get the suffix (i) and by-pass flows get the suffix B. These are not shown on the map for clarity purposes.

Basin A1 is 3.82 acres and consists of proposed single-family residential lots ranging in size from just below a ¼ of an acre to greater than ½ acre, the west half of a portion of proposed Aspen Valley Road, and Jess Evans Drive west of Aspen Valley Road. Runoff generated (Q5 = 5.2 cfs, Q100 = 13.5 cfs) sheet flows towards the curb and gutter and is then directed to the proposed on-grade 15' Type R inlet at Design Point 1. Captured flows at DP 1i (Q5 = 5.2 cfs, Q100 = 10.9 cfs) are piped to DP2.1. By-pass flows at DP 1B(Q100 = 2.6 cfs) continue in the curb and gutter, south, to DP3 per the drainage patterns identified in Basin A3.

Basin A2 is 3.02 acres and consists of proposed single-family residential lots ranging in size from ¼ of an acre to greater than ½ acre, the east half of a portion of proposed Aspen Valley Road, and Jess Evans Drive east of Aspen Valley Road. Runoff generated (Q5 = 4.5 cfs, Q100 = 10.8 cfs) sheet flows towards the curb and gutter and is then directed to the proposed on-grade 15' Type R inlet at Design Point 2. Captured flows at DP 2i (Q5 = 4.5 cfs, Q100 = 9.5 cfs) are piped to DP2.1. By-pass flows at DP 2B (Q100 = 1.3 cfs) continue in the curb and gutter, south, to DP4 per the drainage patterns identified in Basin A4.

Total flow in the pipe at DP 2.1 (24" RCP) is Q5 = 9.3 cfs, and Q100 = 19.6 cfs. Flows at DP2.1 are piped to DP4.1.

Basin A3 is 4.54 acres and consists of proposed single-family residential lots ranging in size from ¼ of an acre to greater than ½ acre, the west half of a portion of proposed Aspen Valley Road, and David Rudabaugh Drive west of Aspen Valley Road. Runoff generated (Q5 = 6.1 cfs, Q100 = 15.1 cfs) sheet flows towards the curb and gutter and is then directed to the proposed on-grade 15' Type R inlet at Design Point 3 (Total Flow = Q5 = 6.1 cfs, Q100 = 17.5). Captured flows at DP 3i (Q5 = 6.1 cfs, Q100 = 12.6 cfs) are piped to DP3.1. By-pass flows at DP 1B (Q100 = 4.9 cfs) continue in the curb and gutter, south, to DP5 per the drainage patterns identified in Basin A5.

Basin A4 is 3.82 acres and consists of proposed single-family residential averaging around a quarter of an acre in size, the east half of a portion of proposed Aspen Valley Road, and David Rudabaugh Drive east of Aspen Valley Road. Runoff generated (Q5 = 6.0 cfs, Q100 = 14.4 cfs) sheet flows towards the curb and gutter and is then directed to the proposed on-grade 15' Type R inlet at Design Point 4 (Total Flow = Q5 = 6.0 cfs, Q100 = 14.4 cfs). Captured flows at DP 4i (Q5 = 6.0 cfs, Q100 = 11.3 cfs) are piped to DP4.1. By-pass flows at DP 4B (Q100 = 3.1 cfs) continue in the curb and gutter, south, to DP6 per the drainage patterns identified in Basin A6.

Total flow in the pipe at DP 4.1 (36" RCP) is Q5 = 20.6 cfs, and Q100 = 42.1 cfs. Flows at DP4.1 are piped to DP5.1.

Basin A5 is 7.53 acres and consists of proposed single-family residential lots ranging in size from just under a ¼ of an acre to greater than ½ acre, the west half of a portion of proposed Aspen Valley Road, and William Downing Drive west of Aspen Valley Road. Runoff generated (Q5 = 7.6 cfs, Q100 = 21.7 cfs) sheet flows towards the curb and gutter and is then directed to the proposed 15' Type R sump inlet at Design Point 5 (Total Flow = Q5 = 7.5 cfs, Q100 = 25.7 cfs). This inlet was sized to capture all flows up to and including the 100-yr storm event. Captured flows at DP 5i (Q5 = 7.6 cfs, Q100 = 25.8 cfs) are piped to DP5.1. If the inlet were to become clogged, flows would overtop the crown of Aspen Valley and either enter the proposed 15' Type R sump inlet at DP-6, or would overtop the curb and gutter and flow directly into the proposed full spectrum EDB at design point 7.1.

Total flow in the pipe at DP 5.1 (30" RCP) is Q5 = 27.9 cfs, and Q100 = 66.1 cfs. Flows at DP5.1 are piped to DP6.1.

Basin A6 is 4.29 acres and consists of proposed single-family residential lots averaging a quarter of an acre in size, the east half of a portion of proposed Aspen Valley Road, and William Downing Drive east of Aspen Valley Road. Runoff generated (Q5 = 6.5 cfs, Q100 = 15.5 cfs) sheet flows towards the curb and gutter and is then directed to the proposed 15' Type R sump inlet at Design Point 6 (Total Flow = Q5 = 6.5 cfs, Q100 = 18.8 cfs). This inlet was sized to capture all flows up to and including the 100-yr storm event. Captured flows at DP 6i (Q5 = 6.5 cfs, Q100 = 18.8 cfs) are piped to DP7.1. If the inlet were to become clogged, flows would overtop the crown of Aspen Valley and either enter the proposed 15' Type R sump inlet at DP-5, or would overtop the curb and gutter and flow directly into the proposed full spectrum EDB at design point 7.1.

Total flow in the pipe at DP 6.1 (36" RCP) is Q5 = 34.0 cfs, and Q100 = 83.2 cfs. Flows at DP6.1 are piped to DP7.1.

Basin A7 is 2.93 acres and consists of proposed single-family residential lots ranging in size from a quarter of an acre to just under 1/3 of an acre and a proposed full-spectrum extended detention basin (EDB) named Pond A. See the water quality section of this report for design information related to Pond A. Runoff generated (Q5 = 1.9 cfs, Q100 = 8.3 cfs) sheet flows towards and into the proposed EDB, Pond A at Design Point 7.1 (Total Flow = Q5 = 35.1 cfs, Q100 = 92.2 cfs). Combined flows include the Basin A7's runoff and the storm sewer outfall into the Pond from Design Point 6.1. A section of Basin A7 (A7A) was analyzed to determine the flowrate for the minor semi-channelized flow into the pond from Lots 76-77 and part of 75. The analysis is included in Appendix C and the swale will be armored with Type VL soil riprap where potentially erosive velocities are encountered.

Basin B1.1 is 2.08 acres and consists of proposed single-family residential lots averaging about a quarter of an acre in size, the west half of William Downing Drive, and a portion of the proposed trail and landscaping that borders the eastern side of Vollmer Road. Runoff generated in this basin (Q5 = 2.8 cfs, Q100 = 7.5 cfs) sheet flows southeast towards the western curbline of William Downing Drive, where it enters the roadway and is directed in the curb line south, to the Filing 2/3 boundary at Design Point 1F (same flows). Flows continue per the drainage patterns identified in the Filing No. 2 FDR. This basin was accounted for in the Filing 2 FDR, and the basin characteristics and anticipated flows have remained consistent with that report. The filing 2 storm sewer and Pond B were sized to accept, detain, and treat these flows in accordance with all local and state criteria.

Basin B1.2 is 1.36 acres and consists of proposed single-family residential lots ranging in size from a quarter of an acre to 1/3 of an acre and the east half of William Downing Drive. Runoff generated in this basin (Q5 = 2.1 cfs, Q100 = 5.1 cfs) sheet flows southwest towards the eastern curbline of William Downing Drive, where it enters the roadway and is directed in the curb line south, to the Filing 2/3 boundary at Design Point 2F (same flows). Flows continue per the drainage patterns identified in the Filing No. 2 FDR. This basin was accounted for in the Filing 2 FDR, and the basin characteristics and anticipated flows have remained consistent with that report. The filing 2 storm sewer and Pond B were sized to accept, detain, and treat these flows in accordance with all local and state criteria.

Basin B1.3 is 0.33 acres and consists of a small portion of proposed single-family residential lots that average a ¼ of an acre in size, a small portion of the open space Tract B, and approximately 130' of the southernmost portion of Aspen Valley Road within Filing 3. Runoff generated (Q5 = 0.7 cfs, Q100 = 1.4 cfs), sheet flows south and towards Aspen Valley Road until it reaches Design Point 1.3 (same flows) at the Filing 2/3 boundary. Flows continue per the drainage patterns identified in the

Filing No. 2 FDR. The proposed flows (Q5 = 0.7 cfs, Q100 = 1.4 cfs) are less than the flows shown in the Filing No. 2 FDR (Q5 = 1.0 cfs, Q100 = 2.2 cfs). This basin was accounted for in the Filing 2 FDR, and the basin characteristics and anticipated flows have remained consistent with that report. The Filing 2 storm sewer and Pond B were sized to accept, detain, and treat these flows in accordance with all local and state criteria.

Basin B4 is 1.21 acres and consists of a portion of Tract C which consists of open space and the proposed EDB, Pond A. This basin boundary extends south to Filing 2/3 boundary. Runoff generated (Q5 = 0.5 cfs, Q100 = 3.1 cfs) in this basin flows overland southeast towards the Filing 2/3 boundary at Design point B4 (same flows). Flows continue per the drainage patterns identified in the Filing No. 2 FDR. Filing 3 basin B4 correlates to Filing 2 basins F5 and part of B4. Filing 2 split the basins further north from the Filing 2/3 boundary and thus results in an area discrepancy between the Filing 2 and Filing 3 analysis. Therefore, the Filing 3 B4 basin was accounted for in the Filing 2 FDR, and the basin characteristics and anticipated flows have remained consistent with that report. The Filing 2 storm sewer and Pond B were sized to accept, detain, and treat these flows in accordance with all local and state criteria.

Basin OS1 is 0.20 acres and consists of undeveloped open space or landscaped areas part of Tract C, bordering the southern side of the Poco Road Right-of-Way. This basin is located at the border of the property and there is no planned imperviousness or development in this basin. Construction consists only of grading work. It was found that in order to match into the existing grades of Poco Road and Right-of-Way, this basin was infeasible to capture and therefore flows off-site to the north, to the Poco Road drainage system. The runoff generated (Q5 = 0.1 cfs, Q100 = 0.6 cfs) reaches the Poco Road Right-of-Way at Design Point OS1 (same flows), and continues per existing drainage patterns flowing to the east into Sand Creek. Because this basin has the same ultimate outfall (Sand Creek) as the existing condition, the drainage system will safely route these flows to their ultimate outfall and no downstream impacts are expected due to this project.

State what those existing flows are

Basin OS2 is 1.01 acres and consists of undeveloped open space or landscaped areas and the existing regional trail and maintenance access that borders the western banks of Sand Creek within Tract C of this development. There is no new planned imperviousness or development in this basin related to this project as the trail was constructed with PCD Project Number CDR-20-004. Construction consists only of grading work. It was found that in order to match into the existing grades of the regional trail/maintenance road, this basin was infeasible to capture and therefore flows off-site to the east and into Sand Creek at Design Point OS2. The runoff generated (Q5 = 0.4 cfs, Q100 = 2.9 cfs) sheet flows east, over the existing regional trail and into Sand Creek per existing drainage patterns. The flows entering the Sand Creek drainage system in the proposed condition are equal to or less than the flows reaching Sand Creek from this project site in the existing condition, and therefore, the drainage system will safely route these flows to their ultimate outfall and no downstream impacts are expected due to this project.

Basin D2 is 0.18 acres and consists of undeveloped open space or landscaped areas bordering Vollmer Road, part of Tract A. There is no new planned imperviousness or development in this basin related to this project. Construction consists only of grading work. It was found that in order to match into the existing grades of the Vollmer Road Right-of-Way, this basin was infeasible to capture on-site and therefore flows off-site to the existing roadside swale of Vollmer Road. Runoff generated (Q_5 = 0.1 cfs, Q_{100} = 0.5 cfs) sheet flows west to the Vollmer Road Right-of-Way at Design point D2. This area was studied with the Final Drainage Report for Homestead North at Sterling Ranch Filing No. 1, By JR Engineering, and the Vollmer Road drainage system was sized and designed to accept these flows and safely route them to their ultimate outfall at Sand Creek. Filing 3 D2 basin correlates to part of Filing 1 D2 basin and proposed flows are less than the existing flows in Filing 1 (Q_5 = 2.8 cfs, Q_{100} = 6.6 cfs). Flows continue per the drainage patterns identified in the Filing 1 report and no downstream impacts are anticipated due to this development. See Appendix D for applicable excerpts.

Basin D3 is 0.17 acres and consists of undeveloped open space or landscaped areas bordering Vollmer Road, part of Tract A. There is no new planned imperviousness or development in this basin related to this project. Construction consists only of grading work. It was found that in order to match into the existing grades of the Vollmer Road Right-of-Way, this basin was infeasible to capture on-site and therefore flows off-site to the existing roadside swale of Vollmer Road. Runoff generated (Q_5 = 0.1 cfs, Q_{100} = 0.5 cfs) sheet flows west to the Vollmer Road Right-of-Way at Design point D3. This area was studied with the Final Drainage Report for Homestead North at Sterling Ranch Filing No. 1, By JR Engineering, and the Vollmer Road drainage system was sized and designed to accept these flows and safely route them to their ultimate outfall at Sand Creek. Filing 3 D3 basin correlates to part of Filing 1 D2 basin and proposed flows are less than the existing flows in Filing 1 (Q_5 = 2.8 cfs, Q_{100} = 6.6 cfs). Flows continue per the drainage patterns identified in the Filing 1 report and no downstream impacts are anticipated due to this development. See Appendix D for applicable excerpts.

DRAINAGE DESIGN CRITERIA

DEVELOPMENT CRITERIA REFERENCE

Storm drainage analysis and design criteria for this project were taken from the "*City of Colorado Springs/El Paso County Drainage Criteria Manual*" Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the "*Urban Storm Drainage Criteria Manual*" Volumes 1 to 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the "*Colorado Springs Drainage Criteria Manual*" (CSDCM), dated May 2014, as adopted by El Paso County.

HYDROLOGIC CRITERIA

All hydrologic data was obtained from the "*El Paso Drainage Criteria Manual*" Volumes 1 and 2, and the "*Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual*"

Volumes 1, 2, and 3. Onsite drainage improvements were designed based on the 5 year (minor) storm event and the 100-year (major) storm event. Runoff was calculated using the Rational Method, and rainfall intensities for the 5-year and the 100-year storm return frequencies were obtained from Table 6-2 of the CSDCM. One-hour point rainfall data for the storm events is identified in the chart below. Runoff coefficients were determined based on proposed land use and from data in Table 6-6 from the CSDCM. Time of concentrations were developed using equations from CSDCM. All runoff calculations and applicable charts and graphs are included in the Appendices.

1-hr Point Rainfall Data

Storm	Rainfall (in.)
5-year	1.50
100-year	2.52

HYDRAULIC CRITERIA

The Rational Method and USDCM's SF-2 and SF-3 forms were used to determine the runoff from the minor and major storms on the site, and the UDFCD MHFD-Detention v4.05 spreadsheet was utilized for evaluating the proposed detention and water quality pond(s). Sump and on-grade inlets were sized using UDFCD UD-Inlet v5.01.

Autodesk Hydraflow express and UDFCD figure 8-22 was used to size the swales. Autodesk Hydraflow express was also used to determine the hydraulic grade lines for the pond outfall. For the tailwater condition, an interpolation of the FEMA BFE cross sections was used. The FEMA BFE elevations used the NAVD(88) datum whereas our site is on the NGVD29 datum. The interpolated value from the BFE elevations were lowered by a factor of 3.82 feet to get to the equivalent elevation on the NGVD29 datum.

Storm StormCAD V8i, a modeling program for stormwater drainage, was utilized to determine the hydraulic grade lines and energy grade lines for the storm sewer network. Manhole and pipe losses for the model were obtained from the *Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual Volume 1*. The manhole loss coefficients used in the model were determined using Figure 7-13 of this manual. The manhole loss coefficients used in the model are shown in the Table below. StormCAD, Autodesk Hydraflow results, along with street and inlet capacities are presented in Appendix C.

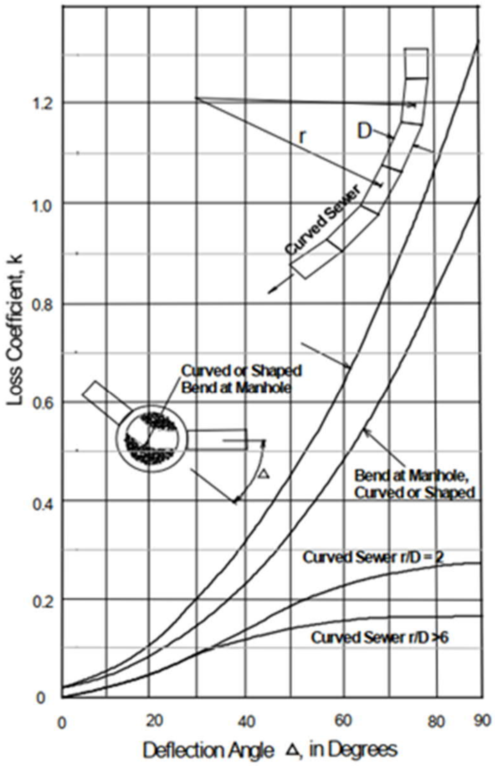


Figure 7-13. Bend loss coefficients

Structure Name	Angle	Headloss
DP01-03	40	0.3
DP01-05	90	1.32
DP01-07	90	1.32
DP01-09	90	1.32
DP01-11	0	0.1
DP02-02	0	0.1
DP03-02	0	0.1
DP04-02	0	0.1
DP05-02	0	0.1

The Sand Creek improvements adjacent to the Sterling Ranch Homestead North are being designed in a separate report, The Final Design Report for Sand Creek Restoration by JR Engineering, April 2022 (PCD Project Number CDR-20-004). The general concept of the channel design is to design a low maintenance, high performance channel with a meandering bankfull channel. The design will cut in a new bankfull section offset to the east from the existing thalweg, grade up to the existing thalweg so that it can remain hydraulically connected to the new thalweg, and then extend a 1% flood terrace to the east between 80 and 120 ft. depending on shear stresses and velocities. The purpose of trying to keep the existing channel hydraulically connected to the new thalweg is to maintain as many existing wetlands as possible and satisfy the ACOE. The previous design in the Kiowa DBPS made no attempt to preserve wetlands in order to satisfy the County's design criteria, and was rejected by the ACOE. While the County's criteria are certainly a determining factor, we consider the need to satisfy the ACOE the highest priority, because without their approval JR won't be granted a 404 permit. The County review of the previous design by the Kiowa DBPS states that the maximum stable longitudinal slope of the channel is 0.17%. Using this longitudinal slope will require the use of at least 10 and possibly 15 GSB drop structures. This channel slope will also ensure the destruction of more wetlands by taking the existing ones offline due to large changes in elevation. JR Engineering's intent to prove that a steeper slope can remain stable long term, thus allowing us to preserve more wetlands and appease the ACOE, a work map for the Final Design Report for Sand Creek Restoration by JR Engineering has been provided for information in Appendix D.

Did not see anything resembling a work map for the channel improvements in Appendix D. Drainage maps from other filings and pond design worksheets were the only items included. Please include a copy of the channel workmap

DRAINAGE FACILITY DESIGN

FOUR STEP PROCESS TO MINIMIZE ADVERSE IMPACTS OF URBANIZATION

In accordance with the El Paso County Drainage Criteria Manual Volume 2, this site has implemented the four step process to minimize adverse impacts of urbanization. The four step process includes reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls.

Water quality and detention for this site is provided in 1 of 3 ponds. See the “Water Quality” exhibit in Appendix E for additional information. The majority of Filing 3, all “A” basins, totaling 29.95 acres, drain to the proposed full-spectrum extended detention basin named Pond A. All “B” basins, drain to Filing No. 2, and the full-spectrum extended detention basin named Pond B. All “D” basins, (named to be consistent with the Filing No. 1 FDR) drain to the full-spectrum extended detention basin named Pond C. Ponds A, B, and C were sized and designed to provide detention and water quality, per the “full-spectrum” design methodology and all local and state criteria. The Filing No. 3 areas that drain to Ponds B or C, have remained consistent with what was planned for in both the Filing No. 1 and Filing No. 2 Final Drainage Reports for the Homestead North at Sterling Ranch developments. See those reports for design details and more information.

Step 1 – Reducing Runoff Volumes: The Homestead North at Sterling Ranch development project consists single -family homes with open spaces and lawn areas interspersed within the development, which helps disconnect impervious areas and reduce runoff volumes. Roof drains from the structures will discharge to lawn areas, where feasible, to allow for infiltration and runoff volume reduction.

Step 2 – Stabilize Drainageways: The site lies within the Sand Creek Drainage Basin. Basin and bridge fees will be due at time of platting. These funds will be used for the channel stabilization being designed by JR Engineering adjacent to the site and on future projects within the basin to stabilize drainageways. The Soils and Geology study on the site showed a potentially unstable region directly adjacent to the western bank of Sand Creek on the southeast corner of the site. At the time of final design, specifications from a Geotechnical Engineer will be implemented to ensure that the developed site is safe. All developed areas of Homestead North at Sterling Ranch Filing No. 3 will discharge into Full Spectrum Detention Ponds, and outflows will be less than or equal to historic flows.

The subdivision improvement agreement (SIA) for Sterling Ranch Filing 1 states that “bank stabilization of the Sand Creek channel shall be required prior to any replats of other final plats adjacent to the channel. The design and installation of said improvements shall be accomplished and guaranteed through the normal subdivision review and collateralization process.” Additionally, “Other drainage improvements in Tract D and future tracts containing the Sand Creek Channel, such as drop structures, check structures and similar stabilization or protection improvements, will be designed and constructed by the District with the final construction drawings to be approved by the County no later than the final platting of the 700th single family lot within the boundaries of the approved Sterling Ranch Sketch Plan and the completion of all said improvements no later than the 800th single family lot with the boundaries of the approved Sterling Ranch Sketch Plan."

Step 3 – Treat the WQCV: Water Quality treatment for this site is provided in three proposed full spectrum water quality detention ponds: Pond A, B, and Pond C. The runoff from this site will be collected within inlets and conveyed to the proposed ponds via storm sewer or overland flows. Upon entrance to the ponds, flows will be captured in a forebay designed to promote settlement of suspended solids. A trickle channel is also incorporated into the ponds to minimize the amount of standing water and provide easy accumulated sediment removal. The outlet structure has been designed to detain the water quality capture volume (WQCV) for 40 hours, and the extended urban runoff volume (EURV) for approx. 72 hours. All flows released from the ponds will be reduced to less than historic rates.

Step 4 – Consider Need for Industrial and Commercial BMPs: There are no commercial or industrial components to this development; therefore no BMPs of this nature are required. BMPs will be utilized to minimize off-site contaminants and to protect the downstream receiving waters. The site is a residential subdivision (ie: not a high-risk site per Figure I-1 in ECM Appendix I), therefore specialized BMPs do not need to be considered. Site specific temporary source control BMPs that will be implemented include, but are not limited to, silt fencing placed around downstream areas of disturbance, construction vehicle tracking pads at the entrances, designated concrete truck washout basin, designated vehicle fueling areas, covered storage areas, spill containment and control, etc. The permanent erosion control BMPs include asphalt drives and parking, storm inlets and storm pipe, the full spectrum water quality and detention ponds, and permanent vegetation.

WATER QUALITY

Where can information for Ponds B & C be found?

Water Quality treatment for this site is provided in three proposed full spectrum water quality detention ponds: Pond A, B, and Pond C. See the "Water Quality Map" in Appendix E. For this Final drainage report the design points, pipes and inlets are discussed in the Proposed Drainage Conditions section of this report. The corresponding design points, pipes and basins are shown within the Proposed Drainage Map within Appendix E. The ponds have been designed per Section 13.3.2.1 of Resolution 15-042 of the El Paso County Drainage Criteria Manual. For additional information on Pond A's storage and outlet characteristics see the UD-Detention design workbook sheets within Appendix C. See below for information regarding Ponds A, B, and C.

Pond A was analyzed for the proposed condition with a tributary area of 29.95 acres and a composite percent impervious of 40.5%. Pond A was designed with a full-spectrum methodology, including a Water Quality Capture Volume drain time of 40 hours and an Excess Urban Runoff Volume (EURV) drain time of 72 hours. Additionally, the pond was designed to drain or infiltrate 97% of the 5-yr storm in 72 hours or less and to drain or infiltrate 99% of events greater than the 5-yr storm in 120 hours or less. Pond A also has a stabilized maintenance access path designed to facilitate easy maintenance by the anticipated equipment to be used by the maintenance entity. The path consists of a gravel section to access the bottom of pond and outlet structure, designed to meet all applicable county criteria and standards. This gravel access allows maintenance vehicles to enter the 6' wide trickle channel, which was designed to be wide enough for maintenance equipment to travel to and access the forebay. There is also a proposed concrete forebay to allow for settlement of sedimentation and ease of removal. The proposed forebay was designed to meet all applicable County criteria and standards. The forebay was sized to hold a minimum volume equal to 3% of the WQCV based on the tributary basins. The forebay notch was sized to release 2% of the undetained peak 100-year flows. See Appendix C for all applicable calculations. The forebay releases flows directly to a concrete trickle channel, which carries flows to the proposed outlet structure. The outlet structure was designed per full-spectrum design methodology, and includes a micropool. Should the pond outlet become clogged, or should the pond see flows in excess of the 100-yr storm, an emergency overflow spillway was provided. The spillway is designed to be stable while conveying the peak, undetained 100-yr flows. The spillway is protected with soil riprap sized per MHFD Figure 12-21. The spillway also has over 1' of freeboard above the 100-yr water surface elevation over the spillway's crest (while conveying peak flows). The emergency overflow path is to the east towards Sand Creek.

Pond A Proposed Design

	Stage (ft.)	Volume Provided (acre-ft)	Release Rate (cfs)
WQCV	3.01	0.455	0.2
EURV	4.46	1.281	0.4
5-year	4.79	1.495	5.4
100-year	5.82	2.246	37.0

Include Required volumes in table and existing flow rates for comparison.

The Final Drainage Report for Homestead North at Sterling Ranch Filing No. 2 identified areas from the Filing No. 3 project site that are tributary. The Filing 2 design and report planned for and accepts these flows, safely routes them to their ultimate outfall, and treats and detains these flows per County and State criteria in the Proposed EDB called Pond B. These areas were identified in the Filing 2 FDR as "Future" basins F1-5. These areas are identified in this drainage report as Basins with the prefix B. This report, per the requirements of the Filing No. 2 FDR, has re-analyzed Pond B, within Filing 2, for the purpose of confirming that Pond B's design is adequate and meets the County and State requirements for water quality and detention, when including the anticipated Filing No. 3 developed flows from B basins. This report has found that no modifications are required to the design of Pond B, however, there was a slight difference in the F basins from the Filing 2 report, versus the Filing 3's B basins. An updated UD-Detention workbook is included in Appendix C of this report. Appendix D, also includes the UD-Detention printouts form the Filing No. 2 report, as a reference.

As previously stated, a small portion of the Filing No. 3 site designated as "D" basins in this report, drains to the proposed Pond C, part of the Filing No. 1 project site. These areas were accounted for and planned for in the design of Filing No. 1 and Pond C. Applicable excerpts from the Filing No. 1 report are included in Appendix D.

As shown on the Water Quality Map included in Appendix E, 4.42 acres of this site, consists of portions of the Sand Creek, an Existing 15' Gravel Maintenance and Pedestrian Trail and undeveloped Basins OS1 and OS2 (grading only, no proposed development) and are excluded from the "Post-Construction (Permanent) Stormwater Management requirements per the "Post Construction Stormwater Management Applicability Evaluation Form" Section II, items G, H, & I.

EROSION CONTROL PLAN

It is the policy of the El Paso County, that a grading and erosion control plan be submitted with the drainage report. Proposed silt fence, vehicles traffic control, temporary sediment basins, seeding and mulching are proposed as erosion control measures. The GEC plans have been submitted concurrently with this report.

OPERATION & MAINTENANCE

In order to ensure the function and effectiveness of the stormwater infrastructure, maintenance activities such as inspection, routine maintenance, restorative maintenance, rehabilitation and repair, are required. The property owner shall be responsible for the inspection, maintenance, rehabilitation and repair of stormwater and erosion control facilities located on the property unless another party accepts such responsibility in writing and responsibility is properly assigned through legal documentation. Access is provided from onsite facilities and easements for proposed infrastructure located offsite. We respectfully request that the Operation & Maintenance Manual be submitted in conjunction with the construction documents. The pond will be owned and maintained by Sterling Ranch Metro District. Maintenance is provided for Pond A with a 12-foot access road off Aspen Valley Road for the proposed forebay and outlet structure. The maintenance drive for Sand Creek improvements is provided directly to the west of Sand Creek.

DRAINAGE AND BRIDGE FEES

The site lies within the Sand Creek Drainage Basin. An estimate of the Impervious Acres and Drainage/Bridge is presented below,

HN F3 Impervious Area Calculation

Breakdown	Acres	% Impervious	Impervious Acres
ROW	7.1418	100%	7.14
Lots	21.8837	50%	10.94
Tracts	11.8016	2%	0.24
Total	40.8271		18.32

2022 Drainage and Bridge Fee – Sterling Ranch Homestead North Filing 3				
Impervious Acres (Ac.)	Drainage Fee (Per Imp. Acre)	Bridge Fee (Per Imp. Acre)	Sterling Ranch Drainage Fee	Sterling Ranch Bridge Fee
18.32	$21,814	$8,923	$399,632.48	$163,469.36

Construction Cost Opinion

A construction cost opinion for the public storm drainage infrastructure has been provided below. The below cost opinion is only an estimate of facility and drainage infrastructure cost and may vary.

Homestead North Filing No. 3 (Public Non-Reimbursable)

Item	Description	Quantity	Unit	Unit Price	Cost
1	18” RCP	230	L.F.	$ 70	$ 16,100.00
2	24" RCP	402	L.F.	$ 83	$ 33,366.00
3	30" RCP	8	L.F.	$ 104	$ 832.00
4	36" RCP	350	L.F.	$ 128	$ 44,800.00
5	42" RCP	184	L.F.	$ 171	$ 31,464.00
6	18" FES	1	Ea.	$ 420	$ 420.00
7	15' Curb Inlet Type R < 5 ft.	5	Ea.	$ 10,984	$ 54,920.00
8	20' Curb Inlet Type R < 5 ft.	1	Ea.	$ 11,706	$ 11,706.00
9	Storm Sewer MH, box base	2	Ea.	$ 12,876	$ 25,752.00
10	Storm Sewer MH, slab base	1	Ea.	$ 7,082	$ 7,082.00
11	Pond A	1	Ea.	$ 40,000	$ 40,000.00
				Sub-Total	$ 266,442.00

Update all storm quantities - No 18" rcp, 42" rcp or 20' inlets shown on plans.

Per LDC section 8.5.5.C.3.b(ii) Fee Reductions, Credits or Reimbursement for Facilities, this development requests that no cash drainage or bridge fees are due at platting as the value of reimbursable DBPS improvements for the Sand Creek Tributary segment 159, 164, 169, 186 and the Briargate Bridge shown in the below table exceed the drainage and bridge fee estimate shown above.

Sterling Ranch Deferred Drainage Fees Analysis
Reimbursable Costs associated with DBPS Segment 159 and 164, Segment 169 and 186

	Reimbursable Estimate Segment 159 and 164 from SR F2 FDR (SF-2015)	$1,918,065.00
	Reimbursable Estimate Segment 169 and 186 from HN F1 FDR (SF-2213)	$611,628.00
	Subtotal Reimb. Costs associated with DBPS Segments 159-164, 169-186	$2,529,693.00
	Earlier Plats Deferred Drainage Fees (Branding Iron F1 & Homestead F1)	$219,540.55
	SR F2 (SF-2015) Drainage Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$400,855.70
	SR F3 (SF-2132) Drainage Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$214,430.47
*	HN F1 (SF-2213) Drainage Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$541,225.00
*	HN F2 (SF-2218) Drainage Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$310,413.22
	HN F3 (SF-2229) Drainage Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$399,632.48
	Subtotal Deferred Drainage Fees	$2,086,097.42
	Unused Reimb. Costs associated with DBPS Segments 159-164, 169-186	$443,595.58

Sterling Ranch Deferred Bridge Fees Analysis
Reimbursable Costs associated with DBPS Bridge at Briargate Parkway and Sterling Ranch Rd.

	Reimbursable Estimate Briargate Parkway Bridge from CDR 2113	$1,546,676.98
	Reimbursable Estimate Sterling Ranch Road Bridge from CDR 226	$990,016.80
	Subtotal Reimb. Costs associated with BGP and SR Rd. Bridges	$2,536,693.78
	SR F3 (SF-2132) Bridge Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$87,709.60
*	HN F1 (SF-2213) Bridge Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$221,388.00
*	HN F2 (SF-2218) Bridge Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$126,974.29
	HN F3 (SF-2229) Bridge Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$163,469.36
	Subtotal Deferred Bridge Fees	$599,541.25
	Unused Reimb. Costs associated with Briargate Parkway and SR Road Bridges	$1,937,152.53

* Filing is not yet approved, actual fee at time of approval may be different than shown here

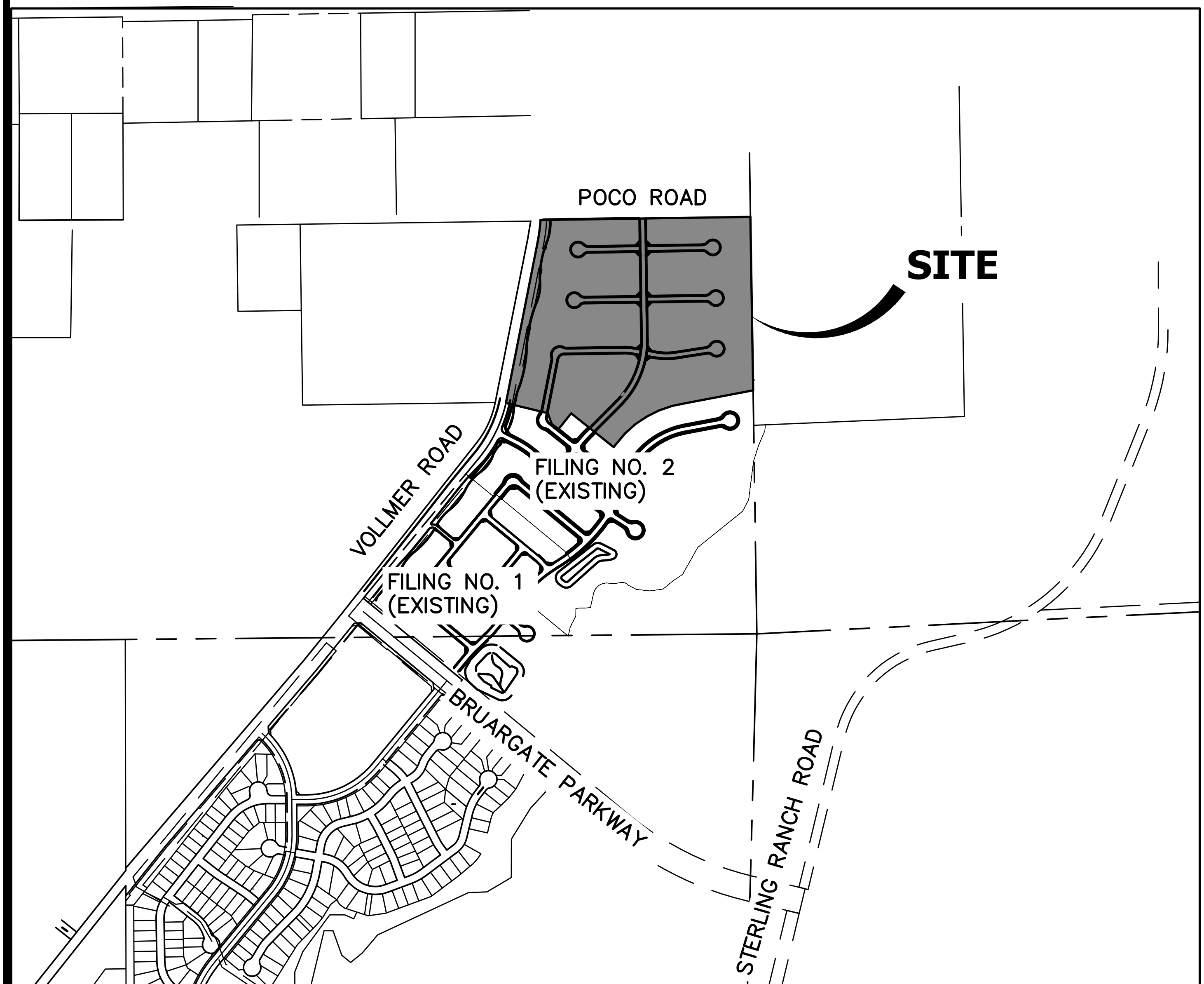
SUMMARY

The proposed Homestead North at Sterling Ranch Filing No. 3 drainage improvements were designed to meet or exceed the El Paso County Drainage Criteria. The proposed development's ponds are designed to release at less than the predeveloped runoff rates per the studies associated with the subject site. The proposed development will not adversely affect the offsite drainageways or surrounding developments. This report is in conformance and meets the latest El Paso County Storm Drainage Criteria requirements.

REFERENCES

1. "El Paso County and City of Colorado Springs Drainage Criteria Manual, Vol I & II".
2. El Paso County ECM, 2019
3. El Paso County DCM Vol. 1 Update, 2015
4. Urban Storm Drainage Criteria Manual (Volumes 1, 2, and 3), Urban Drainage and Flood Control District, June 2001.
5. Upper Sand Creek Detention Evaluation Study, Wilson and Company'
6. Final Drainage Report For Retreat at Timberridge Filing No. 1, Classic Consulting Engineers & Surveyors
7. Sand Creek Drainage Basin Planning Study, Stantec, January 2021
8. Sand Creek Channel Design Report JR Engineering, October 2021- Draft
9. Preliminary Drainage Report And MDDP Addendum For Homestead North At Sterling Ranch Preliminary Plan", prepared by JR Engineering, dated January 2022
10. The Final Drainage Report for Homestead North at Sterling Ranch Filing No. 1, prepared by JR Engineering, Dated June 2022
11. The Final Drainage Report for Homestead North at Sterling Ranch Filing No. 2, prepared by JR Engineering, Dated July 2022.

Appendix A
Vicinity Map, Soil Descriptions, FEMA Floodplain Map



10000 5000 0 10000

ORIGINAL SCALE: 1" = 10000'

VICINITY MAP
HOMESTEAD NORTH AT
STERLING RANCH FILING NO. 3
2000-5188.12
2022-07-19

J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

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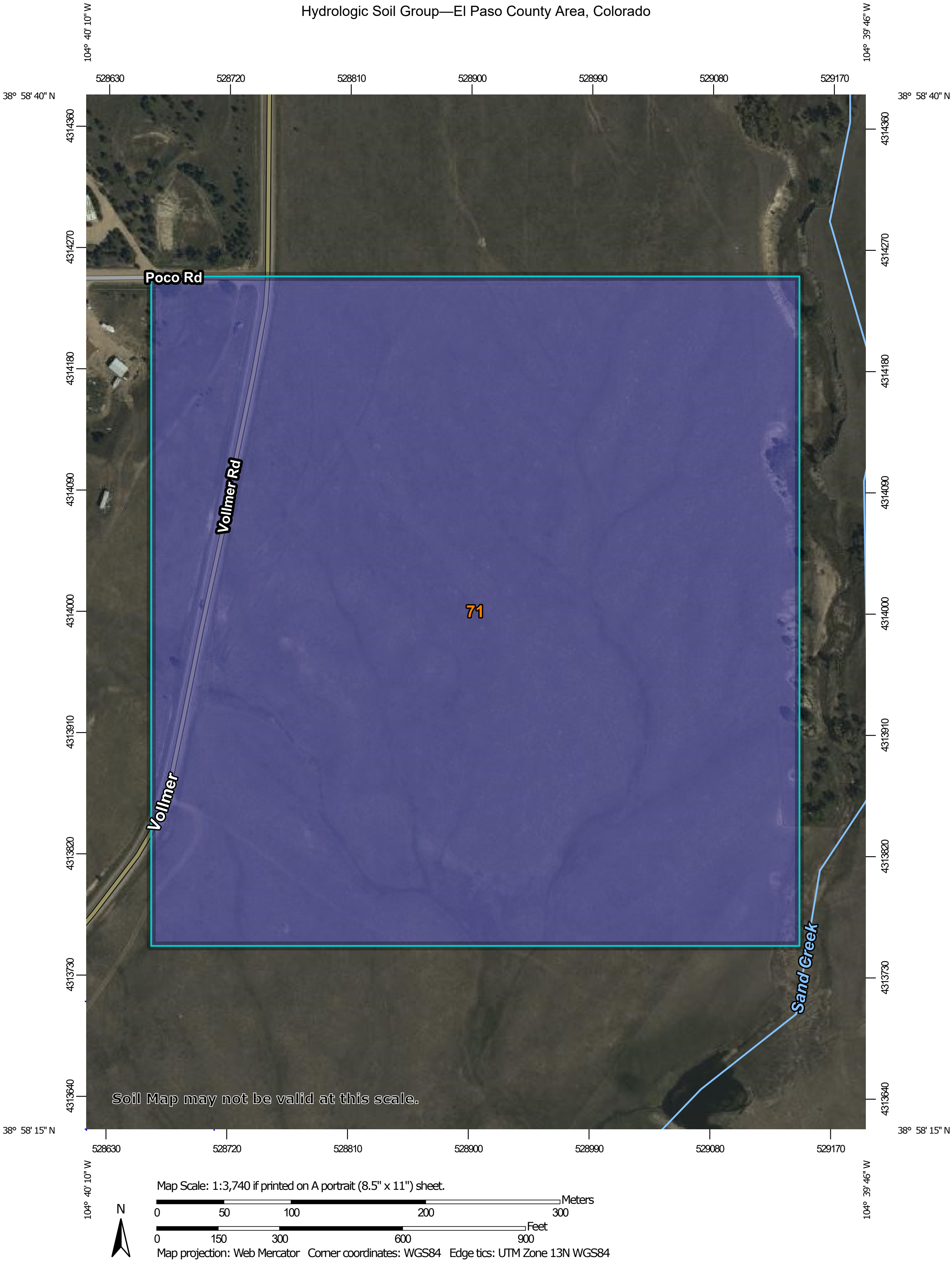

104° 40' 10" W
104° 39' 46" W
38° 58' 40" N
38° 58' 15" N
528630
528720
528810
528900
528990
529080
529170
4314360
4314270
4314180
4314090
4314000
4313910
4313820
4313730
4313640
Poco Rd
Vollmer Rd
Vollmer
71
Sand Creek
Soil Map may not be valid at this scale.
Map Scale: 1:3,740 if printed on A portrait (8.5" x 11") sheet.
N
Meters
0 50 100 200 300
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: Sep 11, 2018—Oct 20, 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
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	59.6	100.0%
Totals for Area of Interest			**59.6**	**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

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM zones zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the **North American Vertical Datum of 1988 (NAVD88)**. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

This map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles and Floodway Data Tables if applicable, in the FIS report. As a result, the profile baselines may deviate significantly from the new base map channel representation and may appear outside of the floodplain.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

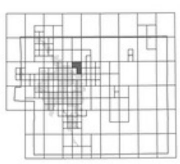
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. The MSC may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

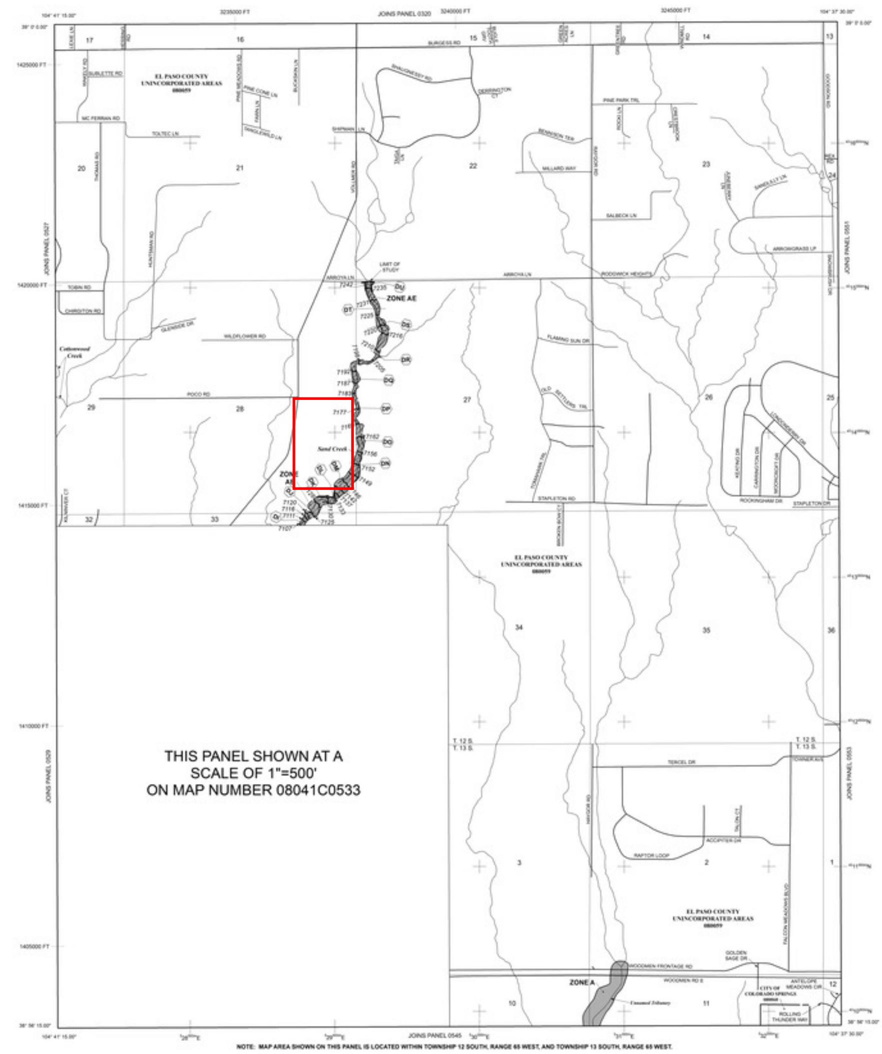
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



This Digital Flood Insurance Rate Map (DFIRM) was produced through a Cooperating Technical Partner (CTP) agreement between the State of Colorado Water Conservation Board (CWCB) and the Federal Emergency Management Agency (FEMA).

Additional Flood Hazard information and resources are available from local communities and the Colorado Water Conservation Board.



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 65 WEST, AND TOWNSHIP 13 SOUTH, RANGE 65 WEST.

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAS) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- **ZONE A** No Base Flood Elevations determined.
- **ZONE AE** Base Flood Elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE AR** Special Flood Hazard Area Formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- **ZONE A99** Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- **ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- **ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- **ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
- **ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- Floodplain boundary
- Floodway boundary
- Zone D Boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

- A — A: Cross section line
- 23 — 23: Transect line
- 97° 07' 30.00" 32° 22' 30.00": Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 1000-meter Universal Transverse Mercator grid ticks, zone 13
- 6000000 FT: 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
- DX5510 ×: Bench mark (see explanation in Notes to Users section of this FIRM panel)
- • M1.5: River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
DECEMBER 7, 2018 - to update corporate limits, to change Base Flood Elevations and Special Flood Hazard Areas, to update map format, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History Table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP

PANEL 0535G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 535 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

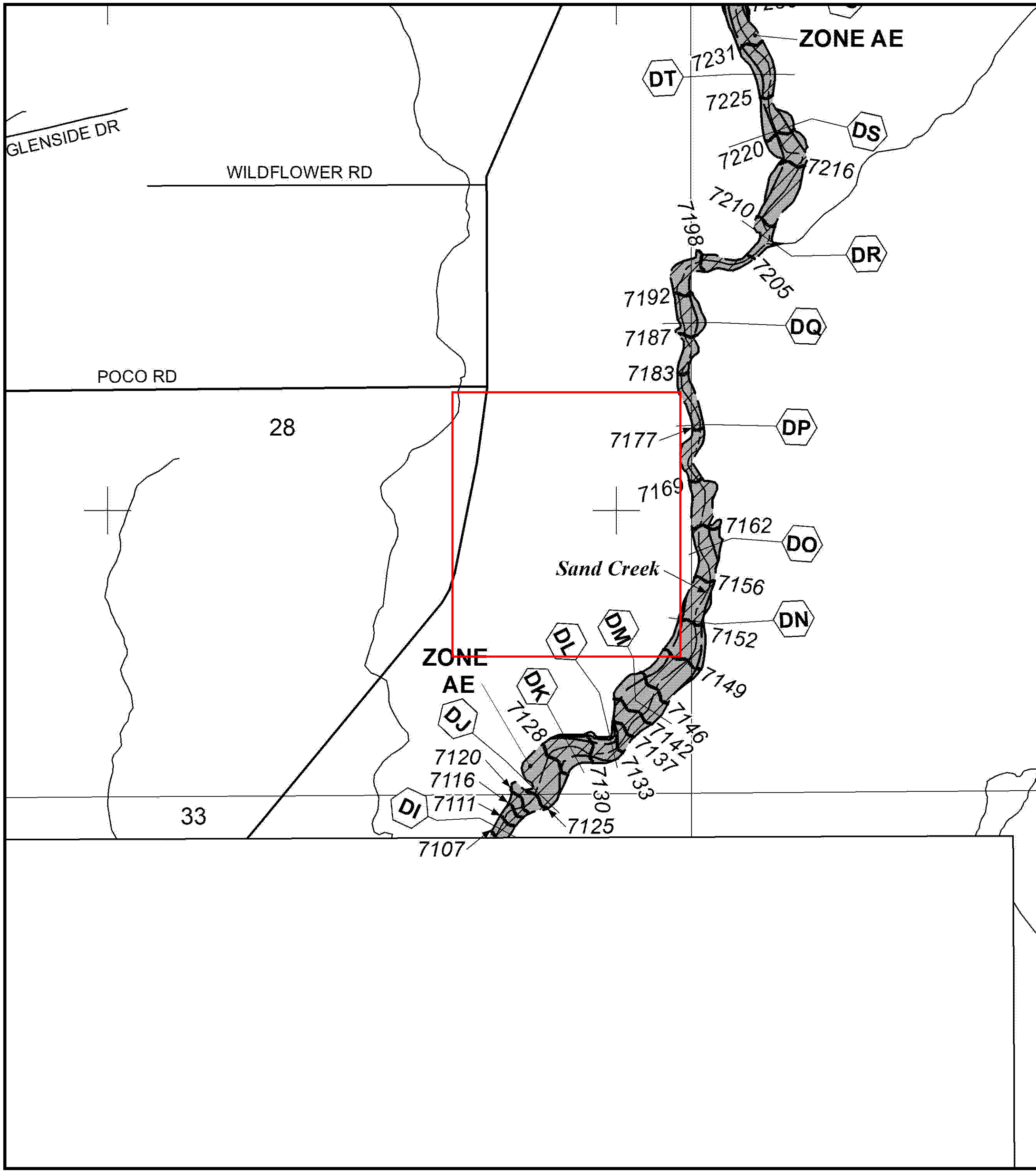
COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	[illegible]	[illegible]	[illegible]
EL PASO COUNTY	[illegible]	[illegible]	[illegible]

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0535G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency



MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 MI

NFIP

PANEL 0535G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO

AND INCORPORATED AREAS

PANEL 535 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0535	G
EL PASO COUNTY	080059	0535	G

Notice to User: The **Map Number** shown below should be used when placing map orders: the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08041C0535G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

Appendix B
Hydrologic Calculations

COMPOSITE % IMPERVIOUS & COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Existing Conditions Rational
Location: El Paso County

Project Name: Homestead North @ Sterling Ranch F3
Project No.: 25188.12
Calculated By: REB
Checked By:
Date: 10/12/22

Basin ID	Total Area (ac)	Streets/Paved (100% Impervious)				Residential (45%-65% Impervious)				Lawns (2% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	
EX1	3.82	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.09	0.36	3.82	2.0%	0.09	0.36	2.0%
EX2	9.74	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.09	0.36	9.74	2.0%	0.09	0.36	2.0%
EX3	21.47	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.09	0.36	21.47	2.0%	0.09	0.36	2.0%
EX4	0.84	0.90	0.96	0.39	46.4%	0.45	0.59	0.00	0.0%	0.09	0.36	0.45	1.1%	0.47	0.64	47.5%
EX1.2	0.17	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.09	0.36	0.17	2.0%	0.09	0.36	2.0%
EXB6	0.13	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.09	0.36	0.13	2.0%	0.09	0.36	2.0%
EXB4	0.43	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.09	0.36	0.43	2.0%	0.09	0.36	2.0%
TOTAL	36.60															3.0%

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Existing Conditions Rational
Location: El Paso County

Project Name: Homestead North @ Sterling Ranch F3
Project No.: 25188.12
Calculated By: REB
Checked By:
Date: 10/12/22

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
EX1	3.82	B	2%	0.09	0.36	300	3.3%	21.3	600	3.3%	7.0	1.3	7.9	29.2	900.0	31.6	29.2
EX2	9.74	B	2%	0.09	0.36	300	2.9%	22.2	1375	2.9%	7.0	1.2	19.2	41.5	1675.0	40.2	40.2
EX3	21.47	B	2%	0.09	0.36	300	2.9%	22.2	1600	2.9%	7.0	1.2	22.4	44.6	1900.0	42.5	42.5
EX4	0.84	B	48%	0.47	0.64	237	5.0%	10.4	0	5.0%	7.0	1.6	0.0	10.4	237.0	17.9	10.4
EX1.2	0.17	B	2%	0.09	0.36	92	2.1%	13.7	0	2.1%	7.0	1.0	0.0	13.7	92.0	25.7	13.7
EXB6	0.13	B	2%	0.09	0.36	75	10.0%	7.4	0	10.0%	7.0	2.2	0.0	7.4	75.0	25.7	10.0
EXB4	0.43	B	2%	0.09	0.36	75	13.0%	6.8	0	13.0%	7.0	2.5	0.0	6.8	75.0	25.7	10.0

NOTES:

$$t_c = t_i + t_t$$ Equation 6-2

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$ Equation 6-3

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L_i = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$ Equation 6-4

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_o = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$
K = NRCS conveyance factor (see Table 6-2).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$ Equation 6-5

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Existing Conditions Rational
Location: El Paso County
Design Storm: 5-Year (Minor)

Project Name: Homestead North @ Sterling Ranch F3
Project No.: 25188.12
Calculated By: REB
Checked By:
Date: 10/12/22

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	E1	EX1	3.82	0.09	29.2	0.34	2.52	0.9															Sheet flows south to DP E1 (Enters north c&g of Perry Owens Dr)
	E2	EX2	9.74	0.09	40.2	0.88	2.04	1.8					1.8	0.88	0.75					600	1.3	7.7	Sheet flows south to ex grass swale, @ DP E2, continues east through basin EX3 to DP3.1
	E3.1	EX3	21.47	0.09	42.5	1.93	1.96	3.8	47.9	2.81	1.78	5.0											Sheet flows southeast to ex grass swale, flows east to DP3.1 @ Sand Creek
	E4	EX4	0.84	0.47	10.4	0.39	4.08	1.6															Sheet flows east to Sand Creek at DP EX4
	1.2	EX1.2	0.17	0.09	13.7	0.02	3.66	0.1															Sheet flows southeast to Filing 2 Boundary @ DP EX1.2
	B6	EXB6	0.13	0.09	10.0	0.01	4.13	0.0															Sheet flows southeast to Filing 2 Boundary @ DP EXB6
	B4	EXB4	0.43	0.09	10.0	0.04	4.13	0.2															Sheet flows southeast to Filing 2 Boundary @ DP EXB4

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Existing Conditions Rational
Location: El Paso County
Design Storm: 100-Year (Major)

Project Name: Homestead North @ Sterling Ranch F3
Project No.: 25188.12
Calculated By: REB
Checked By:
Date: 10/12/22

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
Description	Design Point	Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	E1	EX1	3.82	0.36	29.2	1.38	4.24	5.8															Sheet flows south to DP E1 (Enters north c&g of Perry Owens Dr)
	E2	EX2	9.74	0.36	40.2	3.51	3.43	12.0					12.0	3.51	0.75					600	1.3	7.7	Sheet flows south to ex grass swale, @ DP E2, continues east through basin EX3 to DP3.1
	E3.1	EX3	21.47	0.36	42.5	7.73	3.28	25.4	47.9	11.24	2.99	33.6											Sheet flows southeast to ex grass swale, flows east to DP3.1 @ Sand Creek
	E4	EX4	0.84	0.64	10.4	0.54	6.84	3.7															Sheet flows east to Sand Creek at DP EX4
	1.2	EX1.2	0.17	0.36	13.7	0.06	6.14	0.4															Sheet flows southeast to Filing 2 Boundary @ DP EX1.2
	B6	EXB6	0.13	0.36	10.0	0.05	6.93	0.3															Sheet flows southeast to Filing 2 Boundary @ DP EXB6
	B4	EXB4	0.43	0.36	10.0	0.15	6.93	1.0															Sheet flows southeast to Filing 2 Boundary @ DP EXB4

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

COMPOSITE % IMPERVIOUS & COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: Proposed Conditions Rational
Location: El Paso County

Project Name: Homestead North @ Sterling Ranch F3
Project No.: 25188.12
Calculated By: REB
Checked By:
Date: 10/12/22

Basin ID	Total Area (ac)	Streets/Paved (100% Impervious)				Residential (30%-40% Impervious)				Lawns (2% Impervious)				Basins Total Weighted C Values		Basins Total Weighted % Imp.
		C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	
A1	3.82	0.90	0.96	0.79	20.7%	0.25	0.47	2.40	18.8%	0.09	0.36	0.63	0.3%	0.36	0.55	39.9%
A2	3.02	0.90	0.96	0.82	27.2%	0.25	0.47	2.06	20.5%	0.09	0.36	0.14	0.1%	0.42	0.60	47.7%
A3	4.54	0.90	0.96	0.75	16.5%	0.30	0.50	3.45	30.4%	0.09	0.36	0.34	0.1%	0.38	0.57	47.1%
A4	3.82	0.90	0.96	0.78	20.4%	0.30	0.50	2.73	28.6%	0.09	0.36	0.31	0.2%	0.41	0.58	49.2%
A5	7.53	0.90	0.96	0.79	10.5%	0.30	0.50	4.23	22.5%	0.09	0.36	2.51	0.7%	0.29	0.50	33.6%
A6	4.29	0.90	0.96	0.88	20.5%	0.30	0.50	3.22	30.0%	0.09	0.36	0.19	0.1%	0.41	0.59	50.6%
A7	2.93	0.90	0.96	0.00	0.0%	0.30	0.50	1.03	14.1%	0.09	0.36	1.90	1.3%	0.16	0.41	15.4%
B1.1	2.08	0.90	0.96	0.25	12.0%	0.30	0.50	1.41	27.1%	0.09	0.36	0.42	0.4%	0.33	0.53	39.5%
B1.2	1.36	0.90	0.96	0.21	15.4%	0.30	0.50	1.10	32.4%	0.09	0.36	0.05	0.1%	0.38	0.57	47.9%
B1.3	0.33	0.90	0.96	0.14	40.9%	0.30	0.50	0.08	9.2%	0.09	0.36	0.12	0.7%	0.47	0.64	50.8%
B4	1.21	0.90	0.96	0.00	0.0%	0.30	0.50	0.00	0.0%	0.09	0.36	1.21	2.0%	0.09	0.36	2.0%
OS1	0.20	0.90	0.96	0.00	0.0%	0.30	0.50	0.00	0.0%	0.09	0.36	0.20	2.0%	0.09	0.36	2.0%
OS2	1.01	0.90	0.96	0.00	0.0%	0.30	0.50	0.00	0.0%	0.09	0.36	1.01	2.0%	0.09	0.36	2.0%
D2	0.18	0.90	0.96	0.00	0.0%	0.30	0.50	0.00	0.0%	0.09	0.36	0.18	2.0%	0.09	0.36	2.0%
D3	0.17	0.90	0.96	0.00	0.0%	0.30	0.50	0.00	0.0%	0.09	0.36	0.17	2.0%	0.09	0.36	2.0%
TOTAL POND A	29.95															40.5%
TOTAL SITE	36.49															37.9%

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Proposed Conditions Rational
Location: El Paso County

Project Name: Homestead North @ Sterling Ranch F3
Project No.: 25188.12
Calculated By: REB
Checked By:
Date: 10/12/22

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
A1	3.82	B	40%	0.36	0.55	100	4.5%	8.2	810	2.6%	20.0	3.2	4.2	12.3	910.0	25.0	12.3
A2	3.02	B	48%	0.42	0.60	100	2.0%	9.8	764	1.6%	20.0	2.5	5.0	14.8	864.0	24.3	14.8
A3	4.54	B	47%	0.38	0.57	100	2.1%	10.1	1027	2.8%	20.0	3.3	5.1	15.2	1127.0	24.6	15.2
A4	3.82	B	49%	0.41	0.58	100	7.2%	6.5	861	1.7%	20.0	2.6	5.5	12.0	961.0	24.6	12.0
A5	7.53	B	34%	0.29	0.50	100	4.3%	9.0	1294	2.4%	20.0	3.1	7.0	16.0	1394.0	30.4	16.0
A6	4.29	B	51%	0.41	0.59	100	6.0%	6.9	976	1.4%	20.0	2.4	6.9	13.7	1076.0	25.9	13.7
A7	2.93	B	15%	0.16	0.41	100	9.7%	8.0	161	7.1%	7.0	1.9	1.4	9.4	261.0	24.3	9.4
B1.1	2.08	B	40%	0.33	0.53	100	4.5%	8.5	506	3.9%	20.0	3.9	2.1	10.6	606.0	22.2	10.6
B1.2	1.36	B	48%	0.38	0.57	100	2.4%	9.7	324	3.9%	20.0	3.9	1.4	11.0	424.0	19.6	11.0
B1.3	0.33	B	51%	0.47	0.64	100	1.5%	10.0	30	1.5%	20.0	2.4	0.2	10.2	130.0	17.6	10.2
B4	1.21	B	2%	0.09	0.36	100	8.7%	8.9	42	9.0%	7.0	2.1	0.3	9.3	142.0	25.9	9.3
OS1	0.20	B	2%	0.09	0.36	25	20.0%	3.4	0	20.0%	7.0	3.1	0.0	3.4	25.0	25.7	5.0
OS2	1.01	B	2%	0.09	0.36	50	8.0%	6.5	0	13.0%	7.0	2.5	0.0	6.5	50.0	25.7	6.5
D2	0.18	B	2%	0.09	0.36	30	5.7%	5.6	0	10.0%	7.0	2.2	0.0	5.6	30.0	25.7	5.6
D3	0.17	B	2%	0.09	0.36	30	12.0%	4.4	0	13.0%	7.0	2.5	0.0	4.4	30.0	25.7	5.0

NOTES:

$$t_c = t_i + t_t \quad \text{Equation 6-2}$$

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t} \quad \text{Equation 6-4}$$

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_o = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$
K = NRCS conveyance factor (see Table 6-2).

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}} \quad \text{Equation 6-3}$$

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L_i = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}} \quad \text{Equation 6-5}$$

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: Proposed Conditions Rational
Location: El Paso County
Design Storm: 5-Year

Project Name: Homestead North @ Sterling Ranch F3
Project No.: 25188.12
Calculated By: REB
Checked By:
Date: 10/12/22

STREET		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	1i	A1	3.82	0.36	12.3	1.37	3.81	5.2								5.2	1.37	5.0	18	6	10.4	0.0	Basin A1 runoff captured by 15' Type R on-grade inlet, piped to DP2.1
	1B												0.00	0	2.8					316			Basin A1 runoff inlet by-pass/flow by, continues in gutter to DP3
	2i	A2	3.02	0.42	14.8	1.27	3.54	4.5								4.5	1.27	2.0	18	24	7.3	0.1	Basin A2 runoff captured by 15' Type R on-grade inlet, piped to DP2.1
	2B												0.00	0	2.8					330			Basin A2 runoff inlet by-pass/flow by, continues in gutter to DP4
	2.1								14.9	2.64	3.53	9.3				9.3	2.64	2.7	24	344	9.7	0.6	Flow in Pipe @ DP2.1, piped to DP4.1
	3i	A3	4.54	0.38	15.2	1.74	3.50	6.1								6.1	1.74	4.0	24	10	9.9	0.0	Basin A3 runoff captured by 15' Type R on-grade inlet, piped to DP4.1
	3B												0.00		2.6					334			Basin A3 runoff inlet by-pass/flow by, continues in gutter to DP5
	4i	A4	3.82	0.41	12.0	1.55	3.85	6.0								6.0	1.55	2.5	24	24	8.3	0.0	Basin A4 runoff captured by 15' Type R on-grade inlet, piped to DP4.1
	4B												0.00		2.6					347			Basin A4 runoff inlet by-pass/flow by, continues in gutter to DP6
	4.1								15.5	5.93	3.48	20.6				20.6	5.93	2.2	36	337	11.0	0.5	Flow in Pipe @ DP4.1, piped to DP5.1
	5i	A5	7.53	0.29	16.0	2.21	3.43	7.6								7.6	2.21	7.0	36	5	12.2	0.0	Basin A5 runoff captured by 20' Type R sump inlet, piped to DP5.1
	5.1								16.0	8.14	3.43	27.9				27.9	8.14	3.0	42	24	13.2	0.0	Flow in Pipe @ DP4.1, piped to DP5.1
	6i	A6	4.29	0.41	13.7	1.78	3.65	6.5								6.5	1.78	3.0	42	1	8.4	0.0	Basin A6 runoff captured by 15' Type R sump inlet, piped to DP6.1
	6.1								16.0	9.92	3.42	34.0				34.0	9.92	3.0	42	180	14.0	0.2	Flow in Pipe @ DP6.1, piped to DP7 (Pond A)
	7.1	A7	2.93	0.16	9.4	0.48	4.22	2.0	16.2	10.40	3.40	35.4											Combined flow from Basin A7 runoff & flows piped from DP6.1 in Pond A
	1F	b1.1	2.08	0.33	10.6	0.69	4.04	2.8															Runoff from Basin B1.1, flows south in C&G to DP1F @ Southern project boundary
	2F	B1.2	1.36	0.38	11.0	0.52	3.98	2.1															Runoff from Basin B1.2, flows south in C&G to DP2F @ Southern project boundary
	1.3	B1.3	0.33	0.47	10.2	0.16	4.11	0.7															Runoff from Basin B1.3, flows south in C&G to DP1.3 @ Southern project boundary
	B4	B4	1.21	0.09	9.3	0.11	4.24	0.5															Runoff from Basin B4, flows southeast overland to project boundary
	OS1	OS1	0.20	0.09	5.0	0.02	5.17	0.1															Runoff from Basin OS1, flows north to project boundary, continues east in exisitng POCO Rd C&G
	OS2	OS2	1.01	0.09	6.5	0.09	4.78	0.4															Runoff from Basin OS2, flows east to Sand Creek and continues in creek to South
	D2	D2	0.18	0.09	5.6	0.02	4.99	0.1															Runoff from Basin D2, sheet flows West to ex Vollmer Rd swale @ D2, continues south in swale
	D3	D3	0.17	0.09	5.0	0.02	5.17	0.1															Runoff from Basin D3, sheet flows West to ex Vollmer Rd swale @ D3, continues south in swale

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Proposed Conditions Rational
Location: El Paso County
Design Storm: 100-Year

Project Name: Homestead North @ Sterling Ranch F3
Project No.: 25188.12
Calculated By: REB
Checked By:
Date: 10/12/22

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
Description	Design Point	Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	$Q_{street/swale}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	1i	A1	3.82	0.55	12.3	2.11	6.40	13.5								10.9	1.70	5.0	18	6	13.0	0.0	Basin A1 runoff captured by 15' Type R on-grade inlet, piped to DP2.1
	1B												2.6	0.41	2.8					316	3.3	1.6	Basin A1 runoff inlet by-pass/flow by, continues in gutter to DP3
	2i	A2	3.02	0.60	14.8	1.81	5.94	10.8								9.5	1.60	2.0	18	24	8.8	0.0	Basin A2 runoff captured by 15' Type R on-grade inlet, piped to DP2.1
	2B												1.3	0.21	2.8					330	3.3	1.6	Basin A2 runoff inlet by-pass/flow by, continues in gutter to DP4
	2.1								14.9	3.30	5.93	19.6				19.6	3.30	2.7	24	344	11.9	0.5	Flow in Pipe @ DP2.1, piped to DP4.1
	3i	A3	4.54	0.57	15.2	2.57	5.87	15.1	15.2	2.98	5.87	17.5				12.6	2.15	4.0	24	10	12.2	0.0	Basin A3 runoff captured by 15' Type R on-grade inlet, piped to DP4.1
	3B												4.9	0.83	2.6					334	3.2	1.7	Basin A3 runoff inlet by-pass/flow by, continues in gutter to DP5
	4i	A4	3.82	0.58	12.0	2.23	6.46	14.4	16.5	2.44	5.68	14.4				11.3	1.75	2.5	24	24	10.0	0.0	Basin A4 runoff captured by 15' Type R on-grade inlet, piped to DP4.1
	4B												3.1	0.55	2.6					347	3.2	1.8	Basin A4 runoff inlet by-pass/flow by, continues in gutter to DP6
	4.1								15.3	7.20	5.85	42.1				42.1	7.20	2.2	36	337	13.4	0.4	Flow in Pipe @ DP4.1, piped to DP5.1
	5i	A5	7.53	0.50	16.0	3.78	5.75	21.7	17.0	4.61	5.60	25.8				25.8	4.61	7.0	30	5	18.1	0.0	Basin A5 runoff captured by 15' Type R sump inlet, piped to DP5.1
	5.1								17.0	11.81	5.60	66.1				66.1	11.81	3.0	36	24	16.9	0.0	Flow in Pipe @ DP4.1, piped to DP5.1
	6i	A6	4.29	0.59	13.7	2.52	6.13	15.5	13.8	3.07	6.11	18.8				18.8	3.07	3.0	36	1	12.0	0.0	Basin A6 runoff captured by 15' Type R sump inlet, piped to DP6.1
	6.1								17.0	14.88	5.60	83.2				83.2	14.88	3.0	36	180	17.7	0.2	Flow in Pipe @ DP6.1, piped to DP7 (Pond A)
	7.1	A7	2.93	0.41	9.4	1.20	7.08	8.5	17.2	16.62	5.57	92.6											Combined flow from Basin A7 runoff & flows piped from DP6.1 in Pond A
	1F	B1.1	2.08	0.53	10.6	1.10	6.79	7.5															Runoff from Basin B1.1, flows south in C&G to DP1F @ Southern project boundary
	2F	B1.2	1.36	0.57	11.0	0.77	6.68	5.1															Runoff from Basin B1.2, flows south in C&G to DP2F @ Southern project boundary
	1.3	B1.3	0.33	0.64	10.2	0.21	6.89	1.4															Runoff from Basin B1.3, flows south in C&G to DP1.3 @ Southern project boundary
	B4	B4	1.21	0.36	9.3	0.44	7.13	3.1															Runoff from Basin B4, flows southeast overland to project boundary
	OS1	OS1	0.20	0.36	5.0	0.07	8.68	0.6															Runoff from Basin OS1, flows north to project boundary, continues east in exisitng POCO Rd C&G
	OS2	OS2	1.01	0.36	6.5	0.36	8.02	2.9															Runoff from Basin OS2, flows east to Sand Creek and continues in creek to South
	D2	D2	0.18	0.36	5.6	0.06	8.38	0.5															Runoff from Basin D2, sheet flows West to ex Vollmer Rd swale @ D2, continues south in swale
	D3	D3	0.17	0.36	5.0	0.06	8.68	0.5															Runoff from Basin D3, sheet flows West to ex Vollmer Rd swale @ D3, continues south in swale

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.
All pipes are private and RCP unless otherwise noted. Pipe size shown in table column.

Appendix C
Hydraulic Calculations

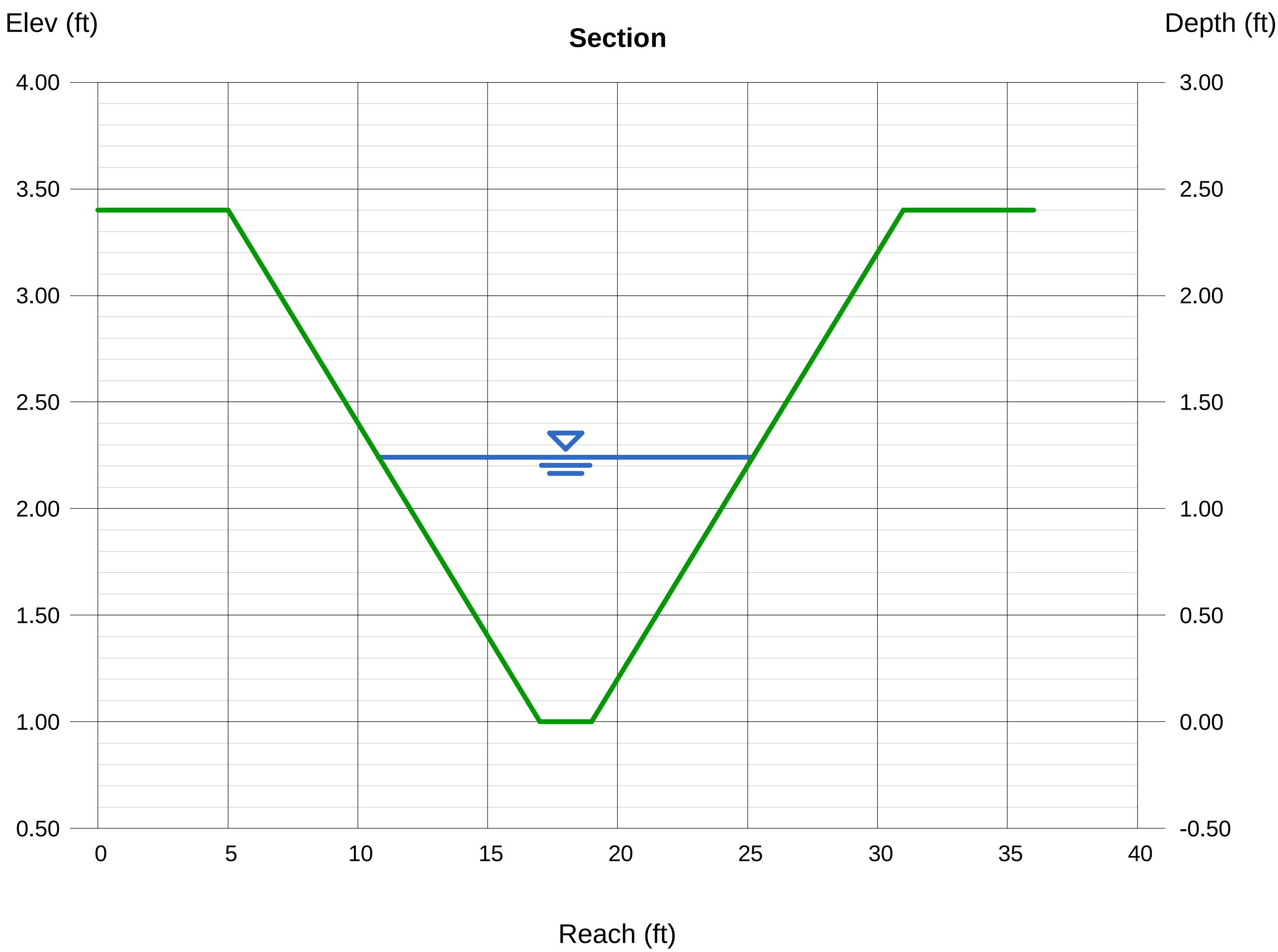
Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 12 2022

Ex. Swale Section A-A

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 2.00	Depth (ft)	= 1.24
Side Slopes (z:1)	= 5.00, 5.00	Q (cfs)	= 33.60
Total Depth (ft)	= 2.40	Area (sqft)	= 10.17
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 3.30
Slope (%)	= 1.00	Wetted Perim (ft)	= 14.65
N-Value	= 0.035	Crit Depth, Yc (ft)	= 1.05
		Top Width (ft)	= 14.40
Calculations		EGL (ft)	= 1.41
Compute by:	Kn		
Known Q (cfs)	= 3		

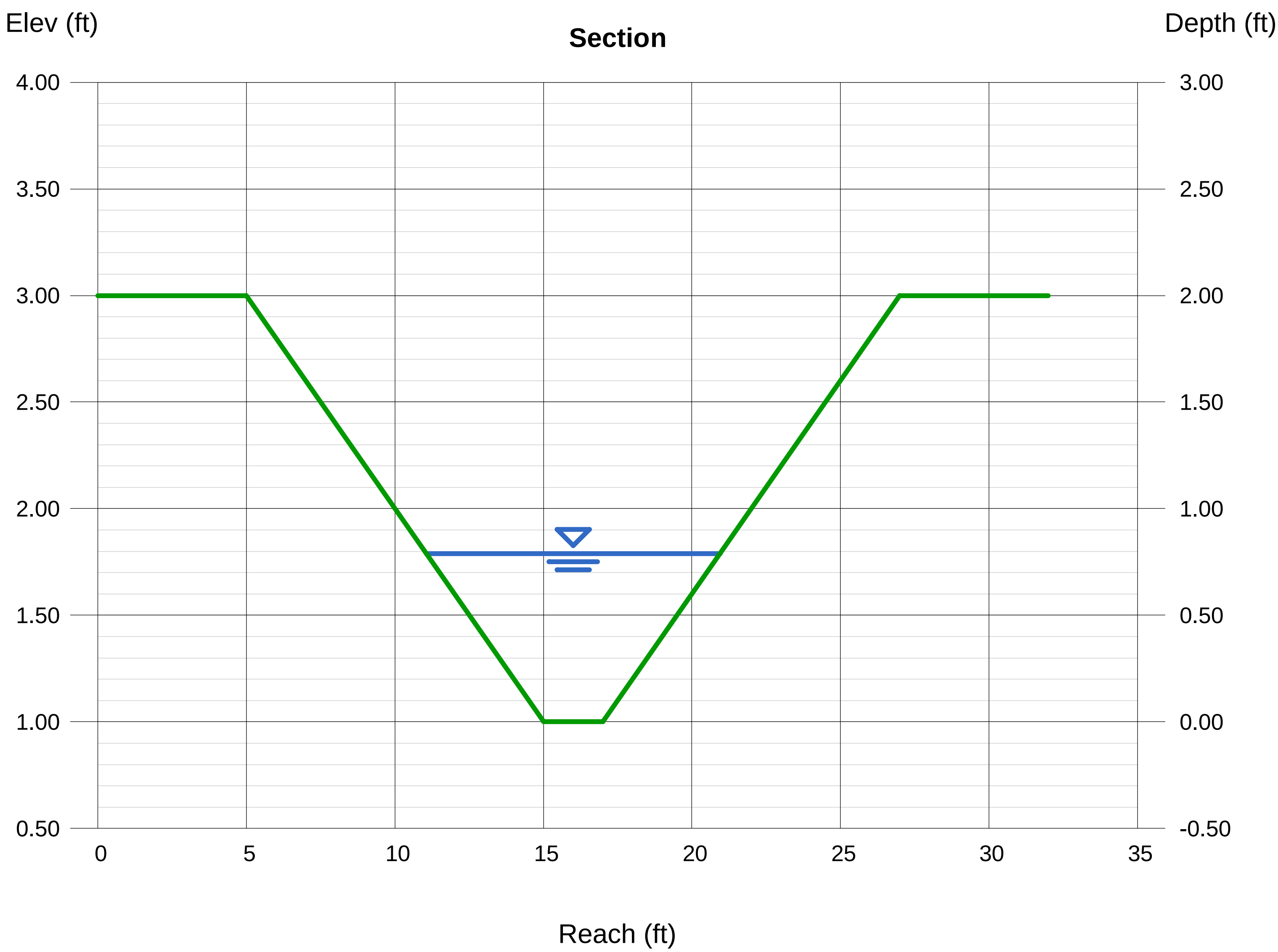
Per drainage map, slope for this section of swale appears to be closer to 0.75%



Channel Report

Ex. Swale Section B-B

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 2.00	Depth (ft)	= 0.79
Side Slopes (z:1)	= 5.00, 5.00	Q (cfs)	= 12.00
Total Depth (ft)	= 2.00	Area (sqft)	= 4.70
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 2.55
Slope (%)	= 1.00	Wetted Perim (ft)	= 10.06
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.65
		Top Width (ft)	= 9.90
Calculations		EGL (ft)	= 0.89
Compute by:	Known Q		
Known Q (cfs)	= 12.00		



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Aug 2 2022

Swale A-A

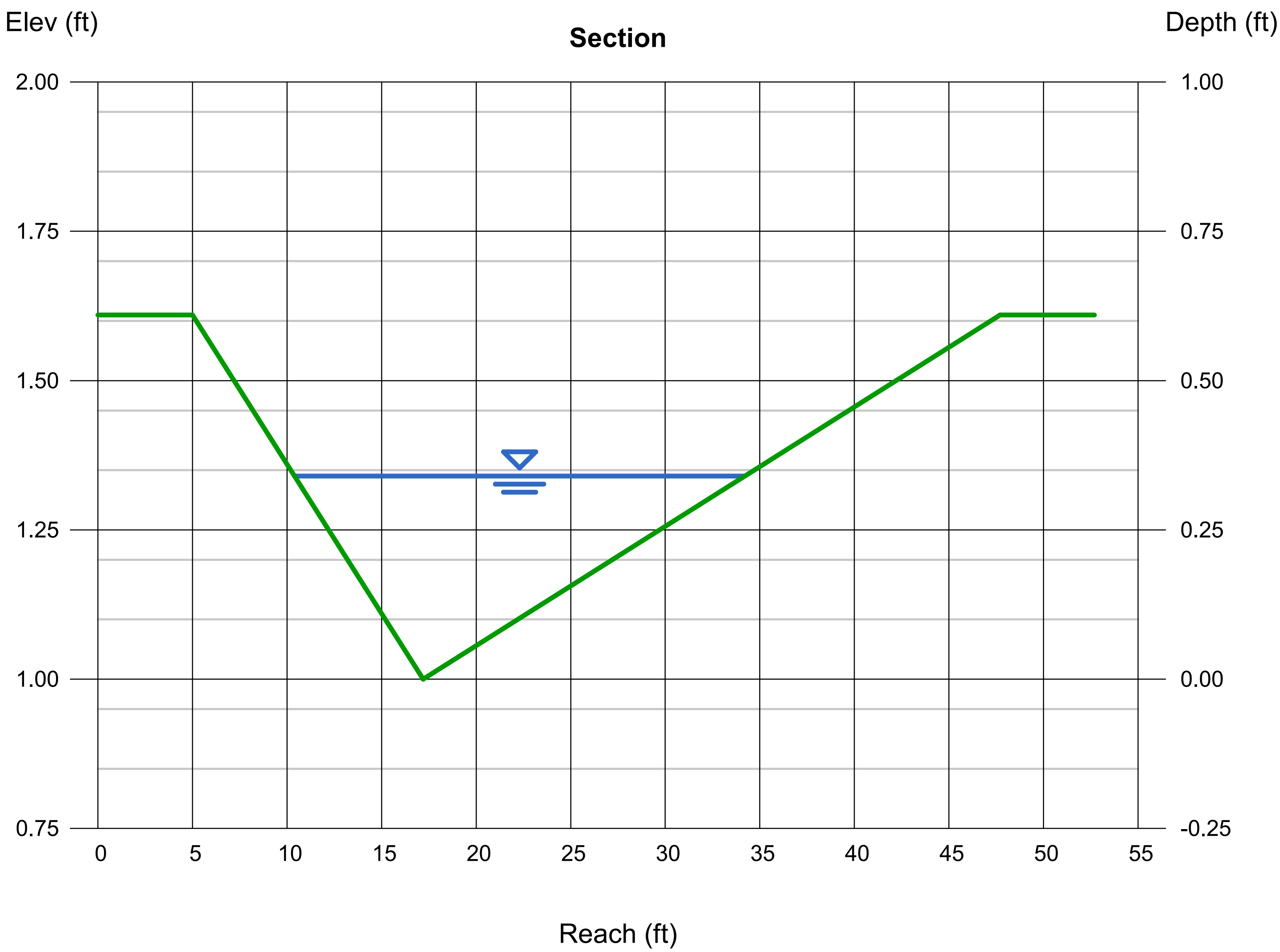
Triangular
Side Slopes (z:1) = 20.00, 50.00
Total Depth (ft) = 0.61

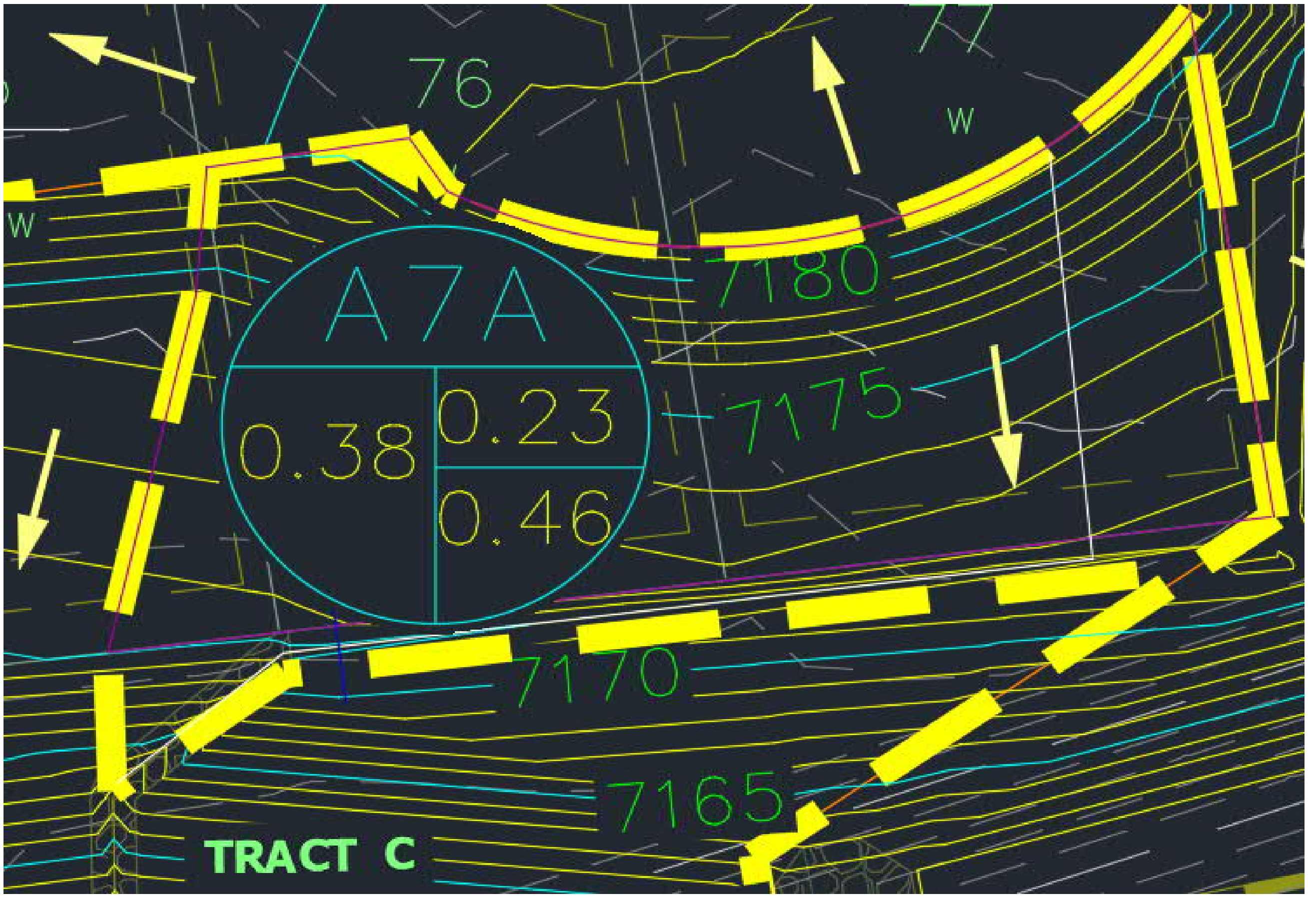
Invert Elev (ft) = 1.00
Slope (%) = 0.70
N-Value = 0.035

Calculations
Compute by: Known Q
Known Q (cfs) = 4.16

A portion of flow from basin A5

Highlighted
Depth (ft) = 0.34
Q (cfs) = 4.160
Area (sqft) = 4.05
Velocity (ft/s) = 1.03
Wetted Perim (ft) = 23.81
Crit Depth, Yc (ft) = 0.25
Top Width (ft) = 23.80
EGL (ft) = 0.36





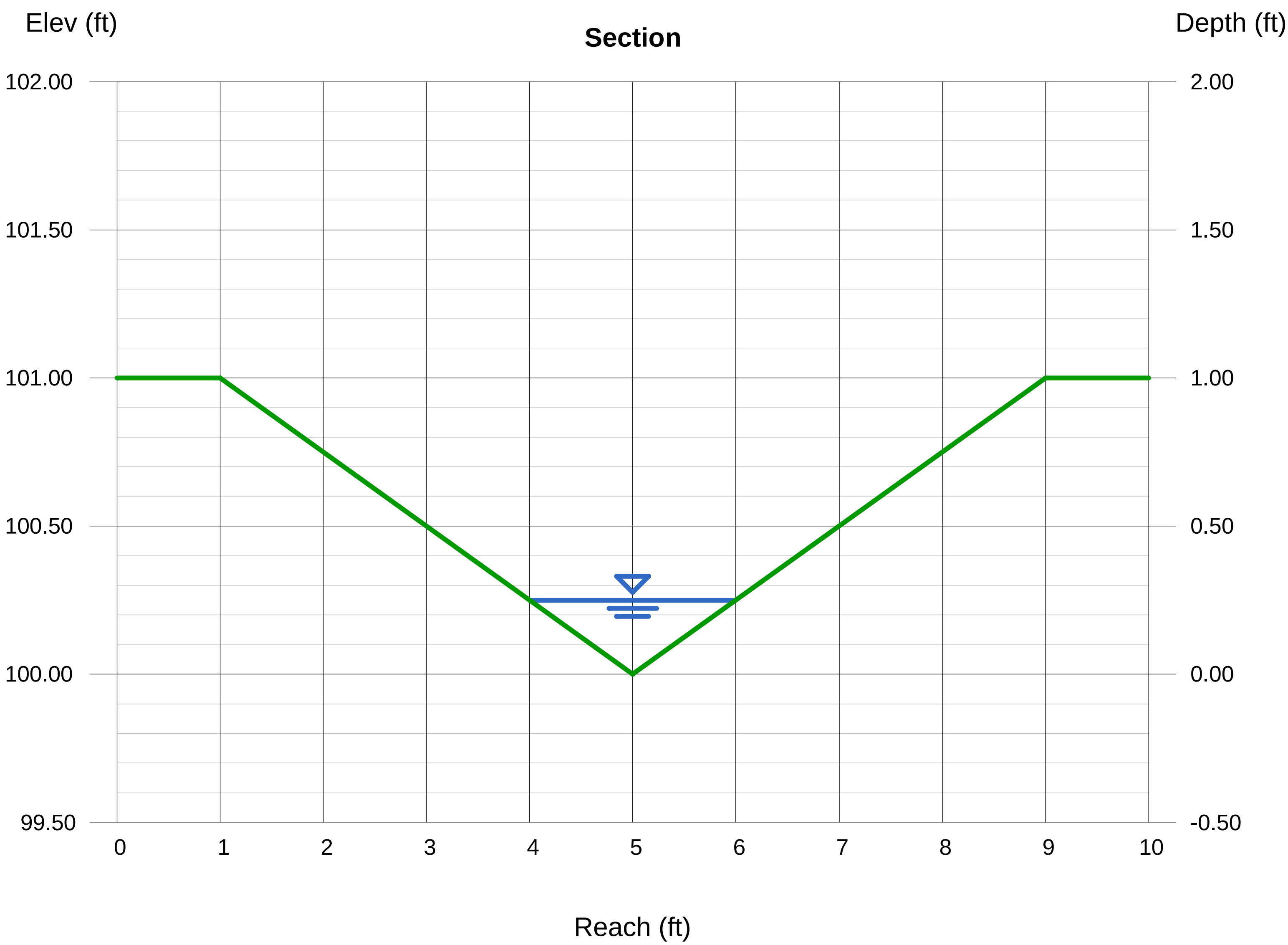
Basin	Area	Percent Impervious (%)	C_5	C_{100}	tc (min.)	Q_5 (cfs)	Q_{100} (cfs)
A7A	0.38	27.1	0.23	0.46	6.9	0.4	1.3

Analysis for minor semi-channelized flow into the pond. Used flows for typical section analysis.
To be protected with Type VL soil riprap.

Channel Report

Pond Swale Analysis (Rundown)

Triangular		**Highlighted**	
Side Slopes (z:1)	= 4.00, 4.00	Depth (ft)	= 0.25
Total Depth (ft)	= 1.00	Q (cfs)	= 1.300
		Area (sqft)	= 0.25
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 5.20
Slope (%)	= 20.40	Wetted Perim (ft)	= 2.06
N-Value	= 0.030	Crit Depth, Yc (ft)	= 0.37
		Top Width (ft)	= 2.00
Calculations		EGL (ft)	= 0.67
Compute by:	Known Q		
Known Q (cfs)	= 1.30		



MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	1i	2i	3i
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	5.2	4.5	6.1
Major Q_{Known} (cfs)	13.5	10.8	17.5

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	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)	5.2	4.5	6.1
Major Total Design Peak Flow, Q (cfs)	13.5	10.8	17.5
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	2.6	1.3	4.9

MHFD-Inlet, Version 5.01 (April 2021)

INLET MANAGEMENT

Worksheet Protected

INLET NAME	4i	5i	6i
Site Type (Urban or Rural)	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET
Hydraulic Condition	On Grade	In Sump	In Sump
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	6.0	7.6	6.5
Major Q_{Known} (cfs)	14.4	25.8	18.8

Bypass (Carry-Over) Flow from Upstream

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

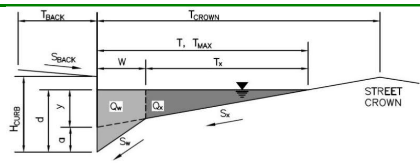
Minor Total Design Peak Flow, Q (cfs)	6.0	7.6	6.5
Major Total Design Peak Flow, Q (cfs)	14.4	25.8	18.8
Minor Flow Bypassed Downstream, Q_b (cfs)	0.0	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	3.1	N/A	N/A

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

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

Project: Homestead North at Sterling Ranch Filing No. 3

Inlet ID: 1i



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	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 =	0.028	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	11.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

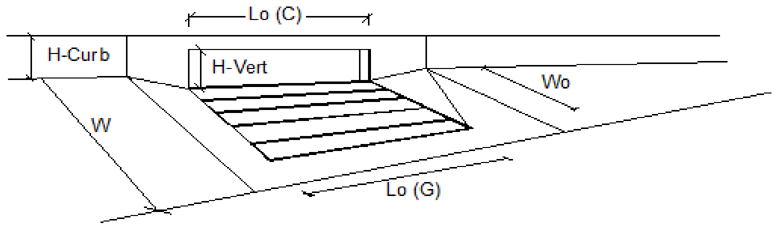
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	7.0	18.1	cfs

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'

INLEET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



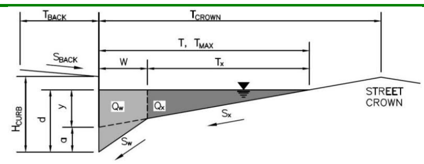
Design Information (Input)		MINOR	MAJOR	
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	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	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	5.2	13.5	cfs
Water Spread Width	T =	9.1	13.8	ft
Water Depth at Flowline (outside of local depression)	d =	3.7	4.8	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.627	0.430	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	1.9	7.7	cfs
Discharge within the Gutter Section W	Q_w =	3.3	5.8	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.45	0.64	sq ft
Velocity within the Gutter Section W	V_W =	7.3	9.1	fps
Water Depth for Design Condition	d_{LOCAL} =	6.7	7.8	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	Q_a =	N/A	N/A	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	Q_b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.138	0.101	ft/ft
Required Length L_T to Have 100% Interception	L_T =	13.14	24.67	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	13.14	15.00	ft
Interception Capacity	Q_i =	5.2	11.0	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	14.34	14.34	ft
Actual Interception Capacity	Q_a =	5.2	10.9	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	Q_b =	0.0	2.6	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	5.2	10.9	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	2.6	cfs
Capture Percentage = Q_a/Q_o =	C% =	100	81	%

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

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

Project: Homestead North at Sterling Ranch Filing No. 3

Inlet ID: 2i



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	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 =	0.028	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	11.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

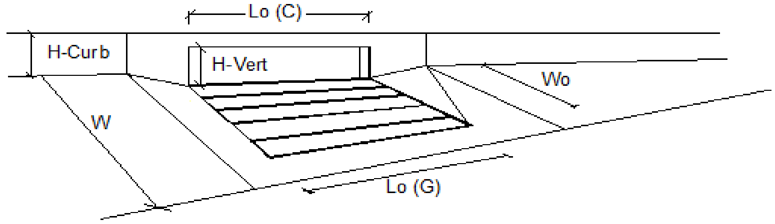
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	7.0	18.1	cfs

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)



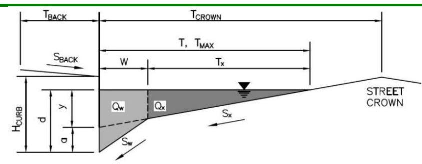
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	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	
Design Discharge for Half of Street (from *Inlet Management*)		Q_o =	4.5	10.8	cfs
Water Spread Width		T =	8.5	12.6	ft
Water Depth at Flowline (outside of local depression)		d =	3.5	4.5	inches
Water Depth at Street Crown (or at T_{MAX})		d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow		E_o =	0.661	0.471	
Discharge outside the Gutter Section W, carried in Section T_x		Q_x =	1.5	5.7	cfs
Discharge within the Gutter Section W		Q_w =	3.0	5.1	cfs
Discharge Behind the Curb Face		Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W		A_W =	0.42	0.59	sq ft
Velocity within the Gutter Section W		V_W =	7.0	8.6	fps
Water Depth for Design Condition		d_{LOCAL} =	6.5	7.5	inches
Grate Analysis (Calculated)			MINOR	MAJOR	
Total Length of Inlet Grate Opening		L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow		$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition			MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Interception Capacity		Q_i =	N/A	N/A	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet		GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet		GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet		L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins		V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow		R_f =	N/A	N/A	
Interception Rate of Side Flow		R_x =	N/A	N/A	
Actual Interception Capacity		Q_a =	N/A	N/A	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)		Q_b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)			MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)		S_e =	0.144	0.108	ft/ft
Required Length L_T to Have 100% Interception		L_T =	11.94	21.29	ft
Under No-Clogging Condition			MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)		L =	11.94	15.00	ft
Interception Capacity		Q_i =	4.5	9.6	cfs
Under Clogging Condition			MINOR	MAJOR	
Clogging Coefficient		CurbCoef =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet		CurbClog =	0.04	0.04	
Effective (Unclogged) Length		L_e =	14.34	14.34	ft
Actual Interception Capacity		Q_a =	4.5	9.5	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a		Q_b =	0.0	1.3	cfs
Summary			MINOR	MAJOR	
Total Inlet Interception Capacity		Q =	4.5	9.5	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)		Q_b =	0.0	1.3	cfs
Capture Percentage = Q_a/Q_o =		C% =	100	88	%

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

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

Project: Homestead North at Sterling Ranch Filing No. 3

Inlet ID: 3i



Gutter Geometry:				
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		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 =	0.028		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	11.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

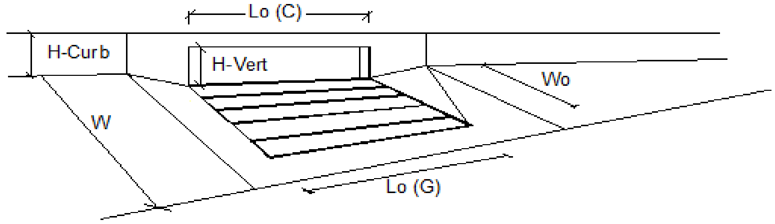
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	7.0	18.1	cfs

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)



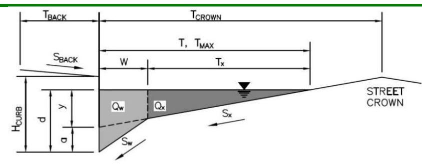
		MINOR	MAJOR	
Design Information (Input) — CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	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	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	6.1	17.5	cfs
Water Spread Width	T =	9.8	15.4	ft
Water Depth at Flowline (outside of local depression)	d =	3.9	5.2	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.590	0.387	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	2.5	10.7	cfs
Discharge within the Gutter Section W	Q_w =	3.6	6.8	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.48	0.70	sq ft
Velocity within the Gutter Section W	V_W =	7.6	9.7	fps
Water Depth for Design Condition	d_{LOCAL} =	6.9	8.2	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	Q_a =	N/A	N/A	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	Q_b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.131	0.093	ft/ft
Required Length L_T to Have 100% Interception	L_T =	14.59	29.26	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	14.59	15.00	ft
Interception Capacity	Q_i =	6.1	12.7	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	14.34	14.34	ft
Actual Interception Capacity	Q_a =	6.1	12.6	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	Q_b =	0.0	4.9	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	6.1	12.6	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	4.9	cfs
Capture Percentage = Q_a/Q_o =	C% =	100	72	%

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

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

Project: Homestead North at Sterling Ranch Filing No. 3

Inlet ID: 4i



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	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 =	0.028	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	11.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

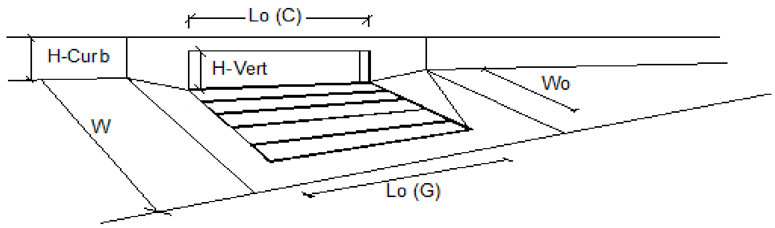
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	7.0	18.1	cfs

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'

INLEET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



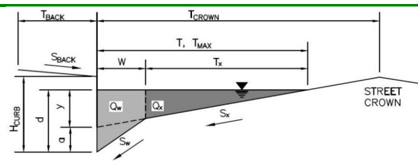
Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	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	
Design Discharge for Half of Street (from *Inlet Management*)	Q_o =	6.0	14.4	cfs
Water Spread Width	T =	9.7	14.2	ft
Water Depth at Flowline (outside of local depression)	d =	3.8	4.9	inches
Water Depth at Street Crown (or at T_{MAX})	d_{CROWN} =	0.0	0.0	inches
Ratio of Gutter Flow to Design Flow	E_o =	0.594	0.419	
Discharge outside the Gutter Section W, carried in Section T_x	Q_x =	2.4	8.4	cfs
Discharge within the Gutter Section W	Q_w =	3.6	6.0	cfs
Discharge Behind the Curb Face	Q_{BACK} =	0.0	0.0	cfs
Flow Area within the Gutter Section W	A_W =	0.47	0.65	sq ft
Velocity within the Gutter Section W	V_W =	7.5	9.2	fps
Water Depth for Design Condition	d_{LOCAL} =	6.8	7.9	inches
Grate Analysis (Calculated)		MINOR	MAJOR	
Total Length of Inlet Grate Opening	L =	N/A	N/A	ft
Ratio of Grate Flow to Design Flow	$E_{o\text{-}GRATE}$ =	N/A	N/A	
Under No-Clogging Condition		MINOR	MAJOR	
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Interception Capacity	Q_i =	N/A	N/A	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient for Multiple-unit Grate Inlet	GrateCoef =	N/A	N/A	
Clogging Factor for Multiple-unit Grate Inlet	GrateClog =	N/A	N/A	
Effective (unclogged) Length of Multiple-unit Grate Inlet	L_e =	N/A	N/A	ft
Minimum Velocity Where Grate Splash-Over Begins	V_o =	N/A	N/A	fps
Interception Rate of Frontal Flow	R_f =	N/A	N/A	
Interception Rate of Side Flow	R_x =	N/A	N/A	
Actual Interception Capacity	Q_a =	N/A	N/A	cfs
Carry-Over Flow = Q_o-Q_a (to be applied to curb opening or next d/s inlet)	Q_b =	N/A	N/A	cfs
Curb or Slotted Inlet Opening Analysis (Calculated)		MINOR	MAJOR	
Equivalent Slope S_e (based on grate carry-over)	S_e =	0.131	0.099	ft/ft
Required Length L_T to Have 100% Interception	L_T =	14.44	25.74	ft
Under No-Clogging Condition		MINOR	MAJOR	
Effective Length of Curb Opening or Slotted Inlet (minimum of L, L_T)	L =	14.44	15.00	ft
Interception Capacity	Q_i =	6.0	11.4	cfs
Under Clogging Condition		MINOR	MAJOR	
Clogging Coefficient	CurbCoef =	1.31	1.31	
Clogging Factor for Multiple-unit Curb Opening or Slotted Inlet	CurbClog =	0.04	0.04	
Effective (Unclogged) Length	L_e =	14.34	14.34	ft
Actual Interception Capacity	Q_a =	6.0	11.3	cfs
Carry-Over Flow = $Q_{b(GRATE)}$-Q_a	Q_b =	0.0	3.1	cfs
Summary		MINOR	MAJOR	
Total Inlet Interception Capacity	Q =	6.0	11.3	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q_b =	0.0	3.1	cfs
Capture Percentage = Q_a/Q_o =	C% =	100	78	%

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

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

Project: Homestead North at Sterling Ranch Filing No. 3

Inlet ID: 5i



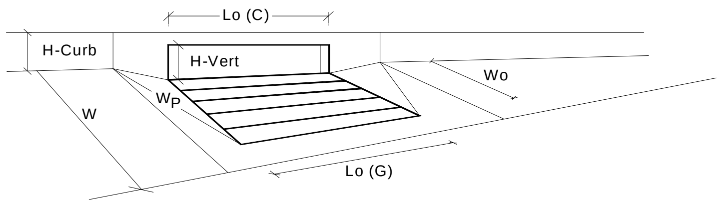
Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.020		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	11.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	3	3	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	5.0	7.7	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	

Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q_{Grate} =	N/A	N/A	cfs

Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.31	1.31	
Clogging Factor for Multiple Units	Clog =	0.04	0.04	
Curb Opening as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	8.4	27.1	cfs
Interception with Clogging	Q_{wa} =	8.0	25.9	cfs
Curb Opening as an Orifice (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	26.8	33.0	cfs
Interception with Clogging	Q_{oa} =	25.7	31.6	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	14.0	27.8	cfs
Interception with Clogging	Q_{ma} =	13.3	26.6	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q_{Curb} =	8.0	25.9	cfs

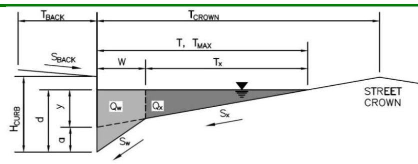
Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	15.00	15.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	14.5	26.0	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	2.1	inches
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.25	0.48	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.47	0.73	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.72	0.88	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	8.0	25.9	cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	7.6	25.8	cfs

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

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

Project: Homestead North at Sterling Ranch Filing No. 3

Inlet ID: 6i



Gutter Geometry:

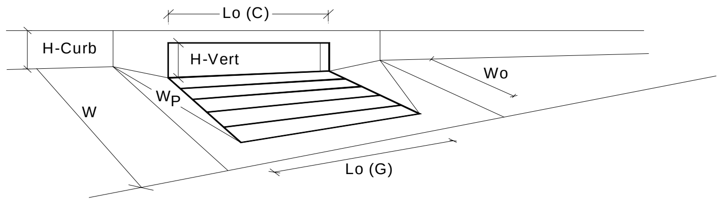
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	11.0	17.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)



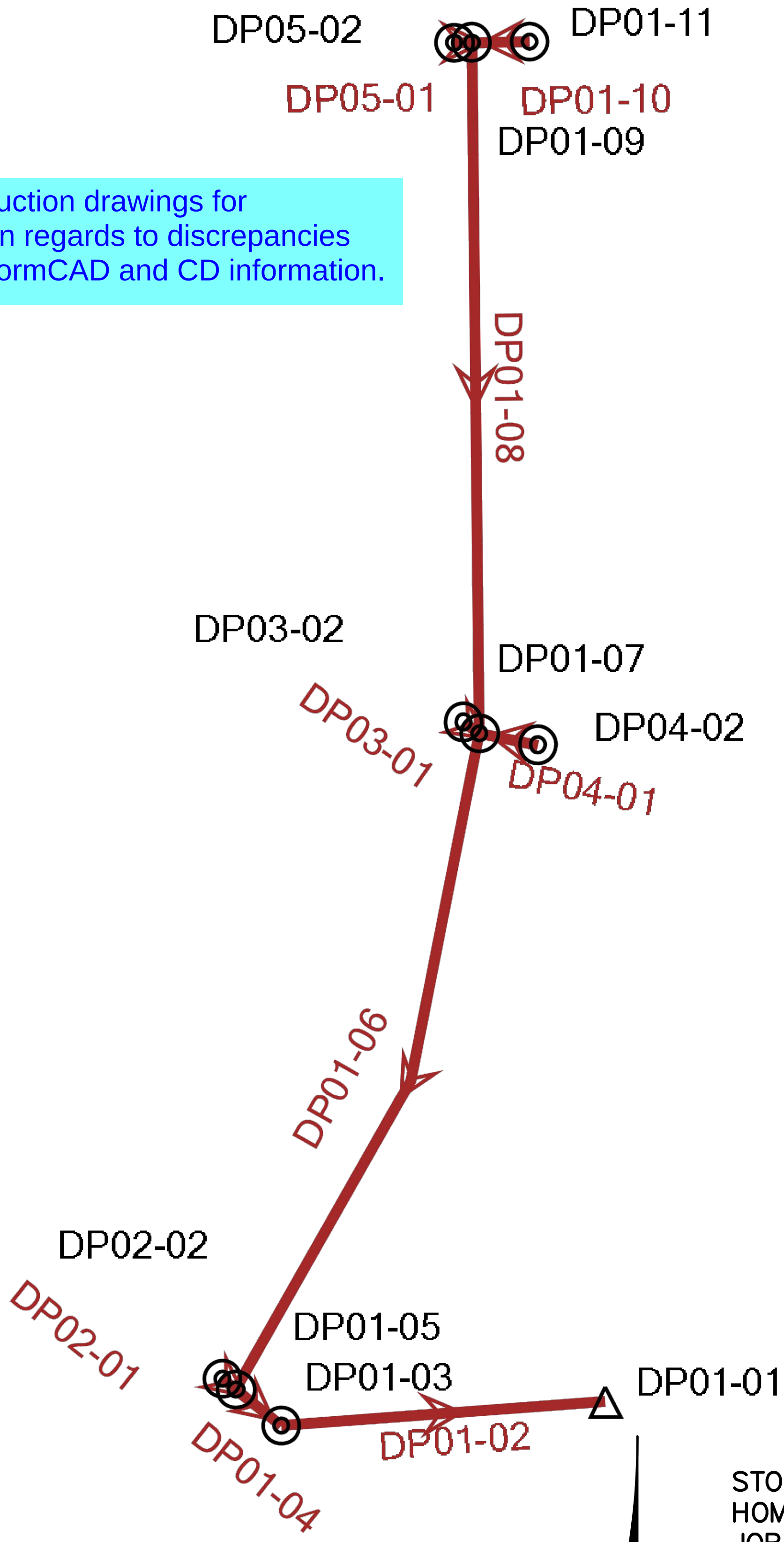
Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.7	7.0	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

Grate Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate Capacity as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	N/A	N/A	cfs
Interception with Clogging	Q_{wa} =	N/A	N/A	cfs
Grate Capacity as a Orifice (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	N/A	N/A	cfs
Interception with Clogging	Q_{oa} =	N/A	N/A	cfs
Grate Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	N/A	N/A	cfs
Interception with Clogging	Q_{ma} =	N/A	N/A	cfs
Resulting Grate Capacity (assumes clogged condition)	Q_{Grate} =	N/A	N/A	cfs

Curb Opening Flow Analysis (Calculated)		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.31	1.31	
Clogging Factor for Multiple Units	Clog =	0.04	0.04	
Curb Opening as a Weir (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{wi} =	6.9	21.1	cfs
Interception with Clogging	Q_{wa} =	6.6	20.2	cfs
Curb Opening as an Orifice (based on Modified HEC22 Method)		MINOR	MAJOR	
Interception without Clogging	Q_{oi} =	26.1	31.5	cfs
Interception with Clogging	Q_{oa} =	24.9	30.1	cfs
Curb Opening Capacity as Mixed Flow		MINOR	MAJOR	
Interception without Clogging	Q_{mi} =	12.5	24.0	cfs
Interception with Clogging	Q_{ma} =	12.0	22.9	cfs
Resulting Curb Opening Capacity (assumes clogged condition)	Q_{Curb} =	6.6	20.2	cfs

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	15.00	15.00	feet
Resultant Street Flow Spread (based on street geometry from above)	T =	13.3	22.9	ft.>T-Crown
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.0	1.4	inches
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.23	0.42	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.44	0.66	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.70	0.84	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	6.6	20.2	cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	6.5	18.8	cfs

See Construction drawings for comments in regards to discrepancies between StormCAD and CD information.



STORMCAD MAP
HOMESTEAD NORTH FILING 3
JOB NO. 25188.12
10/13/2022
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

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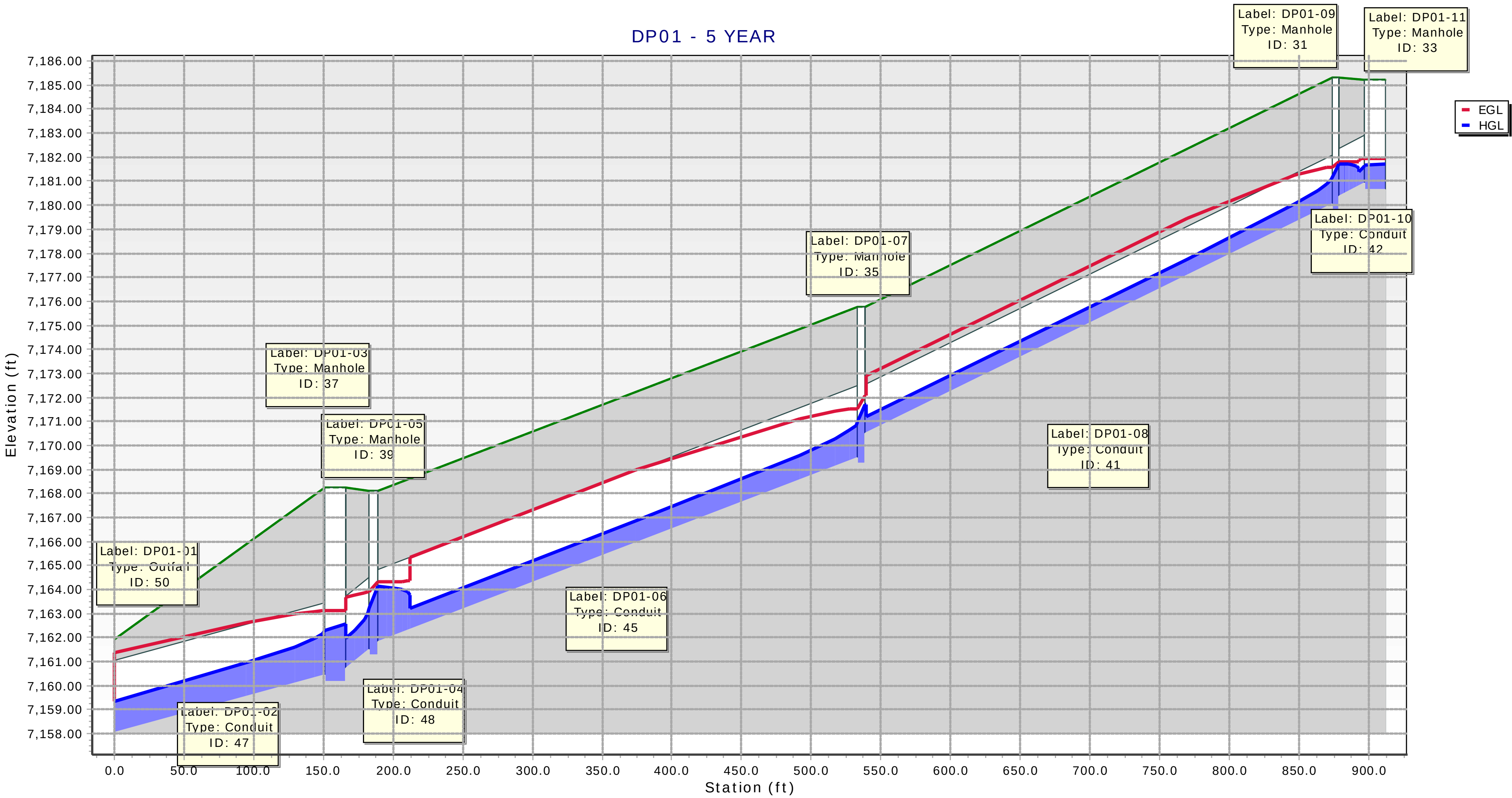
Fort Collins 970-491-9888 • www.jrengineering.com

DP01 - 5 YEAR



Label: DP01-01
Type: Outfall
ID: 50
Label: DP01-02
Type: Conduit
ID: 47
Label: DP01-03
Type: Manhole
ID: 37
Label: DP01-04
Type: Conduit
ID: 48
Label: DP01-05
Type: Manhole
ID: 39
Label: DP01-06
Type: Conduit
ID: 45
Label: DP01-07
Type: Manhole
ID: 35
Label: DP01-08
Type: Conduit
ID: 41
Label: DP01-09
Type: Manhole
ID: 31
Label: DP01-10
Type: Conduit
ID: 42
Label: DP01-11
Type: Manhole
ID: 33
EGL
HGL
Elevation (ft)
7,186.00
7,185.00
7,184.00
7,183.00
7,182.00
7,181.00
7,180.00
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7,175.00
7,174.00
7,173.00
7,172.00
7,171.00
7,170.00
7,169.00
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7,167.00
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7,165.00
7,164.00
7,163.00
7,162.00
7,161.00
7,160.00
7,159.00
7,158.00
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50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
550.0
600.0
650.0
700.0
750.0
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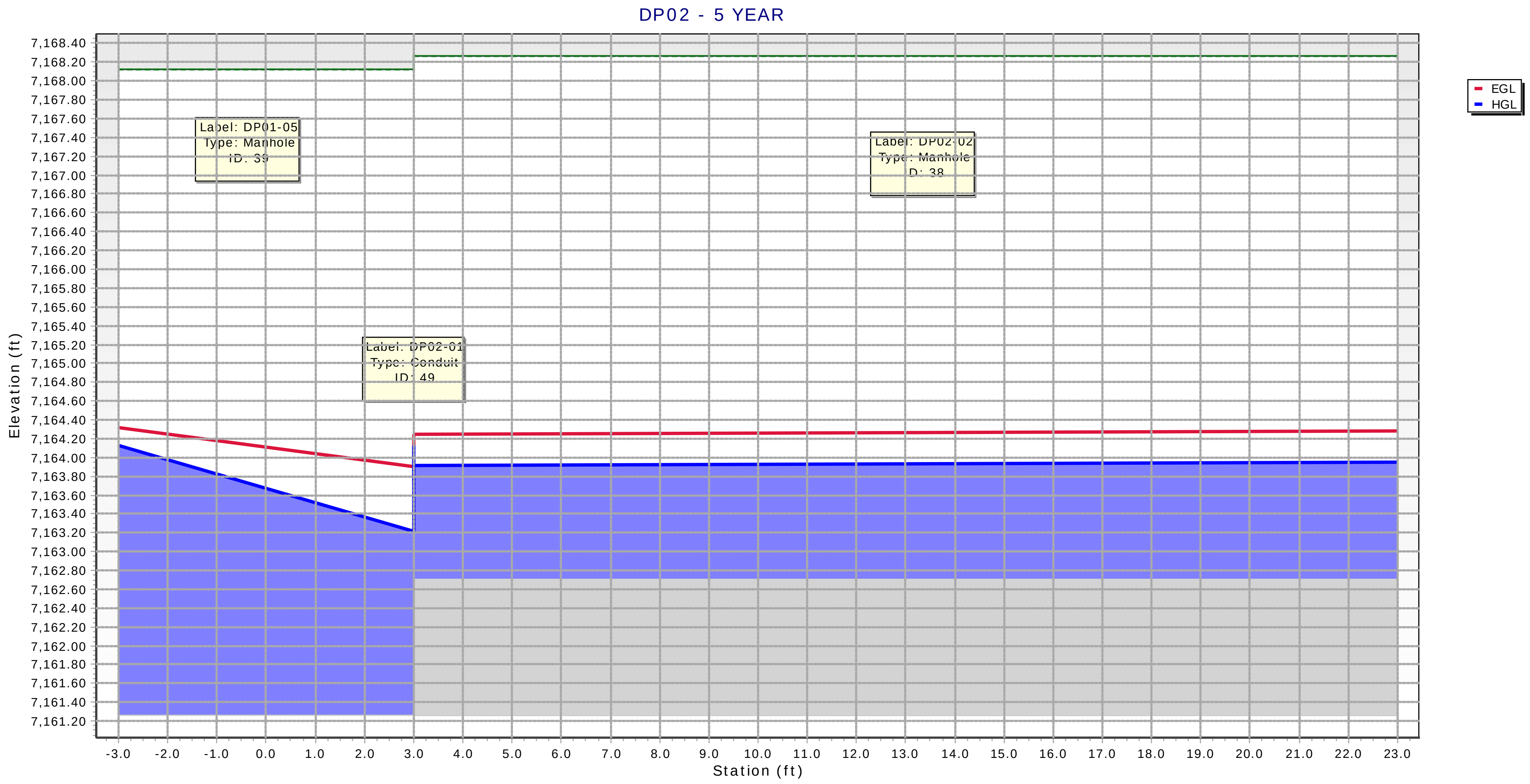
850.0
900.0
Station (ft)


DP02 - 5 YEAR
Elevation (ft)
Station (ft)
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7,168.20
7,168.00
7,167.80
7,167.60
7,167.40
7,167.20
7,167.00
7,166.80
7,166.60
7,166.40
7,166.20
7,166.00
7,165.80
7,165.60
7,165.40
7,165.20
7,165.00
7,164.80
7,164.60
7,164.40
7,164.20
7,164.00
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7,163.60
7,163.40
7,163.20
7,163.00
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7,162.60
7,162.40
7,162.20
7,162.00
7,161.80
7,161.60
7,161.40
7,161.20
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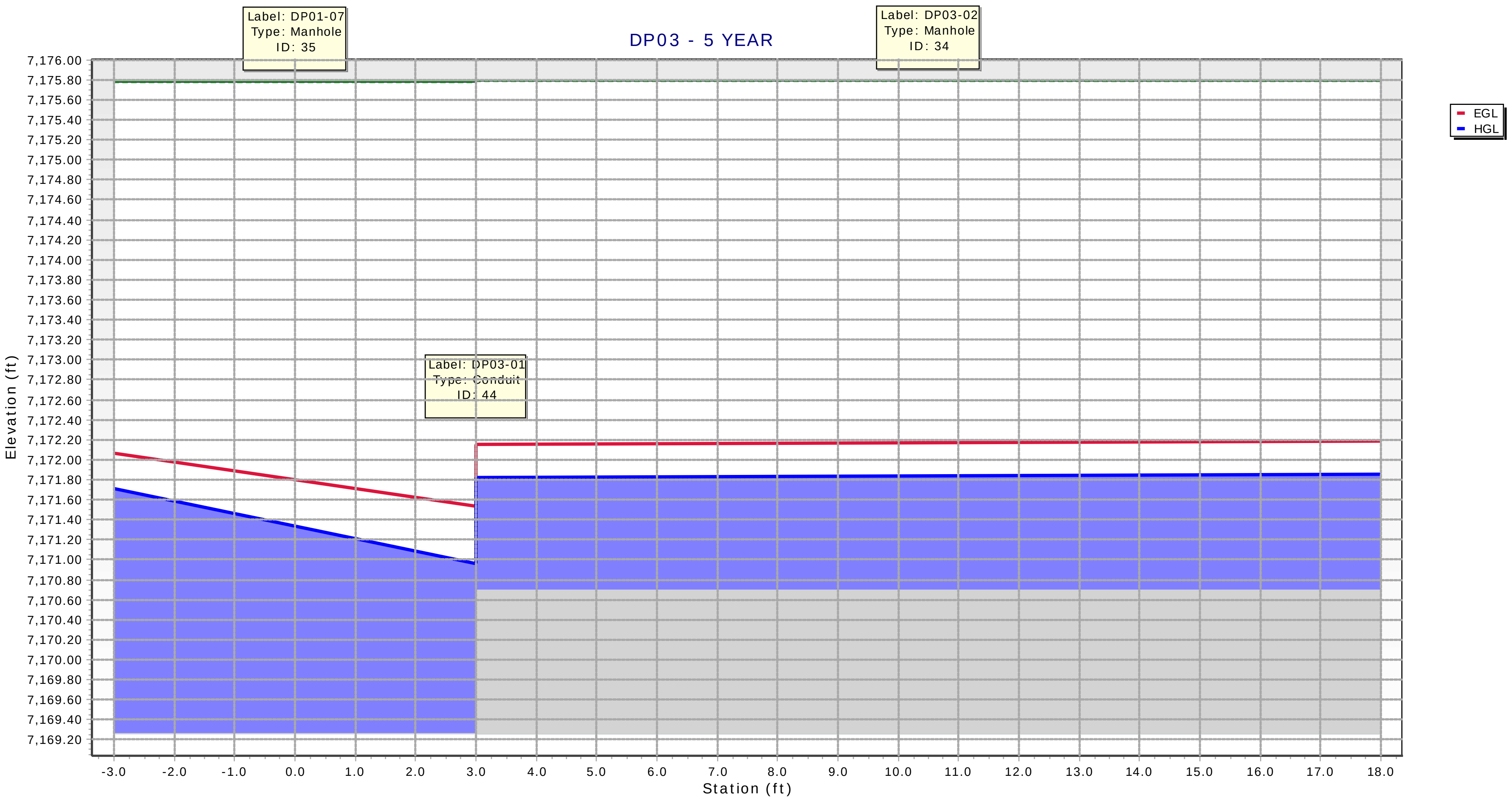
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
18.0
19.0
20.0
21.0
22.0
23.0
Label: DP01-05
Type: Manhole
ID: 39
Label: DP02-02
Type: Manhole
ID: 38
Label: DP02-01
Type: Conduit
ID: 49
EGL
HGL


DP03 - 5 YEAR
Label: DP01-07
Type: Manhole
ID: 35
Label: DP03-02
Type: Manhole
ID: 34
Label: DP03-01
Type: Conduit
ID: 44
EGL
HGL
Elevation (ft)
Station (ft)
7,176.00
7,175.80
7,175.60
7,175.40
7,175.20
7,175.00
7,174.80
7,174.60
7,174.40
7,174.20
7,174.00
7,173.80
7,173.60
7,173.40
7,173.20
7,173.00
7,172.80
7,172.60
7,172.40
7,172.20
7,172.00
7,171.80
7,171.60
7,171.40
7,171.20
7,171.00
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7,170.60
7,170.40
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7,170.00
7,169.80
7,169.60
7,169.40
7,169.20
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-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
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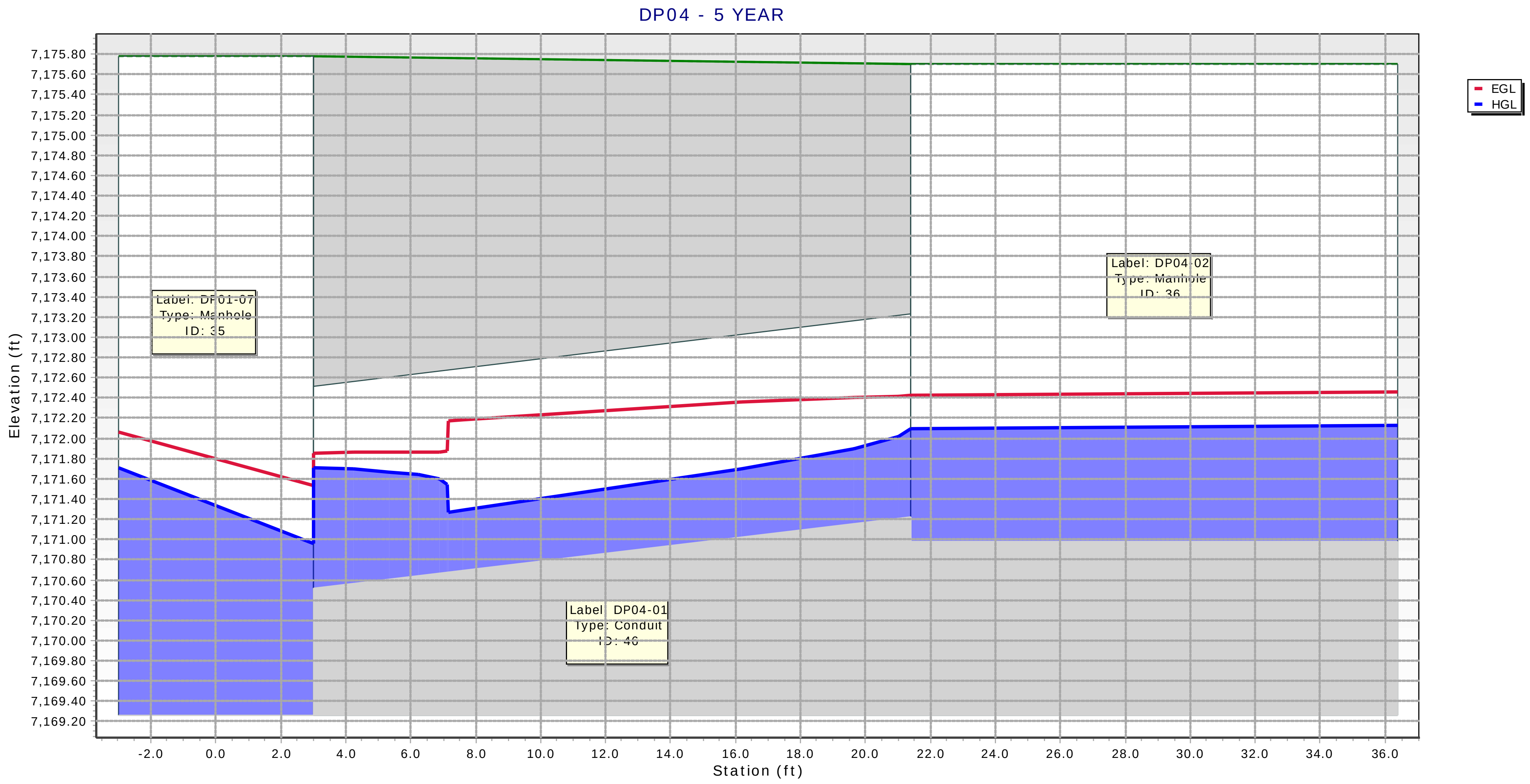
9.0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
18.0



DP04 - 5 YEAR
Elevation (ft)
Station (ft)
EGL
HGL
Label: DP01-07
Type: Manhole
ID: 35
Label: DP04-02
Type: Manhole
ID: 36
Label: DP04-01
Type: Conduit
ID: 46
7,175.80
7,175.60
7,175.40
7,175.20
7,175.00
7,174.80
7,174.60
7,174.40
7,174.20
7,174.00
7,173.80
7,173.60
7,173.40
7,173.20
7,173.00
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7,172.60
7,172.40
7,172.20
7,172.00
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7,171.60
7,171.40
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7,170.60
7,170.40
7,170.20
7,170.00
7,169.80
7,169.60
7,169.40
7,169.20
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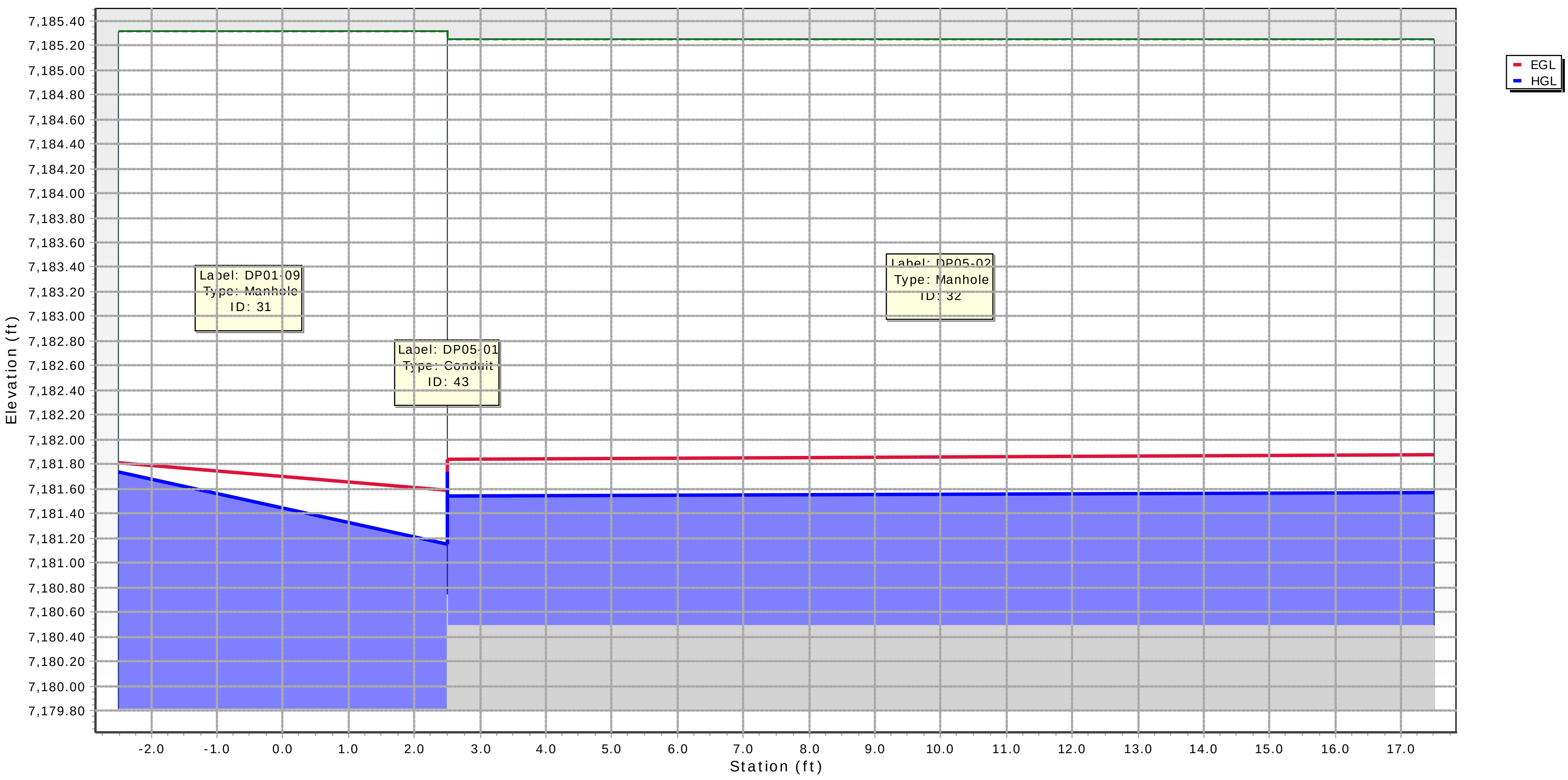
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
22.0
24.0
26.0
28.0
30.0
32.0
34.0
36.0

DP05 - 5 YEAR



DP05 - 5 YEAR
EGL
HGL
Label: DP01-09
Type: Manhole
ID: 31
Label: DP05-01
Type: Conduit
ID: 43
Label: DP05-02
Type: Manhole
ID: 32
Elevation (ft)
7,185.40
7,185.20
7,185.00
7,184.80
7,184.60
7,184.40
7,184.20
7,184.00
7,183.80
7,183.60
7,183.40
7,183.20
7,183.00
7,182.80
7,182.60
7,182.40
7,182.20
7,182.00
7,181.80
7,181.60
7,181.40
7,181.20
7,181.00
7,180.80
7,180.60
7,180.40
7,180.20
7,180.00
7,179.80
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
Station (ft)

Scenario: 5 YEAR
Current Time Step: 0.000 h
Conduit FlexTable: Combined Pipe/Node Report

Upstream Structure	Label	Flow (cfs)	Capacity (Full Flow) (cfs)	Diameter (in)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	HGL (In) (ft)	HGL (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Upstream Structure Headloss Coefficient	Manning's n
DP01-03	DP01-02	34.00	88.49	36.0	158.4	-0.015	11.70	7.158.09	7,160.43	7,161.93	7,168.27	7,162.32	7,159.37	7,163.14	7,161.40	0.300	0.012
DP01-05	DP01-04	27.90	121.61	36.0	27.5	-0.028	13.96	7,160.73	7,161.51	7,168.27	7,168.12	7,163.22	7,162.57	7,163.92	7,163.15	1.320	0.012
DP01-07	DP01-06	20.60	107.14	36.0	350.2	-0.022	11.70	7,161.81	7,169.51	7,168.12	7,175.78	7,170.97	7,164.14	7,171.54	7,164.33	1.320	0.012
DP01-09	DP01-08	9.30	41.07	24.0	340.0	-0.028	10.57	7,170.51	7,180.06	7,175.78	7,185.31	7,181.15	7,171.72	7,181.59	7,172.06	1.320	0.012
DP01-11	DP01-10	4.50	34.15	24.0	28.5	-0.019	7.53	7,180.37	7,180.92	7,185.31	7,185.21	7,181.67	7,181.73	7,181.94	7,181.79	0.100	0.012
DP02-02	DP02-01	7.60	126.17	30.0	8.5	0.081	14.17	7,163.00	7,162.31	7,168.26	7,168.12	7,163.92	7,164.14	7,164.26	7,164.20	0.100	0.012
DP03-02	DP03-01	6.10	56.90	24.0	8.1	0.054	11.82	7,170.95	7,170.51	7,175.79	7,175.78	7,171.83	7,171.72	7,172.16	7,171.87	0.100	0.012
DP04-02	DP04-01	6.00	38.49	24.0	28.9	-0.025	8.91	7,170.51	7,171.23	7,175.78	7,175.70	7,172.09	7,171.72	7,172.42	7,171.86	0.100	0.012
DP05-02	DP05-01	5.20	54.76	24.0	7.5	-0.050	10.98	7,180.36	7,180.74	7,185.31	7,185.25	7,181.54	7,181.73	7,181.84	7,181.81	0.100	0.012

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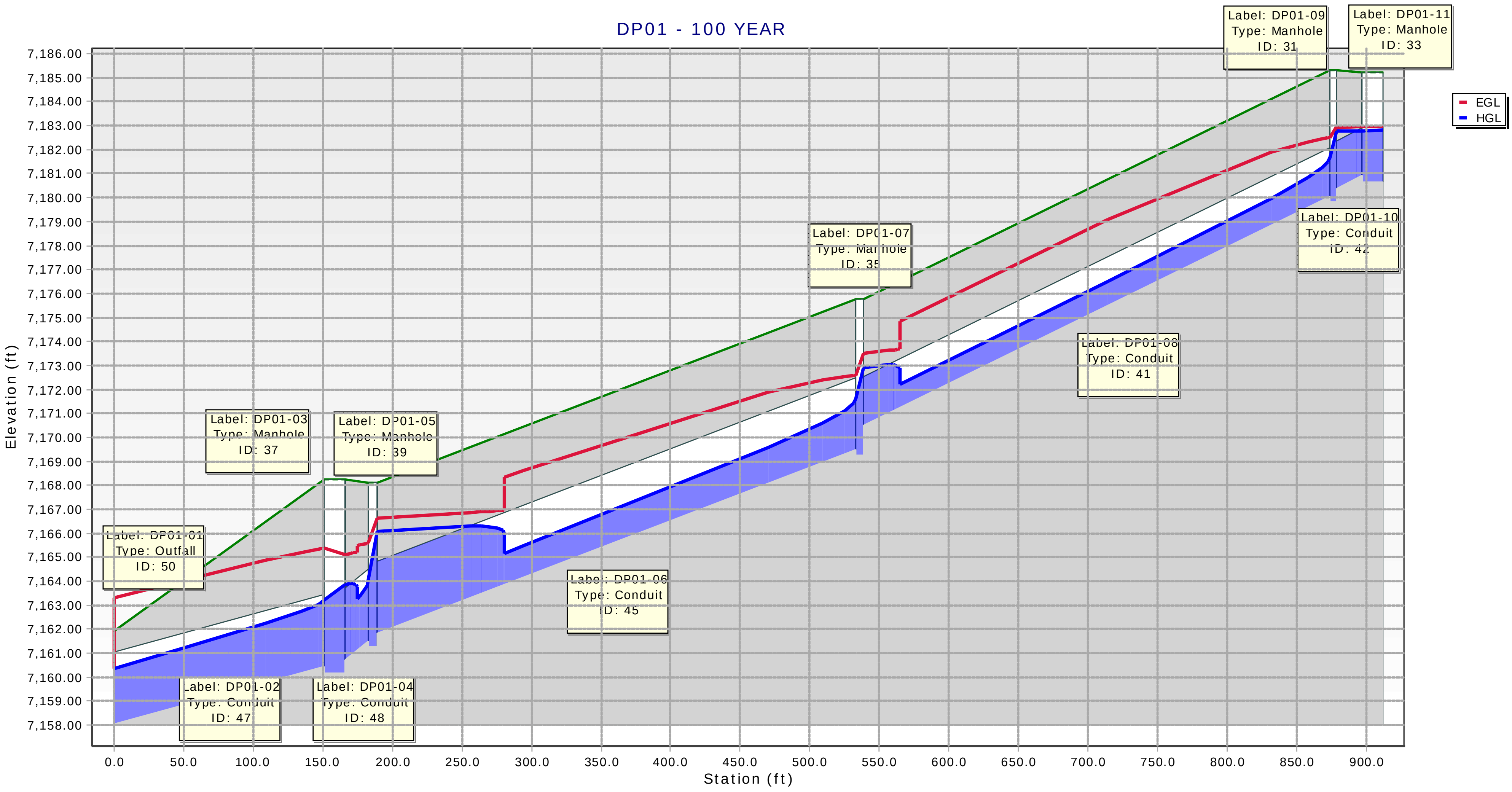
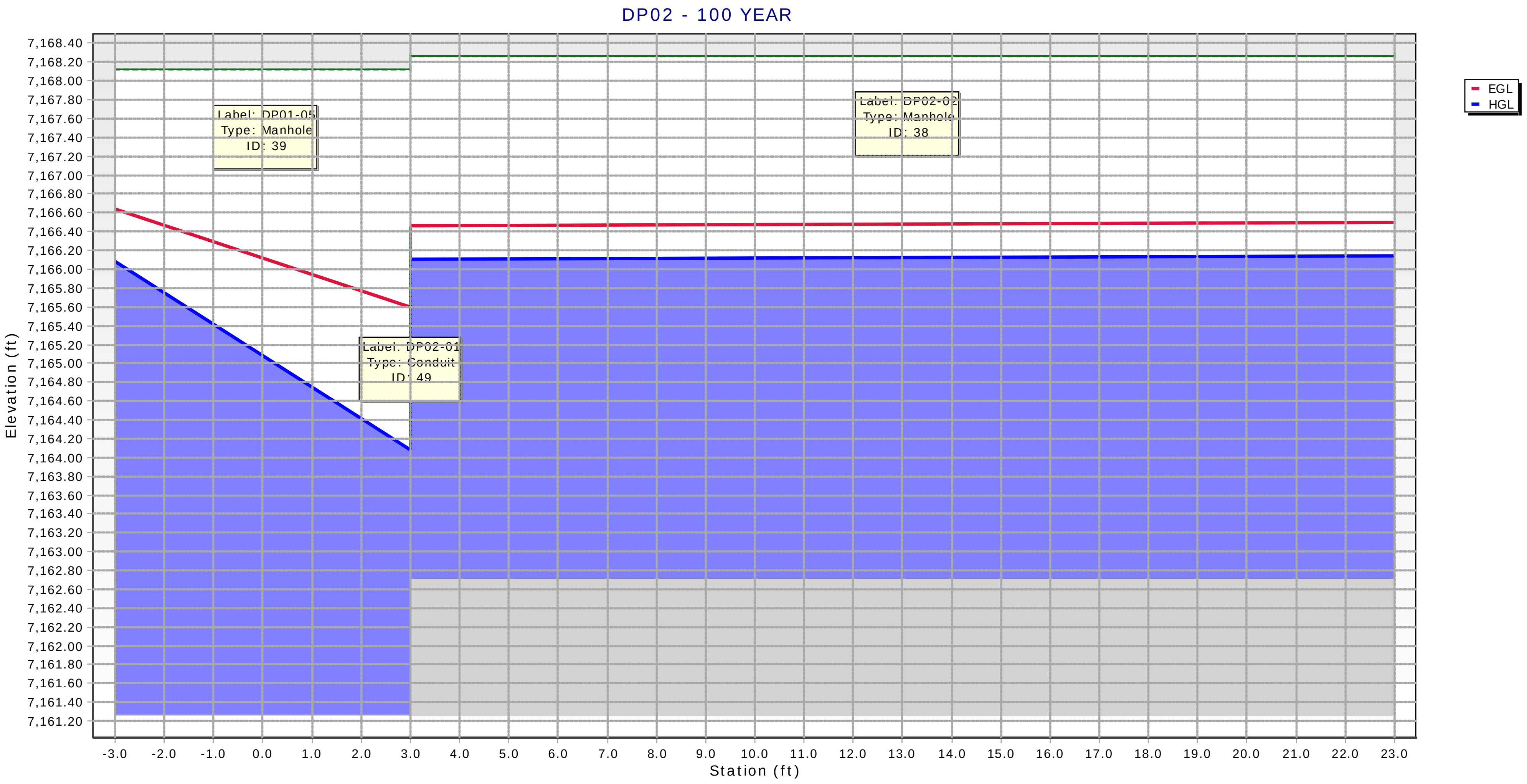
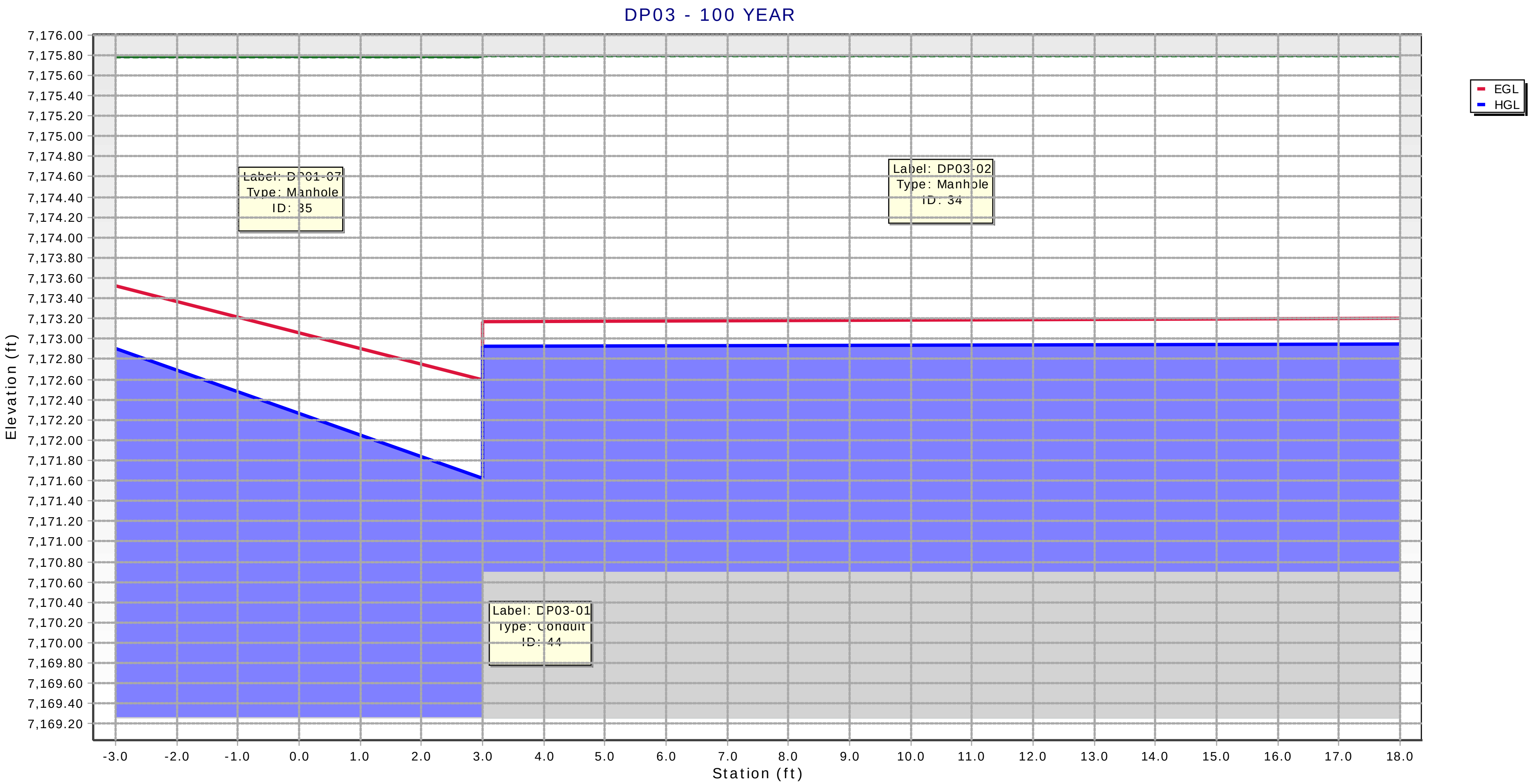
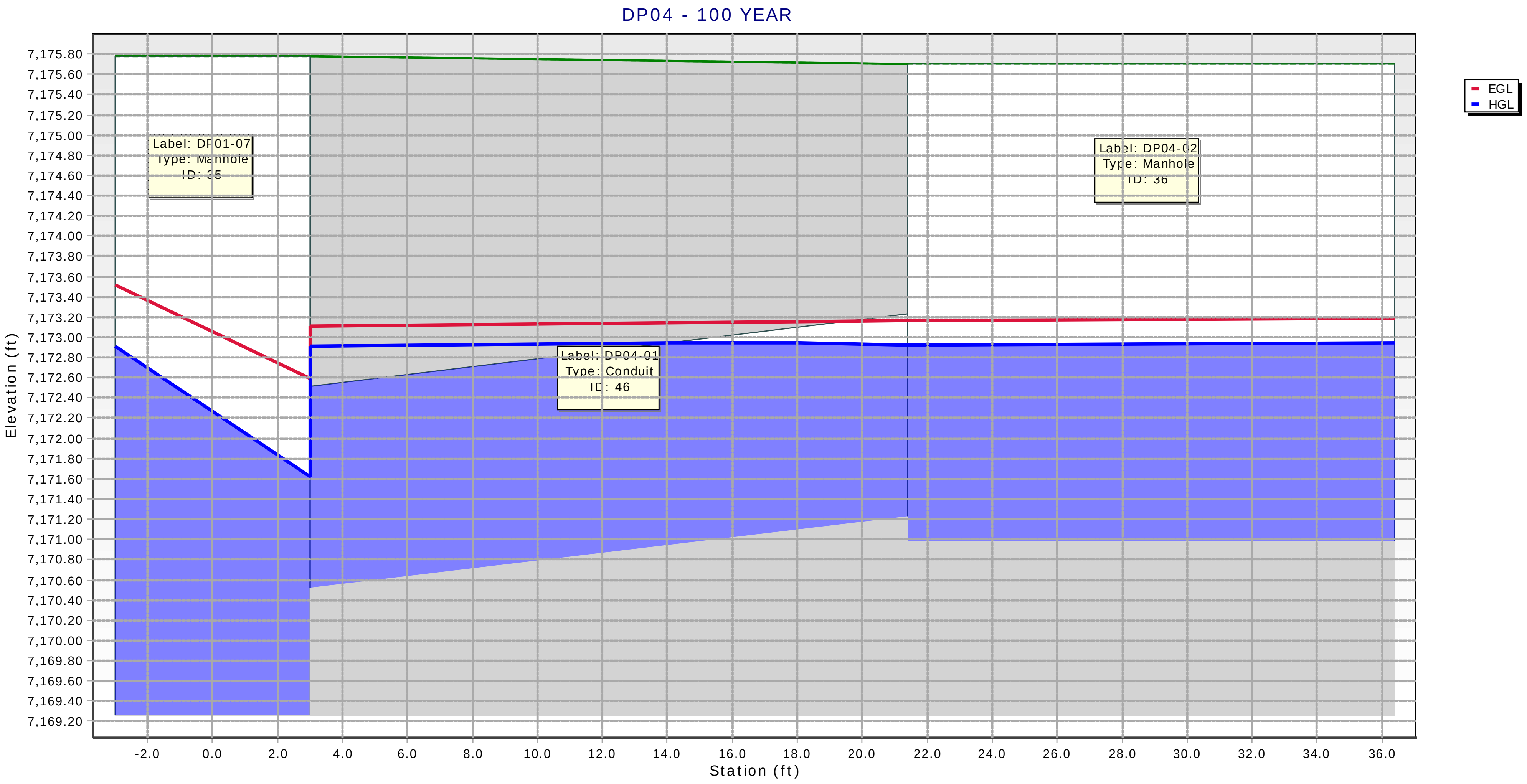


DP01 - 100 YEAR
Elevation (ft)
Station (ft)
EGL
HGL
7,186.00
7,185.00
7,184.00
7,183.00
7,182.00
7,181.00
7,180.00
7,179.00
7,178.00
7,177.00
7,176.00
7,175.00
7,174.00
7,173.00
7,172.00
7,171.00
7,170.00
7,169.00
7,168.00
7,167.00
7,166.00
7,165.00
7,164.00
7,163.00
7,162.00
7,161.00
7,160.00
7,159.00
7,158.00
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
550.0
600.0
650.0
700.0
750.0
800.0
850.0
900.0
Label: DP01-01 Type: Outfall ID: 50
Label: DP01-02 Type: Conduit ID: 47
Label: DP01-03 Type: Manhole ID: 37
Label: DP01-04 Type: Conduit ID: 48
Label: DP01-05 Type: Manhole ID: 39
Label: DP01-06 Type: Conduit ID: 45
Label: DP01-07 Type: Manhole ID: 35
Label: DP01-08 Type: Conduit ID: 41
Label: DP01-09 Type: Manhole ID: 31
Label: DP01-10 Type: Conduit ID: 42
Label: DP01-11 Type: Manhole ID: 33

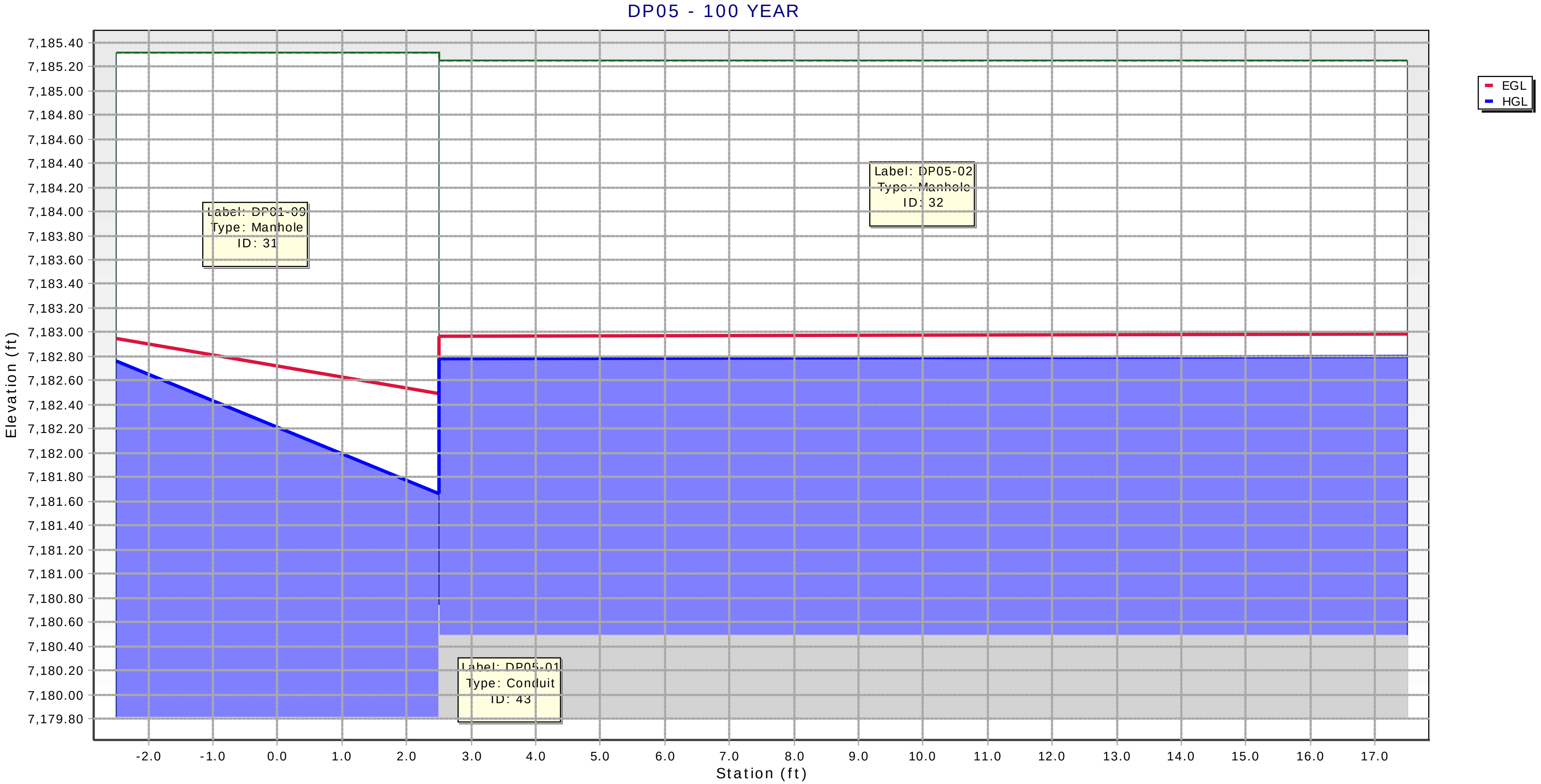

DP02 - 100 YEAR
Elevation (ft)
Station (ft)
EGL
HGL
Label: DP01-05
Type: Manhole
ID: 39
Label: DP02-02
Type: Manhole
ID: 38
Label: DP02-01
Type: Conduit
ID: 49
7,168.40
7,168.20
7,168.00
7,167.80
7,167.60
7,167.40
7,167.20
7,167.00
7,166.80
7,166.60
7,166.40
7,166.20
7,166.00
7,165.80
7,165.60
7,165.40
7,165.20
7,165.00
7,164.80
7,164.60
7,164.40
7,164.20
7,164.00
7,163.80
7,163.60
7,163.40
7,163.20
7,163.00
7,162.80
7,162.60
7,162.40
7,162.20
7,162.00
7,161.80
7,161.60
7,161.40
7,161.20
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
18.0
19.0
20.0
21.0
22.0
23.0



DP03 - 100 YEAR
Elevation (ft)
Station (ft)
7,176.00
7,175.80
7,175.60
7,175.40
7,175.20
7,175.00
7,174.80
7,174.60
7,174.40
7,174.20
7,174.00
7,173.80
7,173.60
7,173.40
7,173.20
7,173.00
7,172.80
7,172.60
7,172.40
7,172.20
7,172.00
7,171.80
7,171.60
7,171.40
7,171.20
7,171.00
7,170.80
7,170.60
7,170.40
7,170.20
7,170.00
7,169.80
7,169.60
7,169.40
7,169.20
-3.0
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
18.0
Label: DP01-07
Type: Manhole
ID: 35
Label: DP03-02
Type: Manhole
ID: 34
Label: DP03-01
Type: Conduit
ID: 44
EGL
HGL



DP04 - 100 YEAR
Label: DP01-07
Type: Manhole
ID: 35
Label: DP04-01
Type: Conduit
ID: 46
Label: DP04-02
Type: Manhole
ID: 36
EGL
HGL
Elevation (ft)
Station (ft)
7,175.80
7,175.60
7,175.40
7,175.20
7,175.00
7,174.80
7,174.60
7,174.40
7,174.20
7,174.00
7,173.80
7,173.60
7,173.40
7,173.20
7,173.00
7,172.80
7,172.60
7,172.40
7,172.20
7,172.00
7,171.80
7,171.60
7,171.40
7,171.20
7,171.00
7,170.80
7,170.60
7,170.40
7,170.20
7,170.00
7,169.80
7,169.60
7,169.40
7,169.20
-2.0
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0
22.0
24.0
26.0
28.0
30.0
32.0
34.0
36.0



DP05 - 100 YEAR
Elevation (ft)
Station (ft)
7,185.40
7,185.20
7,185.00
7,184.80
7,184.60
7,184.40
7,184.20
7,184.00
7,183.80
7,183.60
7,183.40
7,183.20
7,183.00
7,182.80
7,182.60
7,182.40
7,182.20
7,182.00
7,181.80
7,181.60
7,181.40
7,181.20
7,181.00
7,180.80
7,180.60
7,180.40
7,180.20
7,180.00
7,179.80
-2.0
-1.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
Label: DP01-09
Type: Manhole
ID: 31
Label: DP05-02
Type: Manhole
ID: 32
Label: DP05-01
Type: Conduit
ID: 43
EGL
HGL

Scenario: 100 YEAR
Current Time Step: 0.000 h
Conduit FlexTable: Combined Pipe/Node Report

Upstream Structure	Label	Flow (cfs)	Capacity (Full Flow) (cfs)	Diameter (in)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	HGL (In) (ft)	HGL (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Upstream Structure Headloss Coefficient	Manning's n
DP01-03	DP01-02	83.20	88.49	36.0	158.4	-0.015	14.23	7.158.09	7,160.43	7,161.93	7,168.27	7,163.23	7,160.43	7,165.51	7,163.42	0.300	0.012
DP01-05	DP01-04	66.10	121.61	36.0	27.5	-0.028	17.56	7,160.73	7,161.51	7,168.27	7,168.12	7,164.11	7,163.91	7,165.71	7,165.27	1.320	0.012
DP01-07	DP01-06	42.10	107.14	36.0	350.2	-0.022	14.25	7,161.81	7,169.51	7,168.12	7,175.78	7,171.62	7,166.23	7,172.60	7,166.78	1.320	0.012
DP01-09	DP01-08	19.60	41.07	24.0	340.0	-0.028	12.92	7,170.51	7,180.06	7,175.78	7,185.31	7,181.66	7,172.91	7,182.49	7,173.51	1.320	0.012
DP01-11	DP01-10	9.50	34.15	24.0	28.5	-0.019	9.31	7,180.37	7,180.92	7,185.31	7,185.21	7,182.79	7,182.75	7,182.94	7,182.89	0.100	0.012
DP02-02	DP02-01	25.80	126.17	30.0	8.5	0.081	5.26	7,163.00	7,162.31	7,168.26	7,168.12	7,166.25	7,166.23	7,166.68	7,166.65	0.100	0.012
DP03-02	DP03-01	12.60	56.90	24.0	8.1	0.054	14.55	7,170.95	7,170.51	7,175.79	7,175.78	7,172.93	7,172.91	7,173.18	7,173.16	0.100	0.012
DP04-02	DP04-01	11.30	38.49	24.0	28.9	-0.025	10.64	7,170.51	7,171.23	7,175.78	7,175.70	7,172.92	7,172.91	7,173.17	7,173.11	0.100	0.012
DP05-02	DP05-01	10.90	54.76	24.0	7.5	-0.050	3.47	7,180.36	7,180.74	7,185.31	7,185.25	7,182.77	7,182.75	7,182.95	7,182.94	0.100	0.012

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Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	APL
Company:	JR ENGINEERING
Date:	October 18, 2022
Project:	STERLING RANCH HOMESTEAD FIL. 3
Location:	EL PASO COUNTY

Pond A - Forebay

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 40.5 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.405
C) Contributing Watershed Area	Area = 29.950 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 2.52 in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: (●) Water Quality Capture Volume (WQCV); ( ) Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$)	V_{DESIGN}= ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$)	$V_{DESIGN\ OTHER}$= ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= 0.452 ac-ft
I) NRCS Hydrologic Soil Groups of Tributary Watershed	
i) Percentage of Watershed consisting of Type A Soils	HSG_A = %
ii) Percentage of Watershed consisting of Type B Soils	HSG_B = %
iii) Percentage of Watershed consisting of Type C/D Soils	$HSG_{C/D}$ = %
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$= ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	
5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.014 ac-ft
B) Actual Forebay Volume	V_F = 0.015 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 18.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 67.80 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 1.36 cfs
E) Forebay Discharge Design	Choose One: ( ) Berm With Pipe; (●) Wall with Rect. Notch; ( ) Wall with V-Notch Weir — Flow too small for berm w/ pipe
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 6.3 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**APL**
Company:	**JR ENGINEERING**
Date:	**October 18, 2022**
Project:	**STERLING RANCH HOMESTEAD FIL. 3**
Location:	**EL PASO COUNTY**

6. Trickle Channel	Choose One
A) Type of Trickle Channel	◉ Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 10 sq ft
C) Outlet Type	Choose One ◉ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 1.54 inches
E) Total Outlet Area	A_{ot} = 7.58 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 4 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 59 cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 3.3 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 252 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.)	*Aluminum Amico-Klemp SR Series with Cross Rods 2" O.C.*
Other (Y/N): N	
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 355 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = inches

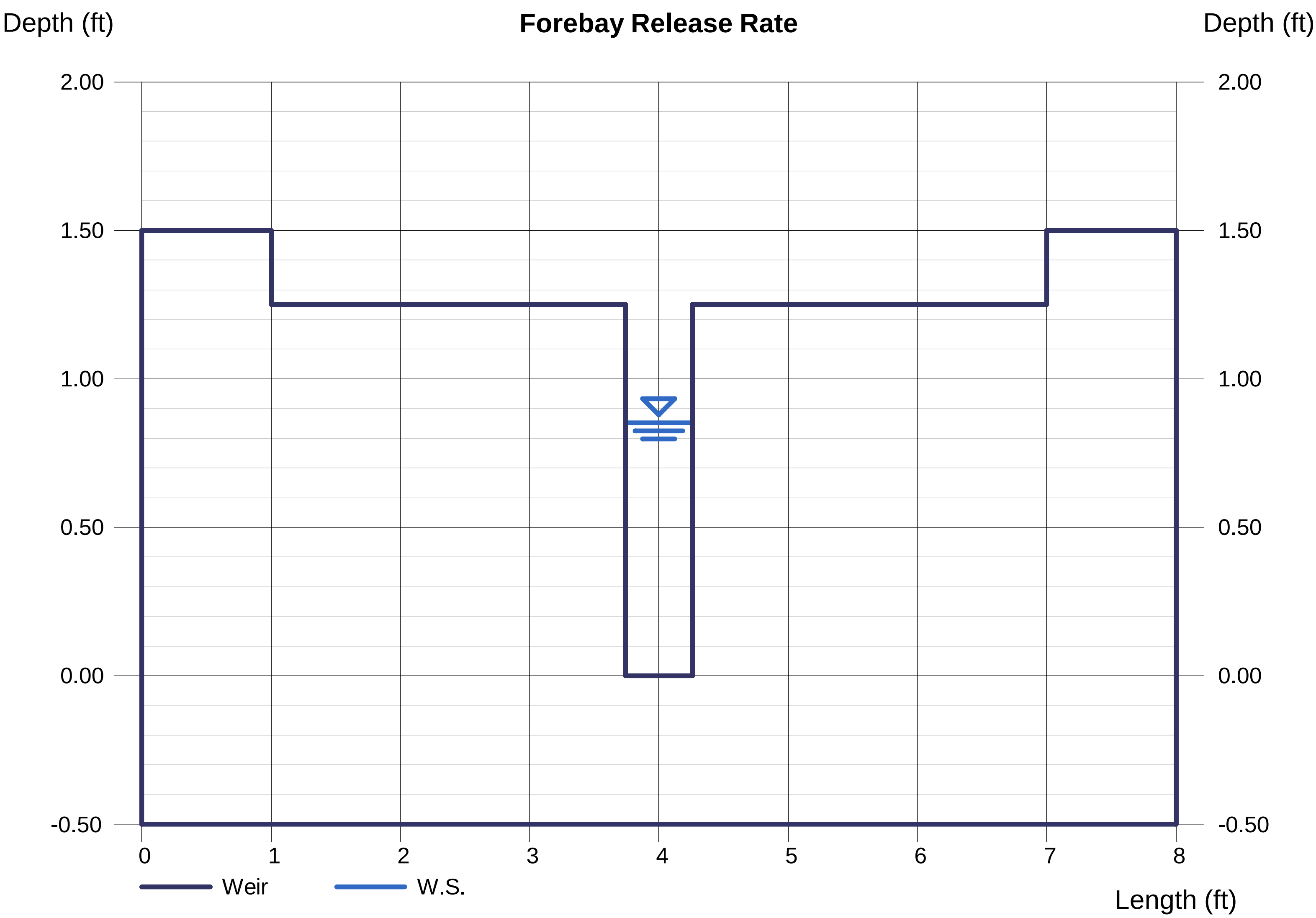
Weir Report

Forebay Release Rate

Compound Weir		**Highlighted**	
Crest	= Sharp	Depth (ft)	= 0.85
Bottom Length (ft)	= 6.00	Q (cfs)	= 1.360
Total Depth (ft)	= 1.50	Area (sqft)	= 0.44
Length, x (ft)	= 0.52	Velocity (ft/s)	= 3.07
Depth, a (ft)	= 1.25	Top Width (ft)	= 0.52

Calculations

Weir Coeff. Cw	= 3.33
Compute by:	Known Q
Known Q (cfs)	= 1.36

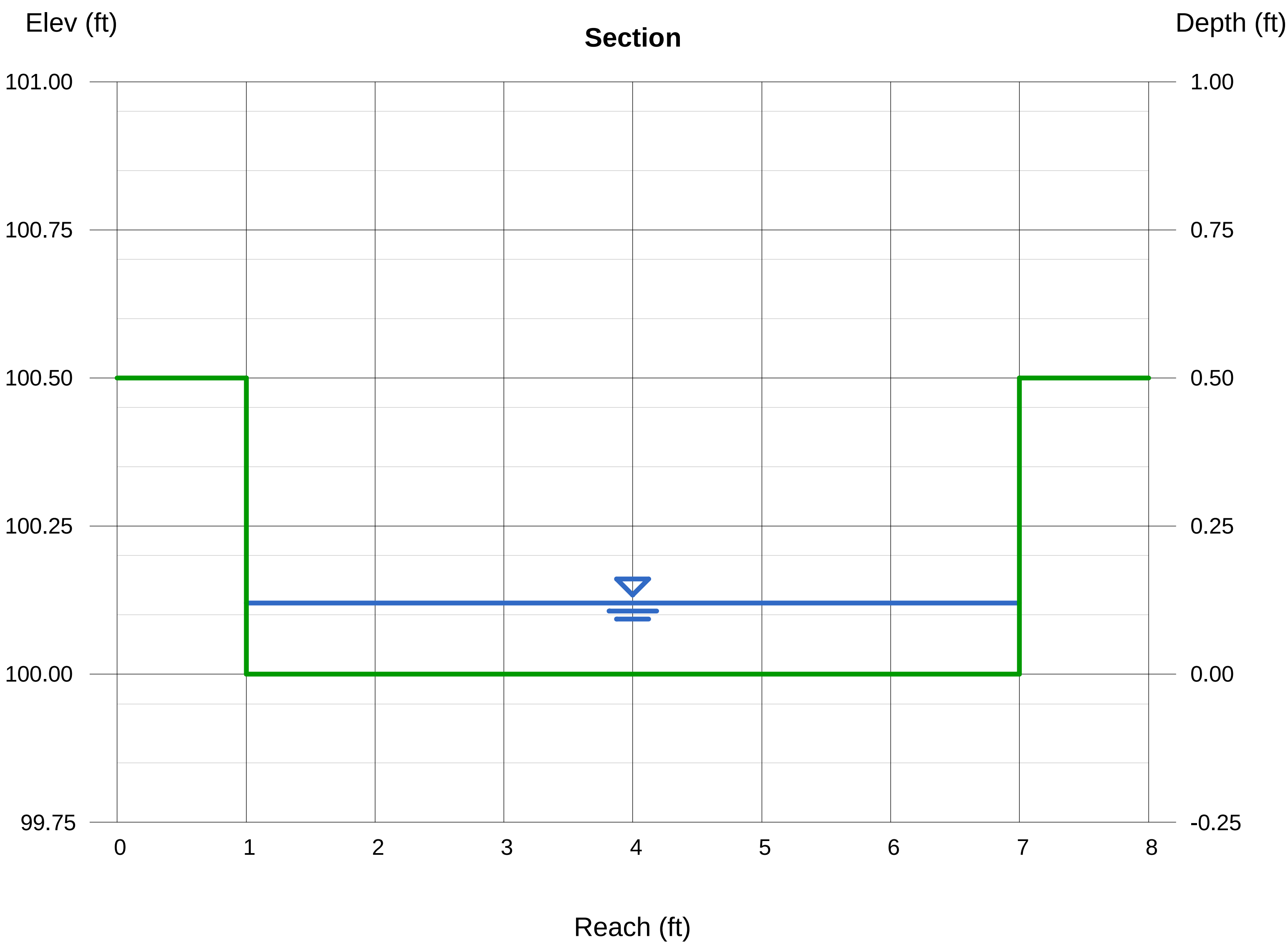


Channel Report

Trickle Channel-Capacity

Rectangular	
Bottom Width (ft)	= 6.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 100.00
Slope (%)	= 0.50
N-Value	= 0.012
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 1.36

Highlighted	
Depth (ft)	= 0.12
Q (cfs)	= 1.360
Area (sqft)	= 0.72
Velocity (ft/s)	= 1.89
Wetted Perim (ft)	= 6.24
Crit Depth, Yc (ft)	= 0.12
Top Width (ft)	= 6.00
EGL (ft)	= 0.18

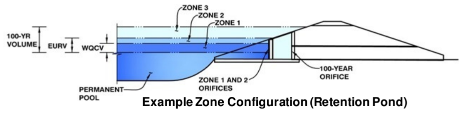


DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: Homestead North at Sterling Ranch Filing No. 3

Basin ID: Pond A



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**			
Watershed Area =	29.95	acres		
Watershed Length =	1,930	ft		
Watershed Length to Centroid =	830	ft		
Watershed Slope =	0.031	ft/ft		
Watershed Imperviousness =	40.50%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.452	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.275	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.247	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.860	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.411	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	3.199	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.813	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.614	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 4 in.) =	8.451	acre-feet	4.00	inches
Approximate 2-yr Detention Volume =	0.941	acre-feet		
Approximate 5-yr Detention Volume =	1.313	acre-feet		
Approximate 10-yr Detention Volume =	1.803	acre-feet		
Approximate 25-yr Detention Volume =	2.013	acre-feet		
Approximate 50-yr Detention Volume =	2.112	acre-feet		
Approximate 100-yr Detention Volume =	2.416	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.452	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.823	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.141	acre-feet
Total Detention Basin Volume =	2.416	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

	Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
55.11	**Top of Micropool**	--	0.00	--	--	--	10	0.000		
	7155.44	--	0.33	--	--	--	50	0.001	10	0.000
	7156	--	0.89	--	--	--	829	0.019	256	0.006
	7157	--	1.89	--	--	--	7,288	0.167	4,314	0.099
	7158	--	2.89	--	--	--	19,027	0.437	17,472	0.401
	7159	--	3.89	--	--	--	26,352	0.605	40,161	0.922
	7160	--	4.89	--	--	--	30,164	0.692	68,419	1.571
	7161	--	5.89	--	--	--	34,095	0.783	100,548	2.308
	7162	--	6.89	--	--	--	38,115	0.875	136,653	3.137
	7163	--	7.89	--	--	--	42,286	0.971	176,853	4.060
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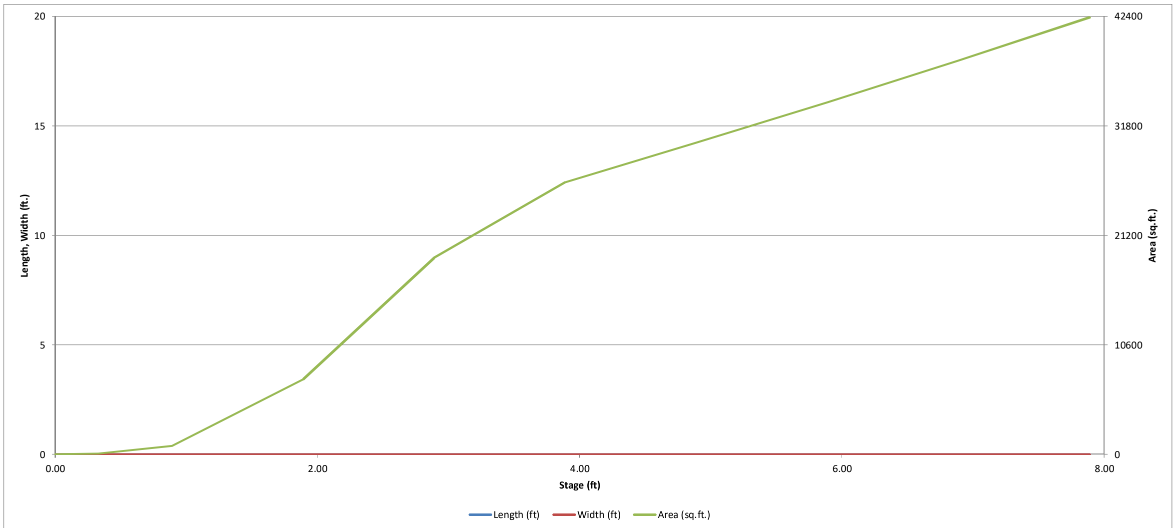
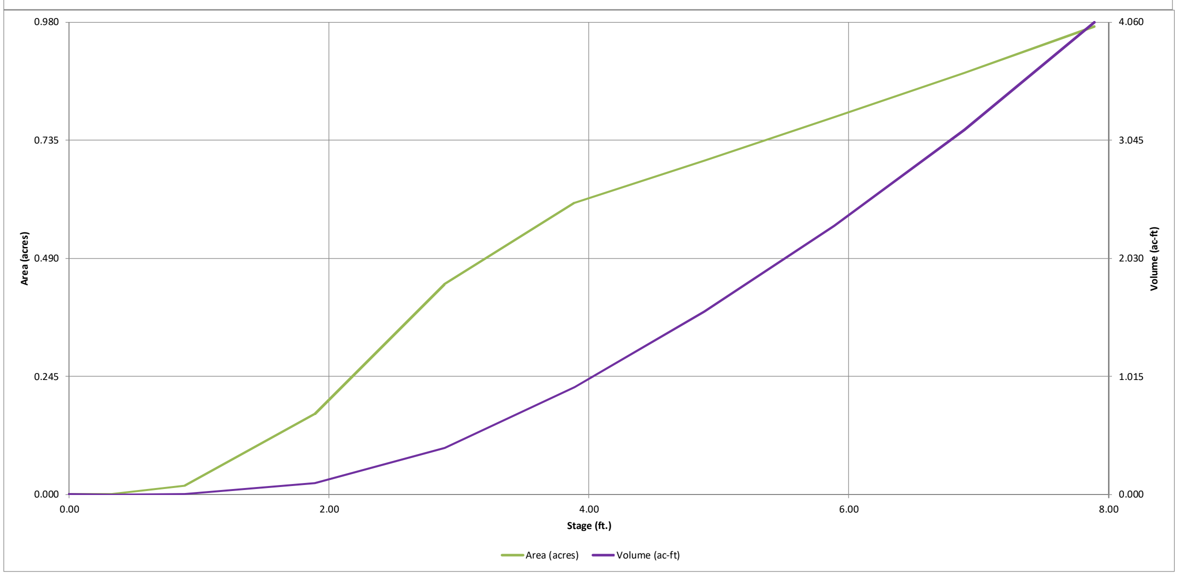
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



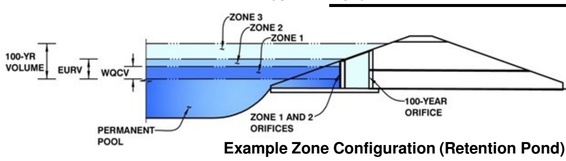


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: **Homestead North at Sterling Ranch Filing No. 3**

Basin ID: **Pond A**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.01	0.452	Orifice Plate
Zone 2 (EURV)	4.46	0.823	Orifice Plate
Zone 3 (100-year)	6.03	1.141	Weir&Pipe (Restrict)
Total (all zones)		2.416	

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

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

Calculated Parameters for Underdrain

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

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	4.50	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	sq. inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.50	3.00	3.25				
Orifice Area (sq. inches)	1.86	1.86	1.86	2.00				

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	5.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	4.50	N/A	feet
Overflow Weir Slope Length =	5.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	5.01	N/A	
Overflow Grate Open Area w/o Debris =	17.40	N/A	ft^2
Overflow Grate Open Area w/ Debris =	8.70	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	30.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	20.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	3.48	N/A	ft^2
Outlet Orifice Centroid =	0.94	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.91	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.90	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	30.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.78	feet
Stage at Top of Freeboard =	7.68	feet
Basin Area at Top of Freeboard =	0.95	acres
Basin Volume at Top of Freeboard =	3.86	acre-ft

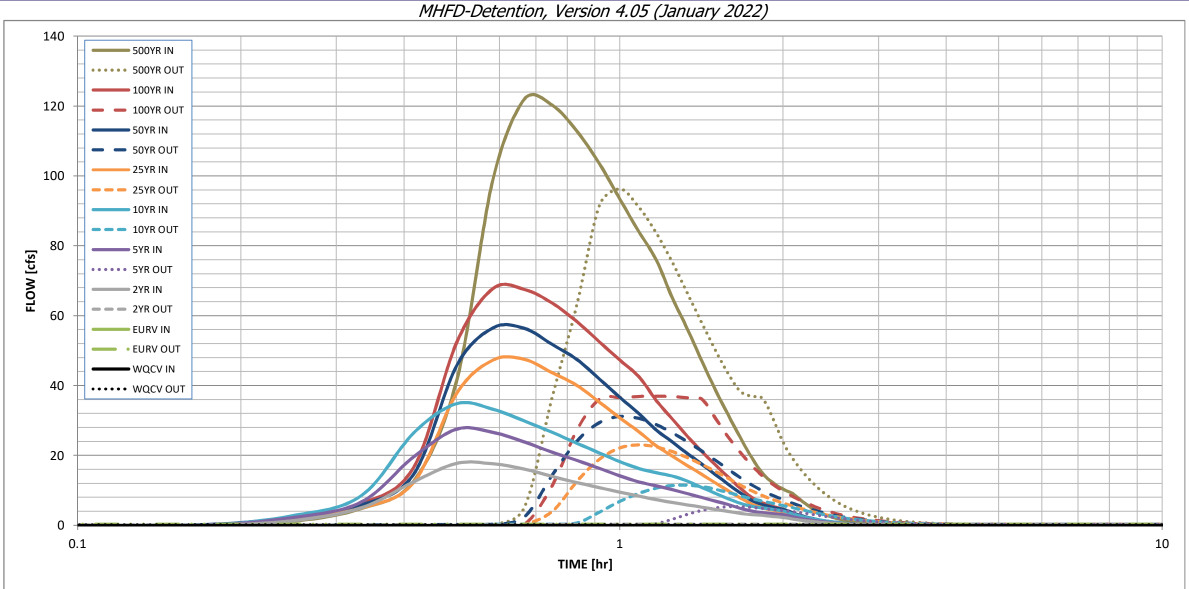
Routed Hydrograph Results

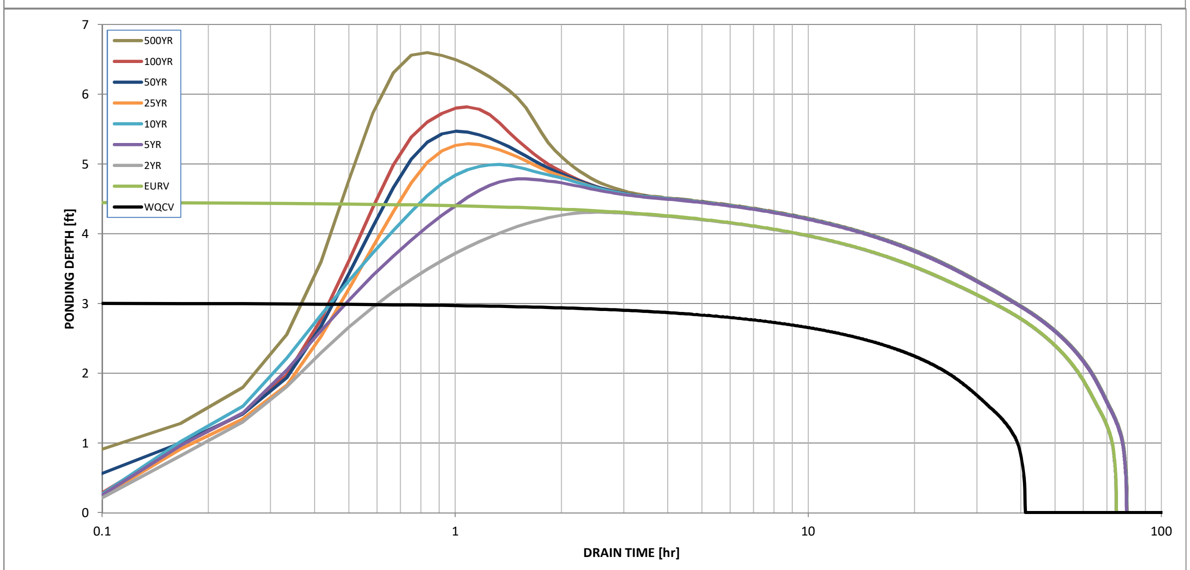
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

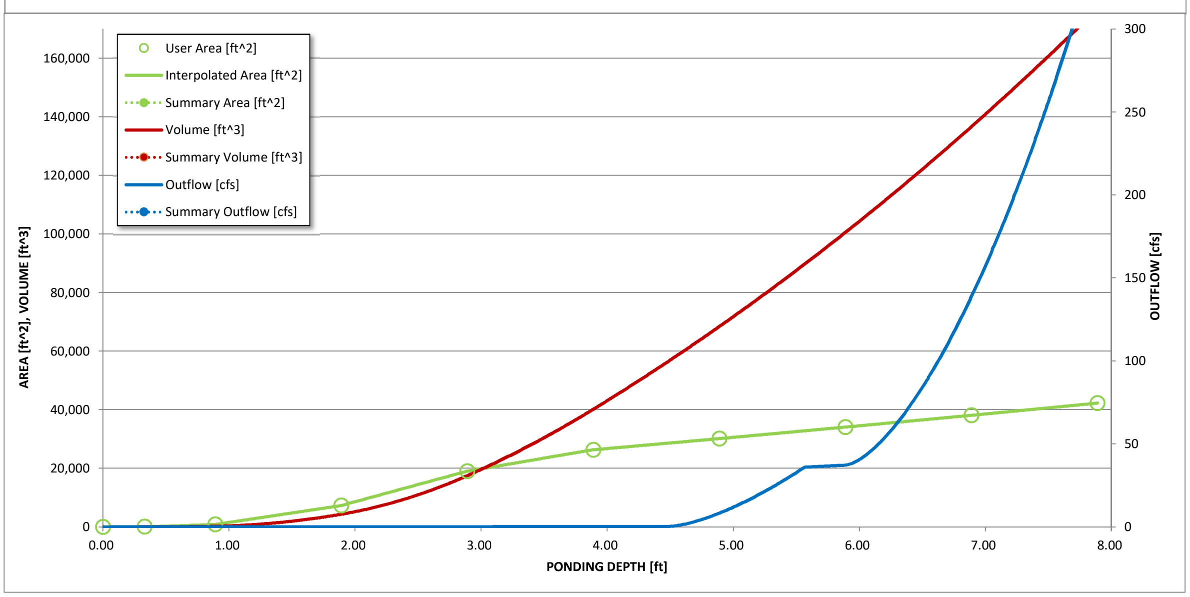
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	4.00
CUHP Runoff Volume (acre-ft) =	0.452	1.275	1.247	1.860	2.411	3.199	3.813	4.614	8.451
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.247	1.860	2.411	3.199	3.813	4.614	8.451
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	3.2	9.0	13.6	24.4	30.6	39.2	76.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.11	0.30	0.46	0.82	1.02	1.31	2.56
Peak Inflow Q (cfs) =	N/A	N/A	17.8	27.5	34.8	47.5	56.5	67.8	122.0
Peak Outflow Q (cfs) =	0.2	0.4	0.4	5.4	11.5	23.1	31.2	37.0	96.3
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.6	0.8	0.9	1.0	0.9	1.3
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.3	0.6	1.3	1.8	2.1	2.3
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	68	67	70	68	66	64	62	53
Time to Drain 99% of Inflow Volume (hours) =	**40**	72	72	76	75	74	73	71	67
Maximum Ponding Depth (ft) =	3.01	4.46	4.31	4.79	4.99	5.29	5.47	5.82	6.60
Area at Maximum Ponding Depth (acres) =	0.46	0.65	0.64	0.68	0.70	0.73	0.74	0.78	0.85
Maximum Volume Stored (acre-ft) =	0.455	1.281	1.177	1.495	1.640	1.848	1.980	2.246	2.879

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.02	1.21
	0:15:00	0.00	0.00	1.39	2.28	2.83	1.90	2.39	2.32	4.86
	0:20:00	0.00	0.00	5.04	6.70	8.48	5.00	5.85	6.25	12.73
	0:25:00	0.00	0.00	12.49	19.66	26.51	12.31	14.72	16.68	41.49
	0:30:00	0.00	0.00	17.77	27.54	34.85	37.80	45.78	52.34	99.09
	0:35:00	0.00	0.00	17.62	26.62	33.22	47.33	56.54	67.79	122.02
	0:40:00	0.00	0.00	16.12	23.88	29.90	47.53	56.38	67.53	120.27
	0:45:00	0.00	0.00	14.04	20.94	26.65	43.70	51.80	63.64	112.83
	0:50:00	0.00	0.00	12.27	18.62	23.51	40.07	47.48	58.31	103.50
	0:55:00	0.00	0.00	10.81	16.33	20.75	35.27	41.90	52.53	93.38
	1:00:00	0.00	0.00	9.49	14.19	18.25	30.76	36.64	47.32	84.11
	1:05:00	0.00	0.00	8.41	12.46	16.30	26.83	32.03	42.59	75.99
	1:10:00	0.00	0.00	7.38	11.32	15.07	22.80	27.33	35.80	64.98
	1:15:00	0.00	0.00	6.57	10.24	14.13	19.83	23.86	30.38	56.06
	1:20:00	0.00	0.00	5.87	9.08	12.66	17.06	20.51	25.44	46.93
	1:25:00	0.00	0.00	5.23	7.99	10.87	14.60	17.52	21.11	38.77
	1:30:00	0.00	0.00	4.59	6.95	9.18	12.18	14.56	17.31	31.67
	1:35:00	0.00	0.00	3.98	5.98	7.66	9.94	11.82	13.85	25.20
	1:40:00	0.00	0.00	3.45	4.89	6.35	7.89	9.33	10.70	19.42
	1:45:00	0.00	0.00	3.07	4.09	5.50	6.11	7.18	8.03	14.87
	1:50:00	0.00	0.00	2.88	3.63	5.01	5.01	5.90	6.41	12.13
	1:55:00	0.00	0.00	2.55	3.35	4.60	4.35	5.11	5.40	10.35
	2:00:00	0.00	0.00	2.28	3.08	4.15	3.92	4.59	4.69	9.09
	2:05:00	0.00	0.00	1.84	2.47	3.33	3.08	3.59	3.58	6.97
	2:10:00	0.00	0.00	1.44	1.93	2.60	2.35	2.74	2.64	5.15
	2:15:00	0.00	0.00	1.13	1.50	2.01	1.80	2.09	1.93	3.78
	2:20:00	0.00	0.00	0.88	1.16	1.54	1.37	1.58	1.42	2.77
	2:25:00	0.00	0.00	0.68	0.89	1.16	1.04	1.20	1.08	2.09
	2:30:00	0.00	0.00	0.53	0.67	0.87	0.78	0.89	0.81	1.56
	2:35:00	0.00	0.00	0.40	0.50	0.65	0.59	0.67	0.62	1.18
	2:40:00	0.00	0.00	0.30	0.37	0.49	0.44	0.50	0.47	0.89
	2:45:00	0.00	0.00	0.22	0.27	0.36	0.33	0.38	0.35	0.67
	2:50:00	0.00	0.00	0.16	0.19	0.26	0.24	0.27	0.25	0.48
	2:55:00	0.00	0.00	0.10	0.13	0.17	0.16	0.18	0.17	0.32
	3:00:00	0.00	0.00	0.06	0.08	0.10	0.10	0.11	0.10	0.19
	3:05:00	0.00	0.00	0.03	0.04	0.05	0.05	0.06	0.05	0.09
	3:10:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Summary Stage-Area-Volume-Discharge Relationships

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

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

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

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

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

Pond A - Spillway RipRap

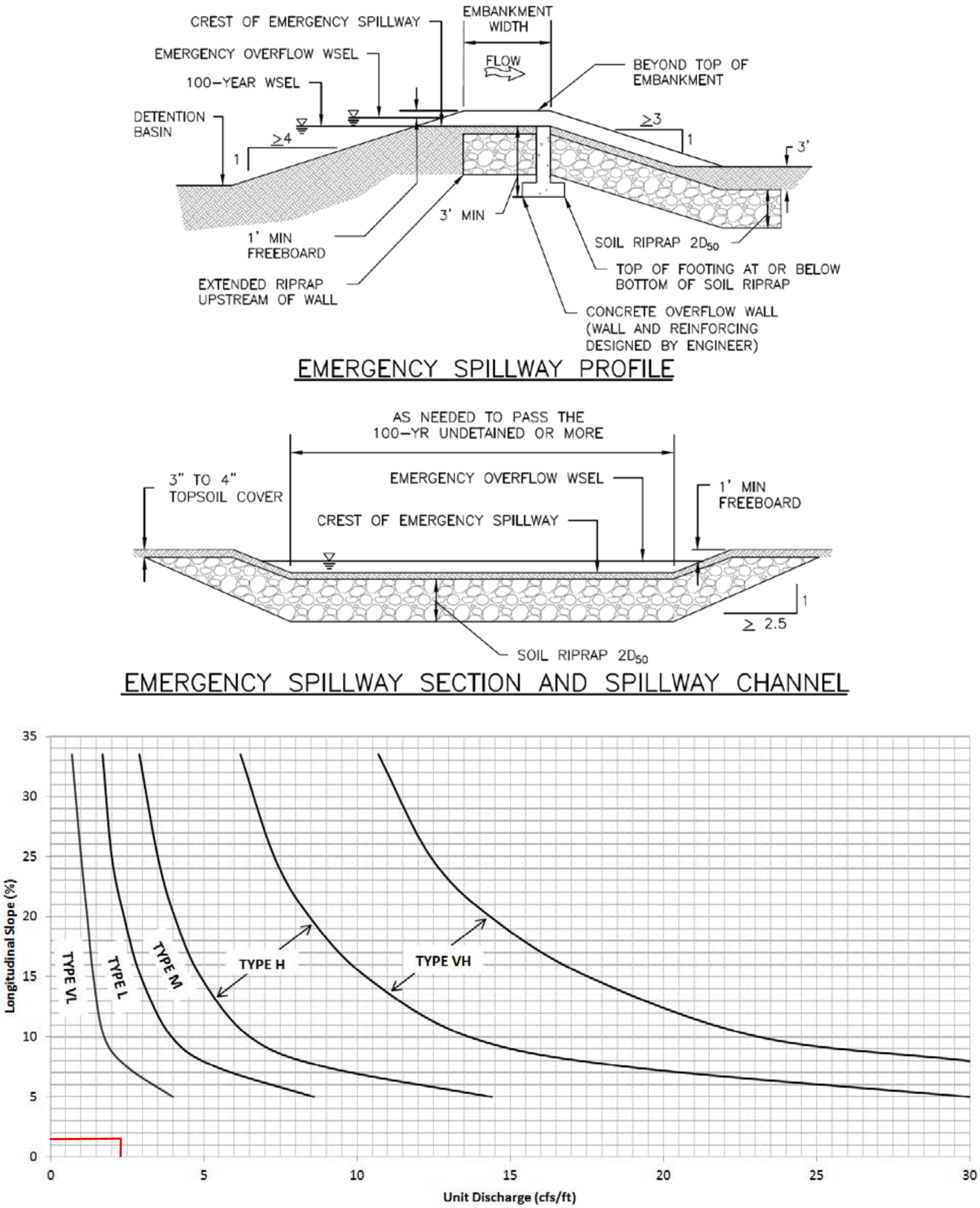


Figure 12-21. Embankment protection details and rock sizing chart (adapted from Arapahoe County)

Culvert Report

Interpolated BFE Tailwater:
NAVD(88) El:7159.50
NGVD29 (Site) El:7155.68

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. — Wednesday, Oct 19 2022

Pond A Outfall-100-year WSEL (Existing Tailwater)

Invert Elev Dn (ft)	= 7154.00
Pipe Length (ft)	= 221.66
Slope (%)	= 0.50
Invert Elev Up (ft)	= 7155.11
Rise (in)	= 30.0
Shape	= Circular
Span (in)	= 30.0
No. Barrels	= 1
n-Value	= 0.012
Culvert Type	= Circular Concrete
Culvert Entrance	= Groove end projecting (C)
Coeff. K,M,c,Y,k	= 0.0045, 2, 0.0317, 0.69, 0.2

Embankment

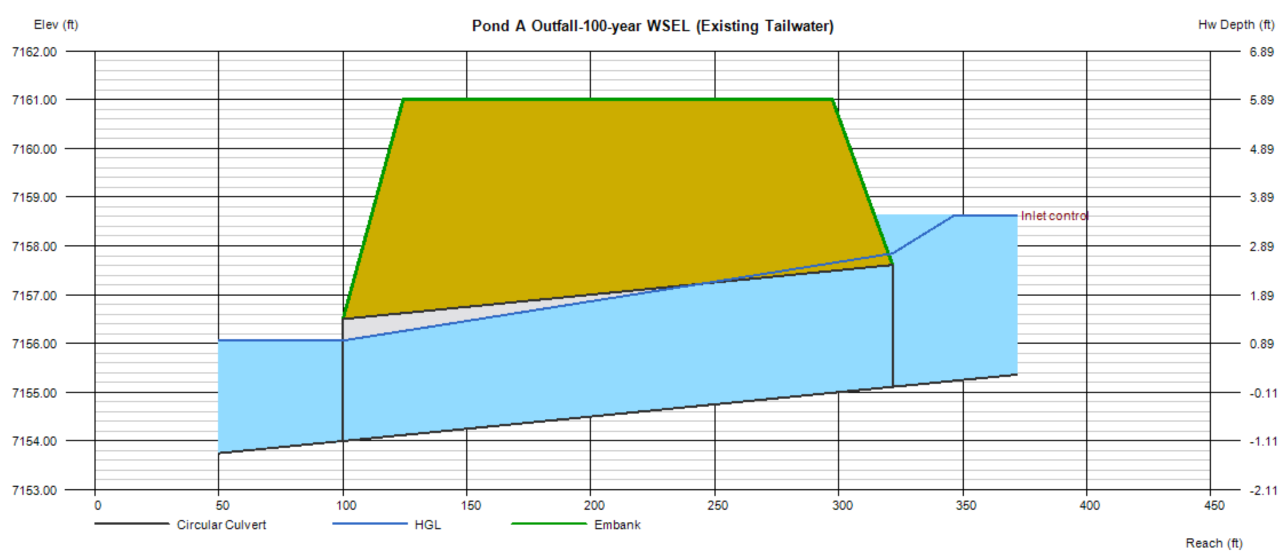
Top Elevation (ft)	= 7161.01
Top Width (ft)	= 173.00
Crest Width (ft)	= 45.90

Calculations

Qmin (cfs)	= 37.00
Qmax (cfs)	= 37.00
Tailwater Elev (ft)	= 7155.68

Highlighted

Qtotal (cfs)	= 37.00
Qpipe (cfs)	= 37.00
Qovertop (cfs)	= 0.00
Veloc Dn (ft/s)	= 8.56
Veloc Up (ft/s)	= 7.54
HGL Dn (ft)	= 7156.06
HGL Up (ft)	= 7157.85
Hw Elev (ft)	= 7158.63
Hw/D (ft)	= 1.41
Flow Regime	= Inlet Control



PIPE OUTFALL RIPRAP SIZING CALCULATIONS

Subdivision:	Proposed Conditions Rational	Project Name:	Homestead North @ Sterling Ranch F3
Location:	El Paso County	Project No.:	25188.12
		Calculated By:	REB
		Checked By:	
		Date:	10/12/22

Pond A Outfall

	STORM DRAIN SYSTEM			
	DESIGN POINT	DESIGN POINT	DESIGN POINT	Notes
Q_{100} (cfs):	37.0			Flows are the greater of proposed vs. future
Conduit	Pipe			
D_c, Pipe Diameter (in):	30			
W, Box Width (ft):	N/A			
H, Box Height (ft):	N/A			
Y_t, Tailwater Depth (ft):	1.00			If unknown, use Y_t/D_c (or H)=0.4
Y_t/Dc or Y_t/H	0.40			
$Q/D^{2.5}$ or $Q/(WH^{3/2})$	3.74			
Supercritical?	No			
Y_n, Normal Depth (ft) [Supercritical]:	1.00			
D_a, H_a (in) [Supercritical]:	N/A			$D_a=(D_c+Y_n)/2$
Riprap d_{50} (in) [Supercritical]:	N/A			
Riprap d_{50} (in) [Subcritical]:	7.76			
Required Riprap Size:	L			Fig. 9-38 or Fig. 9-36
d_{50} (in):	9			
Expansion Factor, $1/(2 \tan\theta)$:	3.90			Read from Fig. 9-35 or 9-36
θ:	0.13			
Erosive Soils?	No			
Area of Flow, A_t (ft^2):	5.29			$A_t=Q/V$
Length of Protection, L_p (ft):	10.9			$L=(1/(2 \tan \theta))(At/Yt - D)$
Min Length (ft)	7.5			Min L=3D or 3H
Max Length (ft)	25.0			Max L=10D or 10H
Min Bottom Width, T (ft):	5.3			$T=2*(L_p*\tan\theta)+W$
Design Length (ft)	11.0			
Design Width (ft)	5.3			
Riprap Depth (in)	18			Depth=2(d_{50})
Type II Bedding Depth (in)*	6			*Not used if Soil Riprap
Cutoff Wall	No			
Cutoff Wall Depth (ft)				Depth of Riprap and Base
Cutoff Wall Width (ft)				

Note: No Type II Base to be used if Soil Riprap is specified within the plans
* For use when the flow in the culvert is supercritical (and less than full).

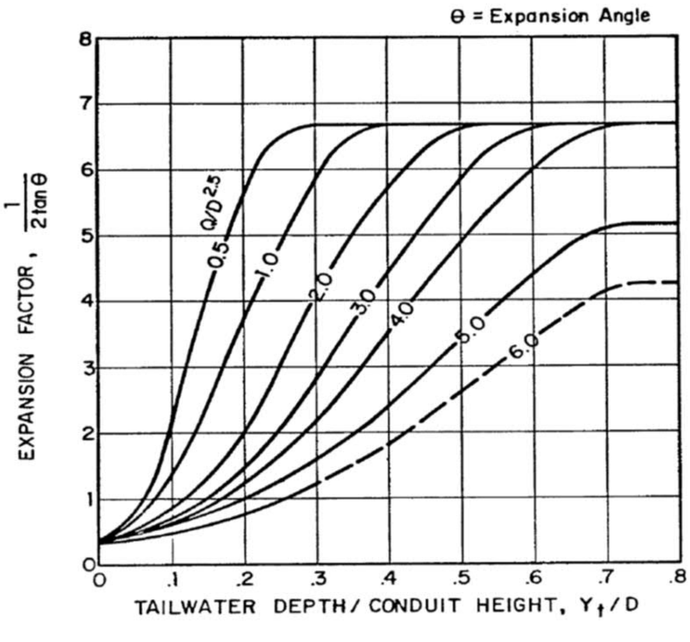


Figure 9-35. Expansion factor for circular conduits

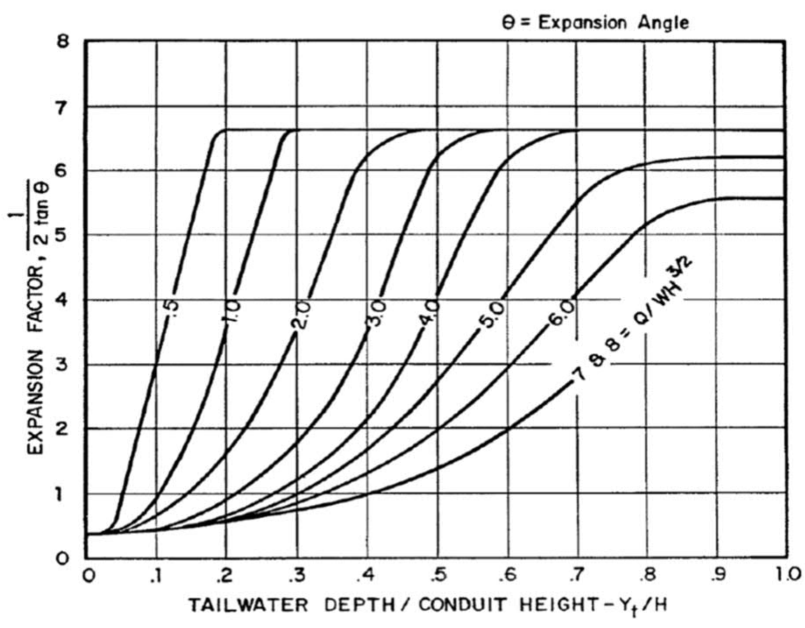


Figure 9-36. Expansion factor for rectangular conduits

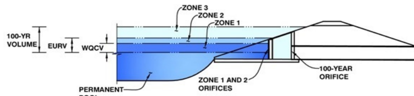
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: **25188.10 Homestead North Filing No. 2**

Basin ID: **POND B (Ultimate)**

Pond B - Filing No. 2, updated for Filing 3 tributary areas (B Basins)



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	28.13	acres
Watershed Length =	1,600	ft
Watershed Length to Centroid =	960	ft
Watershed Slope =	0.032	ft/ft
Watershed Imperviousness =	49.20%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.478	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.478	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.404	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	2.012	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.548	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	3.271	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.855	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.598	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 4 in.) =	8.224	acre-feet	4.00	inches
Approximate 2-yr Detention Volume =	1.113	acre-feet		
Approximate 5-yr Detention Volume =	1.528	acre-feet		
Approximate 10-yr Detention Volume =	2.029	acre-feet		
Approximate 25-yr Detention Volume =	2.224	acre-feet		
Approximate 50-yr Detention Volume =	2.325	acre-feet		
Approximate 100-yr Detention Volume =	2.601	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.478	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.999	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.123	acre-feet
Total Detention Basin Volume =	2.601	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increement = ft

	Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
25.59	**Top of Micropool**	--	0.00	--	--	--	10	0.000		
	7125.93	--	0.33	--	--	--	49	0.001	10	0.000
	7126	--	0.41	--	--	--	65	0.001	14	0.000
	7127	--	1.41	--	--	--	3,181	0.073	1,637	0.038
	7128	--	2.41	--	--	--	12,986	0.298	9,721	0.223
	7129	--	3.41	--	--	--	18,085	0.415	25,256	0.580
	7130	--	4.41	--	--	--	21,210	0.487	44,904	1.031
	7131	--	5.41	--	--	--	24,408	0.560	67,713	1.554
	7132	--	6.41	--	--	--	27,857	0.640	93,845	2.154
	7133	--	7.41	--	--	--	31,439	0.722	123,493	2.835
	7134	--	8.41	--	--	--	35,190	0.808	156,808	3.600
	7135	--	9.41	--	--	--	37,675	0.865	193,240	4.436
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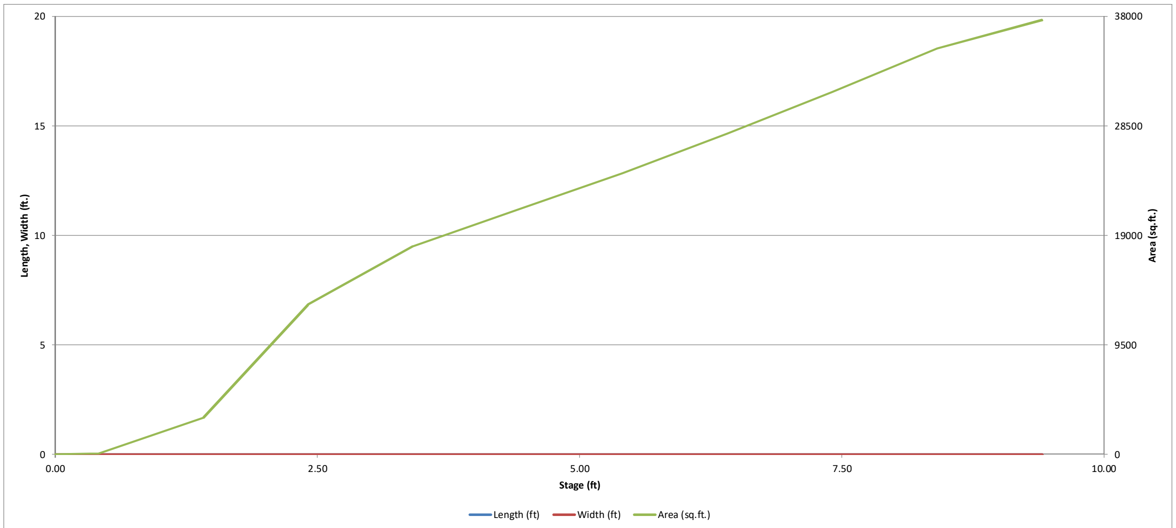
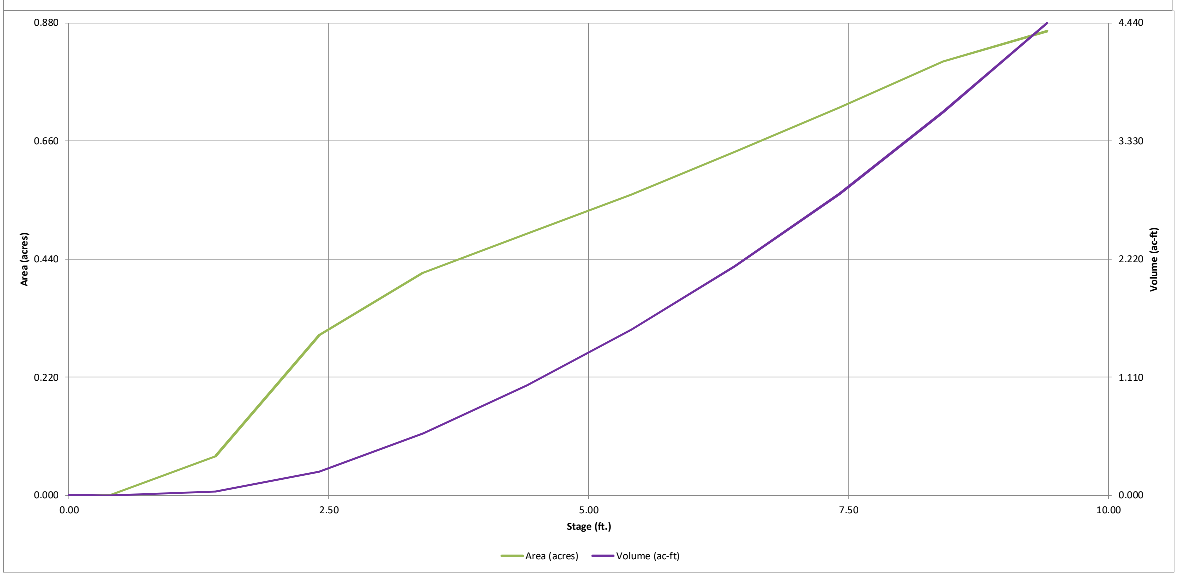
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)





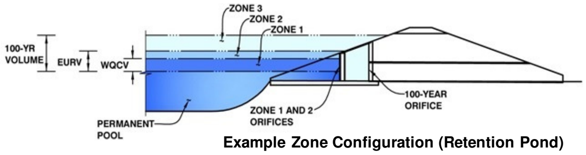
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: 25188.10 Homestead North Filing No. 2

Basin ID: POND B (Ultimate)

no design changes made with this report to Pond B Outlet



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.16	0.478	Orifice Plate
Zone 2 (EURV)	5.28	0.999	Orifice Plate
ne 3 (100-year)	7.08	1.123	Weir&Pipe (Restrict)
Total (all zones)		2.601	

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

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

Calculated Parameters for Underdrain

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

Calculated Parameters for Plate

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	5.28	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	N/A	inches	Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	ow 3 (optiona	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.79	3.57	4.00				
Orifice Area (sq. inches)	2.00	2.00	2.00	12.00				

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.60	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	5.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	0%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.60	N/A	feet
Overflow Weir Slope Length =	5.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	6.88	N/A	
Overflow Grate Open Area w/o Debris =	17.40	N/A	ft^2
Overflow Grate Open Area w/ Debris =	17.40	N/A	ft^2

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

	one 3 Restricto	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	18.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	2.53	N/A	ft^2
Outlet Orifice Centroid =	0.83	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.09	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Calculated Parameters for Spillway

Spillway Invert Stage=	7.20	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.47	feet
Spillway Crest Length =	75.00	feet	Stage at Top of Freeboard =	8.67	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.82	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.81	acre-ft

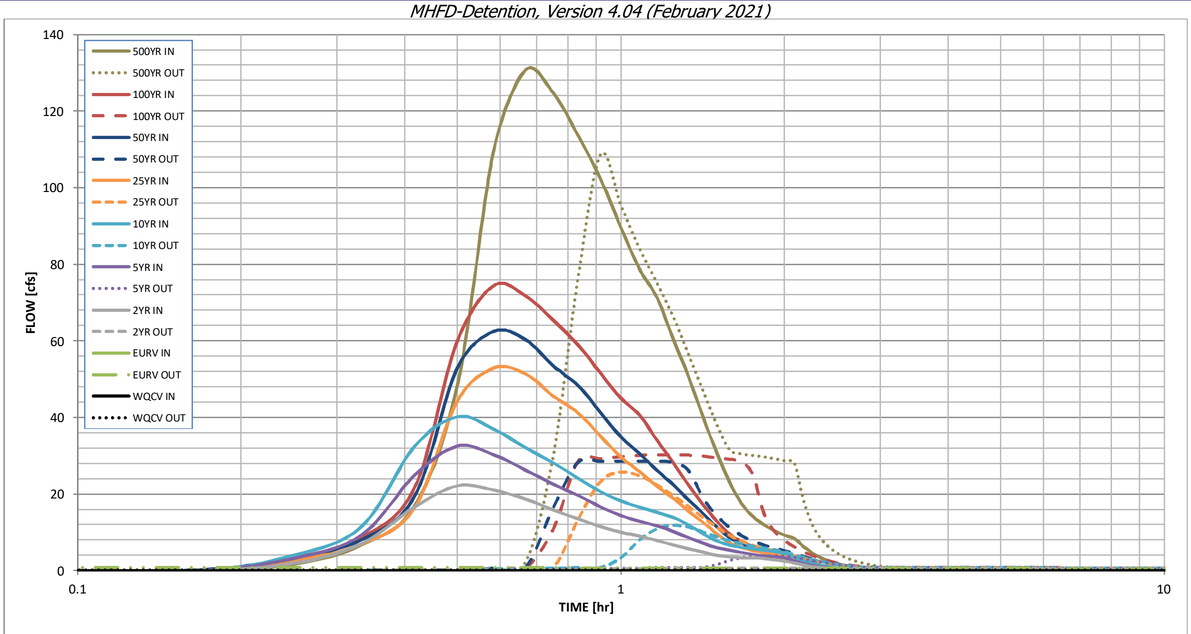
Routed Hydrograph Results

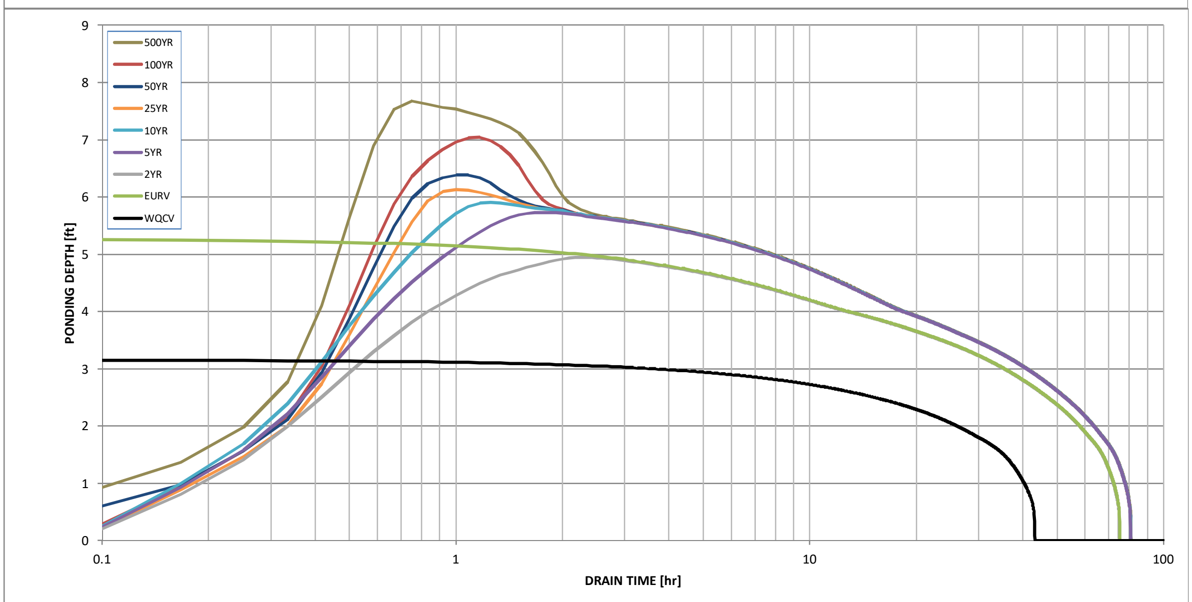
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

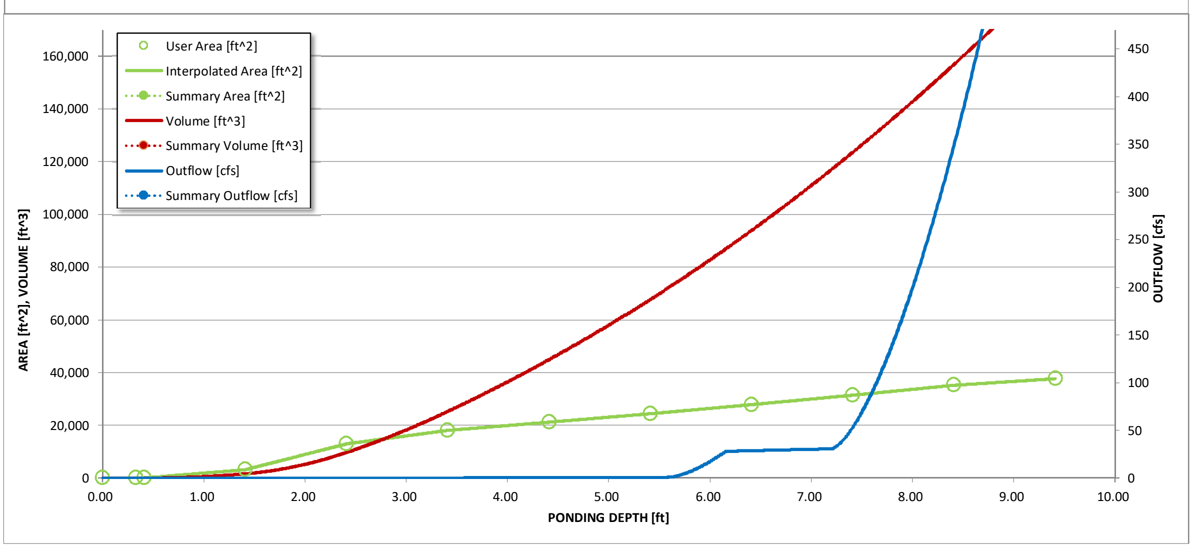
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	4.00
CUHP Runoff Volume (acre-ft) =	0.478	1.478	1.404	2.012	2.548	3.271	3.855	4.598	8.224
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.404	2.012	2.548	3.271	3.855	4.598	8.224
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	3.0	8.4	12.8	22.9	28.7	36.7	72.0
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.11	0.30	0.46	0.81	1.02	1.31	2.56
Peak Inflow Q (cfs) =	N/A	N/A	22.2	32.6	40.2	53.0	62.6	74.5	130.8
Peak Outflow Q (cfs) =	0.2	0.8	0.7	3.9	11.9	25.8	28.7	30.3	108.7
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.5	0.9	1.1	1.0	0.8	1.5
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.6	1.4	1.6	1.7	1.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	40	67	68	71	68	66	64	62	53
Time to Drain 99% of Inflow Volume (hours) =	**42**	72	72	77	76	75	74	73	68
Maximum Ponding Depth (ft) =	3.16	5.28	4.95	5.73	5.91	6.13	6.39	7.04	7.68
Area at Maximum Ponding Depth (acres) =	0.39	0.55	0.53	0.58	0.60	0.62	0.64	0.69	0.74
Maximum Volume Stored (acre-ft) =	0.480	1.482	1.299	1.732	1.839	1.972	2.135	2.574	3.033

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.02	1.71
	0:15:00	0.00	0.00	1.99	3.25	4.03	2.71	3.39	3.31	6.81
	0:20:00	0.00	0.00	7.13	9.42	11.66	7.00	8.16	8.74	17.00
	0:25:00	0.00	0.00	16.72	24.94	32.48	16.43	19.43	21.63	48.65
	0:30:00	0.00	0.00	22.20	32.60	40.24	44.46	53.10	60.17	109.98
	0:35:00	0.00	0.00	21.10	30.30	36.99	52.99	62.57	74.51	130.75
	0:40:00	0.00	0.00	18.74	26.32	32.18	51.45	60.39	71.81	124.81
	0:45:00	0.00	0.00	15.90	22.64	28.18	45.66	53.55	65.48	113.68
	0:50:00	0.00	0.00	13.53	19.68	24.20	41.26	48.40	58.98	102.33
	0:55:00	0.00	0.00	11.55	16.70	20.68	35.18	41.34	51.64	89.59
	1:00:00	0.00	0.00	10.08	14.44	18.22	29.69	34.96	45.09	78.60
	1:05:00	0.00	0.00	9.07	12.93	16.59	25.82	30.52	40.56	71.12
	1:10:00	0.00	0.00	7.88	11.72	15.24	22.06	26.14	33.92	60.17
	1:15:00	0.00	0.00	6.77	10.26	13.92	18.83	22.38	28.05	50.41
	1:20:00	0.00	0.00	5.75	8.64	11.93	15.52	18.41	22.32	40.03
	1:25:00	0.00	0.00	4.82	7.20	9.65	12.58	14.90	17.33	30.92
	1:30:00	0.00	0.00	4.07	6.05	7.81	9.72	11.45	13.00	23.22
	1:35:00	0.00	0.00	3.64	5.42	6.77	7.42	8.72	9.64	17.55
	1:40:00	0.00	0.00	3.46	4.79	6.14	6.11	7.16	7.68	14.15
	1:45:00	0.00	0.00	3.35	4.31	5.69	5.29	6.17	6.44	11.93
	1:50:00	0.00	0.00	3.29	3.96	5.38	4.75	5.52	5.58	10.39
	1:55:00	0.00	0.00	2.91	3.70	5.02	4.38	5.06	4.97	9.29
	2:00:00	0.00	0.00	2.57	3.41	4.53	4.15	4.77	4.55	8.50
	2:05:00	0.00	0.00	1.99	2.63	3.47	3.18	3.65	3.40	6.34
	2:10:00	0.00	0.00	1.50	1.96	2.57	2.35	2.68	2.46	4.58
	2:15:00	0.00	0.00	1.13	1.46	1.90	1.74	1.98	1.83	3.38
	2:20:00	0.00	0.00	0.84	1.09	1.39	1.29	1.47	1.36	2.51
	2:25:00	0.00	0.00	0.62	0.79	1.01	0.94	1.07	1.00	1.84
	2:30:00	0.00	0.00	0.45	0.56	0.73	0.68	0.76	0.72	1.32
	2:35:00	0.00	0.00	0.32	0.39	0.53	0.49	0.56	0.53	0.96
	2:40:00	0.00	0.00	0.21	0.27	0.36	0.35	0.39	0.37	0.67
	2:45:00	0.00	0.00	0.13	0.18	0.23	0.23	0.26	0.24	0.44
	2:50:00	0.00	0.00	0.07	0.10	0.13	0.13	0.15	0.14	0.25
	2:55:00	0.00	0.00	0.03	0.05	0.06	0.06	0.07	0.07	0.12
	3:00:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Summary Stage-Area-Volume-Discharge Relationships

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

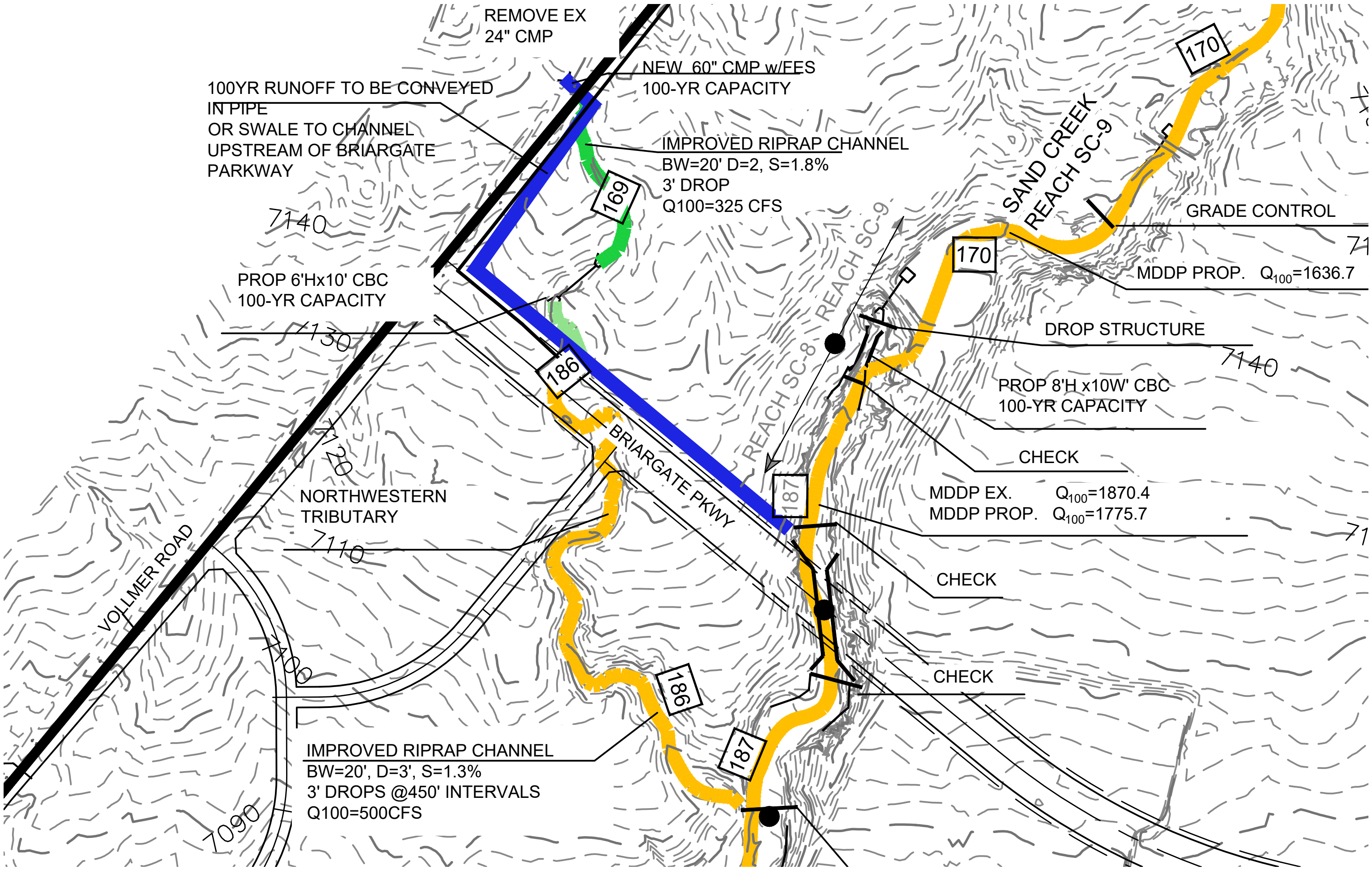
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

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

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

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

Appendix D
Reference Material



NORTHWESTERN TRIBUTARY
SHEET 1 OF 5

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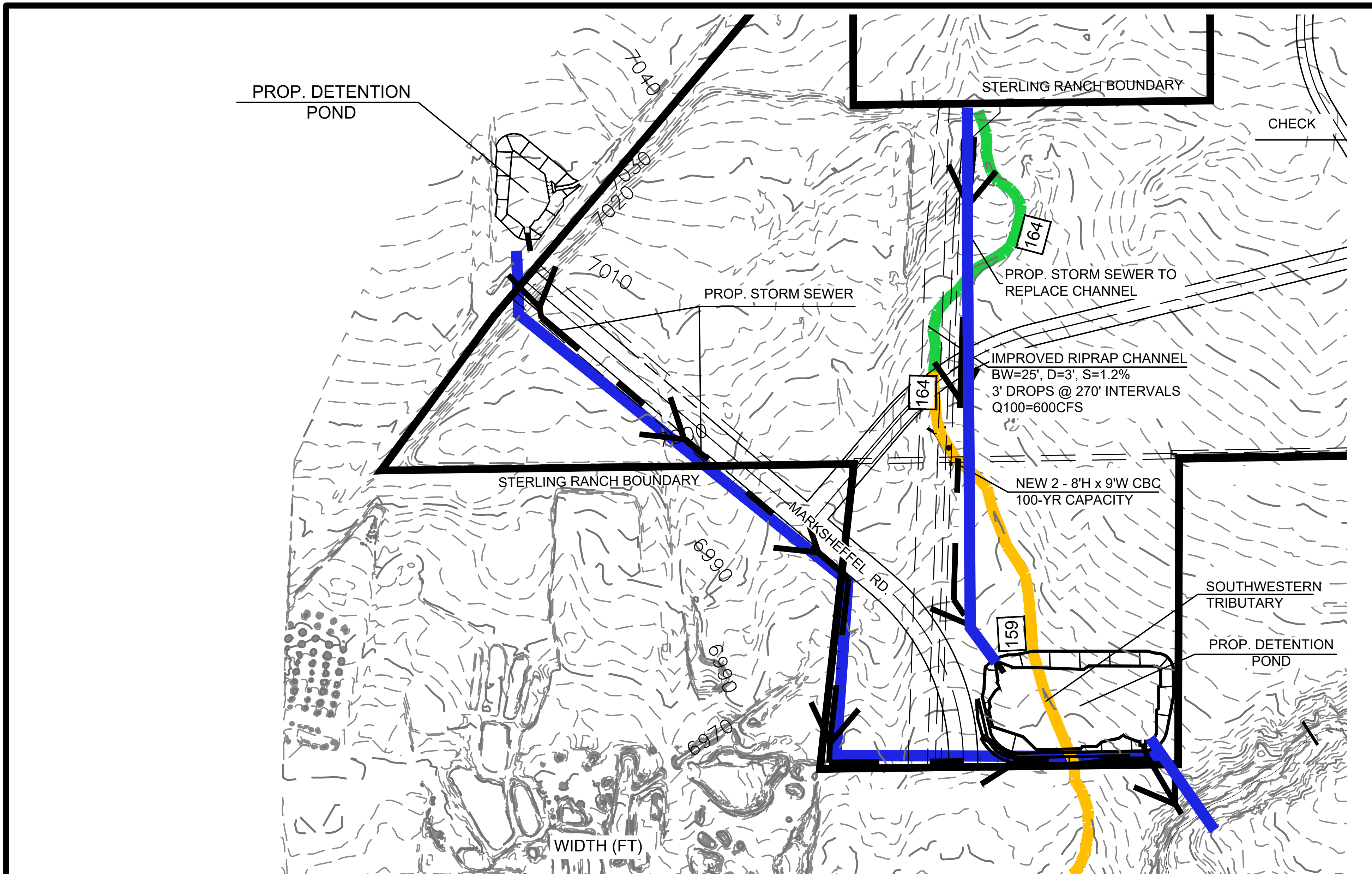

SOUTHWEST TRIBUTARY
SHEET 3 OF 5

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PRELIMINARY DRAINAGE REPORT AND MDDP ADDENDUM
FOR
HOMESTEAD NORTH AT STERLING RANCH PRELIMINARY PLAN

Prepared For:

SR Land, LLC
20 Boulder Crescent, Suite 200
Colorado Springs, CO 80903
(719) 491-3024

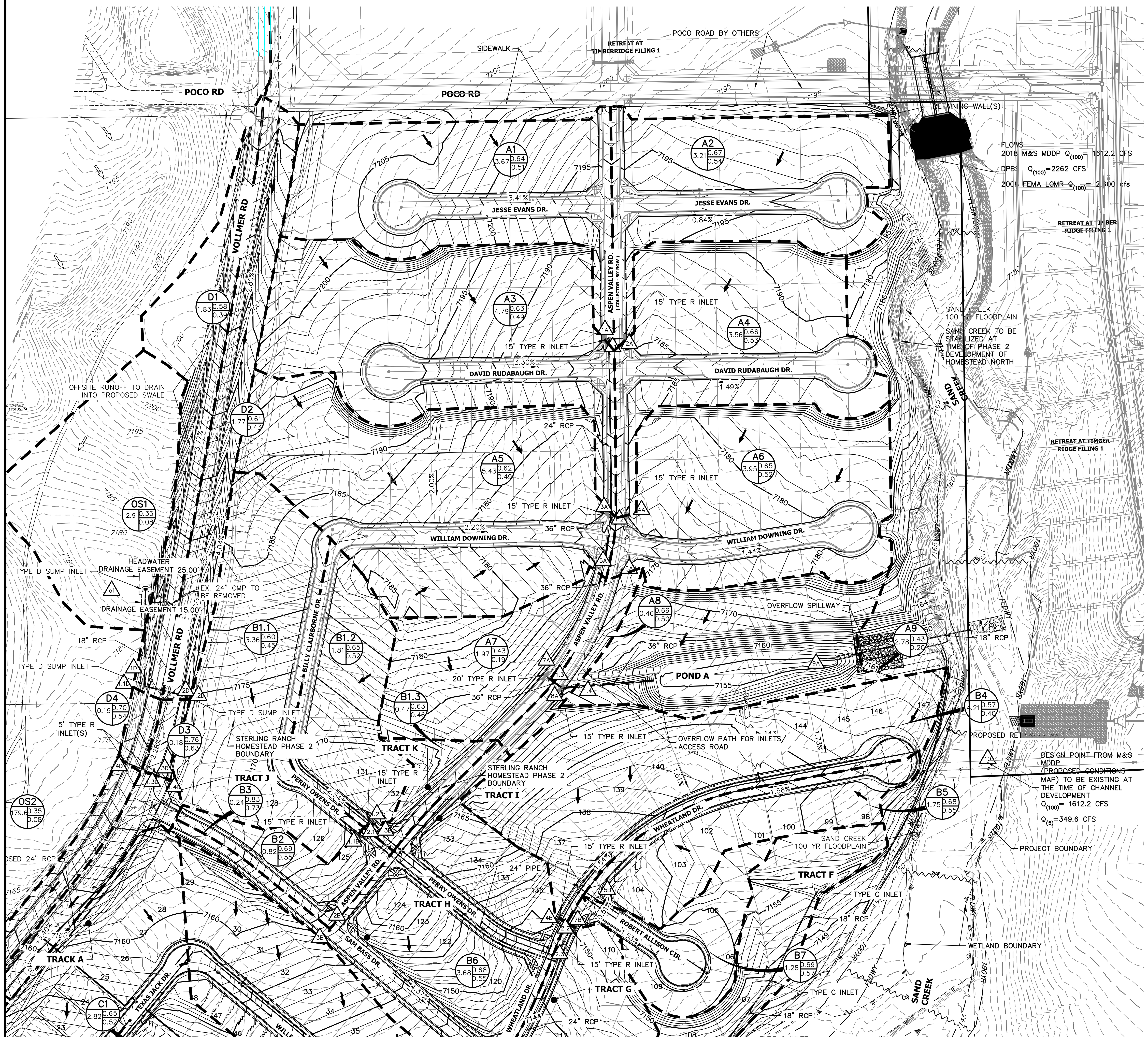
April 1st, 2021
Project No. 25188.00

Prepared By:
JR Engineering, LLC
5475 Tech Center Drive, Suite 235
Colorado Springs, CO 80919
719-593-2593

PCD Filing No.:
SP-20-008

J·R ENGINEERING

DRAINAGE MAP



SEE SHEET 2

LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C -100 YR
D: C-5 YR

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100

PROPOSED 6100

DESIGN POINT SUMMARY TABLE		
DP	Q5	Q100
	Total	Total
1a	6.9	14.7
3a	8.3	20.5
5a	9.5	26.1
7a	10.4	29.9
2a	6.4	13.3
1.1	13.0	18.7
4a	6.6	15.2
1.2	23.5	48.1
6a	10.7	18.5
1.3	43.6	94.5
8a	11.3	20.0
1.4	44.4	96.2
9A	21.6	103.0
1.1b	5.5	12.5
1.2b	3.5	7.4
2.1	8.7	17.5
1.3b	1.0	2.2
2b	2.4	6.8
3b	0.9	1.7
4b	7.1	16.8
6b	10.3	26.5
9b	12.1	30.3
5b	4.3	8.9
7b	7.3	14.9
2.2	16.3	32.9
2.3	23.5	47.3
8b	5.0	13.1
2.4	35.6	77.6
10b	5.7	14.3
2.5	42.5	91.5
11b	0.9	3.7
12b	1.5	4.1
2.6	46.1	102.6
1c	5.4	11.4
2.3c	7.1	14.9
2.1C	0.8	1.6
2.2C	9.8	20.1
4.2c	5.9	13.2
3.1	6.5	11.7
4C	18.9	41.9
3.1c	1.2	2.4
3.2	7.9	12.6
3.2c	3.6	7.9
3.3	14.3	24.1
3.4	31.5	63.1
5C	4.1	8.8
3.5	34.5	69.7
6C	2.5	8.8
3.6	41.4	78.9
1o	0.8	6.0
1d	2.4	6.0
1.1d	3.2	11.6
2d	2.5	6.1
1.2d	5.7	17.7
3d	0.6	1.2
4d	1.0	1.1
1.3d	0.5	2.2
1.4d	6.4	19.2
2o	27.1	190.9
6d	2.5	4.6
5d	3.1	6.1
1.5d	29.2	195.0
1.6d	32.6	205.3
3o	1.7	12.6
8d	2.5	14.4
7d	2.8	4.7
2.1d	3.5	16.1
1.7d	36.0	220.9
5	56.0	264.1

BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C5	C100	tc (min)	Q5 (cfs)	Q100 (cfs)
A1	3.67	52%	0.51	0.64	13.3	6.9	14.7
A2	3.21	57%	0.54	0.67	13.7	6.4	13.3
A3	4.79	50%	0.49	0.63	13.9	8.5	18.4
A4	3.56	55%	0.53	0.66	14.0	6.8	14.2
A5	5.43	50%	0.49	0.62	11.1	10.5	22.6
A6	3.95	53%	0.52	0.65	12.5	7.7	16.2
A7	1.97	15%	0.19	0.43	16.5	1.3	4.8
A8	0.46	52%	0.50	0.66	5.0	1.2	2.6
A9	2.78	16%	0.20	0.43	13.4	2.1	7.4
B1.1	3.36	45%	0.45	0.60	13.4	5.5	12.5
B1.2	1.81	54%	0.52	0.65	12.8	3.5	7.4
B1.3	0.47	47%	0.46	0.63	8.1	1.0	2.2
B2	0.82	58%	0.55	0.69	5.0	2.3	4.9
B3	0.24	79%	0.73	0.83	5.0	0.9	1.7
B4	4.21	39%	0.40	0.57	9.5	7.1	16.8
B5	1.75	58%	0.55	0.68	7.8	4.3	8.9
B6	3.66	57%	0.55	0.68	6.6	9.5	19.9
B7	1.28	60%	0.57	0.69	8.9	3.1	6.4
B8	2.30	55%	0.53	0.66	9.6	5.1	10.7
B9	3.69	65%	0.50	0.64	13.1	6.9	14.8
B10	0.22	80%	0.73	0.83	5.0	0.8	1.6
B11	1.65	15%	0.16	0.40	16.7	0.9	3.7
B12	2.40	40%	0.30	0.50	39.8	1.5	4.1
C1	2.82	69%	0.52	0.65	13.1	5.4	11.4
C2.1	0.20	91%	0.82	0.90	5.0	0.8	1.6
C2.2	4.69	73%	0.56	0.68	12.8	9.9	20.3
C2.3	0.83	67%	0.54	0.68	10.1	1.9	3.9
C3.1	0.35	73%	0.68	0.79	5.0	1.2	2.4
C3.2	1.46	71%	0.56	0.68	8.4	3.6	7.4
C4.1	6.35	65%	0.49	0.63	12.1	12.0	25.8
C4.2	3.44	59%	0.46	0.61	12.7	5.9	13.2
C5	0.16	81%	0.74	0.84	7.2	0.6	1.0
C6	2.48	21%	0.22	0.45	6.8	2.5	8.8
D1	1.83	39%	0.39	0.58	16.7	2.4	6.0
D2	1.77	43%	0.43	0.61	16.3	2.5	6.1
D3	0.18	68%	0.63	0.76	5.4	0.6	1.2
D4	0.19	57%	0.54	0.70	6.3	0.5	1.1
D5	0.91	77%	0.71	0.82	6.0	3.1	6.1
D6	0.83	69%	0.64	0.77	6.4	2.5	5.2
D7	0.75	79%	0.72	0.83	5.0	2.8	5.4
D8	0.72	69%	0.64	0.77	5.0	2.4	4.8
OS1	2.85	2%	0.08	0.35	14.5	0.8	6.0
OS2	179.61	2%	0.08	0.35	47.4	27.1	190.9
OS3	11.99	2%	0.08	0.35	47.6	1.7	12.6

DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
3/23/22
SHEET 1 OF 2

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

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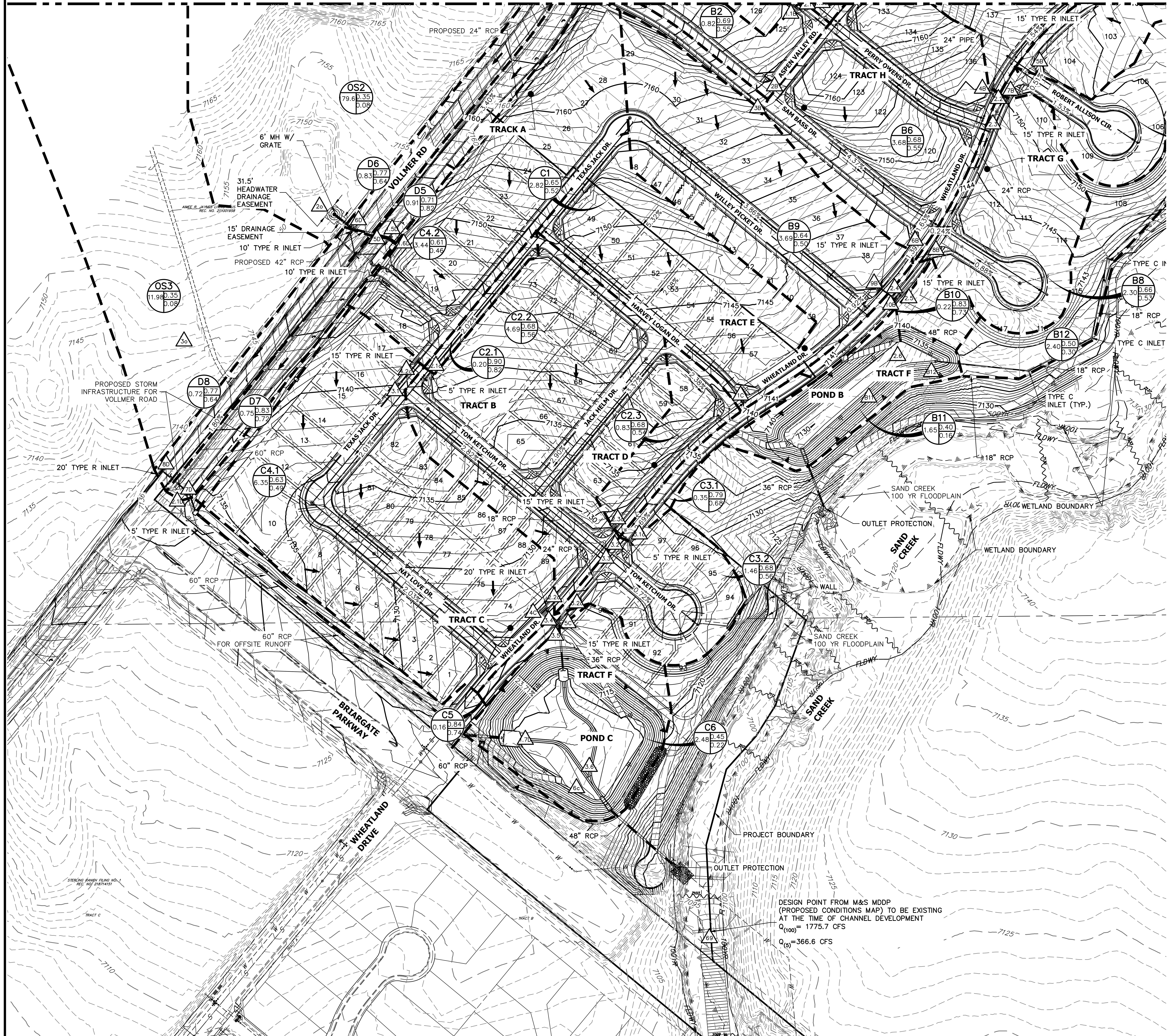
DRAINAGE MAP

SEE SHEET 1



LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C -100 YR
D: C-5 YR

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100

PROPOSED 6100

DESIGN POINT SUMMARY TABLE

DP	Q5 Total	Q100 Total
1a	6.9	14.7
3a	8.3	20.5
5a	9.5	26.1
7a	10.4	29.9
2a	6.4	13.3
1.1	13.0	18.7
4a	6.6	15.2
1.2	23.5	48.1
6a	10.7	18.5
1.3	43.6	94.5
8a	11.3	20.0
1.4	44.4	96.2
9A	21.6	103.0
1.1b	5.5	12.5
1.2b	3.5	7.4
2.1	8.7	17.5
1.3b	1.0	2.2
2b	2.4	6.8
3b	0.9	1.7
4b	7.1	16.8
6b	10.3	26.5
9b	12.1	30.3
5b	4.3	8.9
7b	7.3	14.9
2.2	16.3	32.9
2.3	23.5	47.3
8b	5.0	13.1
2.4	35.6	77.6
10b	5.7	14.3
2.5	42.5	91.5
11b	0.9	3.7
12b	1.5	4.1
2.6	46.1	102.6
1c	5.4	11.4
2.3c	7.1	14.9
2.1C	0.8	1.6
2.2C	9.8	20.1
4.2c	5.9	13.2
3.1	6.5	11.7
4C	18.9	41.9
3.1c	1.2	2.4
3.2	7.9	12.6
3.2c	3.6	7.9
3.3	14.3	24.1
3.4	31.5	63.1
5C	4.1	8.8
3.5	34.5	69.7
6C	2.5	8.8
3.6	41.4	78.9
1o	0.8	6.0
1d	2.4	6.0
1.1d	3.2	11.6
2d	2.5	6.1
1.2d	5.7	17.7
3d	0.6	1.2
4d	1.0	1.1
1.3d	0.5	2.2
1.4d	6.4	19.2
2o	27.1	190.9
6d	2.5	4.6
5d	3.1	6.1
1.5d	29.2	195.0
1.6d	32.6	205.3
3o	1.7	12.6
8d	2.5	14.4
7d	2.8	4.7
2.1d	3.5	16.1
1.7d	36.0	220.9
5	56.0	264.1

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C5	C100	tc (min)	Q5 (cfs)	Q100 (cfs)
A1	3.67	52%	0.51	0.64	13.3	6.9	14.7
A2	3.21	57%	0.54	0.67	13.7	6.4	13.3
A3	4.79	50%	0.49	0.63	13.9	8.5	18.4
A4	3.56	55%	0.53	0.66	14.0	6.8	14.2
A5	5.43	50%	0.49	0.62	11.1	10.5	22.6
A6	3.95	53%	0.52	0.65	12.5	7.7	16.2
A7	1.97	15%	0.19	0.43	16.5	1.3	4.8
A8	0.46	52%	0.50	0.66	5.0	1.2	2.6
A9	2.78	16%	0.20	0.43	13.4	2.1	7.4
B1.1	3.36	45%	0.45	0.60	13.4	5.5	12.5
B1.2	1.81	54%	0.52	0.65	12.8	3.5	7.4
B1.3	0.47	47%	0.46	0.63	8.1	1.0	2.2
B2	0.82	58%	0.55	0.69	5.0	2.3	4.9
B3	0.24	79%	0.73	0.83	5.0	0.9	1.7
B4	4.21	39%	0.40	0.57	9.5	7.1	16.8
B5	1.75	58%	0.55	0.68	7.8	4.3	8.9
B6	3.66	57%	0.55	0.68	6.6	9.5	19.9
B7	1.28	60%	0.57	0.69	8.9	3.1	6.4
B8	2.30	55%	0.53	0.66	9.6	5.1	10.7
B9	3.69	65%	0.50	0.64	13.1	6.9	14.8
B10	0.22	80%	0.73	0.83	5.0	0.8	1.6
B11	1.65	15%	0.16	0.40	16.7	0.9	3.7
B12	2.40	40%	0.30	0.50	39.8	1.5	4.1
C1	2.82	69%	0.52	0.65	13.1	5.4	11.4
C2.1	0.20	91%	0.82	0.90	5.0	0.8	1.6
C2.2	4.69	73%	0.56	0.68	12.8	9.9	20.3
C2.3	0.83	67%	0.54	0.68	10.1	1.9	3.9
C3.1	0.35	73%	0.68	0.79	5.0	1.2	2.4
C3.2	1.46	71%	0.56	0.68	8.4	3.6	7.4
C4.1	6.35	65%	0.49	0.63	12.1	12.0	25.8
C4.2	3.44	59%	0.46	0.61	12.7	5.9	13.2
C5	0.16	81%	0.74	0.84	7.2	0.6	1.0
C6	2.48	21%	0.22	0.45	6.8	2.5	8.8
D1	1.83	39%	0.39	0.58	16.7	2.4	6.0
D2	1.77	43%	0.43	0.61	16.3	2.5	6.1
D3	0.18	68%	0.63	0.76	5.4	0.6	1.2
D4	0.19	57%	0.54	0.70	6.3	0.5	1.1
D5	0.91	77%	0.71	0.82	6.0	3.1	6.1
D6	0.83	69%	0.64	0.77	6.4	2.5	5.2
D7	0.75	79%	0.72	0.83	5.0	2.8	5.4
D8	0.72	69%	0.64	0.77	5.0	2.4	4.8
OS1	2.85	2%	0.08	0.35	14.5	0.8	6.0
OS2	179.61	2%	0.08	0.35	47.4	27.1	190.9
OS3	11.99	2%	0.08	0.35	47.6	1.7	12.6

DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
3/23/22
SHEET 2 OF 2

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

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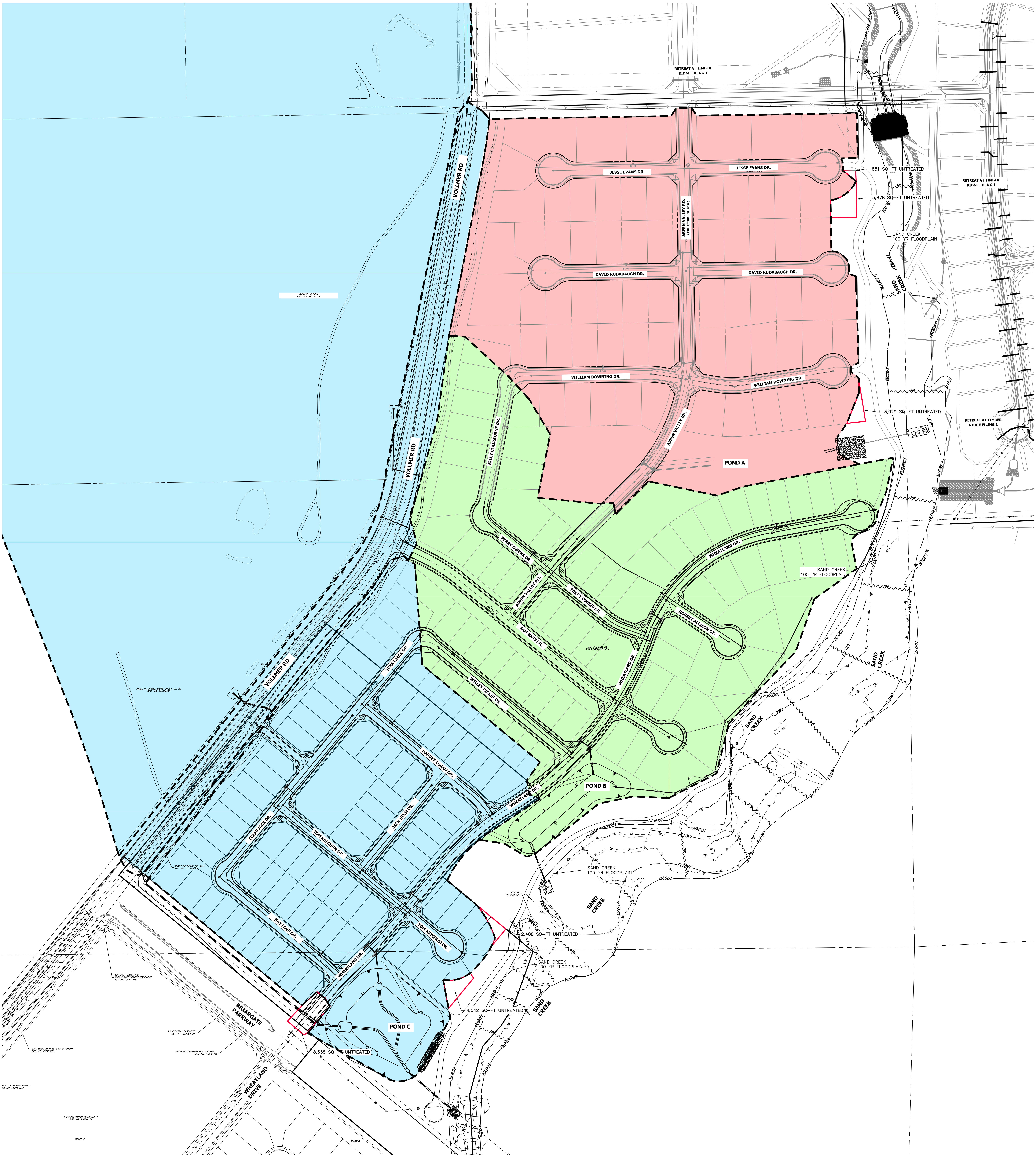
WATER QUALITY CAPTURE PLAN

HOMESTEAD NORTH



(pink)	POND A 29.82 ACRES, 46.5% IMPERVIOUS
(green)	POND B 27.86 ACRES, 50.0% IMPERVIOUS
(blue)	POND C 224.42 ACRES, 10.3% IMPERVIOUS

NOTE:

1. A SEPARATE PLAN FOR STERLING RANCH ROAD AND BRIARGATE PKWY WILL BE PROVIDED IN A THE SEPARATE FDR REQUIRED FOR CONSTRUCTION OF THESE ROADWAYS.
2. A TOTAL OF 20,046 SQ-FT ON SITE IS LEFT UNTREATED.
3. POND C TREATS THE IMPROVEMENTS TO VOLLMER ROAD AND THE OFFSITE TRIBUTARY AREA

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

WQ – PONDS
HOMESTEAD NORTH
JOB NO. 25188.00
03-23-2022
SHEET 1 OF 1

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FINAL DRAINAGE REPORT
FOR
HOMESTEAD NORTH AT STERLING RANCH FILING NO. 1
EL PASO COUNTY, COLORADO

Prepared For:

SR Land, LLC
20 Boulder Crescent, Suite 200
Colorado Springs, CO 80903
(719) 491-3024

June, 2022
Project No. 25188.00

Prepared By:
JR Engineering, LLC
5475 Tech Center Drive, Suite 235
Colorado Springs, CO 80919
719-593-2593

PCD Filing No.:
SF-22-2213

J·R ENGINEERING

DRAINAGE MAP

SEE SHEET 2

LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C -100 YR
D: C-5 YR

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100

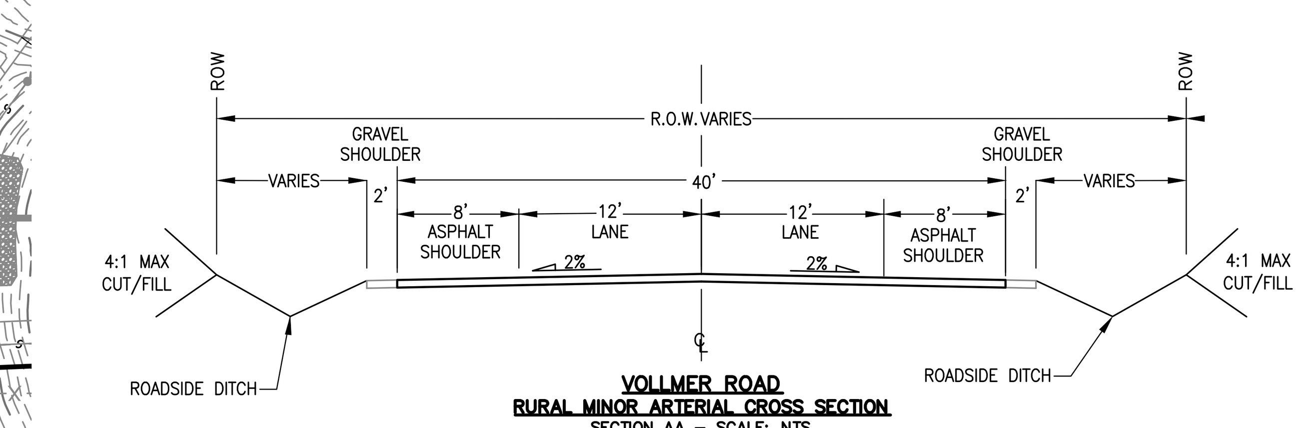
PROPOSED 6100

BASIN SUMMARY TABLE

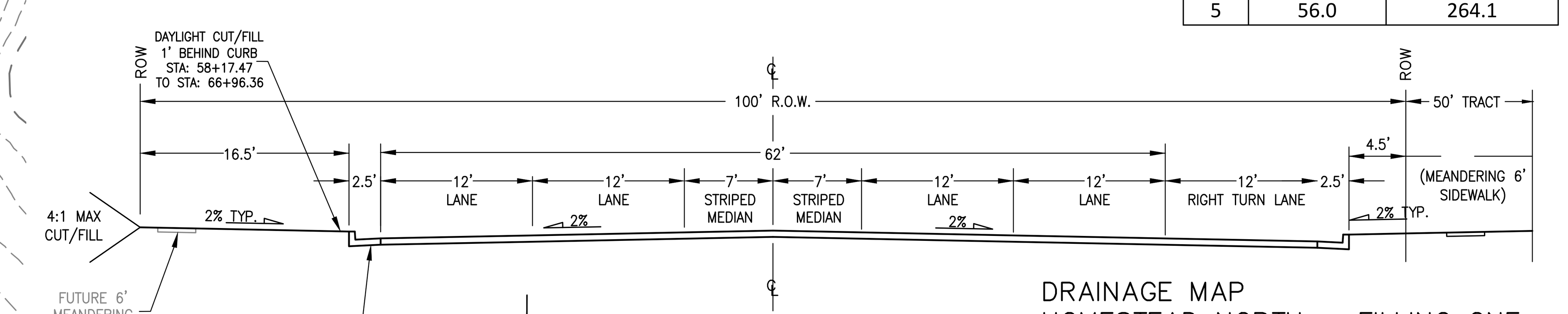
Tributary Sub-basin	Area (acres)	Percent Impervious	C5	C100	tc (min)	Q5 (cfs)	Q100 (cfs)
C1	2.82	69%	0.52	0.65	13.1	5.4	11.4
C2.1	0.20	91%	0.82	0.90	5.0	0.8	1.6
C2.2	4.69	73%	0.56	0.68	12.8	9.9	20.3
C2.3	0.83	67%	0.54	0.68	10.1	1.9	3.9
C3.1	0.35	73%	0.68	0.79	5.0	1.2	2.4
C3.2	1.46	71%	0.56	0.68	8.4	3.6	7.4
C4.1	6.34	65%	0.49	0.63	12.0	12.1	25.9
C4.2	3.59	57%	0.44	0.58	12.9	5.9	13.1
C5	0.16	81%	0.74	0.84	6.4	0.6	1.0
C6	2.59	20%	0.21	0.43	6.8	2.5	8.8
D1	1.77	40%	0.40	0.60	16.5	2.4	6.0
D2	1.44	56%	0.55	0.78	15.0	2.8	6.6
D3	0.18	68%	0.63	0.76	5.4	0.6	1.2
D4	0.19	57%	0.54	0.70	6.3	0.5	1.1
D5	0.91	77%	0.71	0.82	6.0	3.1	6.1
D6	0.83	69%	0.64	0.77	6.4	2.5	5.2
D7	0.75	79%	0.72	0.82	5.0	2.8	5.3
D8	0.72	69%	0.64	0.74	5.0	2.4	4.6
OS1	2.84	2%	0.08	0.35	14.5	0.8	6.0
OS2	179.61	2%	0.08	0.35	47.4	27.1	190.9
OS3	11.98	2%	0.08	0.35	47.6	1.7	12.6

DESIGN POINT SUMMARY TABLE

DP	Q5 Total	Q100 Total
1c	5.4	11.4
2.3c	7.1	14.9
2.3i	7.0	11.5
2.1c	0.8	1.6
2.1i	0.8	1.5
2.2C	9.8	20.1
4.2c	5.9	13.1
4.2i	5.9	10.5
4C	18.8	41.8
3.1	4.7	11.6
3.1c	1.2	2.4
3.1i	1.2	1.9
3.2	7.9	12.9
3.3	9.1	17.6
3.4	26.0	54.9
3.2c	3.6	7.8
5C	4.1	8.7
6C	2.5	8.8
3.5	30.7	65.0
o1	0.8	6.0
1d	2.4	6.0
1.1d	3.2	11.7
2d	2.8	6.6
1.2d	5.8	18.0
3d	0.6	1.2
4d	0.5	1.1
4.1d	0.5	1.1
1.3d	1.0	2.2
1.4d	6.6	19.6
2o	27.1	190.9
6d	2.1	4.3
6.1d	28.1	192.5
1.5d	29.2	195.0
5d	3.1	6.1
1.6d	32.7	205.4
1.7d	36.1	221.0
3o	1.7	12.6
8d	2.5	14.3
2.1d	2.5	13.2
7d	2.4	5.3
2.2d	3.5	16.0
1.7d	36.1	221.0
5	56.0	264.1



VOLLMER ROAD
RURAL MINOR ARTERIAL CROSS SECTION
SECTION AA - SCALE: NTS



VOLLMER ROAD
URBAN MINOR ARTERIAL CROSS SECTION
SECTION BB - SCALE: NTS

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

DRAINAGE MAP
HOMESTEAD NORTH - FILLING ONE
JOB NO. 25188.00
6/13/22
SHEET 1 OF 2

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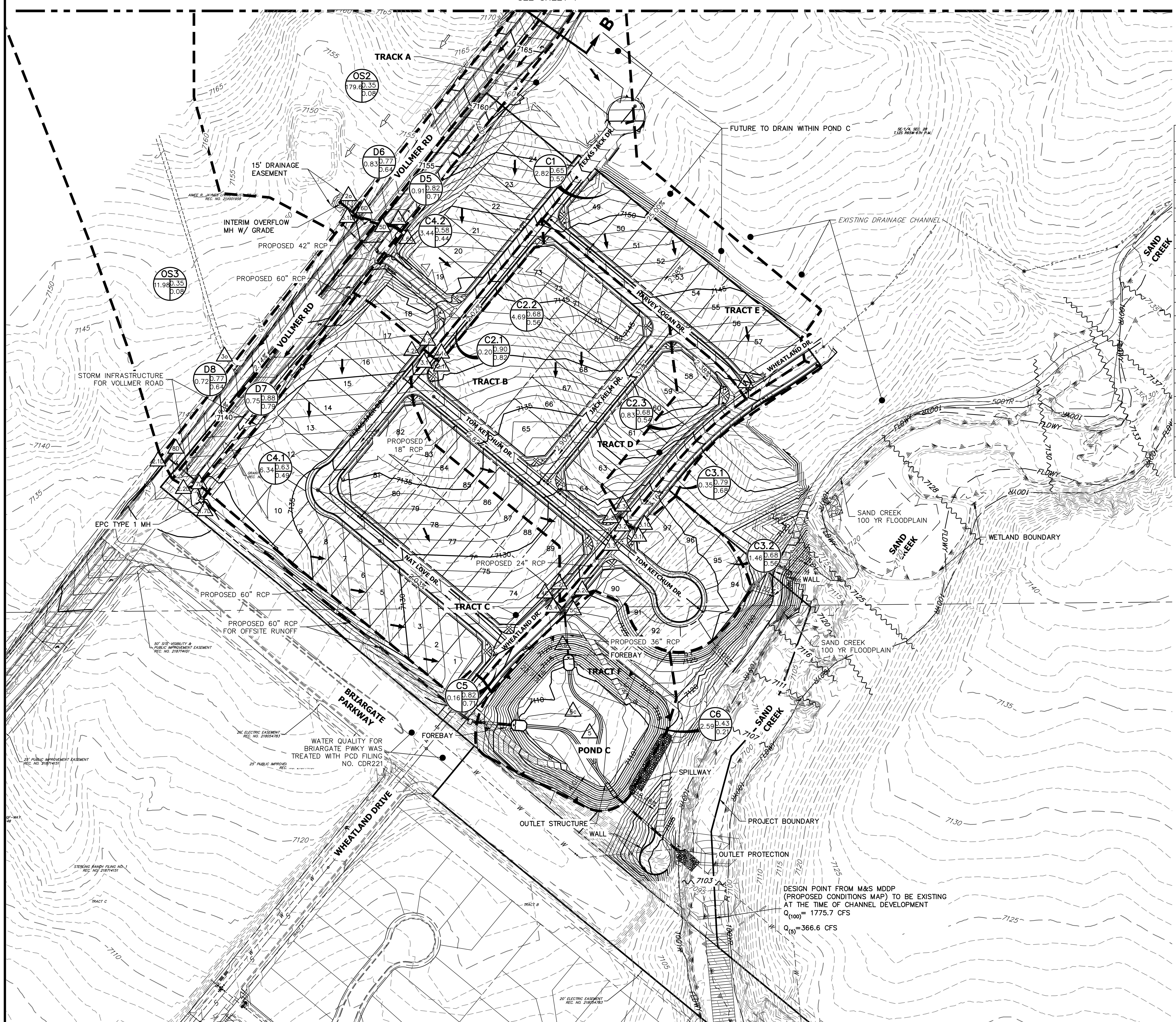
DRAINAGE MAP



LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C -100 YR
D: C-5 YR

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100

PROPOSED 6100

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C5	C100	tc (min)	Q5 (cfs)	Q100 (cfs)
C1	2.82	69%	0.52	0.65	13.1	5.4	11.4
C2.1	0.20	91%	0.82	0.90	5.0	0.8	1.6
C2.2	4.69	73%	0.56	0.68	12.8	9.9	20.3
C2.3	0.83	67%	0.54	0.68	10.1	1.9	3.9
C3.1	0.35	73%	0.68	0.79	5.0	1.2	2.4
C3.2	1.46	71%	0.56	0.68	8.4	3.6	7.4
C4.1	6.34	65%	0.49	0.63	12.0	12.1	25.9
C4.2	3.59	57%	0.44	0.58	12.9	5.9	13.1
C5	0.16	81%	0.74	0.84	6.4	0.6	1.0
C6	2.59	20%	0.21	0.43	6.8	2.5	8.8
D1	1.77	40%	0.40	0.60	16.5	2.4	6.0
D2	1.44	56%	0.55	0.78	15.0	2.8	6.6
D3	0.18	68%	0.63	0.76	5.4	0.6	1.2
D4	0.19	57%	0.54	0.70	6.3	0.5	1.1
D5	0.91	77%	0.71	0.82	6.0	3.1	6.1
D6	0.83	69%	0.64	0.77	6.4	2.5	5.2
D7	0.75	79%	0.72	0.82	5.0	2.8	5.3
D8	0.72	69%	0.64	0.74	5.0	2.4	4.6
OS1	2.84	2%	0.08	0.35	14.5	0.8	6.0
OS2	179.61	2%	0.08	0.35	47.4	27.1	190.9
OS3	11.98	2%	0.08	0.35	47.6	1.7	12.6

DESIGN POINT SUMMARY TABLE

DP	Q5 Total	Q100 Total
1c	5.4	11.4
2.3c	7.1	14.9
2.3i	7.0	11.5
2.1c	0.8	1.6
2.1i	0.8	1.5
2.2C	9.8	20.1
4.2c	5.9	13.1
4.2i	5.9	10.5
4C	18.8	41.8
3.1	4.7	11.6
3.1c	1.2	2.4
3.1i	1.2	1.9
3.2	7.9	12.9
3.3	9.1	17.6
3.4	26.0	54.9
3.2c	3.6	7.8
5C	4.1	8.7
6C	2.5	8.8
3.5	30.7	65.0
o1	0.8	6.0
1d	2.4	6.0
1.1d	3.2	11.7
2d	2.8	6.6
1.2d	5.8	18.0
3d	0.6	1.2
4d	0.5	1.1
4.1d	0.5	1.1
1.3d	1.0	2.2
1.4d	6.6	19.6
2o	27.1	190.9
6d	2.1	4.3
6.1d	28.1	192.5
1.5d	29.2	195.0
5d	3.1	6.1
1.6d	32.7	205.4
1.7d	36.1	221.0
3o	1.7	12.6
8d	2.5	14.3
2.1d	2.5	13.2
7d	2.4	5.3
2.2d	3.5	16.0
1.7d	36.1	221.0
5	56.0	264.1

Design Point	Inlet Size
Inlet DP 2.3C	15' Type R
Inlet DP 2.1C	5' Type R
Inlet DP 4.2C	15' Type R
Inlet DP 3.1C	5' Type R
Inlet DP 4C	15' Type R
Inlet DP 5C	15' Type R
Inlet DP 3D	5' Type R
Inlet DP 4D	5' Type R
Inlet DP 5D	10' Type R
Inlet DP 6D	10' Type R
Inlet DP 7D	10' Type R
Inlet DP 8D	20' Type R
Inlet DP 1D	Type D Inlet
Inlet DP 2D	Type D Inlet

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

DRAINAGE MAP
HOMESTEAD NORTH FILLING NO. 1
JOB NO. 25188.00
6/13/22
SHEET 2 OF 2

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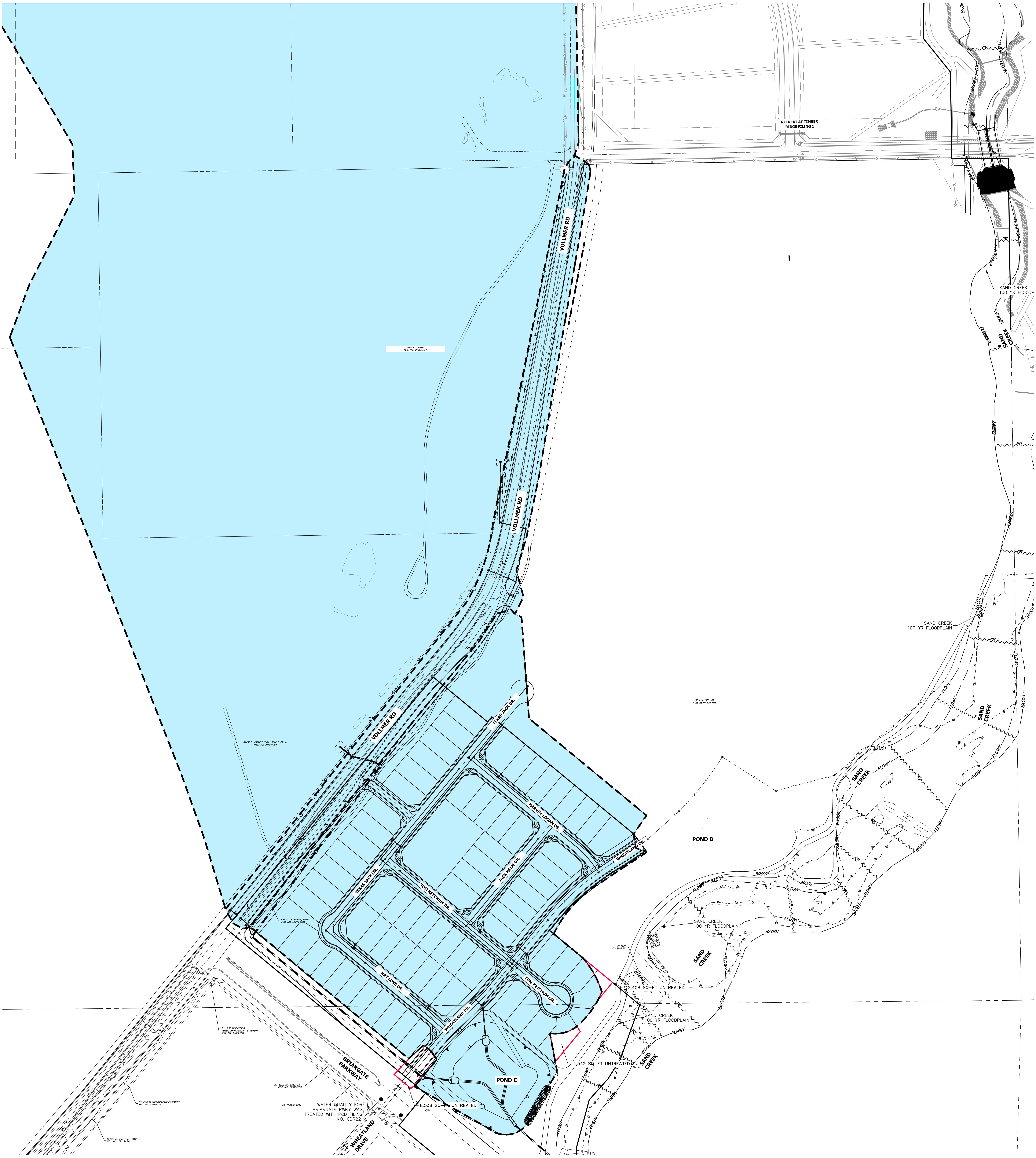
WATER QUALITY CAPTURE PLAN

HOMESTEAD NORTH



NOTE:

1. A SEPARATE PLAN FOR STERLING RANCH ROAD AND BRIARGATE PKWY WILL BE PROVIDED IN A THE SEPARATE FDR REQUIRED FOR CONSTRUCTION OF THESE ROADWAYS.
2. A TOTAL OF 15,488 SQ-FT ON SITE IS LEFT UNTREATED.
3. POND C TREATS THE IMPROVEMENTS TO VOLLMER ROAD AND THE OFFSITE TRIBUTARY AREA

POND C 224.3 ACRES, 10.3% IMPERVIOUS

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

WQ – POND C
HOMESTEAD NORTH – FILING ONE
JOB NO. 25188.00
06-13-2022
SHEET 1 OF 1

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FINAL DRAINAGE REPORT
FOR
HOMESTEAD NORTH AT STERLING RANCH FILING NO. 2

Prepared For:

SR Land, LLC
20 Boulder Crescent, Suite 200
Colorado Springs, CO 80903
(719) 491-3024

July 2022
Project No. 25188.10

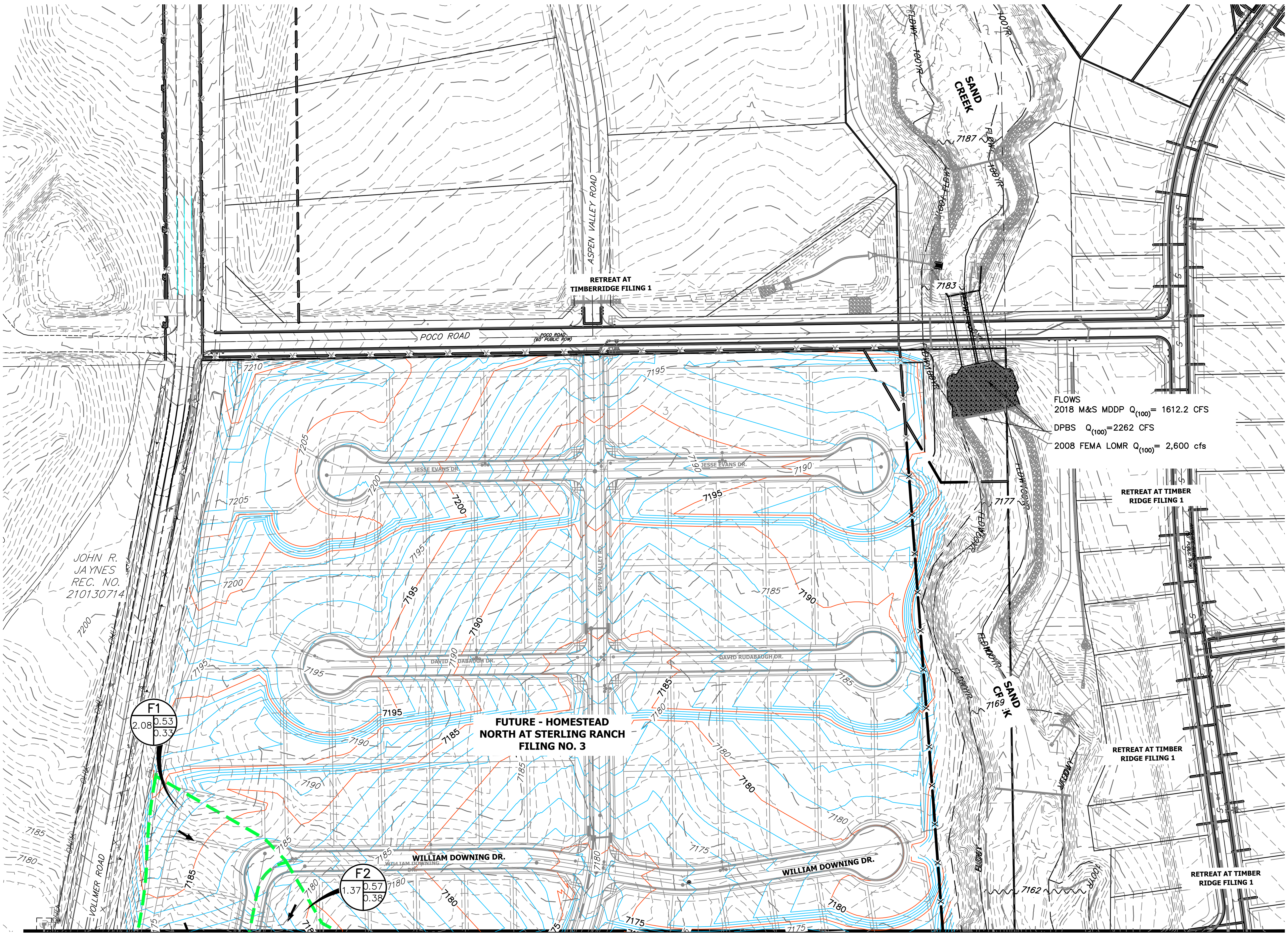
Prepared By:
JR Engineering, LLC
5475 Tech Center Drive, Suite 235
Colorado Springs, CO 80919
719-593-2593

PCD Filing No.:
SF-22-18

J·R ENGINEERING

HOMESTEAD NORTH AT STERLING RANCH FILING NO. 2

DRAINAGE MAP



SEE SHEET 2

LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C -100 YR
D: C-5 YR

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

FUTURE BASIN AREA

PROPOSED R.O.W
PROPOSED PROPERTY LINES
PROPOSED SIDEWALK
EXISTING PROPERTY LINE
ROW EXISTING
FL EXISTING
SIDEWALK EXISTING
DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100
PROPOSED 6100
FUTURE 6100

NOTE: STORM INFRASTRUCTURE IN PUBLIC R.O.W CONSIDERED PUBLIC. ALL OTHER STORM SEWER INFRASTRUCTURE IS PRIVATE UNLESS STATED OTHERWISE.

DESIGN POINT SUMMARY

DP	Q5 Total	Q100 Total
1.1b	5.1	12.1
1.1i	5.1	10.1
1.2b	3.1	7.0
1.2i	3.0	6.8
2.1	8.1	16.9
1.3b	1.1	2.2
2b	2.9	8.1
3b	0.9	1.6
4b	7.1	17.1
4i	6.9	12.9
6b	10.4	26.7
6i	9.0	14.9
9b	7.7	25.3
5b	3.1	6.2
5i	3.1	5.1
2.2	3.1	5.1
7b	4.0	9.0
7i	4.0	8.4
2.3	9.6	17.4
2.4	13.3	25.4
2.5	18.2	36.1
8b	4.7	10.4
2.6	25.5	48.0
2.7	32.4	71.0
10b	5.4	11.7
2.8	36.5	79.9
11b	1.0	4.6
C.1	1.8	3.9
C.2	2.1	5.0
12b	2.1	6.0
3.1	2.1	6.0
13b	0.9	2.1
3.2	2.6	7.1
3.3	2.6	7.1
14b	0.7	1.7
4	40.2	91.5
1F	2.9	7.4
2F	2.1	5.0
3F	0.4	0.6
4F	0.3	0.4

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
B1.1	1.24	52%	0.51	0.64	10.2	2.6	5.5
B1.2	0.42	79%	0.73	0.82	5.0	1.5	2.9
B1.3	0.43	50%	0.49	0.64	7.8	0.9	2.0
B2	0.86	58%	0.55	0.69	5.0	2.4	5.1
B3	0.23	78%	0.72	0.83	5.0	0.9	1.6
B4	3.51	46%	0.46	0.61	9.1	6.9	15.3
B5	1.11	61%	0.58	0.70	6.8	3.1	6.2
B6	3.61	58%	0.55	0.69	6.5	9.5	19.9
B7	1.63	56%	0.54	0.67	7.8	4.0	8.2
B8	2.14	56%	0.54	0.66	8.1	5.1	10.6
B9	3.77	64%	0.50	0.64	11.6	7.3	15.7
B10	0.22	80%	0.73	0.83	5.0	0.8	1.6
B11	1.67	11%	0.14	0.39	9.9	1.0	4.6
B12	2.18	36%	0.29	0.49	16.6	2.1	6.0
B13	0.43	54%	0.39	0.55	5.0	0.9	2.1
B14	0.42	45%	0.33	0.52	6.2	0.7	1.7
C-1	0.92	67%	0.48	0.61	10.1	1.8	3.9
C-2	1.24	52%	0.40	0.57	9.3	2.1	5.0
F1	2.08	43%	0.36	0.55	12.1	2.9	7.4
F2	1.37	48%	0.38	0.57	11.7	2.1	5.0
F3	0.08	100%	0.90	0.96	5.0	0.4	0.6
F4	0.06	100%	0.90	0.96	5.0	0.3	0.4
F5	0.69	2%	0.09	0.36	5.0	0.3	2.2

DRAINAGE MAP
HOMESTEAD NORTH AT STERLING RANCH FILING NO. 2
JOB NO. 25188.10
02-24-2022
SHEET 1 OF 2

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

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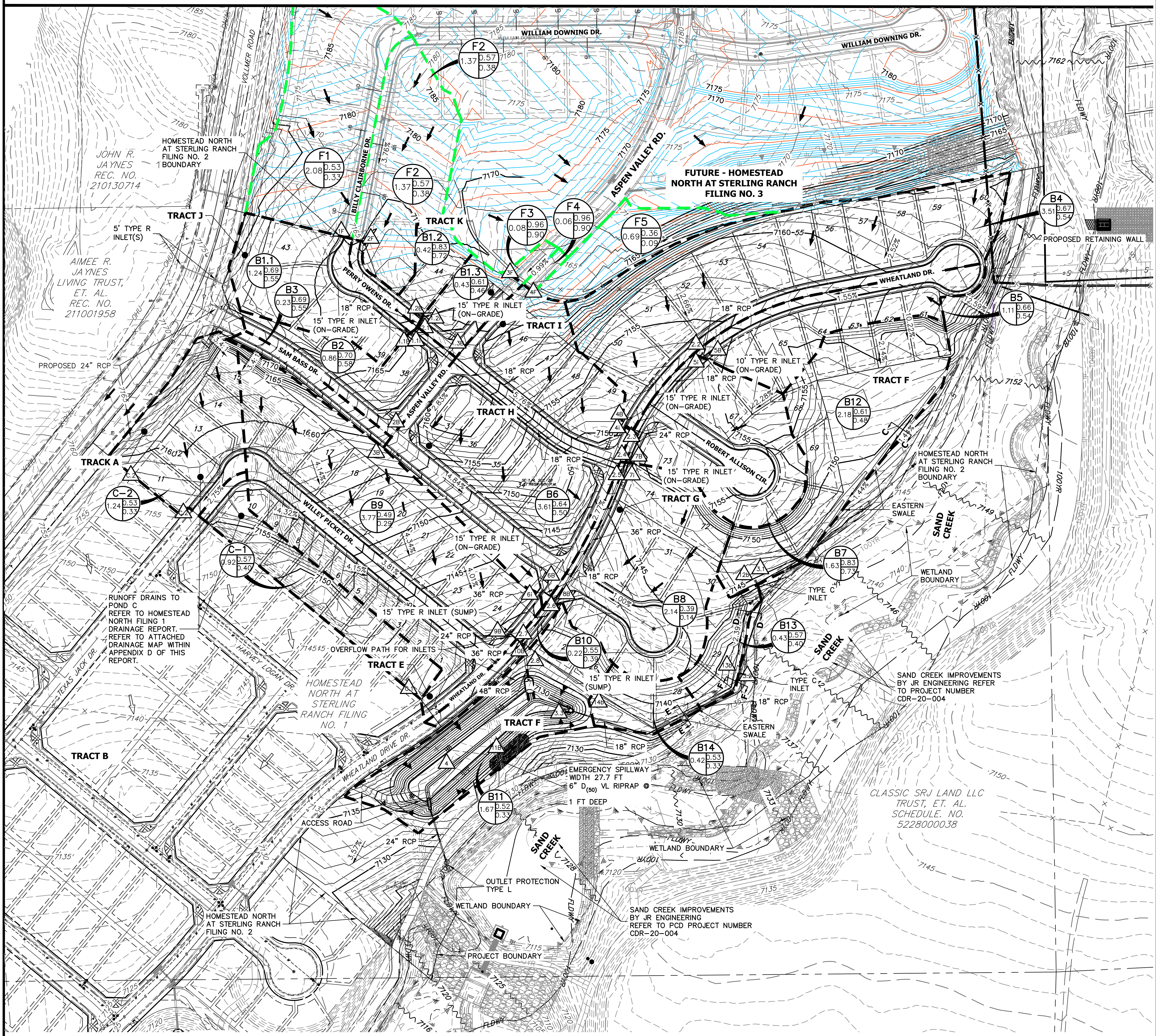
HOMESTEAD NORTH AT STERLING RANCH FILING NO. 2

FUTURE DRAINAGE MAP

SEE SHEET 1



LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C -100 YR
D: C-5 YR

DESIGN POINT

PROPOSED FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

STORM SEWER PROPOSED

FUTURE BASIN AREA

PROPOSED R.O.W

PROPOSED PROPERTY LINES

PROPOSED SIDEWALK

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

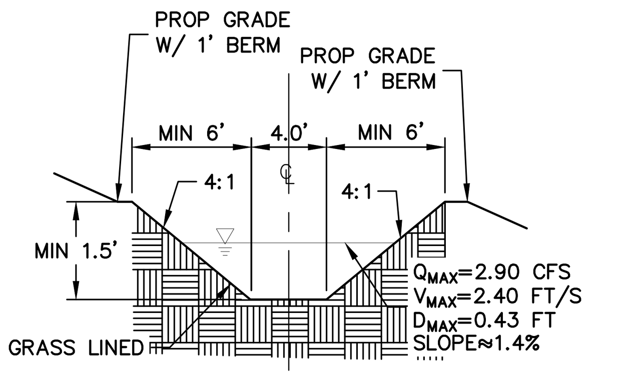
DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING 6100

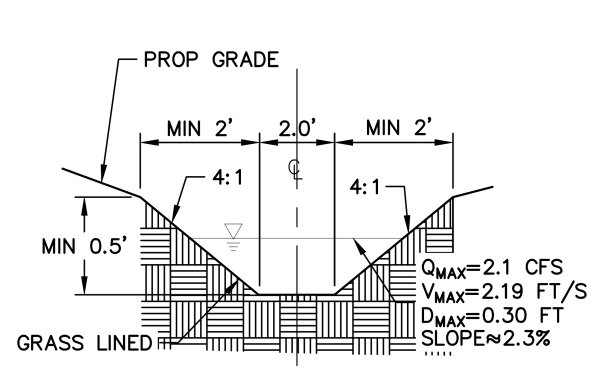
PROPOSED 6100

FUTURE 6100

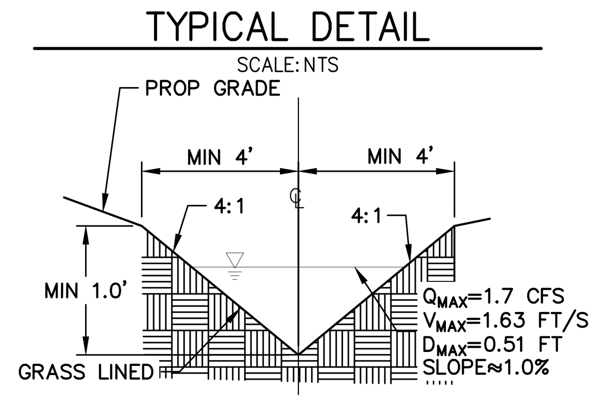
NOTE: STORM INFRASTRUCTURE IN PUBLIC R.O.W CONSIDERED PUBLIC. ALL OTHER STORM SEWER INFRASTRUCTURE IS PRIVATE UNLESS STATED OTHERWISE.



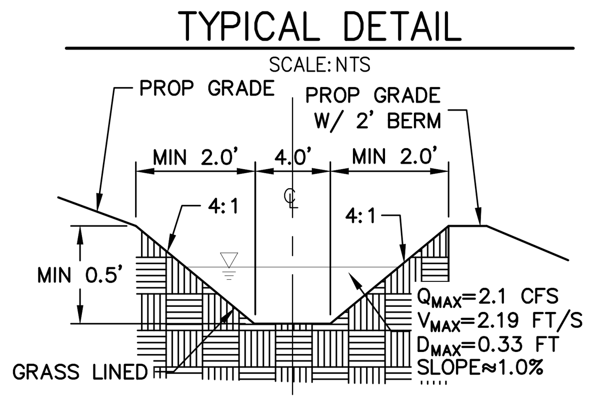
SWALE SECTION C–C
TYPICAL DETAIL
SCALE: NTS



SWALE SECTION D–D
TYPICAL DETAIL
SCALE: NTS



SWALE SECTION E–E
TYPICAL DETAIL
SCALE: NTS



SWALE SECTION F–F
TYPICAL DETAIL
SCALE: NTS

DESIGN POINT SUMMARY

DP	Q5 Total	Q100 Total
1.1b	5.1	12.1
1.1i	5.1	10.1
1.2b	3.1	7.0
1.2i	3.0	6.8
2.1	8.1	16.9
1.3b	1.1	2.2
2b	2.9	8.1
3b	0.9	1.6
4b	7.1	17.1
4i	6.9	12.9
6b	10.4	26.7
6i	9.0	14.9
9b	7.7	25.3
5b	3.1	6.2
5i	3.1	5.1
2.2	3.1	5.1
7b	4.0	9.0
7i	4.0	8.4
2.3	9.6	17.4
2.4	13.3	25.4
2.5	18.2	36.1
8b	4.7	10.4
2.6	25.5	48.0
2.7	32.4	71.0
10b	5.4	11.7
2.8	36.5	79.9
11b	1.0	4.6
C.1	1.8	3.9
C.2	2.1	5.0
12b	2.1	6.0
3.1	2.1	6.0
13b	0.9	2.1
3.2	2.6	7.1
3.3	2.6	7.1
14b	0.7	1.7
4	40.2	91.5
1F	2.9	7.4
2F	2.1	5.0
3F	0.4	0.6
4F	0.3	0.4

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
B1.1	1.24	52%	0.51	0.64	10.2	2.6	5.5
B1.2	0.42	79%	0.73	0.82	5.0	1.5	2.9
B1.3	0.43	50%	0.49	0.64	7.8	0.9	2.0
B2	0.86	58%	0.55	0.69	5.0	2.4	5.1
B3	0.23	78%	0.72	0.83	5.0	0.9	1.6
B4	3.51	46%	0.46	0.61	9.1	6.9	15.3
B5	1.11	61%	0.58	0.70	6.8	3.1	6.2
B6	3.61	58%	0.55	0.69	6.5	9.5	19.9
B7	1.63	56%	0.54	0.67	7.8	4.0	8.2
B8	2.14	56%	0.54	0.66	8.1	5.1	10.6
B9	3.77	64%	0.50	0.64	11.6	7.3	15.7
B10	0.22	80%	0.73	0.83	5.0	0.8	1.6
B11	1.67	11%	0.14	0.39	9.9	1.0	4.6
B12	2.18	36%	0.29	0.49	16.6	2.1	6.0
B13	0.43	54%	0.39	0.55	5.0	0.9	2.1
B14	0.42	45%	0.33	0.52	6.2	0.7	1.7
C-1	0.92	67%	0.48	0.61	10.1	1.8	3.9
C-2	1.24	52%	0.40	0.57	9.3	2.1	5.0
F1	2.08	43%	0.36	0.55	12.1	2.9	7.4
F2	1.37	48%	0.38	0.57	11.7	2.1	5.0
F3	0.08	100%	0.90	0.96	5.0	0.4	0.6
F4	0.06	100%	0.90	0.96	5.0	0.3	0.4
F5	0.69	2%	0.09	0.36	5.0	0.3	2.2

DRAINAGE MAP
HOMESTEAD NORTH AT STERLING RANCH FILING NO. 2
JOB NO. 25188.10
07-15-2022
SHEET 2 OF 2

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

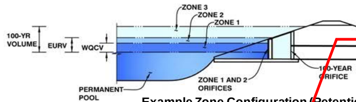
J·R ENGINEERING
A Westrian Company
Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: 25188.10 Homestead North Filing No. 2

Basin ID: Pond B



See app C for up-dated sizing.

Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	27.69	acres
Watershed Length =	1,600	ft
Watershed Length to Centroid =	960	ft
Watershed Slope =	0.032	ft/ft
Watershed Imperviousness =	44.40%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.442	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	1.302	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.255	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	1.836	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	2.352	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	3.073	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.644	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.379	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 4 in.) =	7.939	acre-feet	4.00	inches
Approximate 2-yr Detention Volume =	0.970	acre-feet		
Approximate 5-yr Detention Volume =	1.343	acre-feet		
Approximate 10-yr Detention Volume =	1.815	acre-feet		
Approximate 25-yr Detention Volume =	2.007	acre-feet		
Approximate 50-yr Detention Volume =	2.102	acre-feet		
Approximate 100-yr Detention Volume =	2.380	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.442	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.860	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.078	acre-feet
Total Detention Basin Volume =	2.380	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	user	acre-feet

	Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
25.59	Top of Micropool	--	0.00	--	--	--	10	0.000		
	7125.92	--	0.33	--	--	--	49	0.001	10	0.000
	7126	--	0.41	--	--	--	65	0.001	14	0.000
	7127	--	1.41	--	--	--	3,181	0.073	1,637	0.038
	7128	--	2.41	--	--	--	12,986	0.298	9,720	0.223
	7129	--	3.41	--	--	--	18,085	0.415	25,256	0.580
	7130	--	4.41	--	--	--	21,210	0.487	44,903	1.031
	7131	--	5.41	--	--	--	24,408	0.560	67,712	1.554
	7132	--	6.41	--	--	--	27,857	0.640	93,844	2.154
	7133	--	7.41	--	--	--	31,439	0.722	123,492	2.835
	7134	--	8.41	--	--	--	35,190	0.808	156,807	3.600
	7135	--	9.41	--	--	--	37,675	0.865	193,239	4.436
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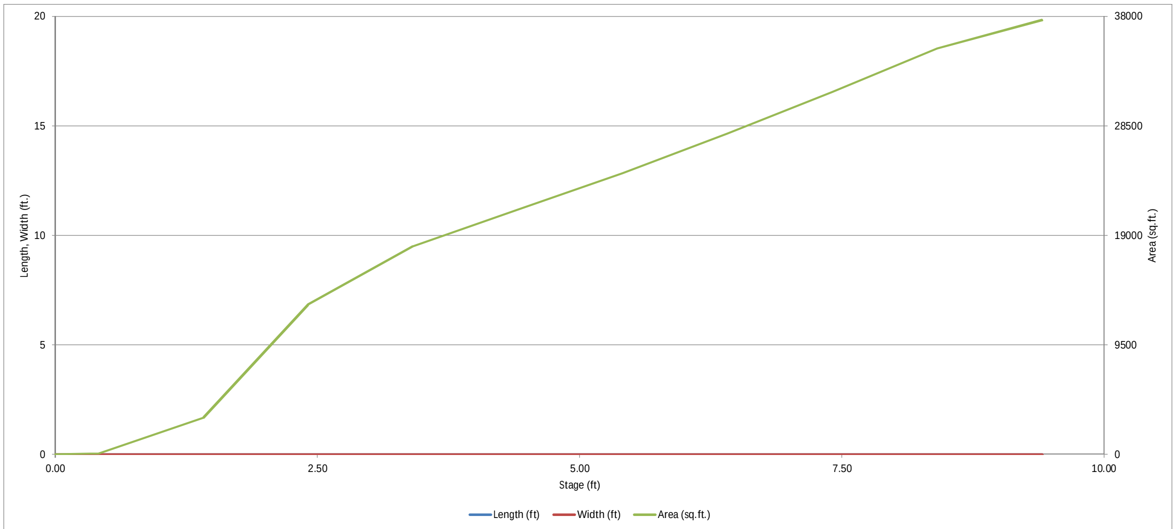
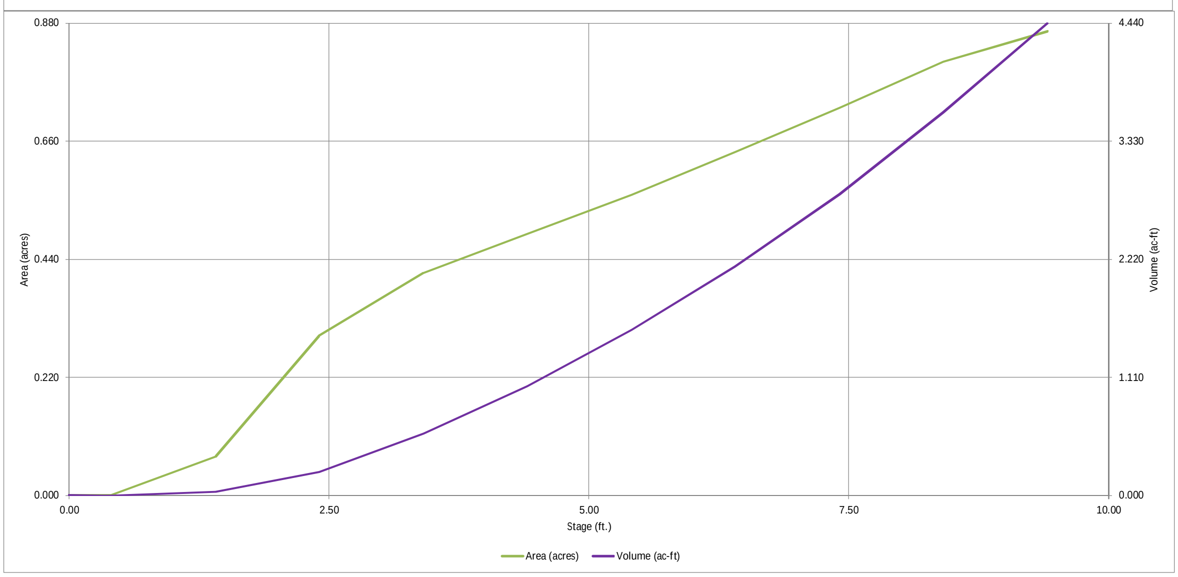

Length, Width (ft.)
Area (sq.ft.)
Stage (ft)
0
5
10
15
20
0
9500
19000
28500
38000
0.00
2.50
5.00
7.50
10.00
Length (ft)
Width (ft)
Area (sq.ft.)

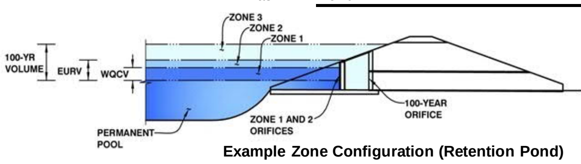

Area (acres)
Volume (ac-ft)
Stage (ft.)
0.000
0.220
0.440
0.660
0.880
0.000
1.110
2.220
3.330
4.440
0.00
2.50
5.00
7.50
10.00
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: 25188.10 Homestead North Filing No. 2

Basin ID: Pond B



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.06	0.442	Orifice Plate
Zone 2 (EURV)	4.95	0.860	Orifice Plate
ne 3 (100-year)	6.76	1.078	Weir&Pipe (Restrict)
	Total (all zones)	2.380	

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	5.36	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	ow 3 (optiona	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.79	3.57	4.00				
Orifice Area (sq. inches)	2.00	2.00	2.00	12.00				

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.60	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	5.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	0%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.60	N/A	feet
Overflow Weir Slope Length =	5.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	6.88	N/A	
Overflow Grate Open Area w/o Debris =	17.40	N/A	ft^2
Overflow Grate Open Area w/ Debris =	17.40	N/A	ft^2

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

	one 3 Restricto	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	24.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	18.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	2.53	N/A	ft^2
Outlet Orifice Centroid =	0.83	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	2.09	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.20	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	75.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.44	feet
Stage at Top of Freeboard =	8.64	feet
Basin Area at Top of Freeboard =	0.82	acres
Basin Volume at Top of Freeboard =	3.79	acre-ft

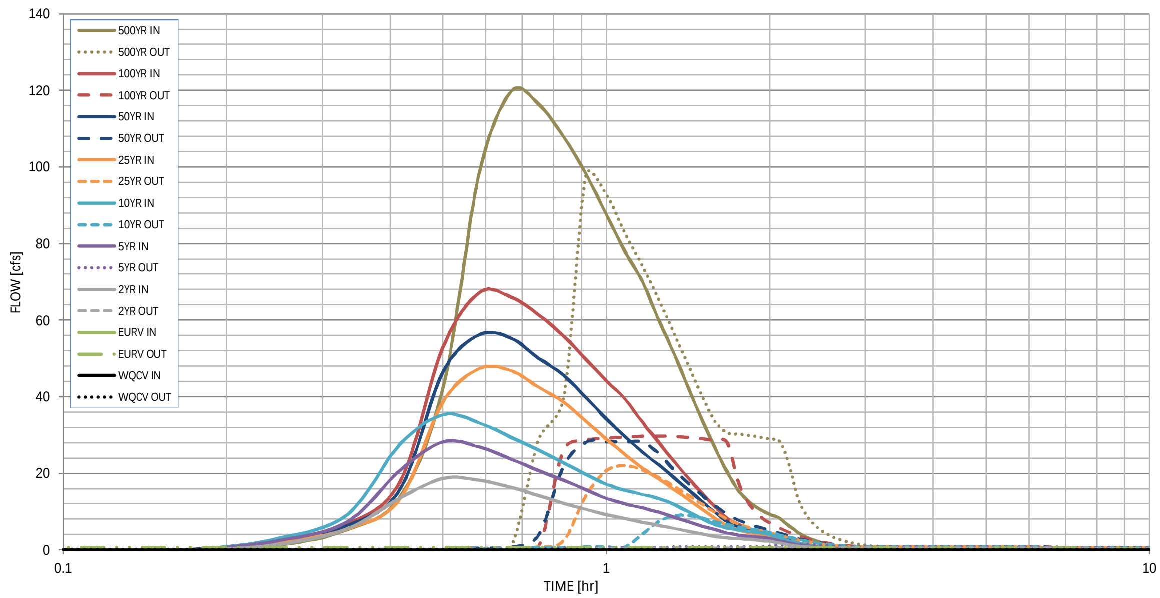
Routed Hydrograph Results

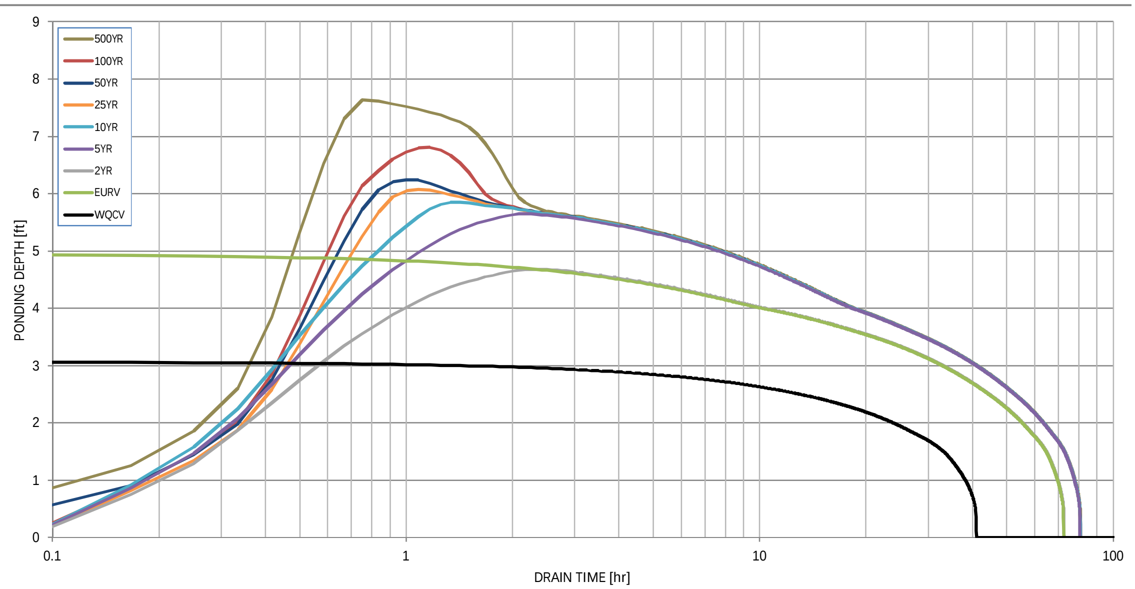
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

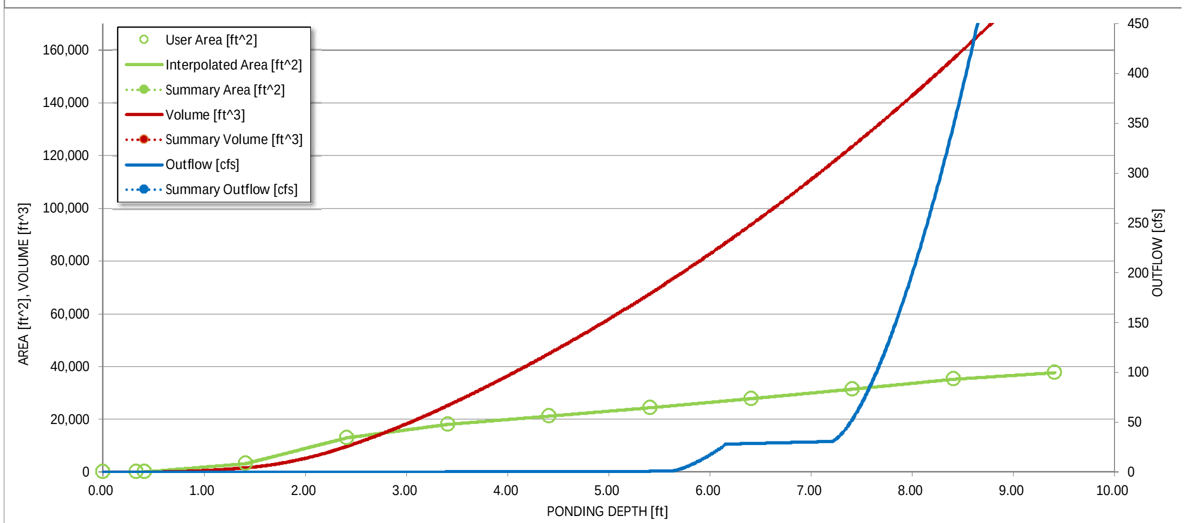
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	4.00
CUHP Runoff Volume (acre-ft) =	0.442	1.302	1.255	1.836	2.352	3.073	3.644	4.379	7.939
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.255	1.836	2.352	3.073	3.644	4.379	7.939
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	3.0	8.2	12.5	22.4	28.1	36.0	70.5
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.11	0.30	0.45	0.81	1.02	1.30	2.55
Peak Inflow Q (cfs) =	N/A	N/A	18.7	28.3	35.4	47.4	56.3	67.3	119.7
Peak Outflow Q (cfs) =	0.2	0.7	0.7	1.6	9.0	22.1	28.3	29.8	98.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.2	0.7	1.0	1.0	0.8	1.4
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.5	1.2	1.6	1.6	1.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	38	66	66	71	69	66	65	63	54
Time to Drain 99% of Inflow Volume (hours) =	40	70	70	77	76	75	74	73	68
Maximum Ponding Depth (ft) =	3.07	4.95	4.68	5.65	5.85	6.07	6.25	6.81	7.64
Area at Maximum Ponding Depth (acres) =	0.38	0.53	0.51	0.58	0.60	0.61	0.63	0.67	0.74
Maximum Volume Stored (acre-ft) =	0.445	1.304	1.165	1.685	1.809	1.942	2.047	2.417	2.996

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

PIPE OUTFALL RIPRAP SIZING CALCULATIONS

Subdivision: Proposed Conditions Rational
Location: El Paso County

Project Name: Homestead North @ Sterling Ranch F3
Project No.: 25188.12
Calculated By: REB
Checked By:
Date: 10/12/22

	STORM DRAIN SYSTEM			
	DESIGN POINT	DESIGN POINT	DESIGN POINT	Notes
Q_{100} (cfs):	37.0			Flows are the greater of proposed vs. future
Conduit	Pipe			
D_c, Pipe Diameter (in):	30			
W, Box Width (ft):	N/A			
H, Box Height (ft):	N/A			
Y_t, Tailwater Depth (ft):	1.00			If unknown, use Y_t/D_c (or H)=0.4
Y_t/Dc or Y_t/H	0.40			
$Q/D^{2.5}$ or $Q/(WH^{3/2})$	3.74			
Supercritical?	No			
Y_n, Normal Depth (ft) [Supercritical]:	1.00			
D_a, H_a (in) [Supercritical]:	N/A			$D_a=(D_c+Y_n)/2$
Riprap d_{50} (in) [Supercritical]:	N/A			
Riprap d_{50} (in) [Subcritical]:	7.76			
Required Riprap Size:	L			Fig. 9-38 or Fig. 9-36
d_{50} (in):	9			
Expansion Factor, $1/(2\tan\theta)$:	3.90			Read from Fig. 9-35 or 9-36
θ:	0.13			
Erosive Soils?	No			
Area of Flow, A_t (ft^2):	5.29			$A_t=Q/V$
Length of Protection, L_p (ft):	10.9			$L=(1/(2\tan\theta))(At/Yt - D)$
Min Length (ft)	7.5			Min L=3D or 3H
Max Length (ft)	25.0			Max L=10D or 10H
Min Bottom Width, T (ft):	5.3			$T=2*(L_p*\tan\theta)+W$
Design Length (ft)	11.0			
Design Width (ft)	5.3			
Riprap Depth (in)	18			Depth=2(d_{50})
Type II Bedding Depth (in)*	6			*Not used if Soil Riprap
Cutoff Wall	No			
Cutoff Wall Depth (ft)				Depth of Riprap and Base
Cutoff Wall Width (ft)				

Note: No Type II Base to be used if Soil Riprap is specified within the plans
* For use when the flow in the culvert is supercritical (and less than full).

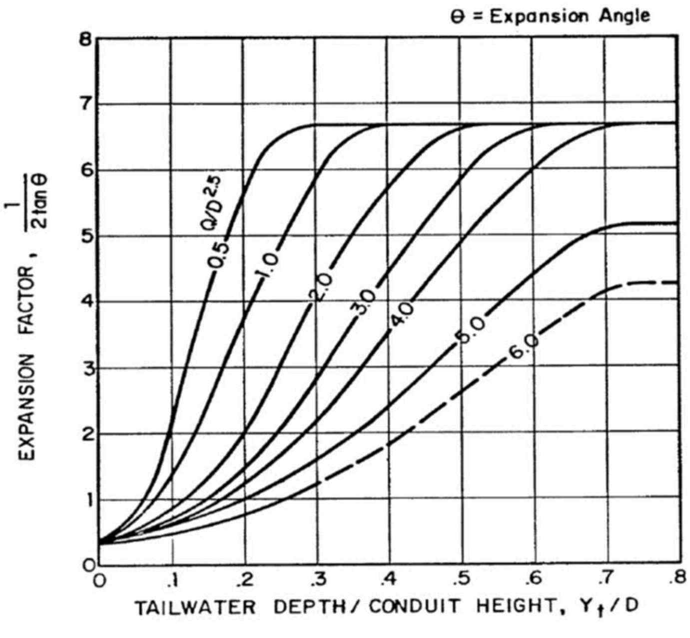


Figure 9-35. Expansion factor for circular conduits

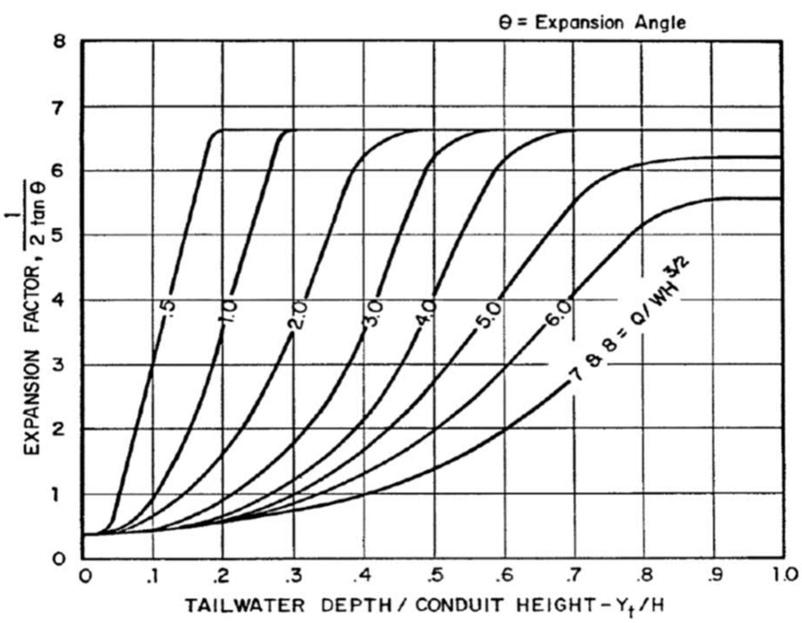
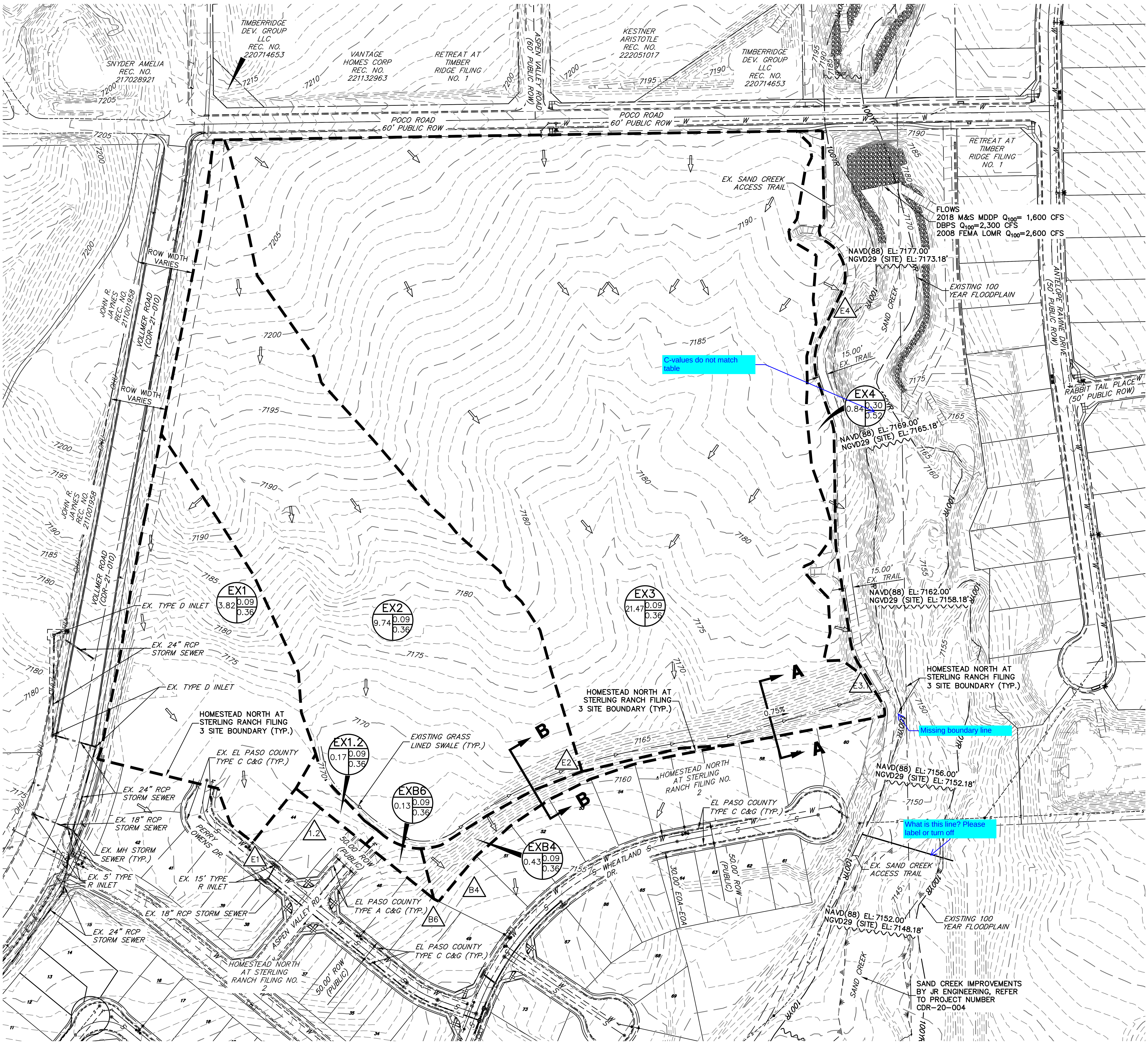


Figure 9-36. Expansion factor for rectangular conduits

Appendix E
Drainage Maps

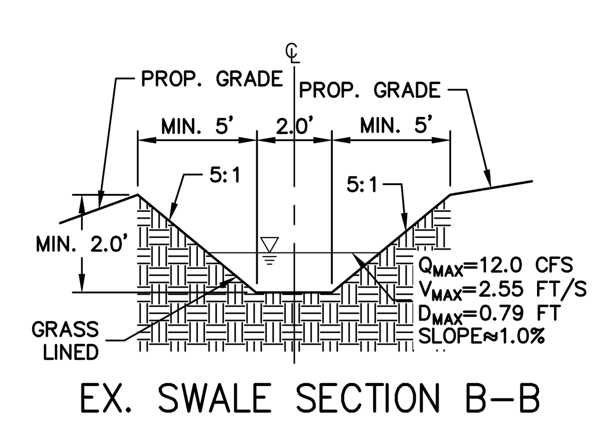
HOMESTEAD NORTH AT STERLING RANCH FILING NO. 3

EXISTING CONDITIONS DRAINAGE MAP

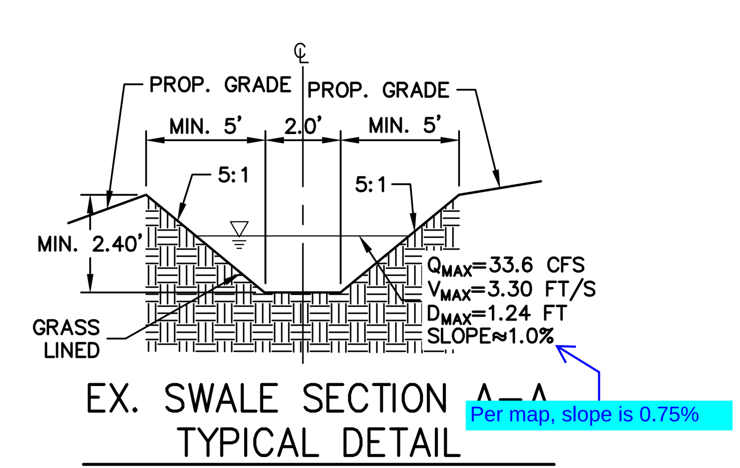


BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EX1	3.82	2%	0.09	0.36	29.2	0.9	5.8
EX2	9.74	2%	0.09	0.36	40.2	1.8	12.0
EX3	21.47	2%	0.09	0.36	42.5	3.8	25.4
EX4	0.84	48%	0.47	0.64	10.4	1.6	3.7
EX1.2	0.17	2%	0.09	0.36	13.7	0.1	0.4
EXB6	0.13	2%	0.09	0.36	10.0	0.0	0.3
EXB4	0.43	2%	0.09	0.36	10.0	0.2	1.0

DESIGN POINT		
DP	Q5 Total	Q100 Total
E1	0.9	5.8
E2	1.8	12.0
E3.1	5.0	33.6
E4	1.6	3.7
1.2	0.1	0.4
B6	0.0	0.3
B4	0.2	1.0



EX. SWALE SECTION B-B
TYPICAL DETAIL
SCALE: N.T.S.



EX. SWALE SECTION A-A
TYPICAL DETAIL
SCALE: N.T.S.

LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C -100 YR
D: C-5 YR

DESIGN POINT

BASIN DRAINAGE AREA

	EXISTING	PROPOSED
SECTION LINE		
BOUNDARY LINE		
PROPERTY LINE		
EASEMENT LINE		
RIGHT OF WAY		
CENTERLINE		
STORM SEWER		
SWALE/WATERWAY FLOWLINE		
INDEX CONTOUR	6100	6100
INTERMEDIATE CONTOUR		
FLOWLINE		
CONCRETE		
100-YEAR FEMA FLOODPLAIN	100YR	
100-YEAR FEMA BFE		
FLOW DIRECTION		

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

EXISTING CONDITIONS DRAINAGE MAP
HOMESTEAD NORTH AT STERLING RANCH FIING NO. 3
JOB NO. 25188.10
10-19-2022
SHEET 1 OF 1

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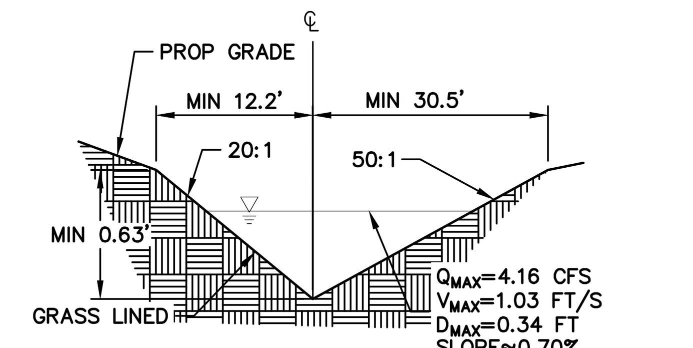
HOMESTEAD NORTH AT STERLING RANCH FILING NO. 3

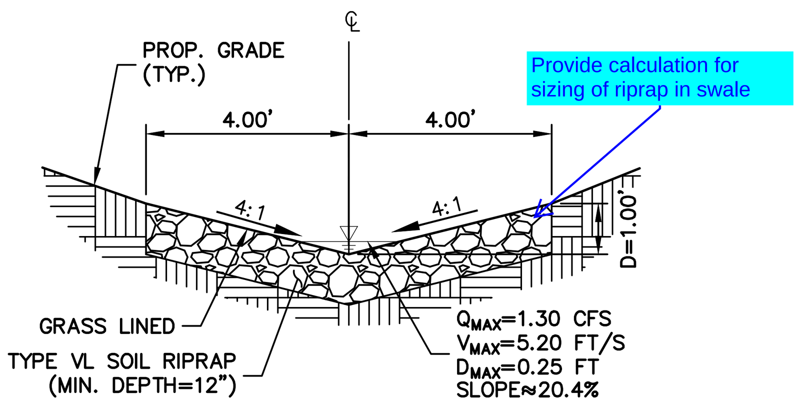
PROPOSED CONDITIONS DRAINAGE MAP

BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A1	3.82	40%	0.36	0.55	12.3	5.2	13.5
A2	3.02	48%	0.42	0.60	14.8	4.5	10.8
A3	4.54	47%	0.38	0.57	15.2	6.1	15.1
A4	3.82	49%	0.41	0.58	12.0	6.0	14.4
A5	7.53	34%	0.29	0.50	16.0	7.6	21.7
A6	4.29	51%	0.41	0.59	13.7	6.5	15.5
A7	2.93	15%	0.16	0.41	9.4	2.0	8.5
B1.1	2.08	40%	0.33	0.53	10.6	2.8	7.5
B1.2	1.36	48%	0.38	0.57	11.0	2.1	5.1
B1.3	0.33	51%	0.47	0.64	10.2	0.7	1.4
B4	1.21	2%	0.09	0.36	9.3	0.5	3.1
OS1	0.20	2%	0.09	0.36	5.0	0.1	0.6
OS2	1.01	2%	0.09	0.36	6.5	0.4	2.9
D2	0.18	2%	0.09	0.36	5.6	0.1	0.5
D3	0.17	2%	0.09	0.36	5.0	0.1	0.5

DESIGN POINT SUMMARY				
DP		Q5	Q100	
		Total	Total	i/B
1	i	5.2	13.5	10.9
	B			2.6
2	i	4.5	10.8	9.5
	B			1.3
2.1		9.3	19.6	
3	i	6.1	17.5	12.6
	B			4.9
4	i	6.0	14.4	11.3
	B			3.1
4.1		20.6	42.1	
5	i	7.6	25.8	25.8
	B			0.0
5.1		27.9	66.1	
6	i	6.5	18.8	18.8
	B			0.0
6.1		34.0	83.2	
7.1		35.4	92.6	
1F		2.8	7.5	
2F		2.1	5.1	
1.3		0.7	1.4	
B4		0.5	3.1	
OS1		0.1	0.6	
OS2		0.4	2.9	
D2		0.1	0.5	
D3		0.1	0.5	



SWALE SECTION A-A
TYPICAL DETAIL
SCALE: N.T.S.



POND MINOR SWALE (RUNDOWN)
TYPICAL DETAIL
SCALE: N.T.S.

LEGEND

BASIN ID
A: BASIN LABEL
B: AREA
C: C -100 YR
D: C-5 YR

DESIGN POINT

BASIN DRAINAGE AREA

	EXISTING	PROPOSED
SECTION LINE		
BOUNDARY LINE		
PROPERTY LINE		
EASEMENT LINE		
RIGHT OF WAY		
CENTERLINE		
STORM SEWER		
SWALE/WATERWAY FLOWLINE		
INDEX CONTOUR	6100	6100
INTERMEDIATE CONTOUR		
FLOWLINE		
CONCRETE		
100-YEAR FEMA FLOODPLAIN	100YR	
100-YEAR FEMA BFE		
FLOW DIRECTION		

PROPOSED CONDITIONS DRAINAGE MAP
HOMESTEAD NORTH AT STERLING RANCH FIING NO. 3
JOB NO. 25188.10
10-25-2022
SHEET 1 OF 1

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

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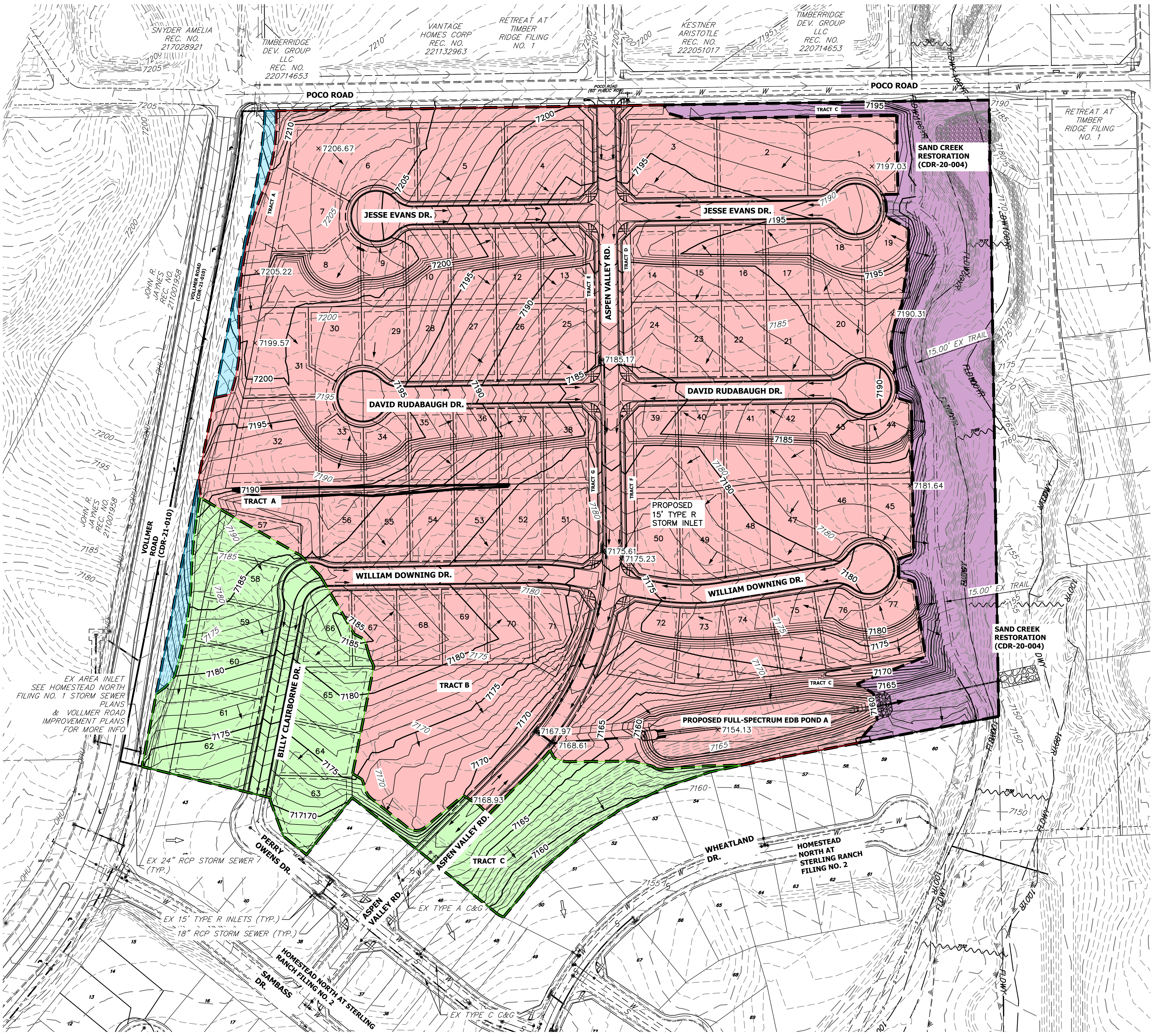
HOMESTEAD NORTH AT STERLING RANCH FILING NO. 3

PROPOSED CONDITIONS WATER QUALITY MAP



(pink)	POND A TOTAL BASIN:	29.95 ACRES
(green)	POND B TOTAL BASIN: TOTAL FROM FILING NO. 3:	28.13 ACRES 4.98 ACRES
(blue)	POND C TOTAL BASIN: TOTAL FROM FILING NO. 3:	224.3 ACRES 0.35 ACRES
(purple)	PLATED FILING NO. 3 WQ EXCLUSIONS: PARTS II G, H, I AREA:	 4.42 ACRES

NOTE:

1. THIS MAP SHOWS HOW WATER QUALITY IS PROVIDED FOR FILING NO. 3 AREAS. SEE THE FILING NO. 1 AND 2 FDR'S FOR THE WATER QUALITY MAPS ASSOCIATED WITH THOSE FILINGS.
2. SEE THE HOMESTEAD NORTH AT STERLING RANCH FILING NO. 1 FINAL DRAINAGE REPORT FOR DETAILED POND C SIZING AND DESIGN INFORMATION.
3. SEE THE HOMESTEAD NORTH AT STERLING RANCH FILING NO. 2 & 3 FINAL DRAINAGE REPORT FOR DETAILED POND B SIZING AND DESIGN INFORMATION.
2. SEE THE HOMESTEAD NORTH AT STERLING RANCH FILING NO. 3 FINAL DRAINAGE REPORT FOR DETAILED POND A SIZING AND DESIGN INFORMATION.

PROPOSED CONDITIONS WATER QUALITY MAP
HOMESTEAD NORTH AT STERLING RANCH FIING NO. 3
JOB NO. 25188.10
08-02-2022
SHEET 1 OF 1

100 50 0 100 200
ORIGINAL SCALE: 1" = 100'

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v2-Drainage Report - Final.pdf Markup Summary

Callout (11)

Subject: Callout
Page Label: 11
Author: CDurham
Date: 12/20/2022 4:02:22 PM
Status:
Color:
Layer:
Space:

State what those existing flows are

Subject: Callout
Page Label: 14
Author: CDurham
Date: 12/20/2022 4:29:46 PM
Status:
Color:
Layer:
Space:

Did not see anything resembling a work map for the channel improvements in Appendix D. Drainage maps from other filings and pond design worksheets were the only items included. Please include a copy of the channel workmap

---

Subject: Callout
Page Label: 16
Author: CDurham
Date: 12/20/2022 4:34:31 PM
Status:
Color:
Layer:
Space:

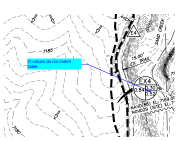
Where can information for Ponds B & C be found?

Subject: Callout
Page Label: 17
Author: CDurham
Date: 12/20/2022 4:39:32 PM
Status:
Color:
Layer:
Space:

Include Required volumes in table and existing flow rates for comparison.

Subject: Callout
Page Label: 39
Author: CDurham
Date: 12/21/2022 10:44:54 AM
Status:
Color:
Layer:
Space:

Per drainage map, slope for this section of swale appears to be closer to 0.75%



Subject: Callout
Page Label: 112
Author: CDurham
Date: 12/21/2022 12:33:20 PM
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Layer:
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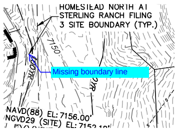
C-values do not match table



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Author: CDurham
Date: 12/21/2022 12:33:36 PM
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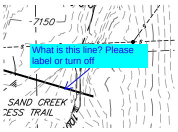
Missing boundary line



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Author: CDurham
Date: 12/21/2022 12:33:58 PM
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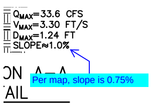

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Page Label: 112
Author: CDurham
Date: 12/21/2022 12:34:18 PM
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Color:
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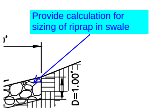
Space:

Per map, slope is 0.75%



Subject: Callout
Page Label: 113
Author: CDurham
Date: 12/21/2022 12:34:55 PM
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Color:
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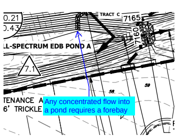
Space:

Provide calculation for sizing of riprap in swale



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Page Label: 113
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Date: 12/21/2022 12:35:33 PM
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Color:
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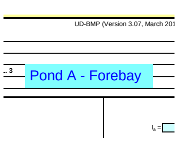
Any concentrated flow into a pond requires a forebay

Text Box (4)



Subject: Text Box
Page Label: 71
Author: CDurham
Date: 12/21/2022 12:04:50 PM
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Color:
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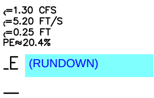
Pond A - Forebay



Subject: Text Box
Page Label: 113
Author: CDurham
Date: 12/21/2022 12:35:08 PM
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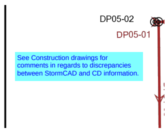
Color:
Layer:
Space:

(RUNDOWN)



Subject: Text Box
Page Label: 58
Author: CDurham
Date: 12/21/2022 3:49:48 PM
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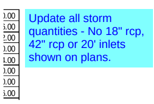
See Construction drawings for comments in regards to discrepancies between StormCAD and CD information.



Subject: Text Box
Page Label: 19
Author: CDurham
Date: 12/21/2022 3:53:48 PM
Status:
Color:
Layer:
Space:

Update all storm quantities - No 18" rcp, 42" rcp or 20' inlets shown on plans.