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

Prepared For:

SR Land, LLC
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March 2022
Project No. 25188.10

Prepared By:
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Colorado Springs, CO 80919
719-593-2593

PCD Filing No.:
XX-XX-XXX

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. 38861
For and On Behalf of JR Engineering, LLC

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: _____

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.

_____ _____

Jennifer Irvine, P.E. Date
County Engineer/ ECM Administrator

Conditions:

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APPENDIX

PURPOSE

This document is intended to serve as the Final Drainage Report for Homestead North at Sterling Ranch Filing No. 2. 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. The proposed use is a permissible use within the residential service zoning criteria.

GENERAL SITE DESCRIPTION

GENERAL LOCATION

Homestead North at Sterling Ranch Filing No. 2 and the undeveloped land to the north (hereby referred to as the "site") is a proposed development Single-Family SF residential, urban (RS-6000) with a total area of approximately 36.30 acres.

The site is located in a portion of the SW ¼ of the SW ¼ of Section 27, the East ½ of section 28 and NE ¼ of section 33, 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. The site is bounded by Homestead North at Sterling Ranch Filing No. 1 to the south, Vacant land and Retreat at Timber Ridge Filing 1 to the north and Sand Creek borders the site to east. Refer to the vicinity map in Appendix A for additional information.

DESCRIPTION OF PROPERTY

The site is currently being designed to accommodate approximately 74 single-family residential lots and (totaling approximately 36.3 platted acres). The site is comprised of variable sloping grasslands that generally slope(s) downward to the east at 3 to 7% towards Sand Creek.

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.

There are no known irrigation facilities located on the project site.

FLOODPLAIN STATEMENT

Based on the FEMA Firm Maps Number 08041C0533G and 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.

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.

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. 2 detention facility closely follows the drainage patterns of pond B in the preliminary drainage report. The Homestead North preliminary drainage report map and WQ map is shown within Appendix E of this report.

EXISTING SUB-BASIN DRAINAGE

The existing/ predeveloped site consists of two basins (H1 and H2). These existing basins outfall to Sand Creek at two outfalls as shown in the Historic Drainage Map in Appendix D. A sub-division to the north of the site is being developed called "Retreat at Timberidge". Runoff from this sub-division will be detained and will not impact storm-water runoff on the Sterling Ranch Homestead site.

Basin H-1 (Q5 = 1.1 cfs, Q100 = 7.5 Cfs) is 5.36 acres of undeveloped land east of Vollmer road. This basin consists of native grass and an existing interim swale constructed during Homestead North at Sterling Ranch Fil. 1. The runoff from this basin drains into an existing interim swale constructed with Homestead North at Sterling Ranch Filing No. 1. Runoff from this basin drains directly into Sand Creek.

Basin H-2 (Q5 = 9.3 cfs, Q100 = 68.5 cfs) is 49.40 acres of undeveloped land adjacent east of Vollmer Road; the northern boundary of this basin borders Retreat at Timberidge to the north. The runoff from this basin is collected in existing drainage draws; the runoff from this basin drains directly into Sand Creek.

PROPOSED DRAINAGE CONDITIONS

Basin OS1 3.83 acres and 2% impervious is an offsite basin that sheet drains to Perry Owens Drive. The basin is comprised of open space and native grass. The runoff (Q_5=1.1 cfs, Q_{100}=7.8 cfs) from basin OS1 drains to design point O.1 at an interim swale.

Basin OS2 9.74 acres and 2% impervious is an offsite basin that drains to an offsite swale that diverts runoff away from the residential lots on Wheatland Drive. The basin is comprised of open space and native grass. The runoff (Q_5=2.0 cfs, Q_{100}=14.8 cfs) from basin OS2 drains to design point O.2 and is collected in an interim swale on the northern portion of the site.

Basin OS3 21.02 acres and 2% impervious is an offsite basin that drains to an offsite swale that diverts offsite runoff away from the residential lots on Wheatland Drive. The runoff confluences with upstream runoff from basin OS2 and directly drains into Sand Creek. The runoff (Q_5=4.1 cfs, Q_{100}=30.0 cfs) from basin OS3 drains to design point O.3 and outfalls directly into sand creek. The runoff from basin OS# confluences with the upstream runoff from basin OS3. The total net runoff at design point O.3 is (Q_5=6.0 cfs, Q_{100}=43.9 cfs). The runoff outfall directly into Sand Creek.

Basin B1.1 1.24 acres and 52% percent impervious is comprised of single-family residential lots, a local road Perry Owens Drive and an urban knuckle. The runoff is routed via proposed El –Paso County type C curb and gutter. The runoff (Q_5=2.4 cfs, Q_{100}=5.1 cfs) from basin B1.1 drains to design point 1.1B a 15 ft on grade type R inlet. The captured runoff is represented by design point 1.1i. The 15 ft type R inlet captures all of the runoff in the 100 year event (Q_5=2.4 cfs, Q_{100}=5.1 cfs). The runoff is then piped to design point 2.1 via 18” proposed public storm sewer.

Basin B1.2 0.38 acres and 51% percent impervious is comprised of single-family residential lots, a local road Perry Owens Drive and an urban knuckle. The direct runoff from basin B1.2 (Q_5=2.5 cfs, Q_{100}=5.3 cfs). The runoff confluences with upstream runoff from basin OS1 and is routed via type C EL Paso County curb and gutter to a 15’ type R on grade inlet at design point 1.2B (Q_5=1.7 cfs,

Q_{100}=9.3 cfs). The captured runoff is represented by design point 1.2i (Q_5=1.7 cfs, Q_{100}=8.5 cfs). The captured runoff is piped to design point 2.1 via an 18" storm pipe. Runoff is by-passed in the 100-year event to design point 1.3B via type C El Paso County curb and gutter (Q_{100}=0.8 cfs).

Basin B1.3 0.45 acres and 47% percent impervious is comprised of single-family residential lots and a local roads Aspen Valley Road and Perry Owens Drive. The runoff (Q_5=0.9 cfs, Q_{100}=2.1 cfs) from basin B1.3 drains to design point 1.3b. The runoff is conveyed by Type A El Paso County curb and gutter in Aspen Valley Road and by type C El Paso County curb and gutter in Perry Owens Drive. Design point 1.3b receives by pass flow from the upstream inlet at design point 2.1i in the 100-year event (0.7 cfs). The Net runoff at design point 1.3b is (Q_5=0.9 cfs, Q_{100}=2.2 cfs).

Basin B2 0.86 acres and 58% percent impervious is comprised of the northern portion of a local residential road Sam Bass Drive adjacent to the intersecting at Vollmer road. The runoff is routed via type A El Paso County Curb and gutter. Runoff (Q_5=2.4 cfs, Q_{100}=5.1 cfs) from basin B2 drains to design point 2B and confluences with bypass runoff from basin B1.2 direct and B1.3. The total runoff off at design point 2b is (Q_5=3.0 cfs, Q_{100}=5.6 cfs).

Basin B3 0.23 acres and 78% percent impervious is comprised of the southern portion of a local residential road Sam Bass Drive adjacent to the intersection of Vollmer road. Runoff (Q_5=0.9 cfs, Q_{100}=1.6 cfs)from basin B3 drains to design point 3B and is routed via type A El Paso County curb and Gutter.

Basin B4 3.51 acres and 46% percent impervious is comprised of single-family residential lots, a local residential road Wheatland Drive and a Cul de Sac. Runoff from basin B4 (Q_5=7.0 cfs, Q_{100}=15.5 cfs) is routed via type C El-Paso County curb and gutter to design point 4B at a 15' type R on-grade inlet. The captured runoff is represented by design point 4i (Q_5=6.9 cfs, Q_{100}=11.7 cfs). The captured runoff is piped via a 24" storm sewer and is then piped to design point 2.3. The bypass runoff (Q_5=6.9 cfs, Q_{100}=3.8 cfs) is conveyed by drainage pans and El Paso County Type A curb and gutter, the bypass runoff drains to design point 6i.

Basin B5 1.11 acres and 61% percent impervious is comprised of single-family residential lots, a residential road Wheatland Drive, and a Cul de Sac. Runoff from this basin is routed via El Paso County type C curb and gutter. Runoff (Q_5=3.1 cfs, Q_{100}=6.2 cfs) from basin B5 drains to design point 5B to a 10' on grade type R inlet. The captured runoff is represented by design point 5i (Q_5=3.1 cfs, Q_{100}=5.0 cfs). The bypassed runoff in the 100 year event (Q_{100}=1.2 cfs) confluence(s) with runoff downstream at design point 8B and is captured at design point 10b at 15' type R sump inlet.

Basin B6 3.61 acres and 58% percent impervious is comprised of single-family residential lots and a local residential roads Sam Bass Drive, Aspen Valley Road, Perry Owens Drive and Wheatland Drive. Runoff (Q_5=9.5 cfs, Q_{100}=19.8 cfs) the runoff in basin B6 is routed via Type A and Type C El Paso County curb and gutter. The runoff from basin 6b drains to design point 6B at a 15' on grade

type R inlet. The runoff is then bypassed (Q_5=7.5 cfs ,Q_{100}=9.9 cfs) to a 15' sump inlet at design point 9B. In total, the flow at design point 6b collects flow from basins B1, B2, B3, B4, and B6.

Basin B7 1.63 acres and 56% percent impervious is comprised of single-family lots, local roads and a Cul de Sac Robert Allison Circle. The runoff is routed via type A and C El Paso County curb and gutter. Runoff (Q_5=4.0 cfs, Q_{100}=8.2 cfs) from basin B7 drains to design point 7B at a 15' on grade type R inlet in confluence with bypass runoff from B5 (Q_{100}=1.2 cfs).

Basin B8 2.14 acres and 56% percent impervious is comprised of single-family lots, local road and a Cul de Sac. The runoff is routed via El Paso County type A and C curb and gutter. The runoff (Q_5=5.1 cfs, Q_{100}=10.6 cfs) from basin B8 drains to design point B8 in confluence with runoff from basins B8, B7 and B5. The net runoff at design point 8B is 4.7 cfs and 11.1 cfs. The runoff then ultimately drains downstream to design point 10b.

Basin B9 3.77 acres and 64% percent impervious is comprised of single-family lots, and an urban knuckle, and local roads Willey Picket Drive and Wheatland Drive. Runoff (Q_5=7.3 cfs, Q_{100}=15.7 cfs) from Basin B9 drains to design point 9B in a 15' type R sump inlet. In total, the runoff from the sump inlet collects runoff from basins B1, B2, B3, B4, B6 and B9. The total runoff collected at the sump inlet is (Q_5=11.8, Q_{100}=26.4 cfs). In the event the inlet clogs in the 100-year event runoff will over flow across the curb and gutter of Wheatland Drive and spill directly into pond B.

Basin B10 0.22 acres and 80% percent impervious is comprised of the southeastern side of the local road Wheatland Drive. The runoff from this basin drains to design point 10b (Q_5=0.8 cfs, Q_{100}=1.6 cfs) a 10' type R sump inlet. The total runoff at design point 10b (Q_5=5.4 cfs, Q_{100}=12.4 cfs) collected is from basins B5, B7, B8, and B10. The runoff will then ultimately go directly into the pond and is piped to the forebay at design point 2.8. In the event the inlet clogs in the 100-year event runoff will overflow across the curb and gutter of Wheatland Drive and spill directly into pond B.

Basin B11 1.67 acres and 11% percent impervious is comprised of pond B. Runoff (Q_5=0.8 cfs, Q_{100}=3.6 cfs) generated in Basin B11 sheet flows into Pond B where it is treated for water-quality and is detained up until the 100 year-event. The UD Detention sheet for pond B is shown in Appendix C of this report.

Basin B12 is 2.18 acres this basin is 36% percent impervious and is comprised of single family walk out lots facing Sand Creek. The runoff (Q_5=2.1 cfs, Q_{100}=5.9 cfs) is conveyed via a grass swale and collected into a type C area inlet at design point 3.1. The runoff is then piped via 18" RCP pipe to design point 3.2.

Basin B13 is 0.43 acres and 54% impervious and is comprised of single family walk out lots facing sand creek. The runoff (Q_5=2.1 cfs, Q_{100}=5.9 cfs) is conveyed via a grass swale and is collected into a

type C area inlet at design point 3.2. The runoff is then piped in confluence runoff from basin B12 in 18" RCP.

Basin B14 is 0.42 acres and 45% impervious and is comprised of single family walk out lots facing sand creek. The runoff (Q_5=0.9 cfs, Q_{100}=2.3 cfs) is conveyed via a grass swale drains directly to pond B at design point 14b.

Basin C-1 is 0.92 acres and 67% percent impervious and is comprised of single family lots. The runoff (Q_5=1.8 cfs, Q_{100}=3.9 cfs) from these lots drains to design point C.1 and is conveyed to the Homestead North Filing No. 1 full spectrum detention facility.

Basin C-2 is 1.24 acres and 52% percent impervious and is comprised of single family lots, road and concrete walk. The runoff (Q_5=2.4 cfs, Q_{100}=5.8 cfs) from these lots drains design point C.2 and is conveyed to the the Homestead North Filing No. 1 full spectrum detention facility.

Pond B has a tributary area 27.69 acres and is 44.4 % impervious. The MHFD Detention workbook version 4.04 was utilized to size the outlet structure and configuration of the Homestead North Filing No. 2 full spectrum detention facility. The WQCV, 5 year and 100 year volumes, releases rates, and stages for the Homestead North Detention pond are shown in Table 1.1 as shown on the following page. These results correspond to the Routed Hydrograph results, as shown in Proposed Homestead North Filing No. 2 MHFD-Detention_v4.04 workbook in Appendix C of this report. The pond has been ultimately sized per the ultimate volume for additional planned development, as shown in the attached preliminary MHFD-Detention_v4.03 workbook within Appendix C of this report. Upon future development of Homestead North Filing 3, the Homestead Filing No. 2 pond will need to be re-analyzed to include the additional developed tributary areas. It is anticipated that the water quality plate will need to be adjusted or changed to accommodate the additional developed flows.

	TABLE 2.2 Pond B		
	Stage –ft	Volume (Acres)	Release Rate (cfs)
WQCV	3.12	0.442	0.2
5 Year	5.72	1.635	3.1
100 Year	6.92	2.370	67.3

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.

Table 3 - 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 v4.04 spreadsheet was utilized for evaluating the proposed detention and water quality pond(s). Sump and on-grade inlets were sized using UDFCD UD-Inlet v2.07. Autodesk Hydraflow express and UDFCD figure 8-22 was used to size the swales. 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 *Modeling Hydraulic and Energy Gradients in Storm Sewers: A Comparison of Computation Methods*, by AMEC Earth & Environmental, Inc. The manhole loss coefficients used in the model can be seen in Table 2. StormCAD, Autodesk Hydraflow results, along with street and inlet capacities are presented in Appendix C.

Table 2 - StormCAD Standard Method Conversions

StormCAD Conversion Table			
Bend Loss	Bend Angle	K coefficient Conversion	
	0	0.05	
	22.5	0.1	
	45	0.4	
	60	0.64	
	90	1.32	
Lateral Loss	1 Lateral K coefficient Conversion		
	Bend Angle	Non Surcharged	Surcharged
	45	0.27	0.47
	60	0.52	0.9
	90	1.02	1.77
	2 Laterals K coefficient Conversion		
	45	0.96	
	60	1.16	
	90	1.52	

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, October 2021. 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 E.

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.

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 northeast 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. Homestead North Filing No. 2 lots will discharge into Full Spectrum Detention Ponds, and outflows will be less than or equal to historic flows. Existing flows from the northwest of Vollmer road and runoff from the Vollmer Road improvements will be piped under Vollmer Road and then along the north side of Briargate Parkway and will be detained and treated for water quality directly on-site. 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. 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. 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

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 basin are shown within the Proposed Drainage Map within Appendix E. The pond has 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 storage and outlet characteristics see the MHFD sheets within Appendix C. Upon future development of Homestead North Filing 3, the Homestead Filing No. 2 pond will need to be re-analyzed to include the additional developed tributary areas. It is anticipated that the water quality plate will need to be adjusted or changed to accommodate the additional developed flows.

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 measure.

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, prior to obtaining a grading permit.

DRAINAGE AND BRIDGE FEES

The site lies within the Sand Creek Drainage Basin. An approximate estimate is presented below, exact fees to be determined at time of final plat.

2022 Drainage and Bridge Fee – Sterling Ranch Homestead North Filing 2				
Impervious Acres (Ac.)	Drainage Fee (Per Imp. Acre)	Bridge Fee (Per Imp. Acre)	Sterling Ranch Drainage Fee	Sterling Ranch Bridge Fee
12.36	$21,814	$8,923	$269,530.29	$110,288.28

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. 2 (Public Non-Reimbursable)

Item	Description	Quantity	Unit	Unit Price	Cost
1	18" RCP	775	L.F.	$ 67	$ 51,925.00
2	24" RCP	898	L.F.	$ 81	$ 72,738.00
3	36" RCP	492	L.F.	$ 124	$ 61,008.00
4	48" RCP	58	L.F.	$ 202	$ 11,716.00
4	36" FES	1	Ea.	$ 600	$ 600.00
5	10' Curb Inlet Type R < 10 ft.	1	Ea.	$ 8,136	$ 8,136.00
6	15' Curb Inlet Type R < 10 ft.	7	Ea.	$ 11,005	$ 77,035.00
7	Grated Inlet CDOT TYPE C	2	Ea.	$ 4,802	$ 9,604.00
8	Storm Sewer MH, box base	3	Ea.	$ 12,034	$ 36,102.00
9	Storm Sewer MH, slab base	6	Ea.	$ 6,619	$ 39,714.00
				Sub-Total	$ 368,578.00

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

From Sterling Ranch Filing 2 FDR (SF-2015) and From Sterling Ranch Filing 3 FDR (SF-22xx)	
Subtotal Segment 159 and 164 E	$1,918,065.00
Drainage Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$400,855.70
Excess Reimb. Costs associated with DBPS Segment 159 and 164	$1,517,209.30
From Sterling Ranch Filing 3 FDR (SF-2132)	
Drainage Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$203,870.00
Excess Reimb. Costs associated with DBPS Segment 159 and 164	$1,313,339.30
From Homestead North Filing 1 FDR (SF-22xx)	
Subtotal Segment 169 and 186	$611,628.00
Drainage Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$501,722.00
Excess Reimb. Costs associated with DBPS Segment 169 and 186	$109,906.00
Homestead North Filing 2 Drainage Fee Deferment	
Excess Reimb. Costs associated with DBPS Segments	$1,423,245.30
Drainage Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$269,530.29

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

From Homestead North Filing 1 FDR (SF-22xx)	
Briargate Bridge	$750,000.00
Bridge Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$205,229.00
Excess Reimb. Costs associated with DBPS Segment 169 and 186	$544,771.00
Homestead North Filing 2 Bridge Fee Deferment	
Excess Reimb. Costs associated with DBPS BGP Bridge	$544,771.00
Bridge Fees Deferred per LDC section 8.5.5.C.3.b(ii)	$110,288.28

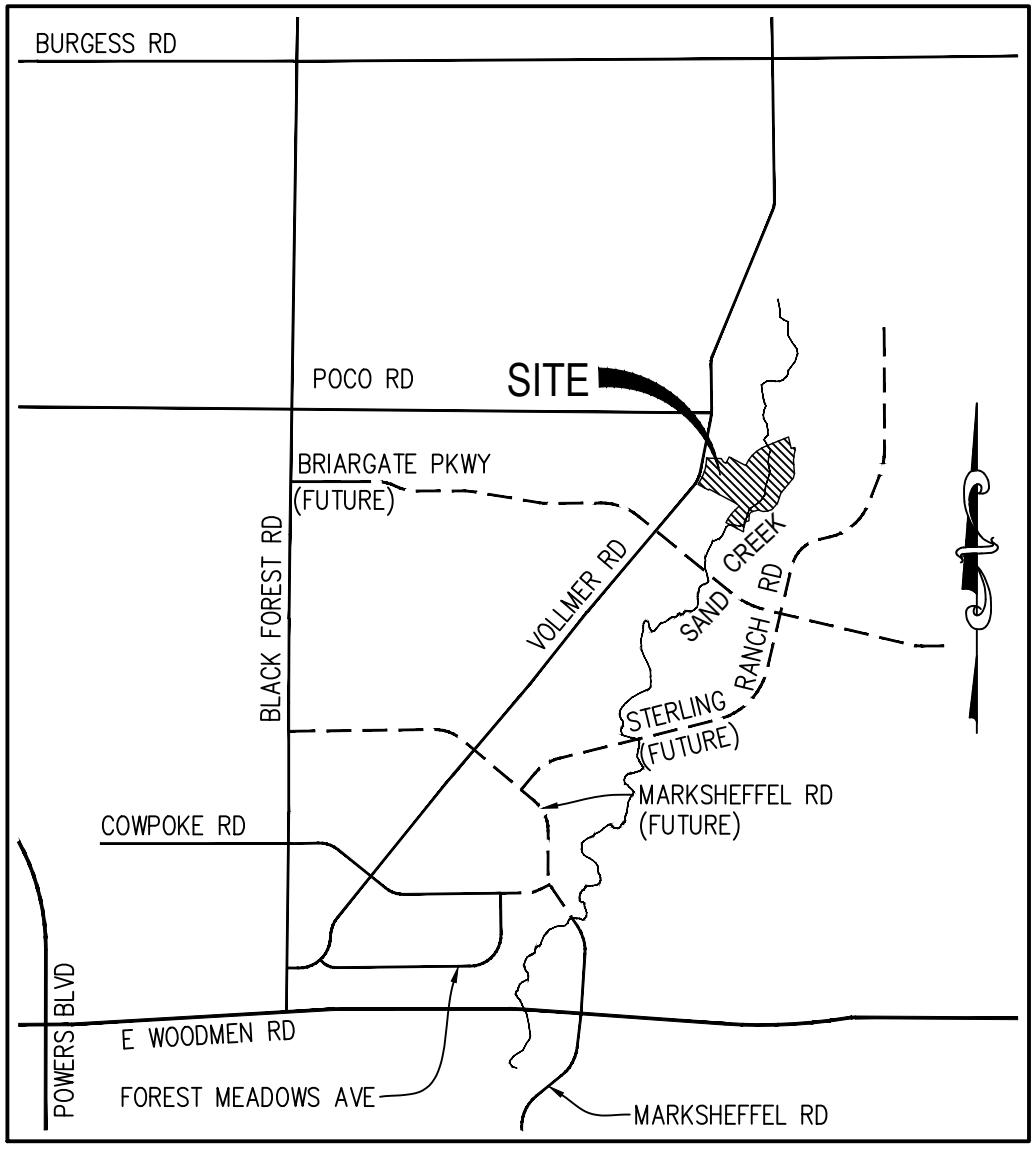
SUMMARY

The proposed Homestead North at Sterling Ranch drainage improvements were designed to meet or exceed the El Paso County Drainage Criteria. The proposed development's ponds are designed to release less than 90% of the predeveloped runoff study associated with the subject site. The proposed development will not adversely affect the offsite drainageways or surrounding development. 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

Appendix A
Vicinity Map, Soil Descriptions, FEMA Floodplain Map



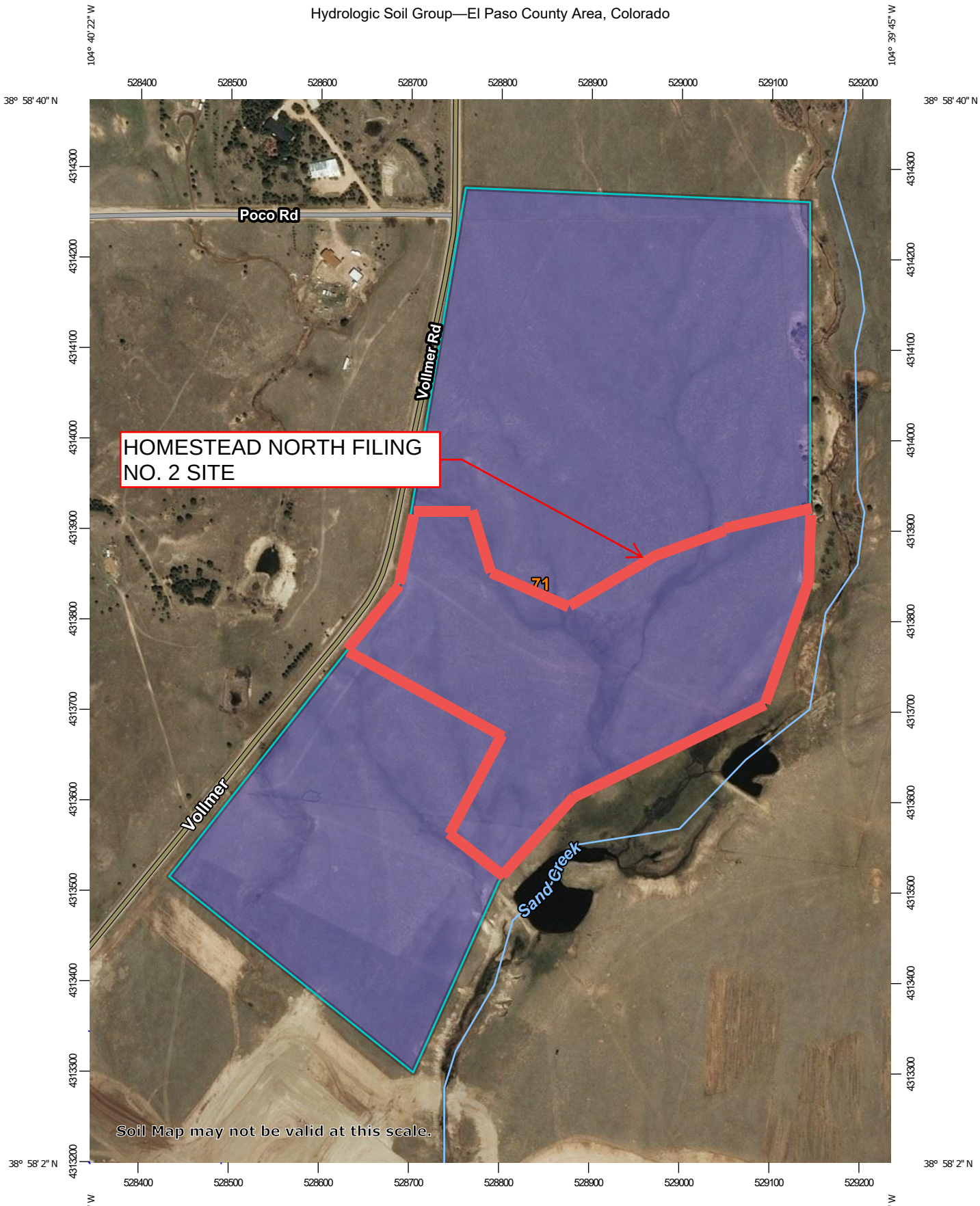
VICINITY MAP

N.T.S.

VICINITY MAP
HOMESTEAD NORTH AT
STERLING RANCH FILING NO. 2
JOB NO. 25188.00
02–16–2022

J·R ENGINEERING
A Westrian Company

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



Map Scale: 1:5,730 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 250 500 1000 1500

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 17, Sep 13, 2019

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

Date(s) aerial images were photographed: Sep 8, 2018—May 26, 2019

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	90.2	100.0%
Totals for Area of Interest			**90.2**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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 2008.

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/.

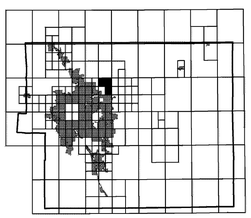
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

El Paso County Vertical Datum Offset Table

Flooding Source	Vertical Datum Offset (ft)

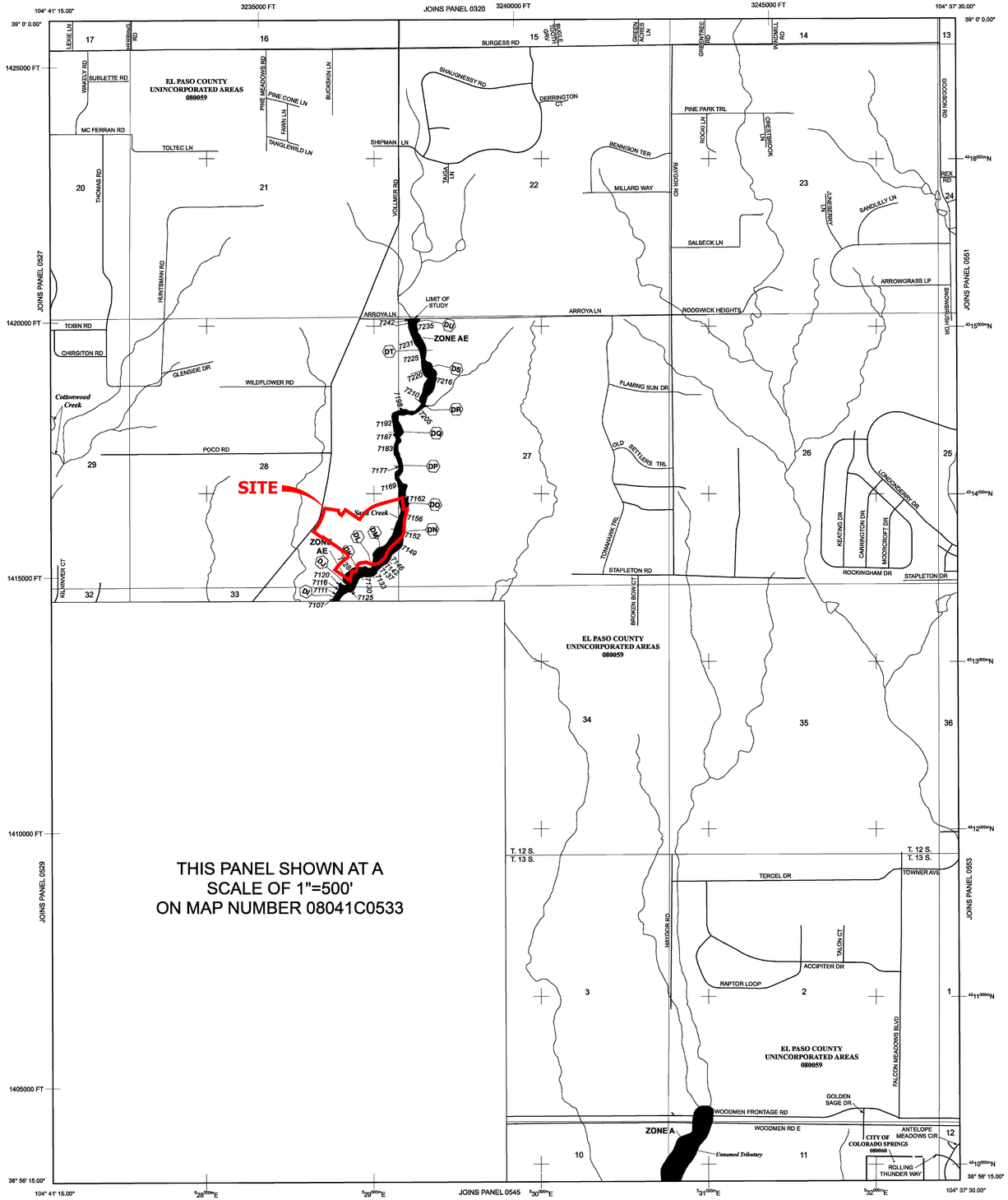
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION

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 (EL 987) — Base Flood Elevation line and value; elevation in feet* / 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)
- 4275000mN — 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 — NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0535G

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 Homestead Fil.2
Location: El Paso County

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/12/22

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}	
H-1	5.36	0.90	0.96	0.03	0.6%	0.45	0.59	0.00	0.0%	0.08	0.35	5.32	2.0%	0.09	0.35	2.6%
H-2	49.40	0.90	0.96	0.01	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	49.39	2.0%	0.08	0.35	2.0%

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Existing Conditions Homestead Fil.2
Location: El Paso County

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/12/22

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)
H-1	5.36	B	3%	0.09	0.35	300	1.0%	31.7	685	2.9%	7.0	3.2	3.6	35.3	985.0	32.7	32.7
H-2	49.40	B	2%	0.08	0.35	130	1.0%	21.0	2216	2.5%	7.0	3.2	11.5	32.5	2346.0	50.9	32.5

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 Homestead Fil.2
Location: El Paso County
Design Storm: 5-Year

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/12/22

		DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
STREET	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
	1h	H-1	5.36	0.09	32.7	0.46	2.35	1.1															
	2h	H-2	49.40	0.08	32.5	3.96	2.36	9.3															

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 Homestead Fil.2
Location: El Paso County
Design Storm: 100-Year

Project Name: Homestead North
Project No.: 25188.00
Calculated By: ARJ
Checked By:
Date: 1/12/22

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			
		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
	1h	H-1	5.36	0.35	32.7	1.90	3.95	7.5															
	2h	H-2	49.40	0.35	32.5	17.30	3.96	68.5															

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: Homestead Fil. 2 - Proposed Conditions
Location: El Paso County

Project Name: Homestead North
Project No.: 25188.10
Calculated By: ARJ
Checked By:
Date: 3/3/22

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}	
OS1	3.83	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	3.83	2.0%	0.08	0.35	2.0%
B1.1	1.24	0.90	0.96	0.25	20.1%	0.45	0.59	0.89	32.2%	0.08	0.35	0.10	0.2%	0.51	0.64	52.4%
B1.2	0.38	0.90	0.96	0.11	29.0%	0.45	0.59	0.18	21.4%	0.08	0.35	0.09	0.5%	0.49	0.64	50.9%
B1.3	0.45	0.90	0.96	0.13	28.0%	0.45	0.59	0.19	18.6%	0.08	0.35	0.14	0.6%	0.46	0.62	47.3%
B2	0.86	0.90	0.96	0.33	38.6%	0.45	0.59	0.35	18.5%	0.08	0.35	0.17	0.4%	0.55	0.68	57.5%
B3	0.23	0.90	0.96	0.18	77.6%	0.45	0.59	0.00	0.0%	0.08	0.35	0.05	0.4%	0.72	0.82	78.1%
B4	3.51	0.90	0.96	0.45	12.9%	0.45	0.59	2.58	33.1%	0.08	0.35	0.48	0.3%	0.46	0.61	46.3%
B5	1.11	0.90	0.96	0.35	31.7%	0.45	0.59	0.73	29.5%	0.08	0.35	0.03	0.1%	0.58	0.70	61.2%
B6	3.61	0.90	0.96	1.25	34.7%	0.45	0.59	1.85	23.0%	0.08	0.35	0.51	0.3%	0.55	0.68	58.0%
B7	1.63	0.90	0.96	0.43	26.6%	0.45	0.59	1.07	29.4%	0.08	0.35	0.13	0.2%	0.54	0.67	56.2%
B8	2.14	0.90	0.96	0.50	23.3%	0.45	0.59	1.53	32.2%	0.08	0.35	0.11	0.1%	0.54	0.66	55.6%
B9	3.77	0.90	0.96	0.80	21.2%	0.45	0.59	2.44	42.1%	0.08	0.35	0.53	0.3%	0.49	0.63	63.6%
B10	0.22	0.90	0.96	0.18	79.1%	0.45	0.59	0.00	0.0%	0.08	0.35	0.05	0.4%	0.73	0.83	79.5%
B11	1.67	0.90	0.96	0.00	0.0%	0.45	0.59	0.25	9.7%	0.08	0.35	1.42	1.7%	0.14	0.39	11.4%
B12	2.18	0.90	0.96	0.00	0.0%	0.45	0.59	1.19	35.5%	0.08	0.35	0.99	0.9%	0.28	0.48	36.4%
B13	0.43	0.90	0.96	0.00	0.0%	0.45	0.59	0.35	53.4%	0.08	0.35	0.08	0.4%	0.38	0.55	53.8%
B14	0.42	0.90	0.96	0.00	0.0%	0.45	0.59	0.28	43.9%	0.08	0.35	0.14	0.6%	0.33	0.51	44.5%
Pond B	27.69															44.4%
OS2	9.74	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	9.74	2.0%	0.08	0.35	2.0%
OS3	21.02	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.08	0.35	21.02	2.0%	0.08	0.35	2.0%
C-1	0.92	0.90	0.96	0.06	6.6%	0.45	0.59	0.86	60.2%	0.08	0.35	0.01	0.0%	0.48	0.61	66.8%
C-2	1.24	0.90	0.96	0.13	10.8%	0.45	0.59	0.78	40.8%	0.08	0.35	0.33	0.5%	0.40	0.57	52.1%

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: Homestead Fil. 2 - Proposed Conditions
Location: El Paso County

Project Name: Homestead North
Project No.: 25188.10
Calculated By: ARJ
Checked By:
Date: 3/3/22

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)
OS1	3.83	B	2%	0.08	0.35	93	3.0%	12.4	350	6.3%	7.0	1.8	3.3	15.7	443	28.2	15.7
OS2	9.74	B	2%	0.08	0.35	207	2.8%	19.0	703	3.6%	7.0	1.3	8.9	27.9	910	32.4	27.9
OS3	21.02	B	2%	0.08	0.35	202	3.5%	17.3	902	2.4%	7.0	1.1	13.8	31.1	1104	36.0	31.1
B1.1	1.24	B	52%	0.51	0.64	100	2.0%	8.5	610	3.1%	20.0	3.5	2.9	11.4	710	20.6	11.4
B1.2	0.38	B	51%	0.49	0.64	100	3.0%	7.6	60	2.5%	20.0	3.2	0.3	7.9	160	17.7	7.9
B1.3	0.45	B	47%	0.46	0.62	50	2.0%	6.5	270	2.0%	20.0	2.8	1.6	8.1	320	20.0	8.1
B2	0.86	B	58%	0.55	0.68	9.5	2.0%	2.4	368	3.4%	20.0	3.7	1.7	4.1	378	18.2	5.0
B3	0.23	B	78%	0.72	0.82	9.5	2.0%	1.7	360	3.7%	20.0	3.9	1.6	3.3	370	14.3	5.0
B4	3.51	B	46%	0.46	0.61	25	2.0%	4.6	680	1.6%	20.0	2.5	4.5	9.1	705	24.0	9.1
B5	1.11	B	61%	0.58	0.70	25	2.0%	3.7	460	1.5%	20.0	2.5	3.1	6.8	485	19.1	6.8
B6	3.61	B	58%	0.55	0.68	9.5	2.0%	2.4	855	3.0%	20.0	3.5	4.1	6.5	865	20.9	6.5
B7	1.63	B	56%	0.54	0.67	50	2.0%	5.7	315	1.5%	20.0	2.4	2.1	7.8	365	19.0	7.8
B8	2.14	B	56%	0.54	0.66	50	2.0%	5.7	280	1.0%	20.0	2.0	2.4	8.1	330	19.4	8.1
B9	3.77	B	64%	0.49	0.63	100	2.0%	8.7	600	2.9%	20.0	3.4	2.9	11.6	700	18.5	11.6
B10	0.22	B	80%	0.73	0.83	9.5	2.0%	1.6	200	0.5%	20.0	1.4	2.4	4.1	210	14.9	5.0
B11	1.67	B	11%	0.14	0.39	30	2.0%	7.6	200	0.5%	20.0	1.4	2.4	9.9	230	28.5	9.9
B12	2.18	B	36%	0.28	0.48	30	2.0%	6.4	500	1.4%	7.0	0.8	10.2	16.6	530	24.8	16.6
B13	0.43	B	54%	0.38	0.55	30	20.0%	2.6	144	2.0%	7.0	1.0	2.4	5.0	174	17.9	5.0
B14	0.42	B	45%	0.33	0.51	30	20.0%	2.8	200	2.0%	7.0	1.0	3.4	6.2	230	20.0	6.2
C-1	0.92	B	67%	0.48	0.61	100	2.0%	9.0	80	3.0%	7.0	1.2	1.1	10.1	180	15.1	10.1
C-2	1.24	B	52%	0.40	0.57	30	2.0%	5.5	902	3.8%	20.0	3.9	3.9	9.4	932	21.9	9.4

NOTES:

$$t_c = t_i + t_t$$

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

Equation 6-2

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

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).

Equation 6-3

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-2
TIME OF CONCENTRATION

Subdivision: Homestead Fil. 2 - Proposed Conditions
Location: El Paso County

Project Name: Homestead North
Project No.: 25188.10
Calculated By: ARJ
Checked By:
Date: 3/3/22

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)

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$ 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: Homestead Fil. 2 - Proposed Conditions
Location: El Paso County
Design Storm: 5-Year

Project Name: Homestead North
Project No.: 25188.10
Calculated By: ARJ
Checked By:
Date: 3/3/22

Description	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)	
	O.2	OS2	9.74	0.08	27.9	0.78	2.59	2.0															Sect. BB Offsite undeveloped runoff. Drains to Sand Creek within interim swale
	O.3	OS3	21.02	0.08	31.1	1.68	2.43	4.1	31.1	2.46	2.43	6.0											Sect. AA Offsite undeveloped runoff. Drains to Sand Creek within interim swale
	1.1b	B1.1	1.24	0.51	11.4	0.63	3.93	2.5					0.00	0	2.6					210	3.2	1.1	On-grade Type R Inlet, Bypass to DP 2B Tributary basins B1.1 and OS1
	1.1i								11.4	0.63	3.93	2.5											Captured runoff from on-grade type R -Inlet DP 1.1b piped to DP2.1
	O.1	OS1	3.83	0.08	15.7	0.31	3.46	1.1															Offsite runoff from basin OS1 sheet flows onto Perry Owens Drive
	1.2b	B1.2	0.38	0.49	7.9	0.19	4.48	0.9	15.7	0.50	3.46	1.7	0.00	0.00	2.6					235	3.2	1.2	On-grade Type R Inlet, Bypass to DP 1.3B Tributary basins B1.2 and OS1
	1.2i								15.7	0.50	3.46	1.7											Captured runoff from on-grade type R -Inlet from DP 1.2b
	2.1								15.7	1.13	3.46	3.9				3.9		2.0	24	487	2.8	2.9	Piped runoff to DP 2.4 Tributary Basins B1.1 OS1 and B1.2
	1.3b	B1.3	0.45	0.46	8.1	0.21	4.45	0.9	8.1	0.21	4.45	0.9											Street flow Indudes by-pass flow from DP 1.2b and direct runoff from basin B1.3
	2b	B2	0.86	0.55	5.0	0.47	5.17	2.4	8.1	0.68	4.45	3.0											Street flow from Sam Bass Drive and Aspen Valley Drive Recives bypass flow from 1.1b,1.2b and direct runoff from basin B1.3 and B2, continues in C&g to DP- 6b
	3b	B3	0.23	0.72	5.0	0.17	5.17	0.9															Street flow from Sam Bass Drive
	4b	B4	3.51	0.46	9.1	1.61	4.27	6.9					0.0	0	2.5					340	3.2	1.8	Type R Inlet, Bypass to DP 6B
	4i								9.1	1.61	4.27	6.9											Captured runoff from on-grade type R -Inlet from DP 4b, Piped to DP2.3
	6b	B6	3.61	0.55	6.5	2.00	4.77	9.5	8.1	2.85	4.45	12.7	5.2	1.169	2.5					95	3.2	0.5	Recives by-pass flows from Basins (B1.1, B1.2 and B4), Direct Runoff from B1.3,B2,B3, and B6 Runoff bypassed to sump inlet at DP 9B
	6i								8.1	1.68	4.45	7.5											Captured runoff from on-grade type R -Inlet DP 6i
	9b	B9	3.77	0.49	11.6	1.86	3.90	7.3	11.6	3.03	3.90	11.8											Sump inlet Recives by-pass flows from (B1.1, B1.2 and B4) Direct Runoff from B1.3,B2,B3, B6 and B9
	5b	B5	1.11	0.58	6.8	0.65	4.70	3.1					0.0	0	1.5					240	2.4	1.6	
	5i								6.8	0.65	4.70	3.1											On-grade Type R Inlet, Bypass to DP 7b Tributary basins B5
	2.2								6.8	0.65	4.70	3.1						2.0	18	240	2.8	1.4	Piped runoff to DP-2.3 Tributary basins B5
	7b	B7	1.63	0.54	7.8	0.88	4.50	4.0	7.8	0.88	4.50	4.0	0.0	0	1.6					340	2.5	2.2	On-grade Type R Inlet, Bypass to DP 8B
	7i								7.8	0.88	4.50	4.0											Captured runoff from on-grade type R -Inlet from DP 1.2b
	2.3								9.1	2.26	4.27	9.6						2.0	24	50	2.8	0.3	Piped runoff Tributary basins B5,and B4
	2.4								9.4	3.14	4.22	13.2						2.0	24	10	2.8	0.1	Piped runoff Tributary Basins B4,B5 and B7

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Homestead Fil. 2 - Proposed Conditions
Location: El Paso County
Design Storm: 5-Year

Project Name: Homestead North
Project No.: 25188.10
Calculated By: ARJ
Checked By:
Date: 3/3/22

Description	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)	
	2.5								18.5	4.27	3.20	13.7						2.0	36	380	2.8	2.2	Piped runoff to DP 2.6 Tributary Basins B1.1, B1.2, B4, B5 and B7
	8b	B8	2.14	0.54	8.1	1.15	4.45	5.1	10.1	1.15	4.12	4.7											Street Flow, Recives bypass flow from DP 7B
	2.6								20.8	5.95	3.03	18.0							36				Piped runoff Tributary Basins B1.1, B1.2,B3, B4, B5,B6, and B7
	2.7								20.8	8.98	3.03	27.2							36				Piped runoff Tributary Basins B1.1, B1.2,B3, B4, B5,B6,B7,B8, and B9
	10b	B10	0.22	0.73	5.0	0.16	5.17	0.8	10.1	1.31	4.12	5.4											Sump inlet revices by-pass flow from 7b and runoff from 5b,8b, and 10b
	2.8								20.8	10.29	3.03	31.2							48				Piped runoff in to forebay Tributary Basins B1.1, B1.2,B3, B4, B5,B6,B7, and B9
	11b	B11	1.67	0.14	9.9	0.23	4.14	1.0															
	12b	B12	2.18	0.28	16.6	0.61	3.37	2.1															
	12b	B12	2.18	0.28	16.6	0.61	3.37	2.1															Runoff from back of yard lots drains in swale to design point 12b
	3.1								16.6	0.61	3.37	2.1							18				Runoff from Basin B12 drains to type C inlet
	13b	B13	0.43	0.38	5.0	0.17	5.16	0.9															Runoff from back of yard lots drains in swale to design point 13b
	3.2								16.6	0.78	3.37	2.6							18				Runoff from Basin B13 drains to type C inlet in confluence with runoff from basin B12
	14b	B14	0.42	0.33	6.2	0.14	4.85	0.7															Runoff from Basin B14 drains directly into pond B
	4								20.8	12.05	3.03	36.5											Flow confluences into Pond B. All of Basin B
	C.1	C-1	0.92	0.48	10.1	0.44	4.12	1.8															Offsite runoff to design point C.1. Runoff treated in Homestead North Filing 1 Pond C Tributary Basin C-1
	C.2	C-2	1.24	0.40	9.4	0.50	4.23	2.1															Offsite runoff to design point C.2. Runoff treated in Homestead North Filing 1 Pond C Tributary Basin C-2

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

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Homestead Fil. 2 - Proposed Conditions
Location: El Paso County
Design Storm: 100-Year

Project Name: Homestead North
Project No.: 25188.10
Calculated By: ARJ
Checked By:
Date: 3/3/22

Description	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)	
	O.2	OS2	9.74	0.35	27.9	3.41	4.35	14.8															Sect. BB Offsite undeveloped runoff. Drains to Sand Creek within interim swale
	O.3	OS3	21.02	0.35	31.1	7.36	4.08	30.0	31.1	10.77	4.08	43.9											Sect. AA Offsite undeveloped runoff. Drains to Sand Creek within interim swale
	1.1b	B1.1	1.24	0.64	11.4	0.80	6.60	5.3					0.00	0.00	2.6					210	3.2	1.1	On-grade Type R Inlet, Bypass to DP 2B Tributary basins B1.1 and OS1
	1.1i								11.4	0.80	6.60	5.3											Captured runoff from on-grade type R -Inlet DP 1.1b piped to DP2.1
	O.1	OS1	3.83	0.35	15.7	1.34	5.80	7.8															Offsite runoff from basin OS1 sheet flows onto Perry Owens Drive
	1.2b	B1.2	0.38	0.64	7.9	0.24	7.52	1.8	15.7	1.58	5.80	9.17	0.70	0.12	2.6					235	3.2	1.2	On-grade Type R Inlet, Bypass to DP 1.3B Tributary basins B1.2 and OS1
	1.2i								15.7	1.46	5.80	8.5											Captured runoff from on-grade type R -Inlet from DP 1.2b
	2.1								15.7	2.26	5.80	13.1				13.1		2.0	24	487	2.8	2.9	Piped runoff to DP 2.4 Tributary Basins B1.1 OS1 and B1.2
	1.3b	B1.3	0.45	0.62	8.1	0.28	7.47	2.1	16.9	0.40	5.61	2.2											Street flow Indudes by-pass flow from DP 1.2b and direct runoff from basin B1.3
	2b	B2	0.86	0.68	5.0	0.59	8.68	5.1	16.9	0.99	5.61	5.56											Street flow from Sam Bass Drive and Aspen Valley Drive Recives bypass flow from 1.1b,1.2b and direct runoff from basin B1.3 and B2, continues in C&g to DP- 6b
	3b	B3	0.23	0.82	5.0	0.19	8.68	1.6															Street flow from Sam Bass Drive
	4b	B4	3.51	0.61	9.1	2.12	7.16	15.2					3.5	0.49	2.5					340	3.2	1.8	Type R Inlet, Bypass to DP 6B
	4i								9.1	1.63	7.16	11.7											Captured runoff from on-grade type R -Inlet from DP 4b, Piped to DP2.3
	6b	B6	3.61	0.68	6.5	2.47	8.01	19.8	16.9	4.14	5.61	23.23	13.3	2.37	2.5					95	3.2	0.5	Recives by-pass flows from Basins (B1.1, B1.2 and B4), Direct Runoff from B1.3,B2,B3, and B6 Runoff bypassed to sump inlet at DP 9B
	6i								16.9	1.77	5.61	9.93											Captured runoff from on-grade type R -Inlet DP 6i
	9b	B9	3.77	0.63	11.6	2.40	6.55	15.7	17.4	4.77	5.54	26.42											Sump inlet Recives by-pass flows from (B1.1, B1.2 and B4) Direct Runoff from B1.3,B2,B3, B6 and B9
	5b	B5	1.11	0.70	6.8	0.78	7.90	6.2					1.2	0.15	1.5					240	2.4	1.6	
	5i								6.8	0.63	7.90	5.0											On-grade Type R Inlet, Bypass to DP 7b Tributary basins B5
	2.2								6.8	0.63	7.90	5.0						2.0	18	240	2.8	1.4	Piped runoff to DP-2.3 Tributary basins B5
	7b	B7	1.63	0.67	7.8	1.09	7.55	8.2	8.5	1.24	7.35	9.1	1.4	0.19	1.6					340	2.5	2.2	On-grade Type R Inlet, Bypass to DP 8B
	7i								8.5	1.05	7.35	7.7											Captured runoff from on-grade type R -Inlet from DP 1.2b
	2.3								9.1	2.26	7.16	16.2						2.0		50	2.8	0.3	Piped runoff Tributary basins B5,and B4
	2.4								9.4	3.31	7.08	23.5						2.0	24	10	2.8	0.1	Piped runoff Tributary Basins B4,B5 and B7
	2.5								18.5	5.57	5.38	30.0						2.0	36	380	2.8	2.2	Piped runoff to DP 2.6 Tributary Basins B1.1, B1.2, B4, B5 and B7
	8b	B8	2.14	0.66	8.1	1.42	7.47	10.6	10.1	1.61	6.91	11.1											Street Flow, Recives bypass flow from DP 7B
	2.6								20.8	7.34	5.09	37.4							36				Piped runoff Tributary Basins B1.1, B1.2,B3, B4, B5,B6, and B7

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: Homestead Fil. 2 - Proposed Conditions
Location: El Paso County
Design Storm: 100-Year

Project Name: Homestead North
Project No.: 25188.10
Calculated By: ARJ
Checked By:
Date: 3/3/22

Description	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)	
	2.7								20.8	12.11	5.09	61.6											Piped runoff Tributary Basins B1.1, B1.2,B3, B4, B5,B6,B7,B8, and B9
	10b	B10	0.22	0.83	5.0	0.19	8.68	1.6	10.1	1.80	6.91	12.4											Sump inlet revices by-pass flow from 7b and runoff from 5b,8b, and 10b
	2.8								20.8	13.91	5.09	70.8							48				Piped runoff in to forebay Tributary Basins B1.1, B1.2,B3, B4, B5,B6,B7, and B9
	11b	B11	1.67	0.39	9.9	0.64	6.95	4.4															
	12b	B12	2.18	0.48	16.6	1.05	5.66	5.9															Runoff from back of yard lots drains in swale to design point 12b
	3.1								16.6	1.05	5.66	5.9							18				Runoff from Basin B12 drains to type C inlet
	13b	B13	0.43	0.55	5.0	0.24	8.66	2.1															Runoff from back of yard lots drains in swale to design point 13b
	3.2								16.6	1.29	5.66	7.3							18				Runoff from Basin B13 drains to type C inlet in confluence with runoff from basin B12
	14b	B14	0.42	0.51	6.2	0.21	8.14	1.7															Runoff from Basin B14 drains directly into pond B
	4								20.8	16.05	5.09	81.7											Flow confluences into Pond B. All of Basin B
	C.1	C-1	0.92	0.61	10.1	0.57	6.92	3.9															Offsite runoff to design point C.1. Runoff treated in Homestead North Filing 1 Pond C Tributary Basin C-1
	C.2	C-2	1.24	0.57	9.4	0.70	7.10	5.0															Offsite runoff to design point C.2. Runoff treated in Homestead North Filing 1 Pond C Tributary Basin C-2

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

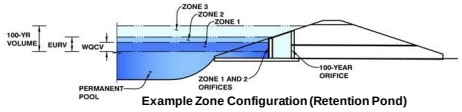
Appendix C
Hydraulic Calculations

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: 25188.10 Homestead North Filing No. 2

Basin ID:



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

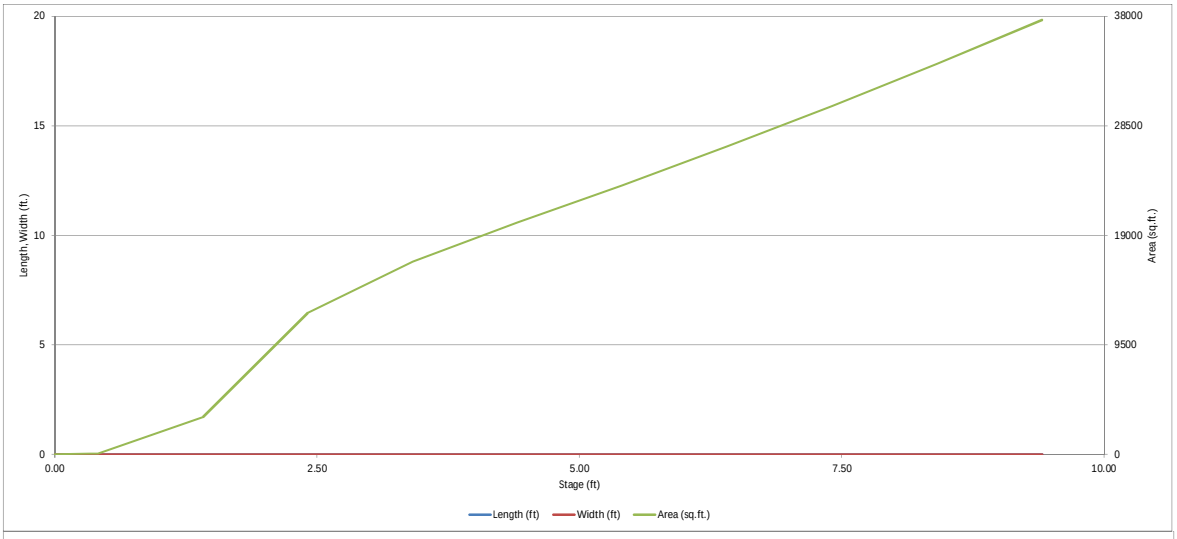
Zone 1 Volume (WQCV) =	0.442	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.860	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	1.078	acre-feet
Total Detention Basin Volume =	2.380	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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

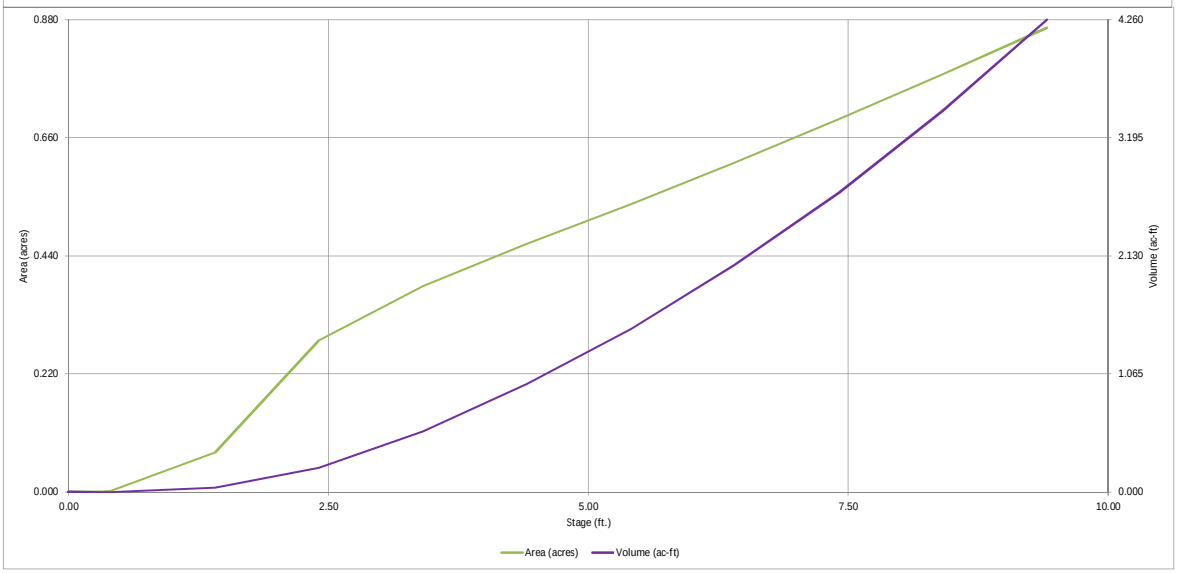
Depth Increment = ft

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)
25.59 Top of Micropool	--	0.00	--	--	--	10	0.000		
7125.93	--	0.33	--	--	--	49	0.001	10	0.000
7126	--	0.41	--	--	--	86	0.002	15	0.000
7127	--	1.41	--	--	--	3,212	0.074	1,664	0.038
7128	--	2.41	--	--	--	12,291	0.282	9,415	0.216
7129	--	3.41	--	--	--	16,722	0.384	23,922	0.549
7130	--	4.41	--	--	--	20,119	0.462	42,343	0.972
7131	--	5.41	--	--	--	23,358	0.536	64,081	1.471
7132	--	6.41	--	--	--	26,733	0.614	89,127	2.046
7133	--	7.41	--	--	--	30,244	0.694	117,616	2.700
7134	--	8.41	--	--	--	33,892	0.778	149,684	3.436
7135	--	9.41	--	--	--	37,675	0.865	185,467	4.258

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



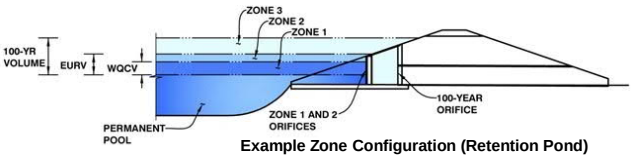


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: 25188.10 Homestead North Filing No. 2

Basin ID:



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	3.12	0.442	Orifice Plate
Zone 2 (EURV)	5.09	0.860	Orifice Plate
one 3 (100-year)	6.94	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 Area =	N/A	ft^2
Underdrain Orifice Diameter =	N/A	inches	Underdrain Orifice Centroid =	N/A	feet

Calculated Parameters for Underdra

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)	WQ Orifice Area per Row =	N/A	ft^2
Depth at top of Zone using Orifice Plate =	5.36	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

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	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	4.00				

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

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected
Overflow Weir Front Edge Height, Ho =	5.60	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.60	N/A
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	5.00	N/A
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	6.88	N/A
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	17.40	N/A
Overflow Grate Type =	Type C Grate	N/A		Overflow Grate Open Area w/ Debris =	17.40	N/A
Debris Clogging % =	0%	N/A	%			

Calculated Parameters for Overflow

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

	Zone 3 Restricto	Not Selected			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 Orifice Area =	2.53	N/A
Outlet Pipe Diameter =	24.00	N/A	inches	Outlet Orifice Centroid =	0.83	N/A
Restrictor Plate Height Above Pipe Invert =	18.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	2.09	N/A

Calculated Parameters for Outlet Pipe w/ Flow Restriction

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	7.20	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.44	feet
Spillway Crest Length =	75.00	feet	Stage at Top of Freeboard =	8.64	feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.80	acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	3.62	acre-ft

Calculated Parameters for Spillway

Routed Hydrograph Results

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

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52
CUHP Runoff Volume (acre-ft) =	0.442	1.302	1.255	1.836	2.352	3.073	3.644	4.379
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.255	1.836	2.352	3.073	3.644	4.379
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	3.0	8.2	12.5	22.4	28.1	36.0
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	0.45	0.81	1.02	1.30
Peak Inflow Q (cfs) =	N/A	N/A	18.7	28.3	35.4	47.4	56.3	67.3
Peak Outflow Q (cfs) =	0.2	0.5	0.5	3.1	10.7	23.5	28.5	30.0
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.9	1.0	1.0	0.8
Structure Controlling Flow =	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.2	0.6	1.3	1.6	1.7
Max Velocity through Grate 2 (fps) =	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	75	72	70	68	66
Time to Drain 99% of Inflow Volume (hours) =	40	72	72	80	79	78	77	76
Maximum Ponding Depth (ft) =	3.12	5.09	4.85	5.72	5.89	6.10	6.30	6.92
Area at Maximum Ponding Depth (acres) =	0.35	0.51	0.49	0.56	0.57	0.59	0.61	0.65
Maximum Volume Stored (acre-ft) =	0.442	1.303	1.182	1.635	1.737	1.860	1.979	2.370

ain

Orifice

ft^2
feet

/ Weir

feet
feet

ft^2
ft^2

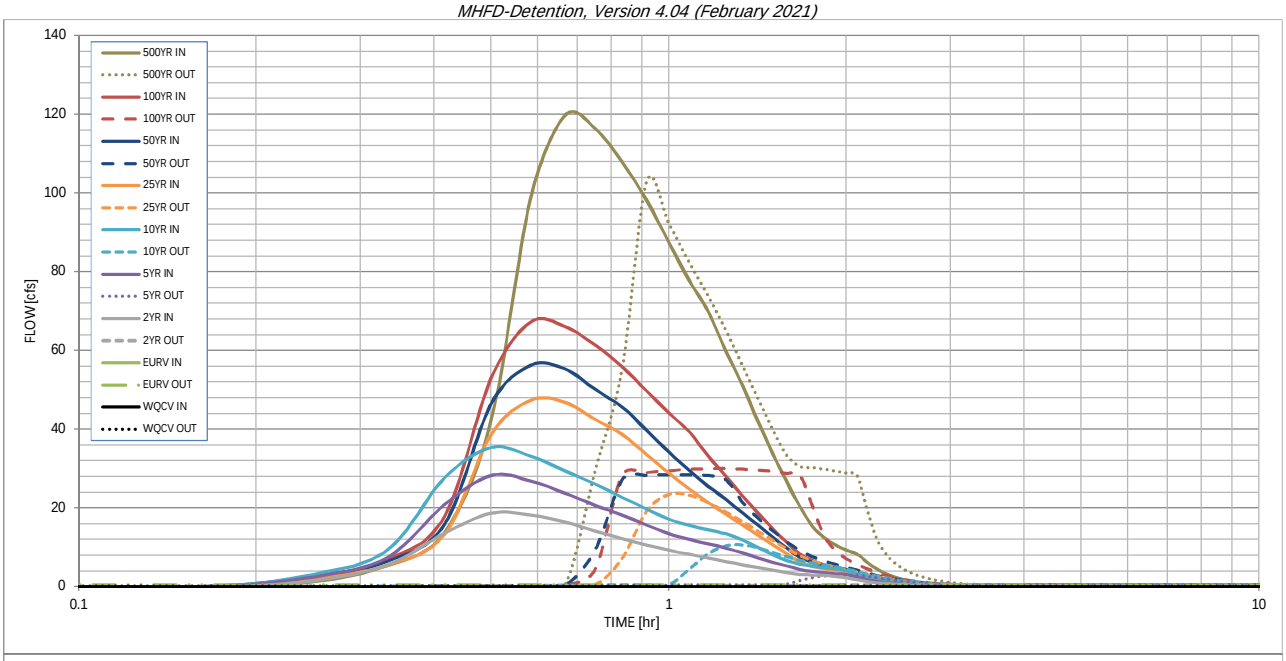
Plate

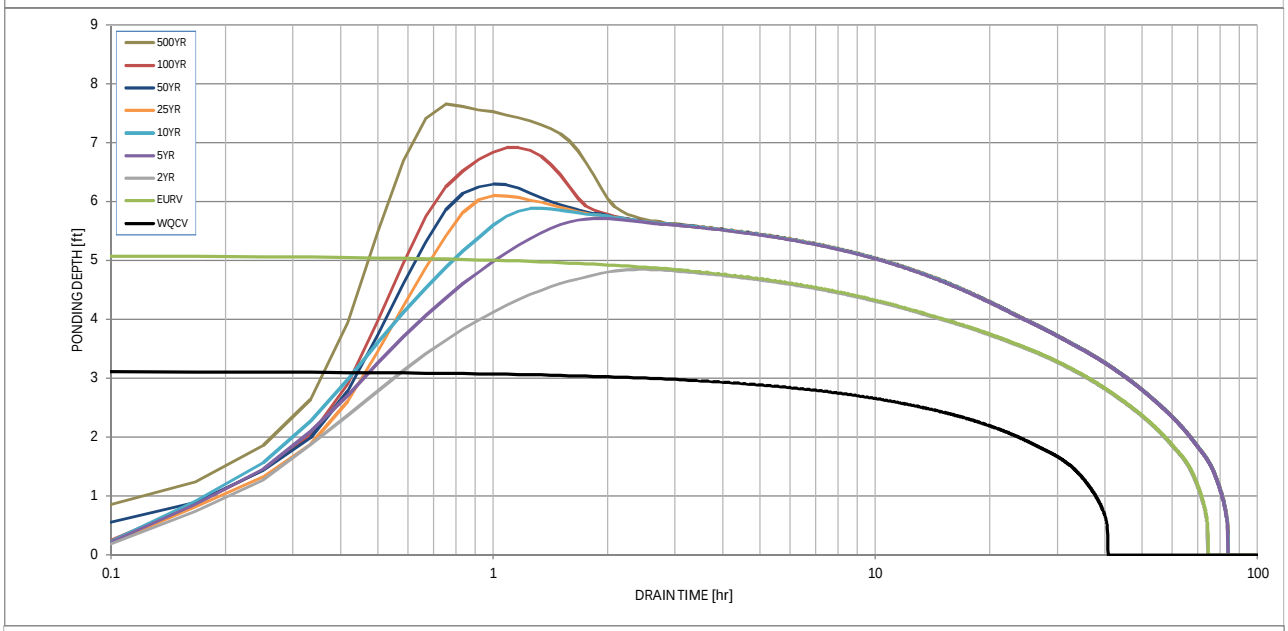
ft^2
feet
radians

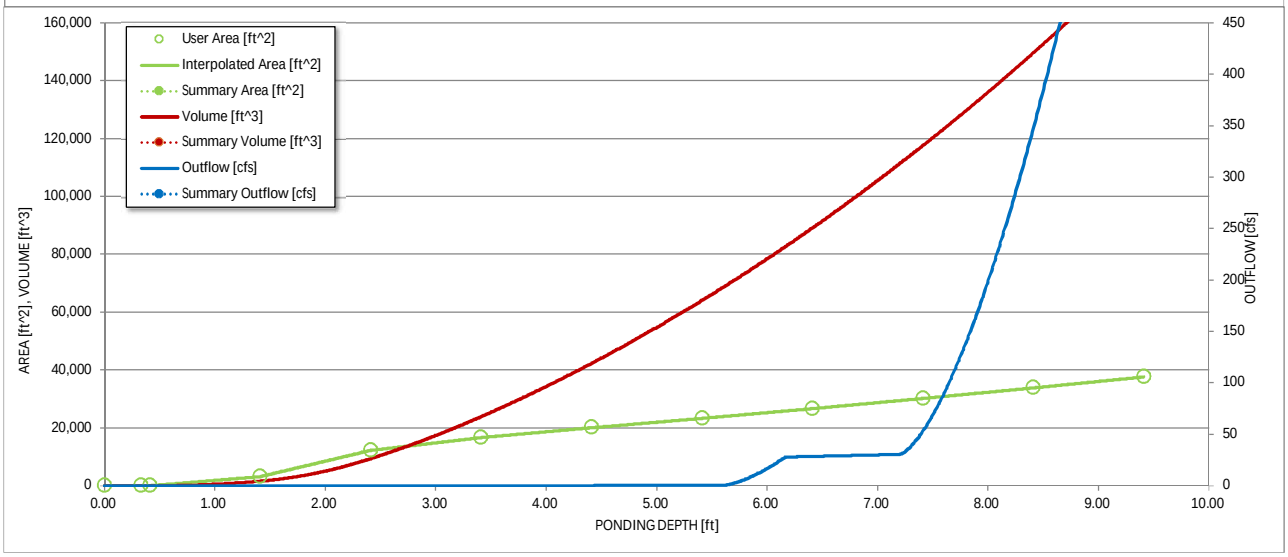
500 Year
4.00
7.939
7.939
70.5
2.55
119.7
102.9
1.5
Spillway
1.8
N/A
57
71
7.66
0.71
2.869

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	0.18	0.02	1.35
	0:15:00	0.00	0.00	1.56	2.56	3.17	2.13	2.67	2.60	5.41
	0:20:00	0.00	0.00	5.63	7.46	9.36	5.56	6.49	6.94	13.86
	0:25:00	0.00	0.00	13.61	20.88	27.68	13.40	15.94	17.90	42.45
	0:30:00	0.00	0.00	18.74	28.32	35.41	38.74	46.60	53.06	98.82
	0:35:00	0.00	0.00	18.24	26.90	33.22	47.40	56.32	67.31	119.75
	0:40:00	0.00	0.00	16.49	23.82	29.49	46.91	55.38	66.10	116.43
	0:45:00	0.00	0.00	14.22	20.74	26.12	42.52	50.15	61.47	107.92
	0:50:00	0.00	0.00	12.28	18.25	22.76	38.74	45.69	55.91	98.24
	0:55:00	0.00	0.00	10.66	15.77	19.78	33.65	39.79	49.78	87.53
	1:00:00	0.00	0.00	9.26	13.52	17.19	28.90	34.24	44.19	77.77
	1:05:00	0.00	0.00	8.28	12.02	15.59	24.85	29.55	39.37	69.87
	1:10:00	0.00	0.00	7.29	11.01	14.49	21.36	25.49	33.22	59.77
	1:15:00	0.00	0.00	6.42	9.86	13.48	18.52	22.16	28.04	51.17
	1:20:00	0.00	0.00	5.65	8.60	11.89	15.74	18.80	23.07	42.03
	1:25:00	0.00	0.00	4.91	7.38	9.95	13.18	15.71	18.67	33.87
	1:30:00	0.00	0.00	4.20	6.28	8.19	10.69	12.69	14.81	26.74
	1:35:00	0.00	0.00	3.60	5.33	6.71	8.38	9.90	11.32	20.41
	1:40:00	0.00	0.00	3.19	4.47	5.79	6.43	7.54	8.39	15.45
	1:45:00	0.00	0.00	3.00	3.94	5.26	5.27	6.19	6.70	12.54
	1:50:00	0.00	0.00	2.90	3.59	4.90	4.56	5.34	5.62	10.62
	1:55:00	0.00	0.00	2.59	3.34	4.55	4.11	4.79	4.88	9.29
	2:00:00	0.00	0.00	2.30	3.07	4.12	3.79	4.40	4.34	8.32
	2:05:00	0.00	0.00	1.82	2.43	3.24	2.97	3.43	3.29	6.31
	2:10:00	0.00	0.00	1.40	1.86	2.47	2.23	2.58	2.39	4.59
	2:15:00	0.00	0.00	1.08	1.42	1.87	1.68	1.93	1.75	3.36
	2:20:00	0.00	0.00	0.83	1.08	1.40	1.27	1.45	1.32	2.52
	2:25:00	0.00	0.00	0.63	0.81	1.04	0.95	1.08	0.99	1.87
	2:30:00	0.00	0.00	0.48	0.60	0.77	0.70	0.80	0.74	1.40
	2:35:00	0.00	0.00	0.35	0.43	0.57	0.51	0.58	0.55	1.03
	2:40:00	0.00	0.00	0.26	0.32	0.42	0.39	0.44	0.41	0.77
	2:45:00	0.00	0.00	0.18	0.22	0.30	0.28	0.31	0.29	0.55
	2:50:00	0.00	0.00	0.12	0.15	0.19	0.19	0.21	0.20	0.36
	2:55:00	0.00	0.00	0.07	0.09	0.11	0.11	0.13	0.12	0.22
	3:00:00	0.00	0.00	0.03	0.05	0.06	0.06	0.07	0.06	0.11
	3:05:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	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).

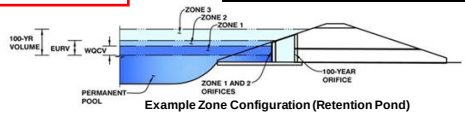
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.03 (May 2020)

FROM PRELIMINARY

Project: Homestead North at Sterling Ranch

Basin ID: Pond B



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	27.86	acres
Watershed Length =	1,290	ft
Watershed Length to Centroid =	775	ft
Watershed Slope =	0.020	ft/ft
Watershed Imperviousness =	50.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
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) =	0.479	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	1.489	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	1.408	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.) =	2.543	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	3.255	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	3.834	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	4.566	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 4 in.) =	8.151	acre-feet	4.00 inches
Approximate 2-yr Detention Volume =	1.124	acre-feet	
Approximate 5-yr Detention Volume =	1.540	acre-feet	
Approximate 10-yr Detention Volume =	2.040	acre-feet	
Approximate 25-yr Detention Volume =	2.233	acre-feet	
Approximate 50-yr Detention Volume =	2.335	acre-feet	
Approximate 100-yr Detention Volume =	2.606	acre-feet	

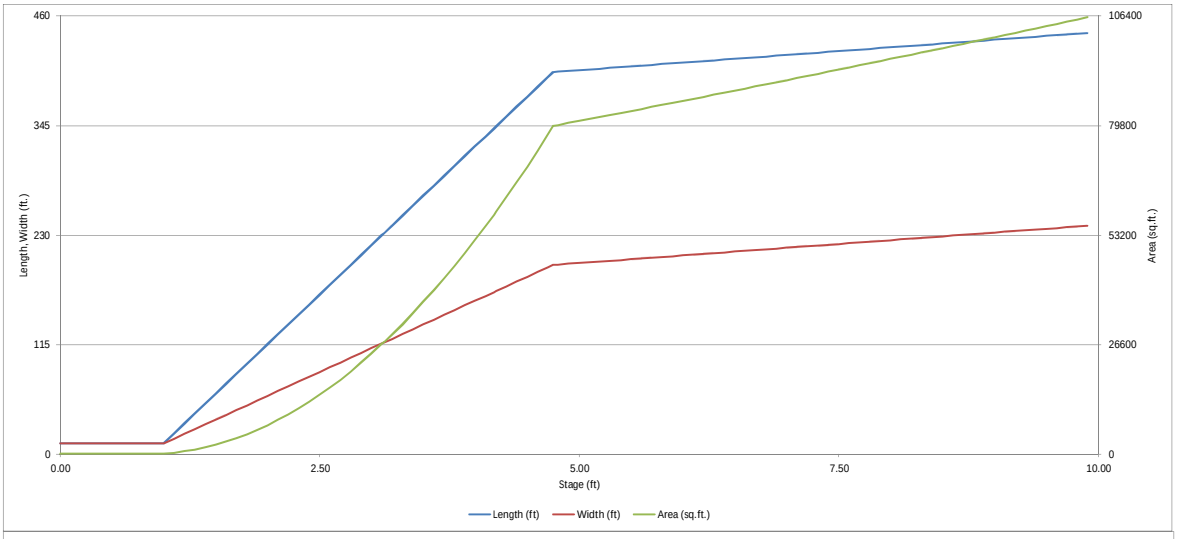
Define Zones and Basin Geometry

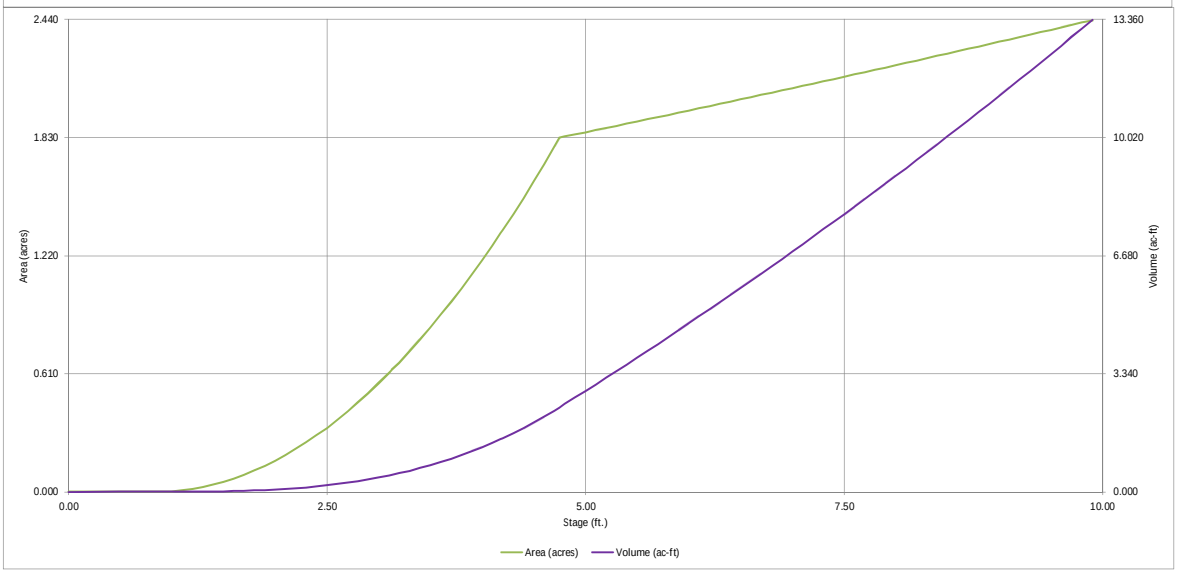
Zone 1 Volume (WQCV) =	0.479	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.010	acre-feet
Zone 3 (100yr + 1 / 2 WQCV - Zones 1 & 2) =	1.356	acre-feet
Total Detention Basin Volume =	2.845	acre-feet
Initial Surcharge Volume (ISV) =	63	ft^3
Initial Surcharge Depth (ISD) =	0.50	ft
Total Available Detention Depth (H_{total}) =	5.00	ft
Depth of Trickle Channel (H_{TC}) =	0.50	ft
Slope of Trickle Channel (S_{TC}) =	0.010	ft/ft
Slopes of Main Basin Sides (S_{main}) =	4	H:V
Basin Length-to-Width Ratio (R_{LW}) =	2	
Initial Surcharge Area (A_{ISV}) =	125	ft^2
Surcharge Volume Length (L_{ISV}) =	11.2	ft
Surcharge Volume Width (W_{ISV}) =	11.2	ft
Depth of Basin Floor (H_{FLOOR}) =	3.75	ft
Length of Basin Floor (L_{FLOOR}) =	401.2	ft
Width of Basin Floor (W_{FLOOR}) =	198.7	ft
Area of Basin Floor (A_{FLOOR}) =	79,711	ft^2
Volume of Basin Floor (V_{FLOOR}) =	103,743	ft^3
Depth of Main Basin (H_{MAIN}) =	0.25	ft
Length of Main Basin (L_{MAIN}) =	403.2	ft
Width of Main Basin (W_{MAIN}) =	200.7	ft
Area of Main Basin (A_{MAIN}) =	80,914	ft^2
Volume of Main Basin (V_{MAIN}) =	20,078	ft^3
Calculated Total Basin Volume (V_{total}) =	2.845	acre-feet

Depth Increment = 0.10 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	0.00		11.2	11.2	125		0.003		
ISV	0.50		11.2	11.2	125		0.003	63	0.001
	0.60		11.2	11.2	125		0.003	75	0.002
	0.70		11.2	11.2	125		0.003	88	0.002
	0.80		11.2	11.2	125		0.003	100	0.002
	0.90		11.2	11.2	125		0.003	113	0.003
	1.00		11.2	11.2	125		0.003	125	0.003
	1.10		21.6	16.2	349		0.008	148	0.003
	1.20		32.0	21.2	678		0.016	199	0.005
	1.30		42.4	26.2	1,110		0.025	287	0.007
	1.40		52.8	31.2	1,646		0.038	424	0.010
	1.50		63.2	36.2	2,287		0.052	620	0.014
	1.60		73.6	41.2	3,031		0.070	885	0.020
	1.70		84.0	46.2	3,879		0.089	1,229	0.028
	1.80		94.4	51.2	4,831		0.111	1,664	0.038
	1.90		104.8	56.2	5,888		0.135	2,199	0.050
	2.00		115.2	61.2	7,048		0.162	2,845	0.065
	2.10		125.6	66.2	8,312		0.191	3,612	0.083
	2.20		136.0	71.2	9,681		0.222	4,511	0.104
	2.30		146.4	76.2	11,153		0.256	5,552	0.127
	2.40		156.8	81.2	12,729		0.292	6,745	0.155
	2.50		167.2	86.2	14,409		0.331	8,101	0.186
	2.60		177.6	91.2	16,194		0.372	9,630	0.221
	2.70		188.0	96.2	18,082		0.415	11,343	0.260
	2.80		198.4	101.2	20,074		0.461	13,250	0.304
	2.90		208.8	106.2	22,170		0.509	15,362	0.353
	3.00		219.2	111.2	24,371		0.559	17,688	0.406
	3.10		229.6	116.2	26,675		0.612	20,239	0.465
Zone 1 (WQCV)	3.13		232.7	117.7	27,387		0.629	21,050	0.483
	3.20		240.0	121.2	29,083		0.668	23,026	0.529
	3.30		250.4	126.2	31,596		0.725	26,059	0.598
	3.40		260.8	131.2	34,212		0.785	29,349	0.674
	3.50		271.2	136.2	36,932		0.848	32,905	0.755
	3.60		281.6	141.2	39,756		0.913	36,739	0.843
	3.70		292.0	146.2	42,685		0.980	40,860	0.938
	3.80		302.4	151.2	45,717		1.050	45,279	1.039
	3.90		312.8	156.2	48,853		1.122	50,007	1.148
	4.00		323.2	161.2	52,094		1.196	55,053	1.264
	4.10		333.6	166.2	55,438		1.273	60,429	1.387
Zone 2 (EURV)	4.18		341.9	170.2	58,188		1.336	64,974	1.492
	4.20		344.0	171.2	58,886		1.352	66,144	1.518
	4.30		354.4	176.2	62,438		1.433	72,210	1.658
	4.40		364.8	181.2	66,095		1.517	78,635	1.805
	4.50		375.2	186.2	69,855		1.604	85,432	1.961
	4.60		385.6	191.2	73,719		1.692	92,610	2.126
	4.70		396.0	196.2	77,688		1.783	100,179	2.300
Floor	4.75		401.2	198.7	79,711		1.830	104,114	2.390
	4.80		401.6	199.1	79,951		1.835	108,106	2.482
	4.90		402.4	199.9	80,432		1.846	116,125	2.666
Z3 (100+1/2WQCV	5.00		403.2	200.7	80,914		1.858	124,192	2.851
	5.10		404.0	201.5	81,398		1.869	132,308	3.037
	5.20		404.8	202.3	81,883		1.880	140,472	3.225
	5.30		405.6	203.1	82,369		1.891	148,684	3.413
	5.40		406.4	203.9	82,857		1.902	156,946	3.603
	5.50		407.2	204.7	83,346		1.913	165,256	3.794
	5.60		408.0	205.5	83,836		1.925	173,615	3.986
	5.70		408.8	206.3	84,327		1.936	182,023	4.179
	5.80		409.6	207.1	84,820		1.947	190,481	4.373
	5.90		410.4	207.9	85,314		1.959	198,987	4.568
	6.00		411.2	208.7	85,809		1.970	207,543	4.765
	6.10		412.0	209.5	86,306		1.981	216,149	4.962
	6.20		412.8	210.3	86,804		1.993	224,805	5.161
	6.30		413.6	211.1	87,303		2.004	233,510	5.361
	6.40		414.4	211.9	87,803		2.016	242,265	5.562
	6.50		415.2	212.7	88,305		2.027	251,071	5.764
	6.60		416.0	213.5	88,808		2.039	259,926	5.967
	6.70		416.8	214.3	89,312		2.050	268,832	6.172
	6.80		417.6	215.1	89,818		2.062	277,789	6.377
	6.90		418.4	215.9	90,324		2.074	286,796	6.584
	7.00		419.2	216.7	90,832		2.085	295,854	6.792
	7.10		420.0	217.5	91,342		2.097	304,962	7.001
	7.20		420.8	218.3	91,852		2.109	314,122	7.211
	7.30		421.6	219.1	92,364		2.120	323,333	7.423
	7.40		422.4	219.9	92,877		2.132	332,595	7.635
	7.50		423.2	220.7	93,392		2.144	341,908	7.849
	7.60		424.0	221.5	93,908		2.156	351,273	8.064
	7.70		424.8	222.3	94,425		2.168	360,690	8.280
	7.80		425.6	223.1	94,943		2.180	370,158	8.498
	7.90		426.4	223.9	95,463		2.192	379,679	8.716
	8.00		427.2	224.7	95,983		2.203	389,251	8.936
	8.10		428.0	225.5	96,506		2.215	398,875	9.157
	8.20		428.8	226.3	97,029		2.227	408,552	9.379
	8.30		429.6	227.1	97,554		2.240	418,281	9.602
	8.40		430.4	227.9	98,080		2.252	428,063	9.827
	8.50		431.2	228.7	98,607		2.264	437,897	10.053
	8.60		432.0	229.5	99,135		2.276	447,784	10.280
	8.70		432.8	230.3	99,665		2.288	457,724	10.508
	8.80		433.6	231.1	100,196		2.300	467,717	10.737
	8.90		434.4	231.9	100,729		2.312	477,764	10.968
	9.00		435.2	232.7	101,262		2.325	487,863	11.200
	9.10		436.0	233.5	101,797		2.337	498,016	11.433
	9.20		436.8	234.3	102,334		2.349	508,223	11.667
	9.30		437.6	235.1	102,871		2.362	518,483	11.903
	9.40		438.4	235.9	103,410		2.374	528,797	12.140
	9.50		439.2	236.7	103,950		2.386	539,165	12.378
	9.60		440.0	237.5	104,491		2.399	549,587	12.617
	9.70		440.8	238.3	105,034		2.411	560,063	12.857
	9.80		441.6	239.1	105,578		2.424	570,594	13.099
	9.90		442.4	239.9	106,123		2.436	581,179	13.342

FROM PRELIMINARY





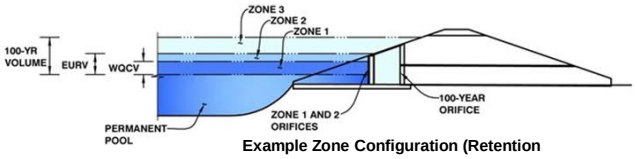
DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

FROM PRELIMINARY

Project: Homestead North at Sterling Ranch

Basin ID: Pond B



Example Zone Configuration (Retention

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
e 1 (WQCV)	3.13	0.479	Orifice Plate
e 2 (EURV)	4.18	1.010	Orifice Plate
1/2WQCV)	5.00	1.356	Weir&Pipe (Restrict)
Total (all zones)		2.845	

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

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

Calculated Parameters for Underdrain

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

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 =	4.11	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

Calculated Parameters for Plate

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	ow 4 (optiona	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	ow 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.37	2.74	3.20				
Orifice Area (sq. inches)	1.60	1.60	1.60	9.00				

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected			Not Selected	Not Selected	
Invert of Vertical Orifice =		N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =		N/A	ft^2
Depth at top of Zone using Vertical Orifice =	N/A	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =		N/A	feet
Vertical Orifice Diameter =		N/A	inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.11	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.11	N/A	feet
Overflow Weir Front Edge Length =	5.00	N/A	feet	Overflow Weir Slope Length =	5.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	5.76	N/A	
Horiz. Length of Weir Sides =	5.00	N/A	feet	Overflow Grate Open Area w/o Debris =	17.50	N/A	ft^2
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area	Overflow Grate Open Area w/ Debris =	5.25	N/A	ft^2
Debris Clogging % =	70%	N/A	%				

Calculated Parameters for Overflow Weir

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

	one 3 Restrictc	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	3.04	N/A	ft^2
Outlet Pipe Diameter =	33.00	N/A	inches	Outlet Orifice Centroid =	0.80	N/A	feet
Restrictor Plate Height Above Pipe Invert =	16.80		inches	Half-Central Angle of Restrictor Plate on Pipe =	1.59	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.16	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.91 feet
Spillway Crest Length =	23.00	feet	Stage at Top of Freeboard =	7.07 feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	2.09 acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	6.94 acre-ft

Calculated Parameters for Spillway

Routed Hydrograph Results

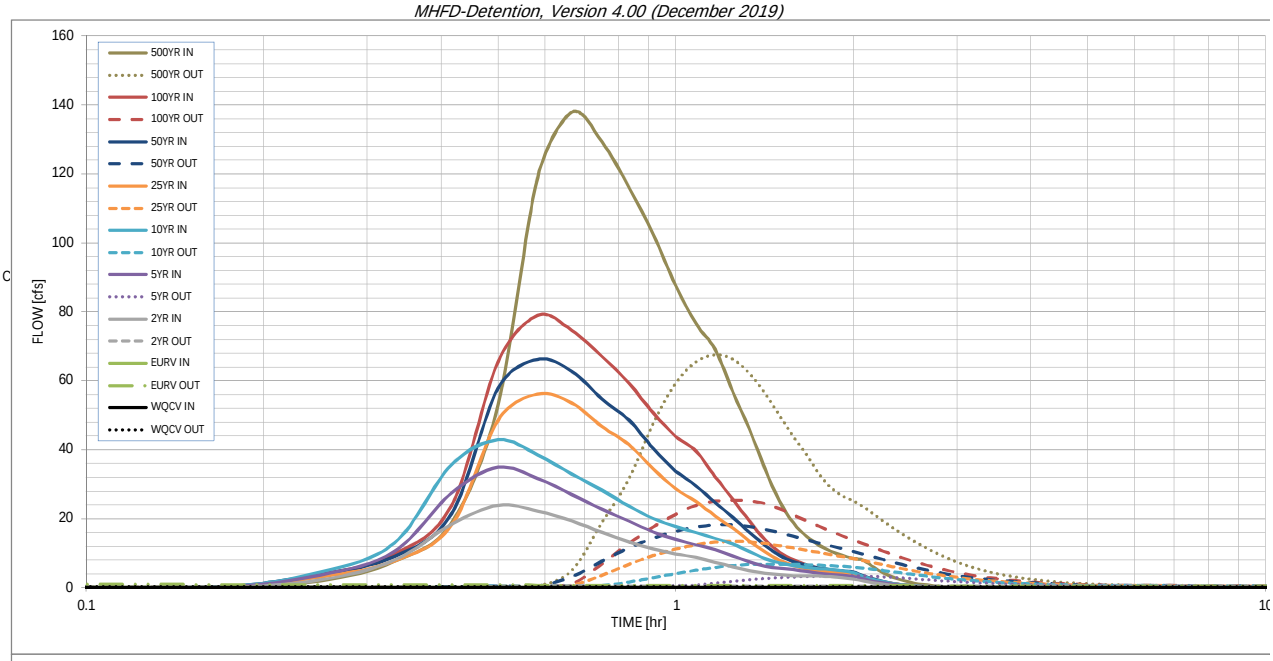
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

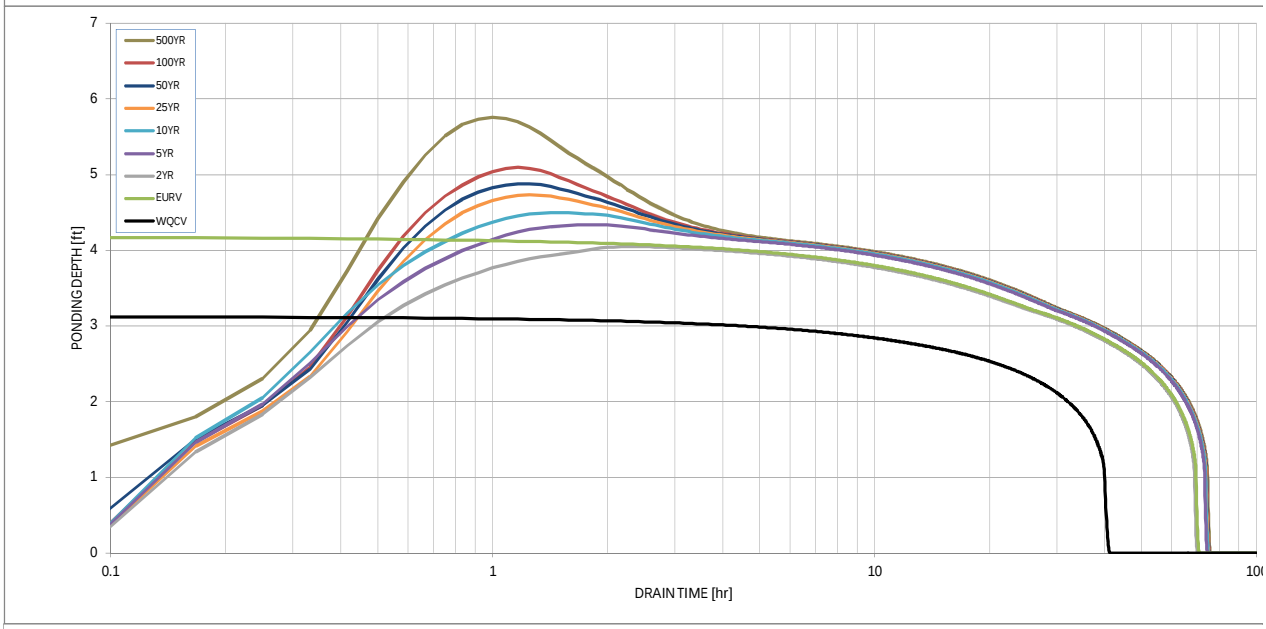
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	4.00
CUHP Runoff Volume (acre-ft) =	0.479	1.489	1.408	2.012	2.543	3.255	3.834	4.566	8.151
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	1.408	2.012	2.543	3.255	3.834	4.566	8.151
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	3.2	9.1	13.8	24.2	30.4	38.6	75.6
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.12	0.33	0.49	0.87	1.09	1.39	2.71
Peak Inflow Q (cfs) =	N/A	N/A	23.9	34.9	42.9	56.2	66.2	79.0	137.9
Peak Outflow Q (cfs) =	0.2	1.0	0.5	3.4	6.8	13.4	18.2	25.4	67.6
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.5	0.6	0.6	0.7	0.9
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	verflow Weir	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	verflow Weir	Spillway
Max Velocity through Grate 1 (fps) =	N/A	0.03	N/A	0.2	0.4	0.7	1.0	1.4	1.9
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	64	63	66	65	63	61	59	51
Time to Drain 99% of Inflow Volume (hours) =	40	67	67	70	70	70	69	68	65
Maximum Ponding Depth (ft) =	3.13	4.18	4.05	4.34	4.50	4.73	4.88	5.09	5.75
Area at Maximum Ponding Depth (acres) =	0.63	1.34	1.23	1.46	1.59	1.81	1.84	1.87	1.94
Maximum Volume Stored (acre-ft) =	0.483	1.492	1.312	1.701	1.945	2.354	2.629	3.019	4.276

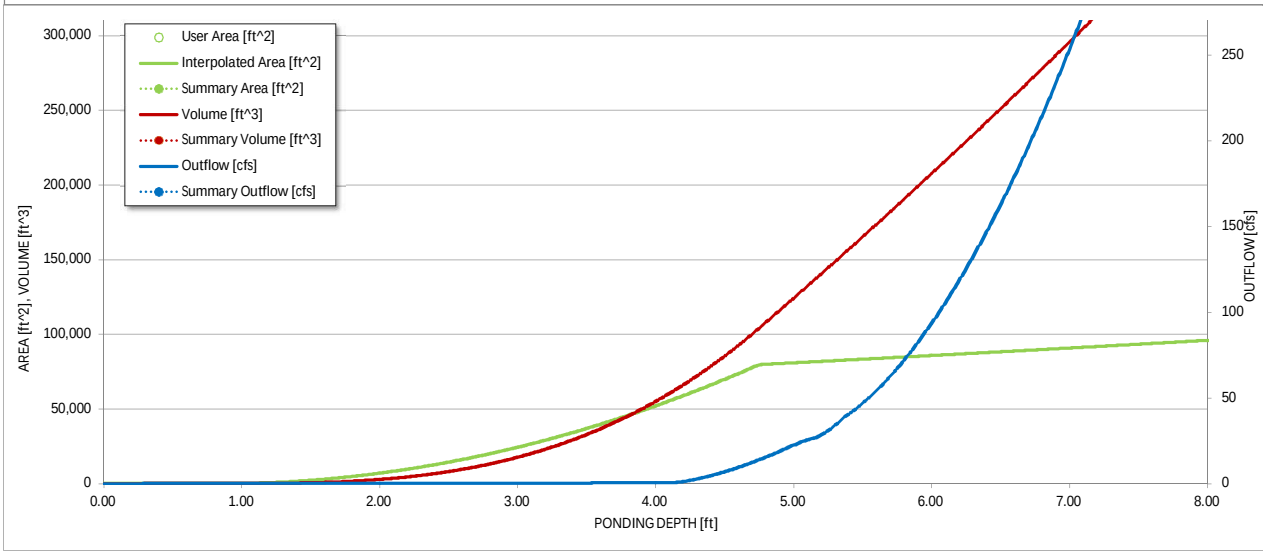
FROM PRELIMINARY

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.00 (December 2019)







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

FROM PRELIMINARY

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	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]
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	0.26	0.03	1.94
0:15:00	0.00	0.00	2.25	3.68	4.56	3.07	3.82	3.74	7.60
0:20:00	0.00	0.00	7.96	10.47	12.93	7.75	9.02	9.68	18.73
0:25:00	0.00	0.00	18.41	27.41	35.61	18.07	21.36	23.77	53.14
0:30:00	0.00	0.00	23.88	34.90	42.90	48.54	57.90	65.58	118.97
0:35:00	0.00	0.00	22.17	31.65	38.52	56.18	66.22	79.00	137.93
0:40:00	0.00	0.00	19.33	26.98	32.92	53.54	62.76	74.62	129.24
0:45:00	0.00	0.00	16.01	22.72	28.26	46.69	54.71	67.07	116.05
0:50:00	0.00	0.00	13.29	19.30	23.63	41.48	48.60	59.29	102.37
0:55:00	0.00	0.00	11.19	16.14	20.00	34.37	40.35	50.64	87.66
1:00:00	0.00	0.00	9.79	14.00	17.71	28.69	33.79	43.89	76.53
1:05:00	0.00	0.00	8.75	12.42	15.96	24.94	29.48	39.51	69.11
1:10:00	0.00	0.00	7.35	10.96	14.29	20.83	24.67	32.15	56.88
1:15:00	0.00	0.00	6.06	9.22	12.69	17.21	20.44	25.64	46.02
1:20:00	0.00	0.00	4.95	7.48	10.52	13.53	16.04	19.30	34.53
1:25:00	0.00	0.00	4.15	6.23	8.45	10.42	12.31	14.00	25.12
1:30:00	0.00	0.00	3.71	5.57	7.21	7.92	9.35	10.26	18.74
1:35:00	0.00	0.00	3.50	5.22	6.44	6.42	7.55	8.05	14.86
1:40:00	0.00	0.00	3.40	4.64	5.89	5.49	6.42	6.66	12.33
1:45:00	0.00	0.00	3.33	4.18	5.51	4.88	5.67	5.69	10.58
1:50:00	0.00	0.00	3.27	3.85	5.24	4.47	5.16	5.03	9.37
1:55:00	0.00	0.00	2.86	3.60	4.89	4.20	4.82	4.56	8.50
2:00:00	0.00	0.00	2.51	3.31	4.37	4.01	4.58	4.26	7.93
2:05:00	0.00	0.00	1.89	2.48	3.24	3.00	3.42	3.16	5.85
2:10:00	0.00	0.00	1.38	1.80	2.32	2.16	2.46	2.28	4.19
2:15:00	0.00	0.00	1.00	1.30	1.67	1.56	1.77	1.65	3.04
2:20:00	0.00	0.00	0.72	0.93	1.20	1.12	1.27	1.20	2.19
2:25:00	0.00	0.00	0.51	0.64	0.84	0.79	0.89	0.84	1.54
2:30:00	0.00	0.00	0.35	0.43	0.58	0.55	0.62	0.59	1.07
2:35:00	0.00	0.00	0.23	0.30	0.39	0.38	0.43	0.40	0.73
2:40:00	0.00	0.00	0.14	0.19	0.24	0.24	0.27	0.26	0.46
2:45:00	0.00	0.00	0.07	0.10	0.13	0.14	0.15	0.14	0.25
2:50:00	0.00	0.00	0.03	0.05	0.05	0.06	0.07	0.06	0.11
2:55:00	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.02
3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.03 (May 2020)

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.

FROM PRELIMINARY

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

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

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

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

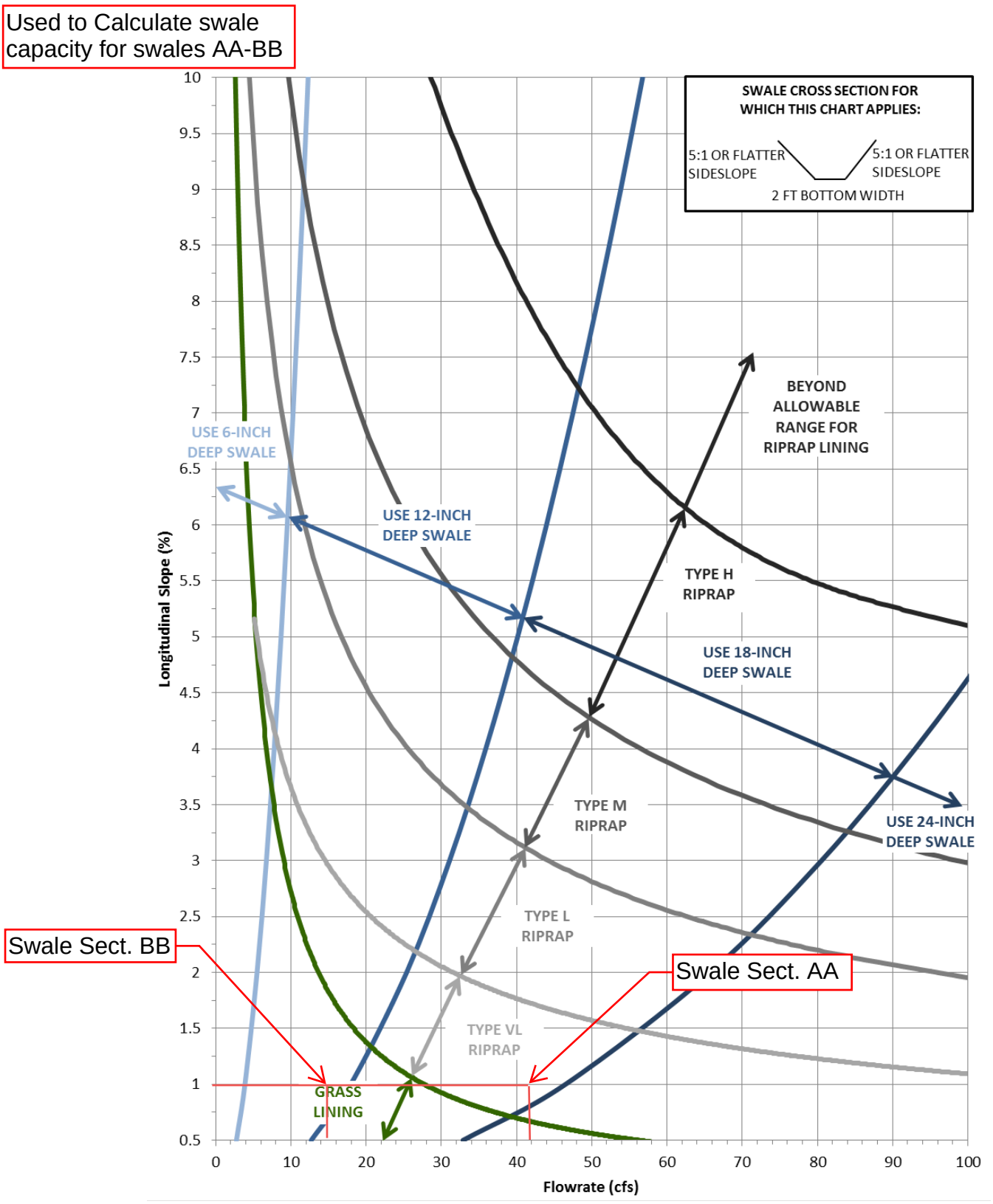


Figure 8-22. Swale stability chart; 2- to 4-foot bottom width and side slopes between 5:1 and 10:1 (Note: Riprap classifications refer to gradation for riprap used in soil riprap or void-filled riprap. See Figure 8-34 for gradations.) (Source: Muller Engineering Company)

Channel Report

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

Swale Sect. AA - DP O.3

Trapezoidal

Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 5.00, 5.00
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 7158.00
Slope (%)	= 1.00
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 43.90

Highlighted

Depth (ft)	= 1.39
Q (cfs)	= 43.90
Area (sqft)	= 12.44
Velocity (ft/s)	= 3.53
Wetted Perim (ft)	= 16.18
Crit Depth, Yc (ft)	= 1.19
Top Width (ft)	= 15.90
EGL (ft)	= 1.58

Section

Channel Report

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

Swale Sect. AA - DP O.2

Trapezoidal

Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 5.00, 5.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 7164.00
Slope (%)	= 1.00
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 14.80

Highlighted

Depth (ft)	= 0.87
Q (cfs)	= 14.80
Area (sqft)	= 5.52
Velocity (ft/s)	= 2.68
Wetted Perim (ft)	= 10.87
Crit Depth, Yc (ft)	= 0.72
Top Width (ft)	= 10.70
EGL (ft)	= 0.98

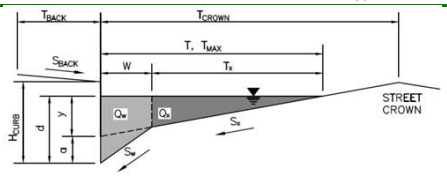
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 1.1B



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.2	ft
Gutter Width	W =	1.17	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 =	0.030	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.2	16.2	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.5	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

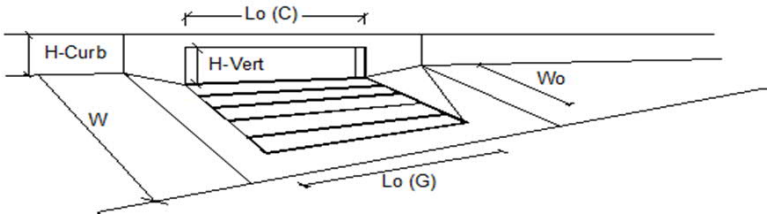
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**15.5**	**15.5**	**cfs**

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

Version 4.05 Released March 2017



Design Information (Input)		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	
Total Inlet Interception Capacity	**Q =**	**2.4**	**5.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**100**	**%**

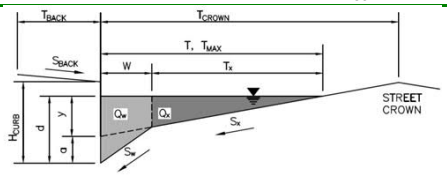
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 1.2B



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.2	ft
Gutter Width	W =	1.17	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 =	0.030	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.2	16.2	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.5	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

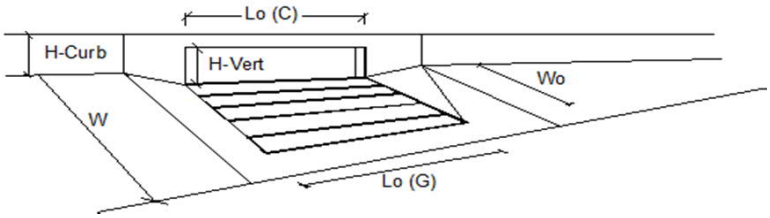
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**15.5**	**15.5**	**cfs**

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

Version 4.05 Released March 2017



Design Information (Input)		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	
Total Inlet Interception Capacity	**Q =**	**1.7**	**8.5**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.7**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**93**	**%**

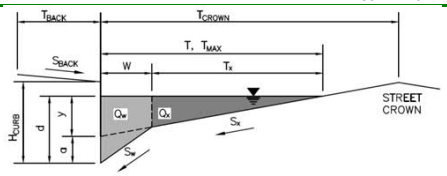
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 4b



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.2	ft
Gutter Width	W =	1.17	ft
Street Transverse Slope	S_X =	0.025	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 =	0.016	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.2	16.2	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.5	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

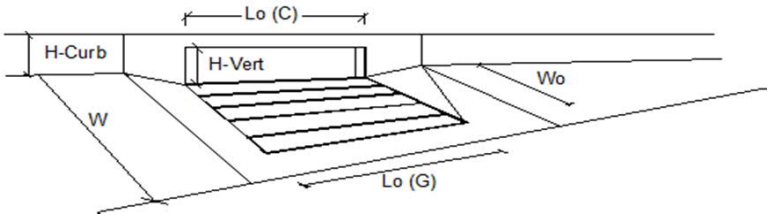
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**16.3**	**16.3**	**cfs**

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

Version 4.05 Released March 2017



Design Information (Input)		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 =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7.0**	**12.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**3.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**99**	**78**	**%**

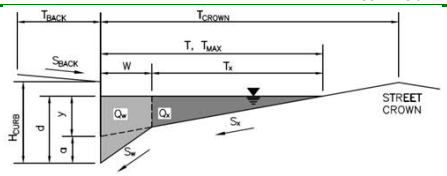
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 9b



Gutter Geometry (Enter data in the blue cells)

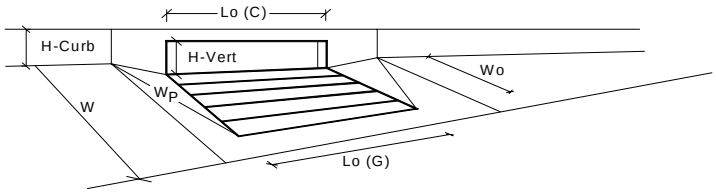
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.2	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.2	16.2	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.5	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

Version 4.05 Released March 2017



Design Information (Input)		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 =	5.7	7.5	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	
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} =	0.31	0.46	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.54	0.71	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.77	0.87	
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 =**	**11.8**	**24.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	9.2	22.6	cfs

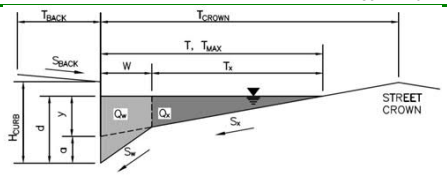
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 7b



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.2	ft
Gutter Width	W =	1.17	ft
Street Transverse Slope	S_X =	0.022	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 =	0.016	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.2	16.2	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.5	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

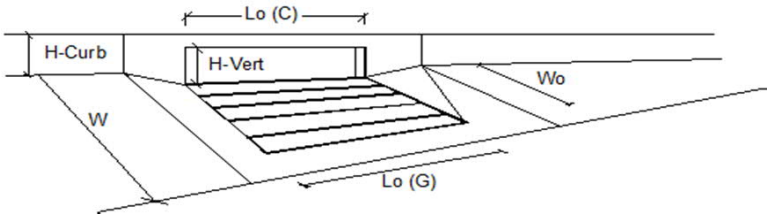
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**13.2**	**13.2**	**cfs**

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

Version 4.05 Released March 2017



Design Information (Input)		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	
Total Inlet Interception Capacity	**Q =**	**5.0**	**9.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.4**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**88**	**%**

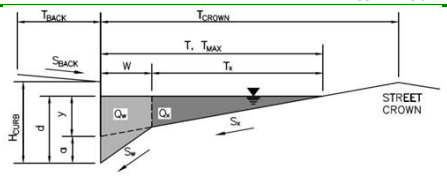
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 10b



Gutter Geometry (Enter data in the blue cells)

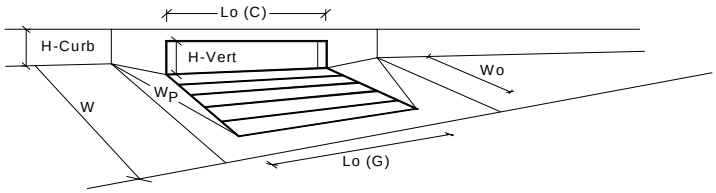
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	9.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.2	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.016	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.2	16.2	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.5	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

Version 4.05 Released March 2017



Design Information (Input)		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 =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	5.4	7.5	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) =	20.00	20.00	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	
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} =	0.28	0.46	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.51	0.71	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.75	0.87	
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 =**	**9.3**	**22.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	5.4	12.5	cfs

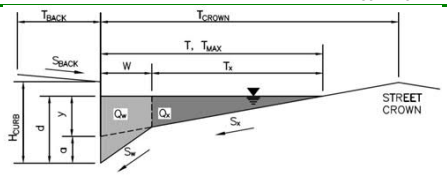
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP 6B



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.2	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 =	0.020	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.2	16.2	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.5	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☑	check = yes

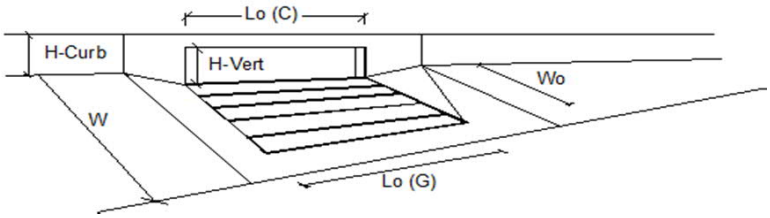
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**18.1**	**43.3**	**cfs**

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

Version 4.05 Released March 2017



Design Information (Input)		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 =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**7.5**	**9.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**5.2**	**13.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**59**	**42**	**%**

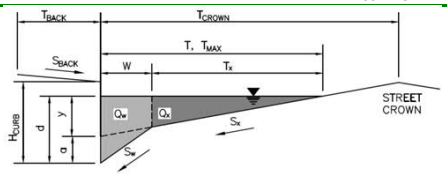
Version 4.05 Released March 2017

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

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

Project: Homestead North

Inlet ID: Inlet DP5B



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.016	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	16.2	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 =	0.014	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.2	16.2	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.5	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

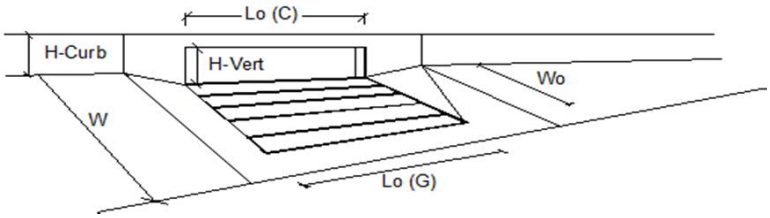
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**15.1**	**15.1**	**cfs**

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

Version 4.05 Released March 2017



Design Information (Input)		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 =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**3.2**	**5.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**1.2**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**100**	**81**	**%**

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: ARJ
Company: JR ENGINEERING
Date: January 25, 2022
Project: STERLING RANCH HOMESTEAD FIL. 2
Location: EL PASO COUNTY

1. Basin Storage Volume

A) Effective Imperviousness of Tributary Area, I_a — I_a = 50.0 %

B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$) — i = 0.500

C) Contributing Watershed Area — Area = 27.860 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)
$V_{DESIGN\ USER}$ = 0.457 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} = 102.60 cfs

ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)
Q_F = 2.05 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 = 7.6 in

Weir Report

Pond Forebay Notch

Rectangular Weir

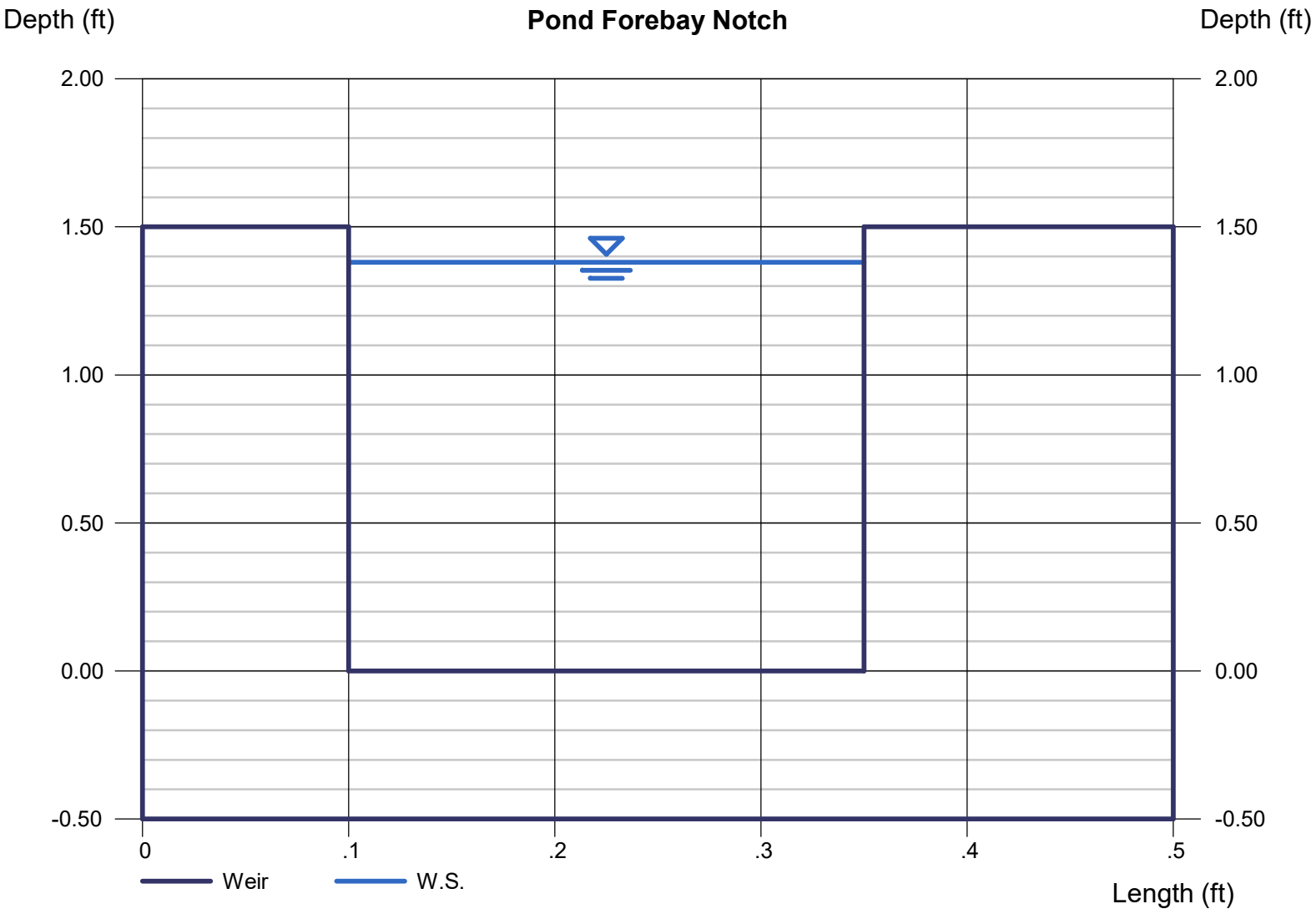
Crest	= Sharp
Bottom Length (ft)	= 0.25
Total Depth (ft)	= 1.50

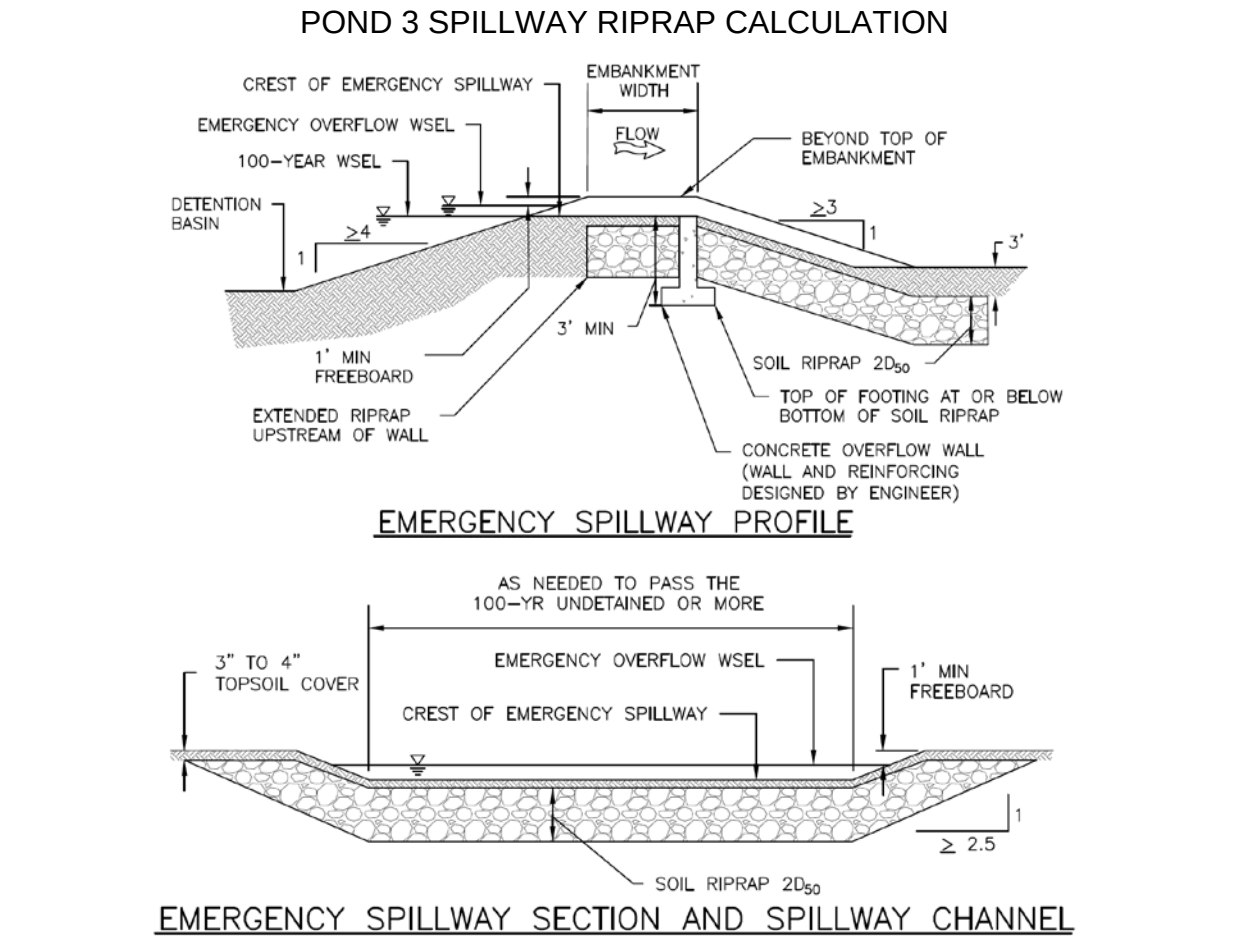
Calculations

Weir Coeff. Cw	= 3.33
Compute by:	Known Q
Known Q (cfs)	= 1.35

Highlighted

Depth (ft)	= 1.38
Q (cfs)	= 1.350
Area (sqft)	= 0.35
Velocity (ft/s)	= 3.91
Top Width (ft)	= 0.25





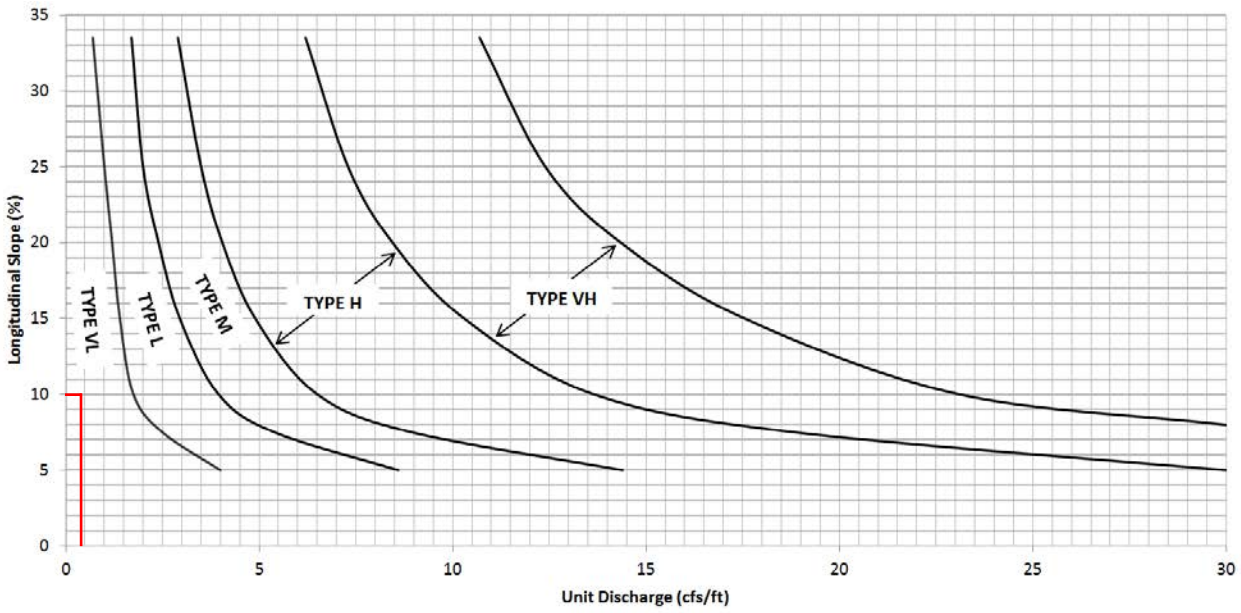
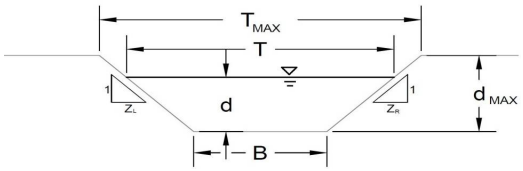


Figure 12-21. Embankment protection details and rock sizing chart (adapted from Arapahoe County)

AREA INLET IN A SWALE

Inlet 12b



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

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.035	
Channel Invert Slope	S_O =	0.0140	ft/ft
Bottom Width	B =	4.00	ft
Left Side Slope	Z1 =	4.00	ft/ft
Right Side Sloe	Z2 =	4.00	ft/ft

Check one of the following soil types:

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

Choose One:
- Non-Cohesive
- Cohesive
- Paved

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	**6.00**	**8.00**	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	**0.50**	**0.50**	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	**2.2**	**7.8**	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	**0.25**	**0.50**	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	**2.1**	**5.9**	cfs
Water Depth	d =	**0.24**	**0.43**	ft

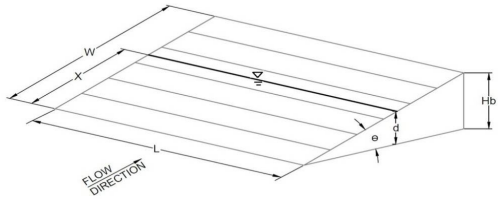
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'

AREA INLET IN A SWALE

Inlet 12b

Inlet Design Information (Input)

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

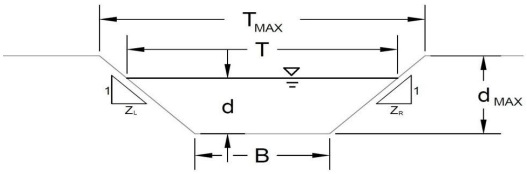


		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.24	0.43	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.2**	**5.2**	**cfs**
Bypassed Flow	**Q_b =**	**0.0**	**0.7**	**cfs**
Capture Percentage = Qa/Qo	**C% =**	**100**	**89**	**%**

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

AREA INLET IN A SWALE

inlet 13b



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

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D, or E =		
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	0.035	
Channel Invert Slope	S_O =	0.0239	ft/ft
Bottom Width	B =	4.00	ft
Left Side Slope	Z1 =	4.00	ft/ft
Right Side Sloe	Z2 =	4.00	ft/ft

Check one of the following soil types:

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

Choose One:
- (•) **Non-Cohesive**
- ( ) **Cohesive**
- ( ) **Paved**

		Minor Storm	Major Storm	
Maximum Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	6.00	8.00	ft
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	0.50	0.50	ft

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	2.9	10.2	cfs
MAJOR STORM Allowable Capacity is based on Depth Criterion	d_{allow} =	0.25	0.50	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	0.6	1.4	cfs
Water Depth	d =	0.10	0.17	ft

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

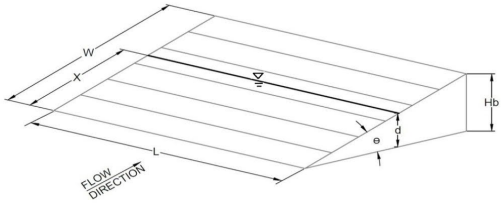
AREA INLET IN A SWALE

inlet 13b

Inlet Design Information (Input)

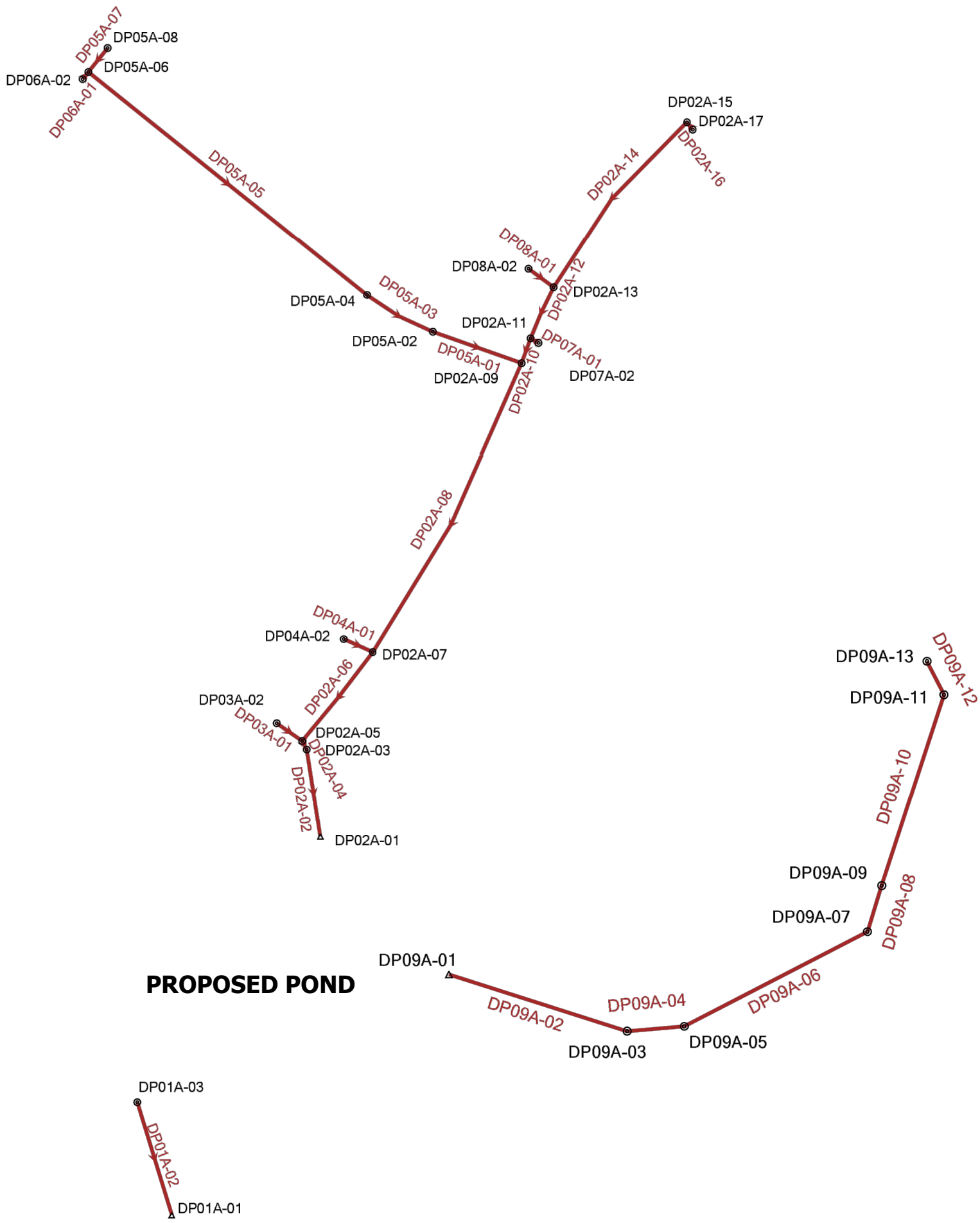
Type of Inlet	CDOT Type C	Inlet Type =	CDOT Type C

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



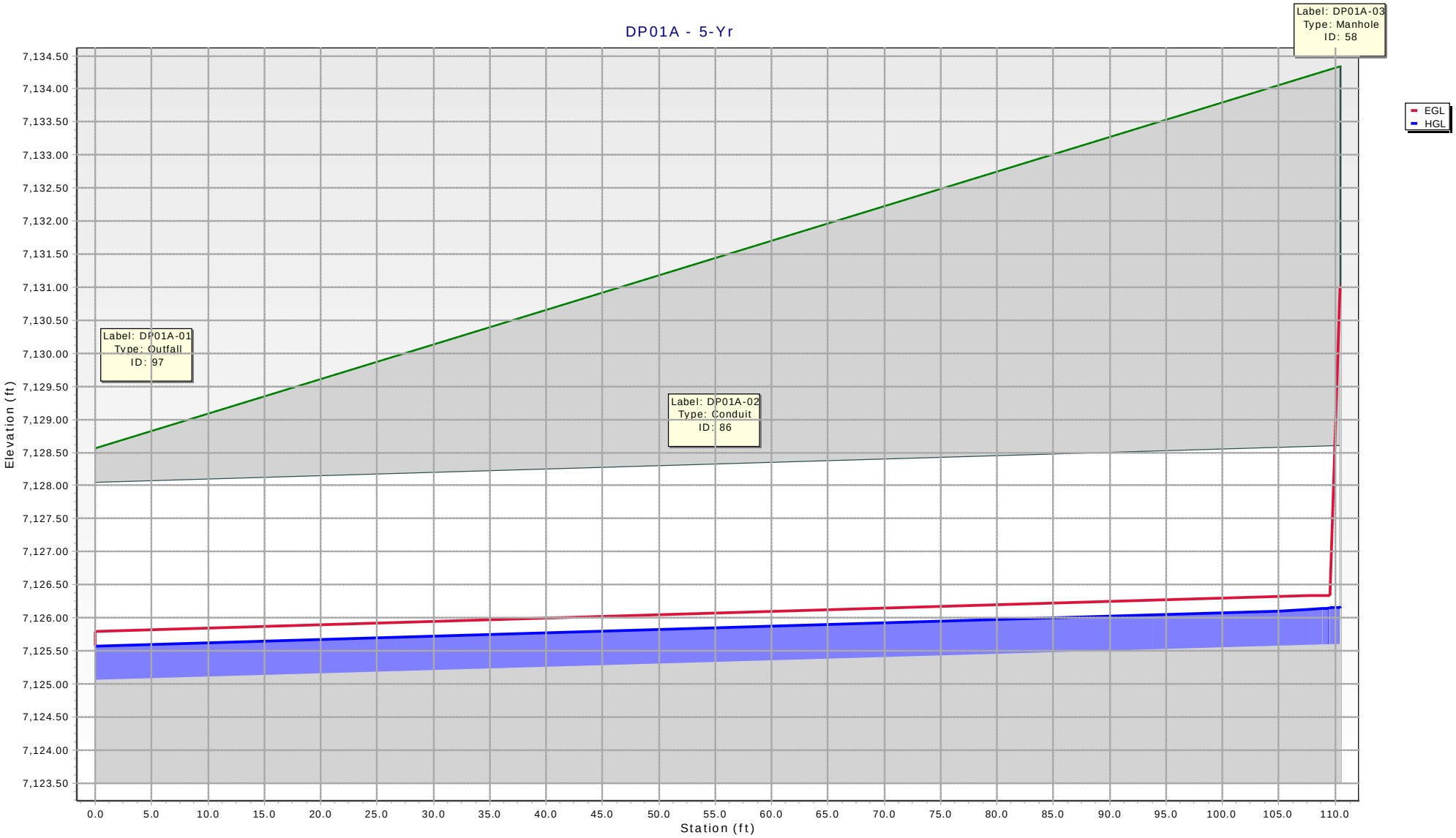
		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.10	0.17	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	0.6	1.2	cfs
Bypassed Flow	Q_b =	0.0	0.2	cfs
Capture Percentage = Qa/Qo	C% =	99	89	%

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



STORMCAD MAP
HOMESTEAD NORTH FILING 2
JOB NO. 25188.10
02/15/2022
SHEET 1 OF 1

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


DP01A - 5-Yr
Label: DP01A-03
Type: Manhole
ID: 58
EGL
HGL
Label: DP01A-01
Type: Outfall
ID: 97
Label: DP01A-02
Type: Conduit
ID: 86
Elevation (ft)
7,134.50
7,134.00
7,133.50
7,133.00
7,132.50
7,132.00
7,131.50
7,131.00
7,130.50
7,130.00
7,129.50
7,129.00
7,128.50
7,128.00
7,127.50
7,127.00
7,126.50
7,126.00
7,125.50
7,125.00
7,124.50
7,124.00
7,123.50
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
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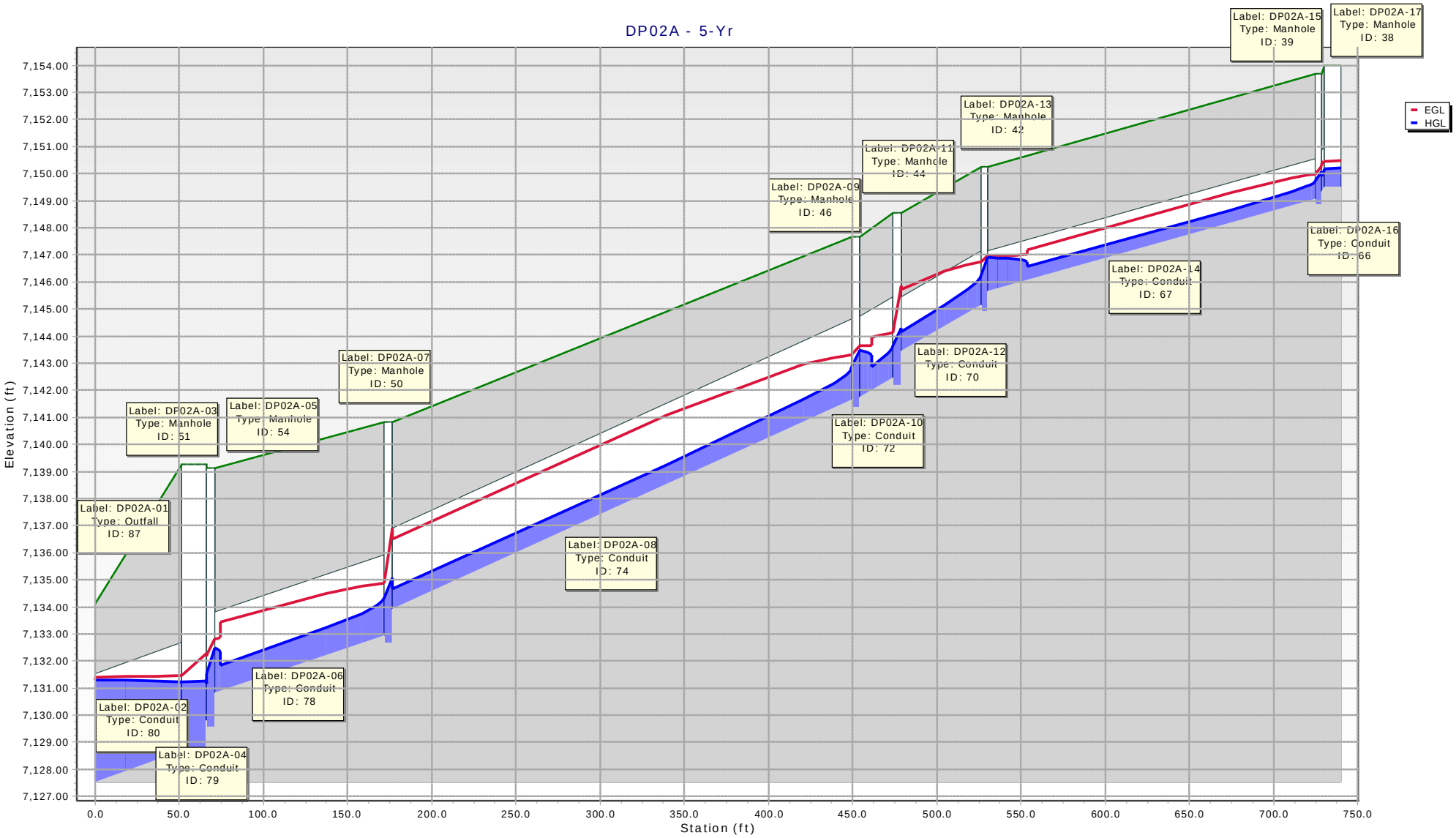
95.0
100.0
105.0
110.0
Station (ft)


DP02A - 5-Yr
Elevation (ft)
Station (ft)
7,154.00
7,153.00
7,152.00
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7,148.00
7,147.00
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7,144.00
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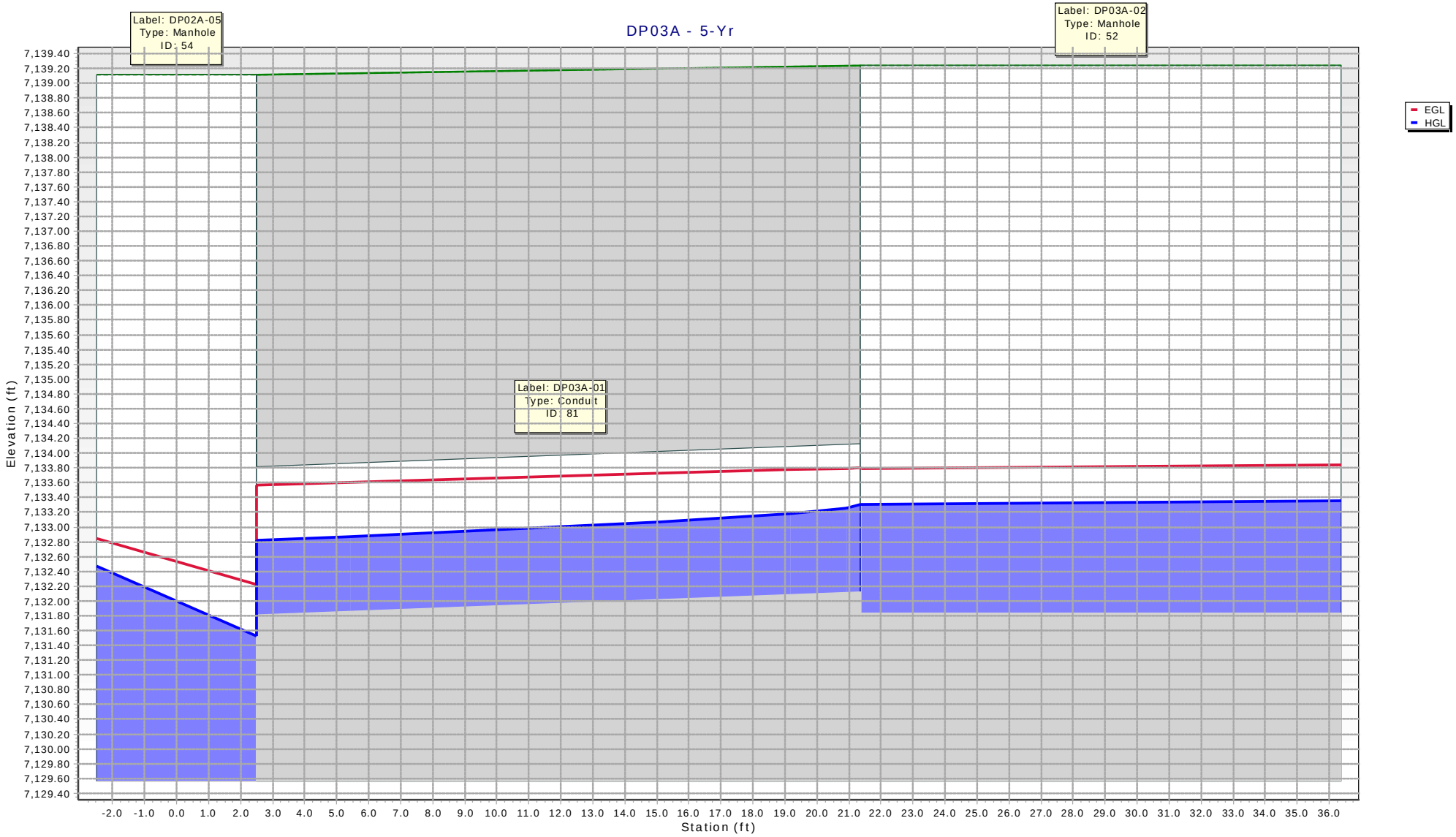
7,133.00
7,132.00
7,131.00
7,130.00
7,129.00
7,128.00
7,127.00
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
550.0
600.0
650.0
700.0
750.0
EGL
HGL
Label: DP02A-01
Type: Outfall
ID: 87
Label: DP02A-02
Type: Conduit
ID: 80
Label: DP02A-03
Type: Manhole
ID: 51
Label: DP02A-04
Type: Conduit
ID: 79
Label: DP02A-05
Type: Manhole
ID: 54
Label: DP02A-06
Type: Conduit
ID: 78
Label: DP02A-07
Type: Manhole
ID: 50
Label: DP02A-08
Type: Conduit
ID: 74
Label: DP02A-09
Type: Manhole
ID: 46
Label: DP02A-10
Type: Conduit
ID: 72
Label: DP02A-11
Type: Manhole
ID: 44
Label: DP02A-12
Type: Conduit
ID: 70
Label: DP02A-13
Type: Manhole
ID: 42
Label: DP02A-14
Type: Conduit
ID: 67
Label: DP02A-15
Type: Manhole
ID: 39
Label: DP02A-16
Type: Conduit
ID: 66
Label: DP02A-17
Type: Manhole
ID: 38


DP03A - 5-Yr
Label: DP02A-05
Type: Manhole
ID: 54
Label: DP03A-02
Type: Manhole
ID: 52
Label: DP03A-01
Type: Conduit
ID: 81
EGL
HGL
Elevation (ft)
7,139.40
7,139.20
7,139.00
7,138.80
7,138.60
7,138.40
7,138.20
7,138.00
7,137.80
7,137.60
7,137.40
7,137.20
7,137.00
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7,136.60
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7,133.40
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7,132.20
7,132.00
7,131.80
7,131.60
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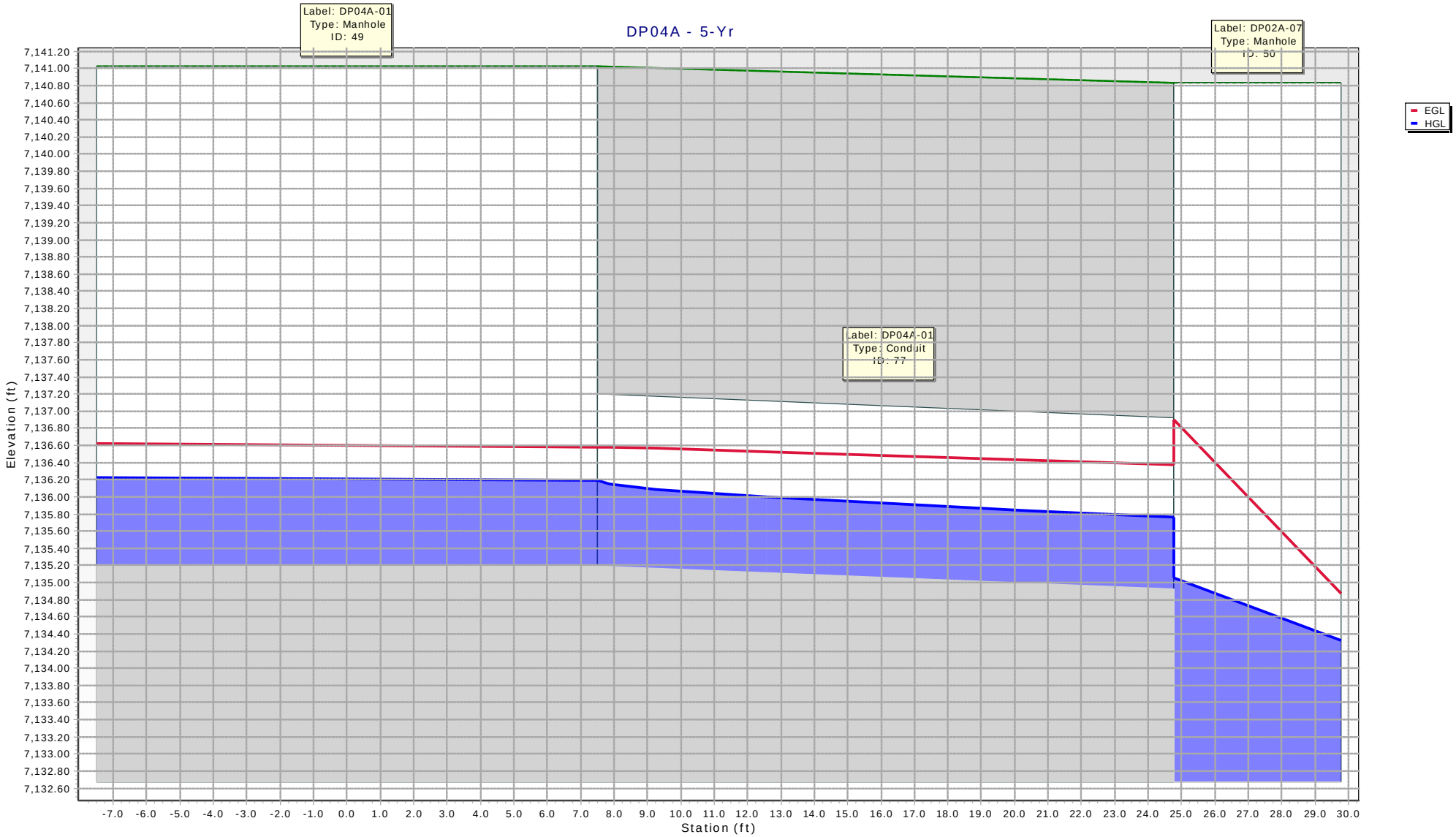
7,131.00
7,130.80
7,130.60
7,130.40
7,130.20
7,130.00
7,129.80
7,129.60
7,129.40
-2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0
Station (ft)


DP04A - 5-Yr
Label: DP04A-01
Type: Manhole
ID: 49
Label: DP02A-07
Type: Manhole
ID: 50
Label: DP04A-01
Type: Conduit
ID: 77
EGL
HGL
Elevation (ft)
Station (ft)
7,141.20
7,141.00
7,140.80
7,140.60
7,140.40
7,140.20
7,140.00
7,139.80
7,139.60
7,139.40
7,139.20
7,139.00
7,138.80
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7,138.00
7,137.80
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7,133.80
7,133.60
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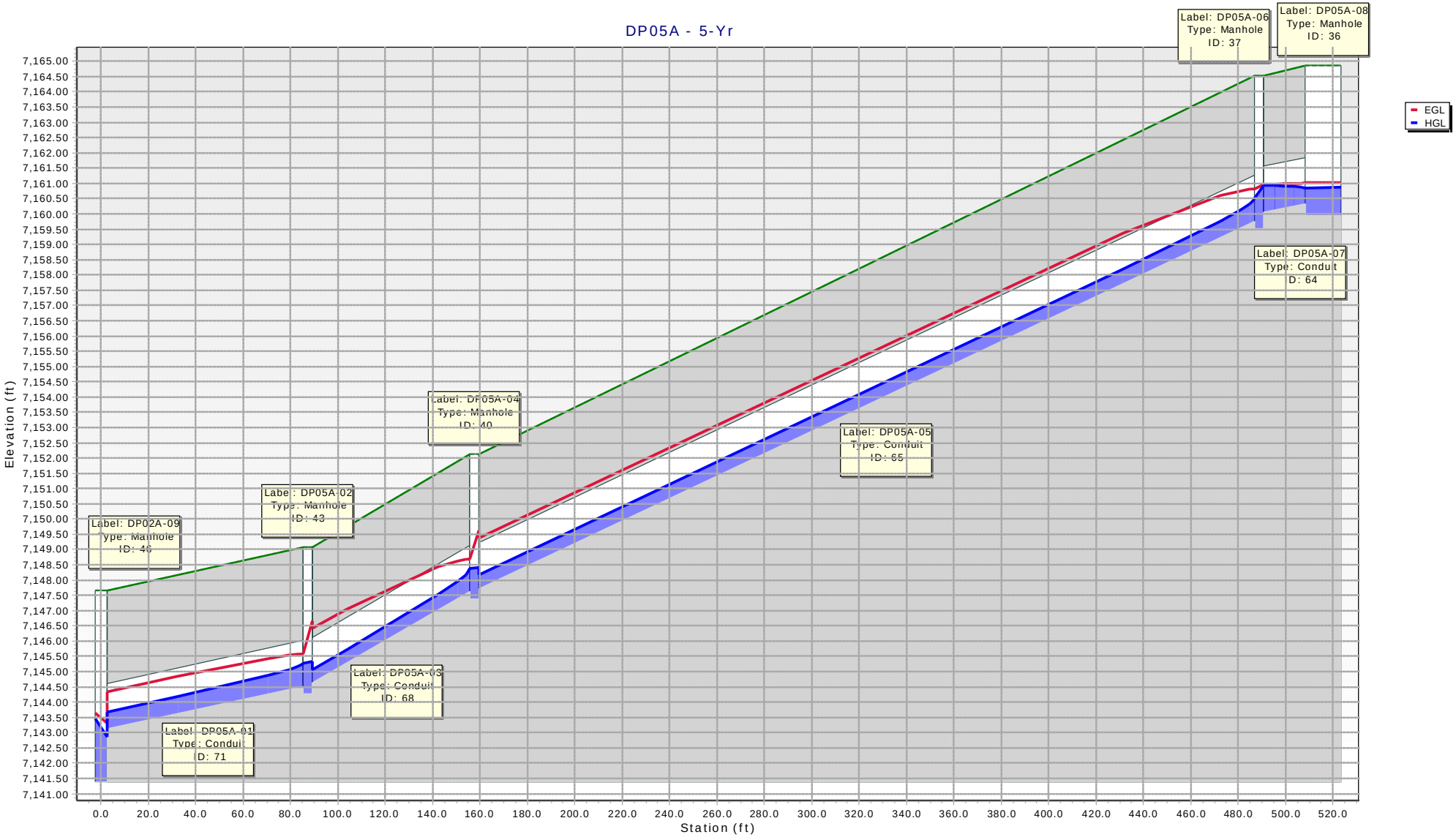
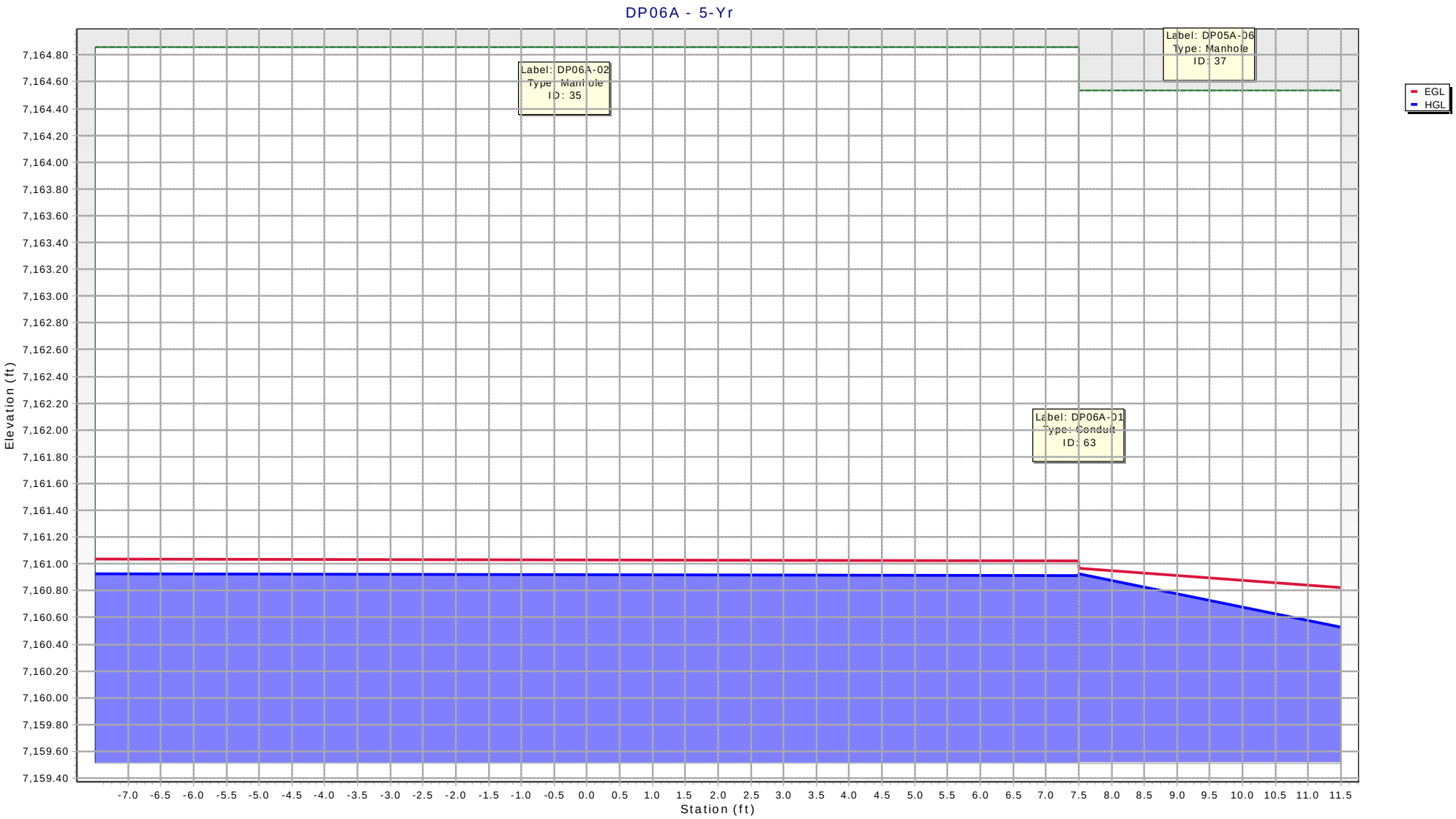
7,132.80
7,132.60
-7.0 -6.0 -5.0 -4.0 -3.0 -2.0 -1.0 0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0 14.0 15.0 16.0 17.0 18.0 19.0 20.0 21.0 22.0 23.0 24.0 25.0 26.0 27.0 28.0 29.0 30.0


DP05A - 5-Yr
Elevation (ft)
Station (ft)
EGL
HGL
Label: DP05A-06
Type: Manhole
ID: 37
Label: DP05A-08
Type: Manhole
ID: 36
Label: DP05A-07
Type: Conduit
D: 64
Label: DP05A-04
Type: Manhole
ID: 40
Label: DP05A-05
Type: Conduit
ID: 65
Label: DP05A-02
Type: Manhole
ID: 43
Label: DP02A-09
Type: Manhole
ID: 46
Label: DP05A-03
Type: Conduit
ID: 68
Label: DP05A-01
Type: Conduit
D: 71


DP06A - 5-Yr
Label: DP06A-02
Type: Manhole
ID: 35
Label: DP05A-06
Type: Manhole
ID: 37
Label: DP06A-01
Type: Conduit
ID: 63
EGL
HGL
Elevation (ft)
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
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7,161.80
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7,160.80
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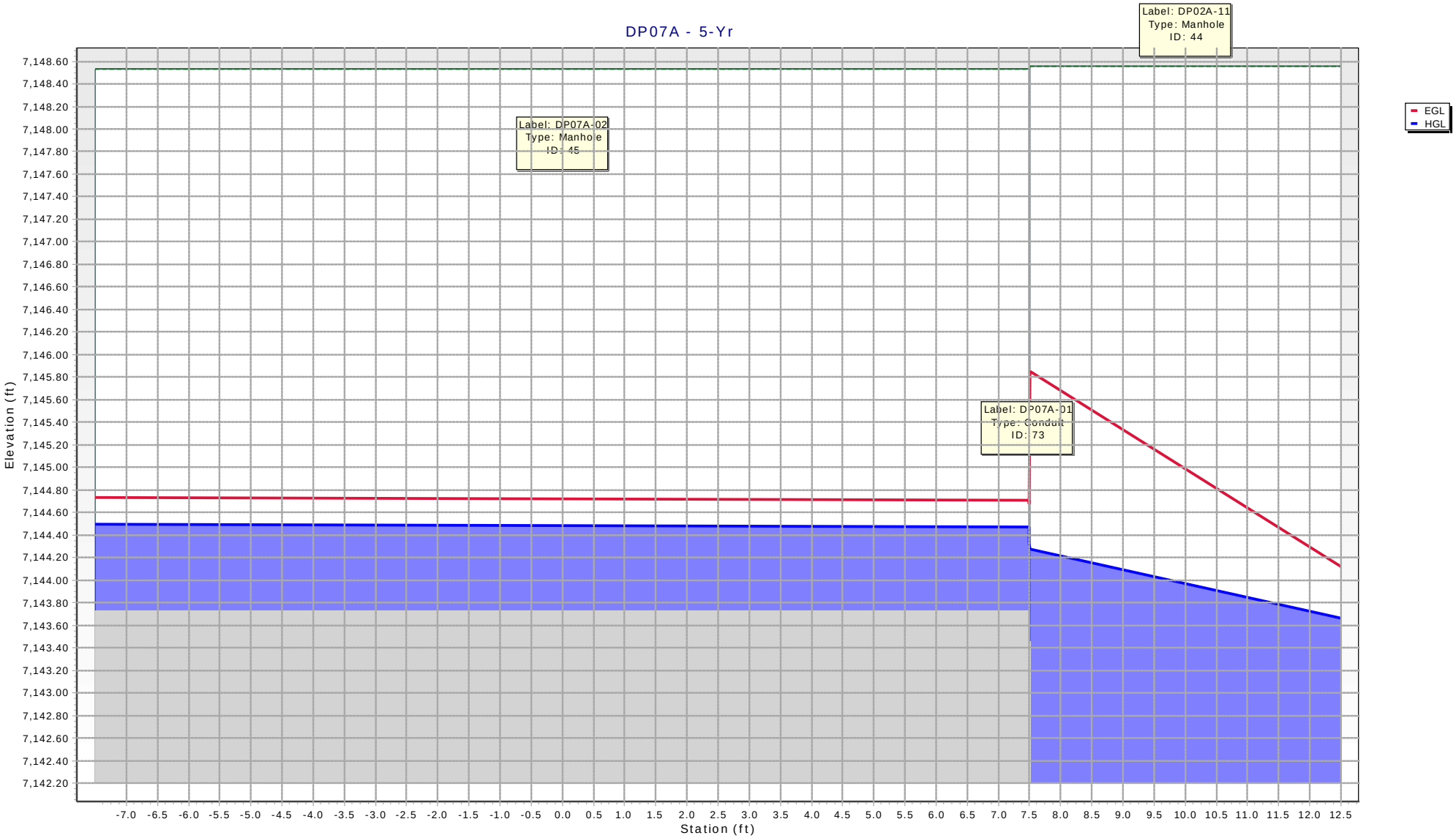
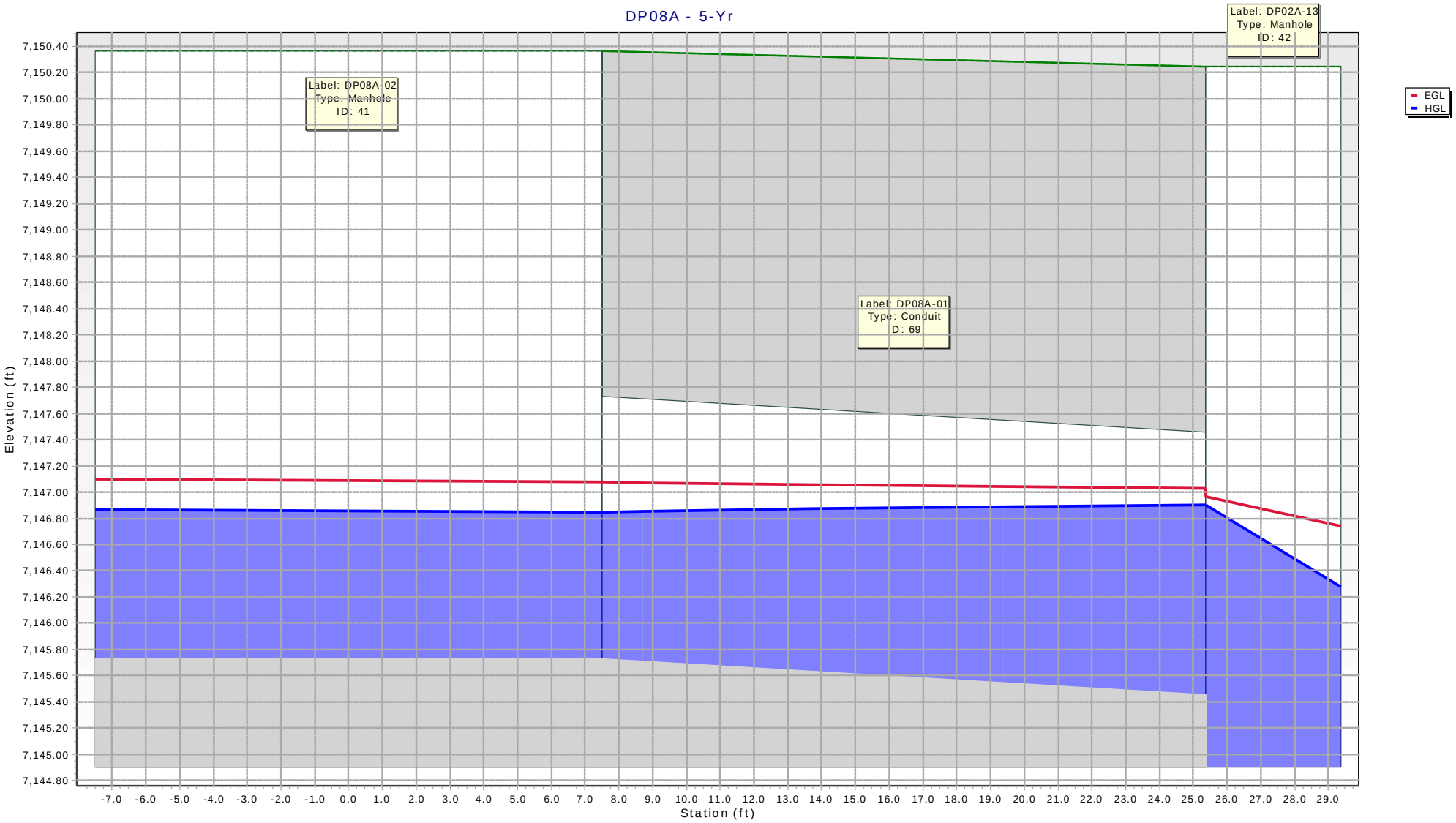
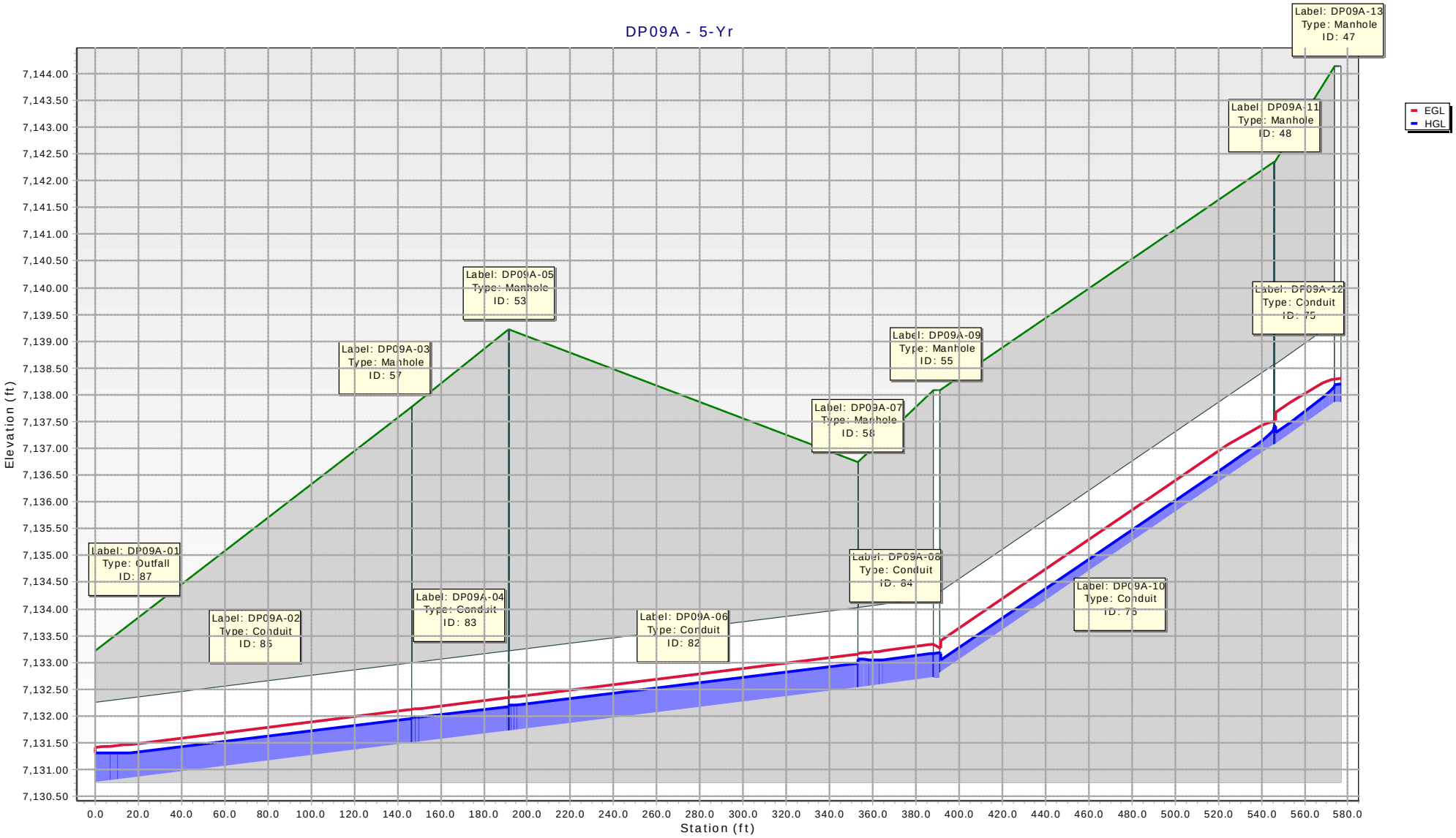
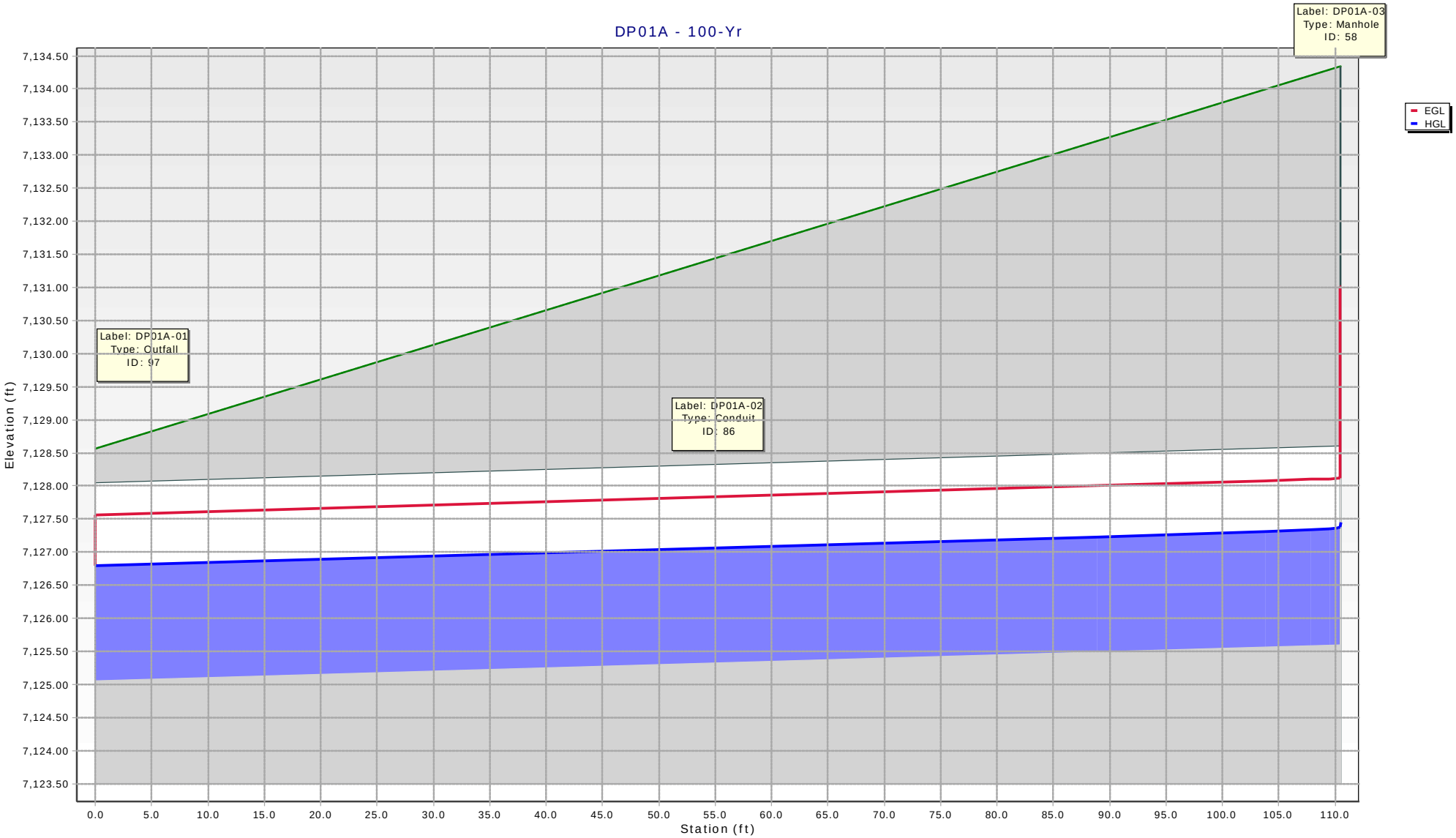
7,160.00
7,159.80
7,159.60
7,159.40
-7.0 -6.5 -6.0 -5.5 -5.0 -4.5 -4.0 -3.5 -3.0 -2.5 -2.0 -1.5 -1.0 -0.5 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5
Station (ft)

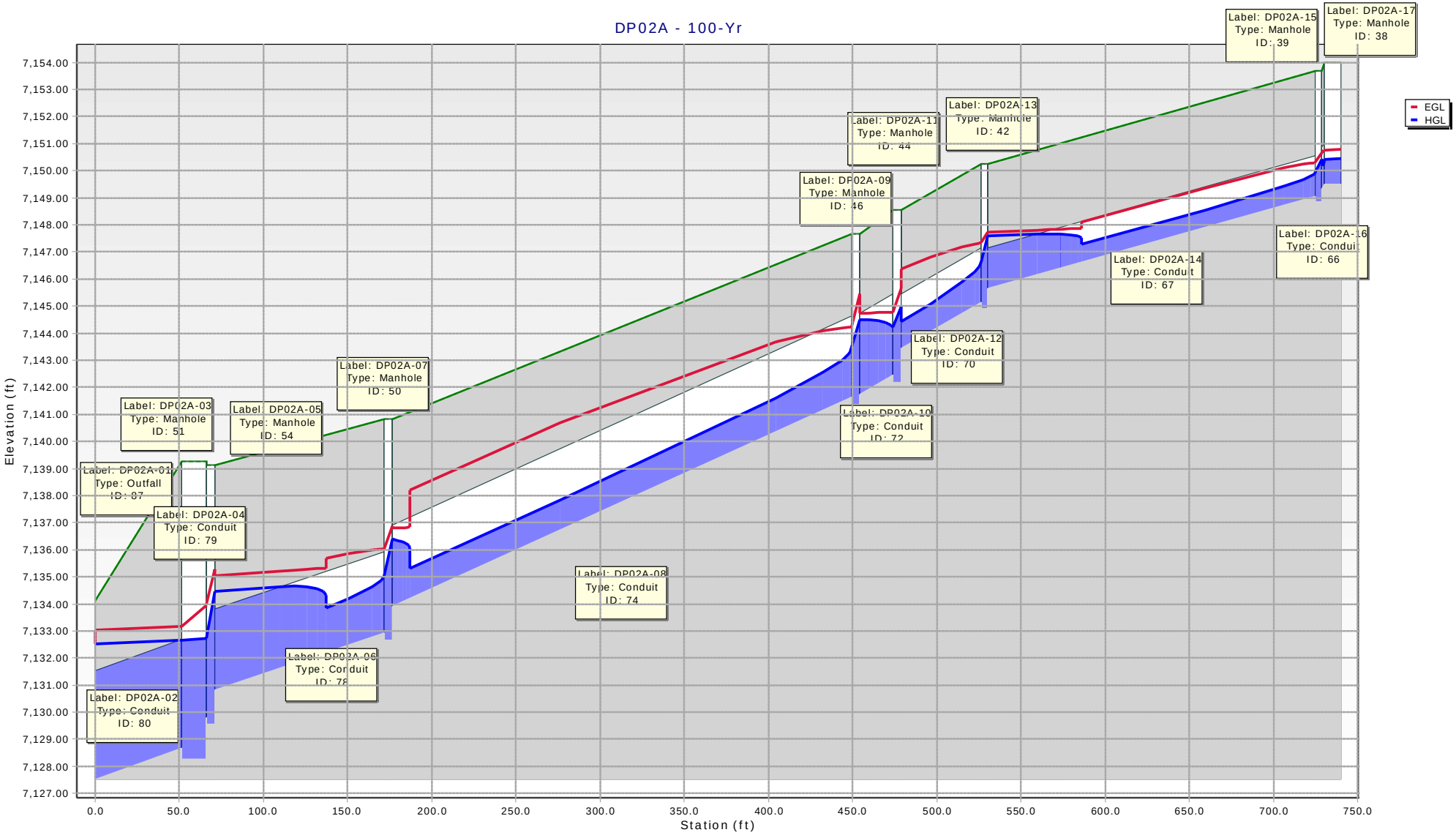

DP07A - 5-Yr
Label: DP02A-11
Type: Manhole
ID: 44
Label: DP07A-02
Type: Manhole
ID: 45
Label: DP07A-01
Type: Conduit
ID: 73
EGL
HGL
Elevation (ft)
7,148.60
7,148.40
7,148.20
7,148.00
7,147.80
7,147.60
7,147.40
7,147.20
7,147.00
7,146.80
7,146.60
7,146.40
7,146.20
7,146.00
7,145.80
7,145.60
7,145.40
7,145.20
7,145.00
7,144.80
7,144.60
7,144.40
7,144.20
7,144.00
7,143.80
7,143.60
7,143.40
7,143.20
7,143.00
7,142.80
7,142.60
7,142.40
7,142.20
-7.0 -6.5 -6.0 -5.5 -5.0 -4.5 -4.0 -3.5 -3.0 -2.5 -2.0 -1.5 -1.0 -0.5 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5
Station (ft)

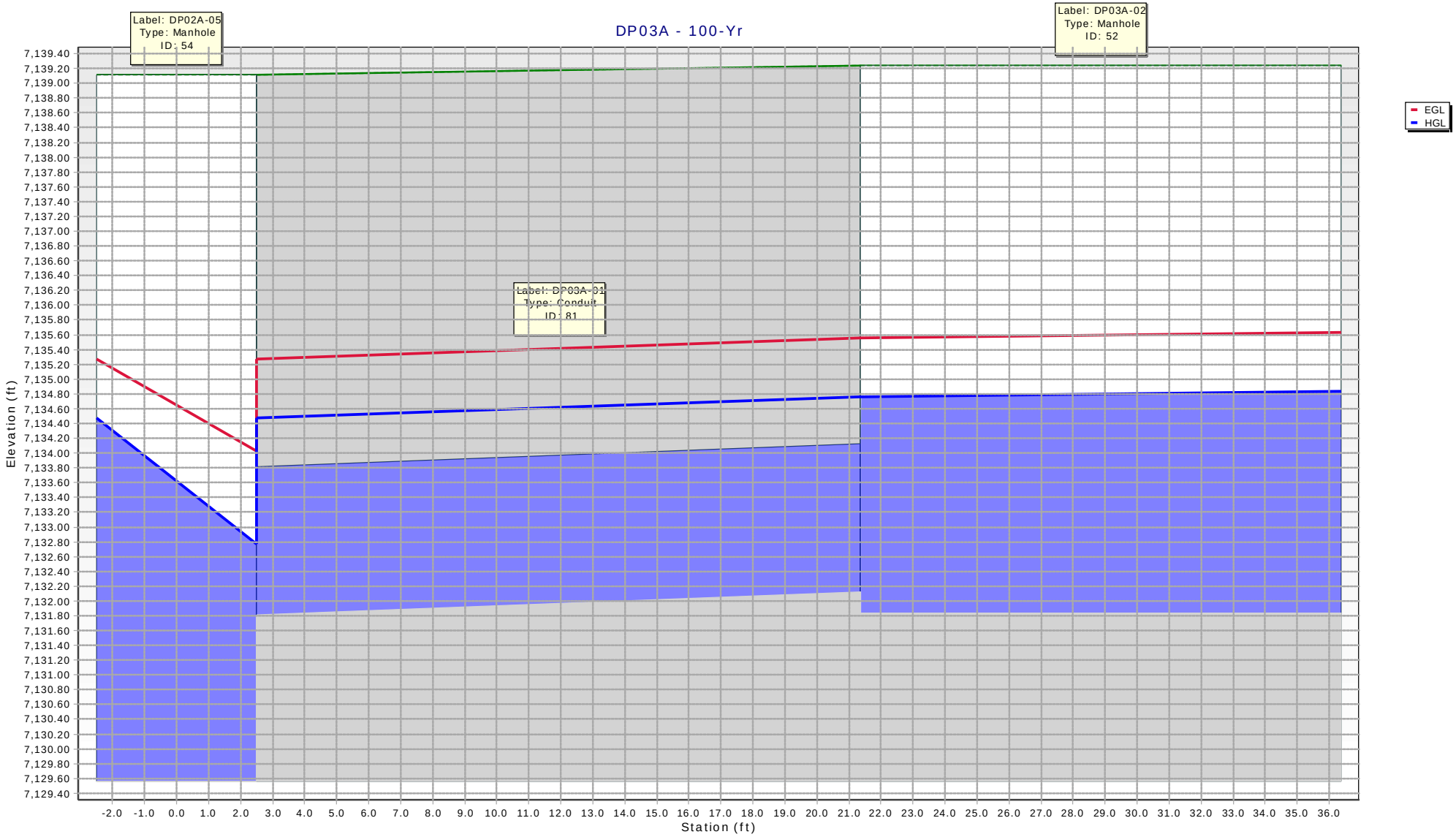

DP08A - 5-Yr
Label: DP02A-13
Type: Manhole
ID: 42
Label: DP08A-02
Type: Manhole
ID: 41
Label: DP08A-01
Type: Conduit
D: 69
EGL
HGL
Elevation (ft)
7,150.40
7,150.20
7,150.00
7,149.80
7,149.60
7,149.40
7,149.20
7,149.00
7,148.80
7,148.60
7,148.40
7,148.20
7,148.00
7,147.80
7,147.60
7,147.40
7,147.20
7,147.00
7,146.80
7,146.60
7,146.40
7,146.20
7,146.00
7,145.80
7,145.60
7,145.40
7,145.20
7,145.00
7,144.80
-7.0 -6.0 -5.0 -4.0 -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 24.0 25.0 26.0 27.0 28.0 29.0
Station (ft)

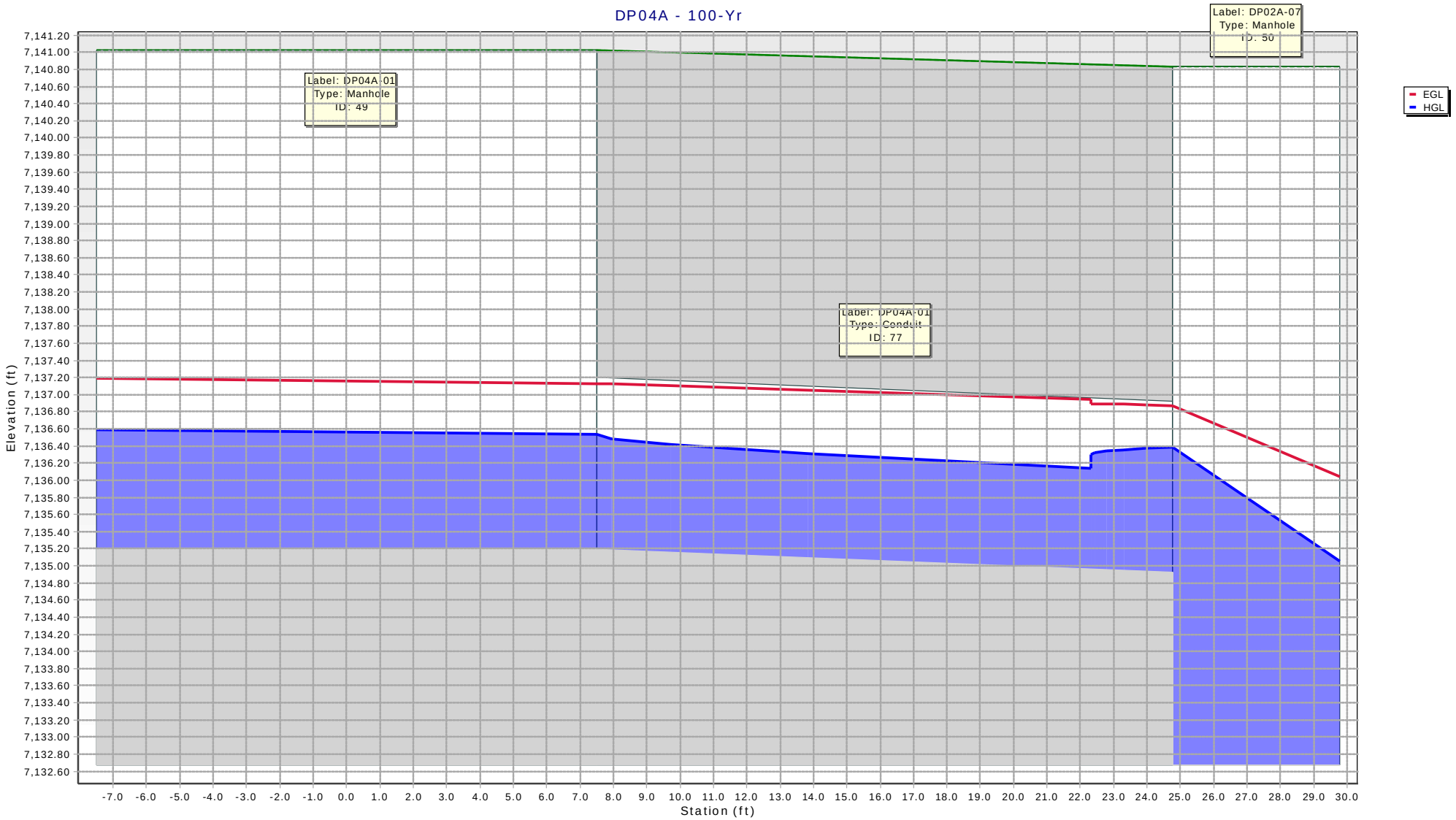

DP09A - 5-Yr
Label: DP09A-13
Type: Manhole
ID: 47
Label: DP09A-11
Type: Manhole
ID: 48
Label: DP09A-12
Type: Conduit
ID: 75
Label: DP09A-05
Type: Manhole
ID: 53
Label: DP09A-03
Type: Manhole
ID: 57
Label: DP09A-09
Type: Manhole
ID: 55
Label: DP09A-07
Type: Manhole
ID: 58
Label: DP09A-01
Type: Outfall
ID: 87
Label: DP09A-02
Type: Conduit
ID: 85
Label: DP09A-04
Type: Conduit
ID: 83
Label: DP09A-06
Type: Conduit
ID: 82
Label: DP09A-08
Type: Conduit
ID: 84
Label: DP09A-10
Type: Conduit
ID: 76
EGL
HGL
Elevation (ft)
7,144.00
7,143.50
7,143.00
7,142.50
7,142.00
7,141.50
7,141.00
7,140.50
7,140.00
7,139.50
7,139.00
7,138.50
7,138.00
7,137.50
7,137.00
7,136.50
7,136.00
7,135.50
7,135.00
7,134.50
7,134.00
7,133.50
7,133.00
7,132.50
7,132.00
7,131.50
7,131.00
7,130.50
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
220.0
240.0
260.0
280.0
300.0
320.0
340.0
360.0
380.0
400.0
420.0
440.0
460.0
480.0
500.0
520.0
540.0
560.0
580.0
Station (ft)

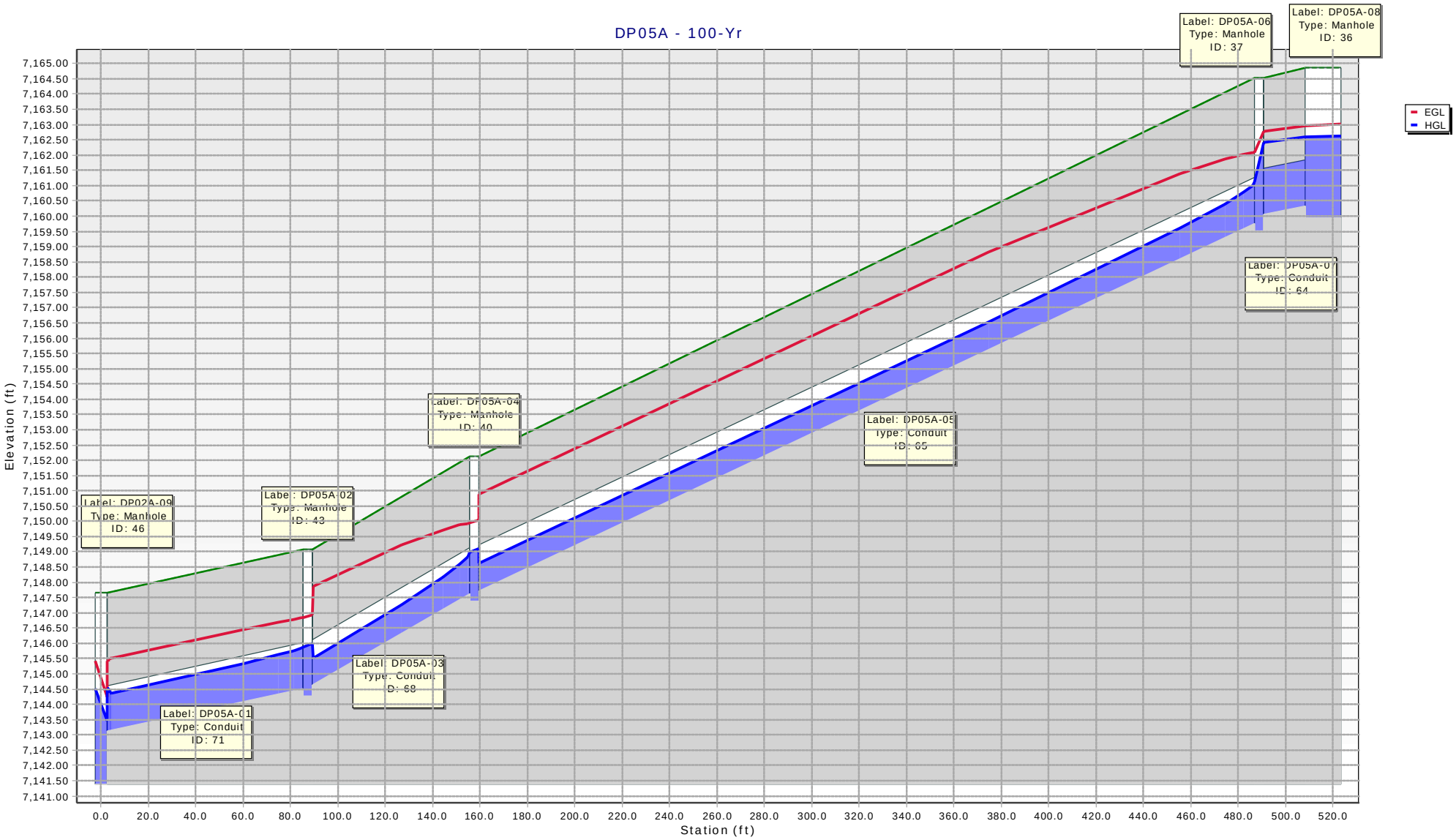
Homestead North Filing No. 2- 5-year Model Results																			
Upstream Structure	Label	Flow (cfs)	Capacity (Full Flow) (cfs)	Diameter (in)	Number of Barrels	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Upstream Structure Headloss Coefficient	Manning's n	Headloss (ft)
DP01A-03	DP01A-02	3.1	47.06	36	1	110.5	0.005	3.77	7,125.60	7,125.05	7,134.34	7,128.56	7,126.15	7,125.57	7,126.34	7,125.79	0.1	0.013	0.58
DP02A-03	DP02A-02	32.1	201.61	48	1	58.7	0.02	11.74	7,128.68	7,127.52	7,139.24	7,134.11	7,131.23	7,131.31	7,131.45	7,131.42	0.1	0.013	-0.08
DP02A-05	DP02A-04	28.1	87.71	36	1	7.5	0.017	11.04	7,129.81	7,129.68	7,139.12	7,139.24	7,131.52	7,131.16	7,132.23	7,132.18	1.35	0.013	0.37
DP02A-07	DP02A-06	19.2	93.96	36	1	105.3	0.02	10.44	7,132.92	7,130.83	7,140.83	7,139.12	7,134.32	7,132.47	7,134.87	7,132.84	1.35	0.013	1.85
DP02A-09	DP02A-08	14.6	111.06	36	1	277.9	0.028	10.88	7,141.63	7,133.92	7,147.65	7,140.83	7,142.85	7,134.66	7,143.30	7,136.50	1.35	0.013	8.19
DP02A-11	DP02A-10	14.5	114.51	36	1	24.4	0.029	11.1	7,142.45	7,141.73	7,148.56	7,147.65	7,143.66	7,143.46	7,144.12	7,143.65	1.35	0.013	0.2
DP02A-13	DP02A-12	9.9	40.92	24	1	52	0.033	10.73	7,145.15	7,143.45	7,150.25	7,148.56	7,146.28	7,144.16	7,146.74	7,145.73	1.35	0.013	2.12
DP02A-15	DP02A-14	3.2	13.73	18	1	198.4	0.017	6.34	7,149.04	7,145.65	7,153.69	7,150.25	7,149.73	7,146.90	7,149.99	7,146.96	1.35	0.013	2.83
DP02A-17	DP02A-16	3.2	14.85	18	1	8.5	0.02	6.7	7,149.51	7,149.34	7,153.99	7,153.69	7,150.20	7,150.08	7,150.46	7,150.29	0.1	0.013	0.12
DP03A-02	DP03A-01	10.9	23.28	24	1	28.9	0.011	7.29	7,132.12	7,131.81	7,139.24	7,139.12	7,133.30	7,132.81	7,133.80	7,133.56	0.1	0.013	0.49
DP04A-01	DP04A-01	7.8	22.62	24	1	27.3	0.01	6.54	7,135.20	7,134.92	7,141.03	7,140.83	7,136.19	7,135.76	7,136.58	7,136.37	0.1	0.013	0.43
DP05A-02	DP05A-01	3.9	13.35	18	1	87.3	0.016	6.55	7,144.53	7,143.12	7,149.07	7,147.65	7,145.29	7,143.68	7,145.58	7,144.34	0.11	0.013	1.61
DP05A-04	DP05A-03	3.9	21.72	18	1	70.2	0.043	9.3	7,147.63	7,144.63	7,152.13	7,149.07	7,148.39	7,145.06	7,148.68	7,146.41	0.11	0.013	3.32
DP05A-06	DP05A-05	3.9	20.02	18	1	331.3	0.036	8.78	7,159.77	7,147.73	7,164.53	7,152.13	7,160.53	7,148.18	7,160.82	7,149.38	1.35	0.013	12.35
DP05A-08	DP05A-07	1.7	10.5	18	1	27	0.01	4.37	7,160.34	7,160.07	7,164.86	7,164.53	7,160.85	7,160.93	7,161.01	7,160.97	0.1	0.013	-0.07
DP06A-02	DP06A-01	2.4	10.19	18	1	8.5	0.009	4.72	7,160.15	7,160.07	7,164.86	7,164.53	7,160.91	7,160.93	7,161.02	7,161.01	0.1	0.013	-0.01
DP07A-02	DP07A-01	5	3.58	18	1	8.6	-0.001	2.83	7,143.45	7,143.46	7,148.53	7,148.56	7,144.47	7,144.32	7,144.71	7,144.67	0.1	0.013	0.15
DP08A-02	DP08A-01	7	22.62	24	1	27.4	0.01	6.35	7,145.73	7,145.45	7,150.37	7,150.25	7,146.84	7,146.90	7,147.08	7,147.03	0.1	0.013	-0.06
DP09A-03	DP09A-02	1.5	7.43	18	1	146.6	0.005	3.29	7,131.50	7,130.76	7,137.78	7,133.21	7,131.96	7,131.31	7,132.12	7,131.41	0.14	0.013	0.65
DP09A-05	DP09A-04	1.5	7.43	18	1	44.9	0.005	3.29	7,131.72	7,131.50	7,139.22	7,137.78	7,132.18	7,131.98	7,132.35	7,132.13	0.14	0.013	0.2
DP09A-07	DP09A-06	1.5	7.43	18	1	161.6	0.005	3.29	7,132.53	7,131.72	7,136.74	7,139.22	7,132.99	7,132.20	7,133.16	7,132.35	0.4	0.013	0.78
DP09A-09	DP09A-08	1.5	7.43	18	1	36.4	0.005	3.29	7,132.71	7,132.53	7,138.08	7,136.74	7,133.17	7,133.06	7,133.34	7,133.17	0.1	0.013	0.12
DP09A-11	DP09A-10	0.75	17.31	18	1	156.5	0.027	4.9	7,137.07	7,132.81	7,142.34	7,138.08	7,137.39	7,133.19	7,137.50	7,133.26	0.4	0.013	4.2
DP09A-13	DP09A-12	0.75	17.31	18	1	29.4	0.027	4.9	7,137.86	7,137.07	7,144.14	7,142.34	7,138.19	7,137.43	7,138.30	7,137.51	0.1	0.013	0.75

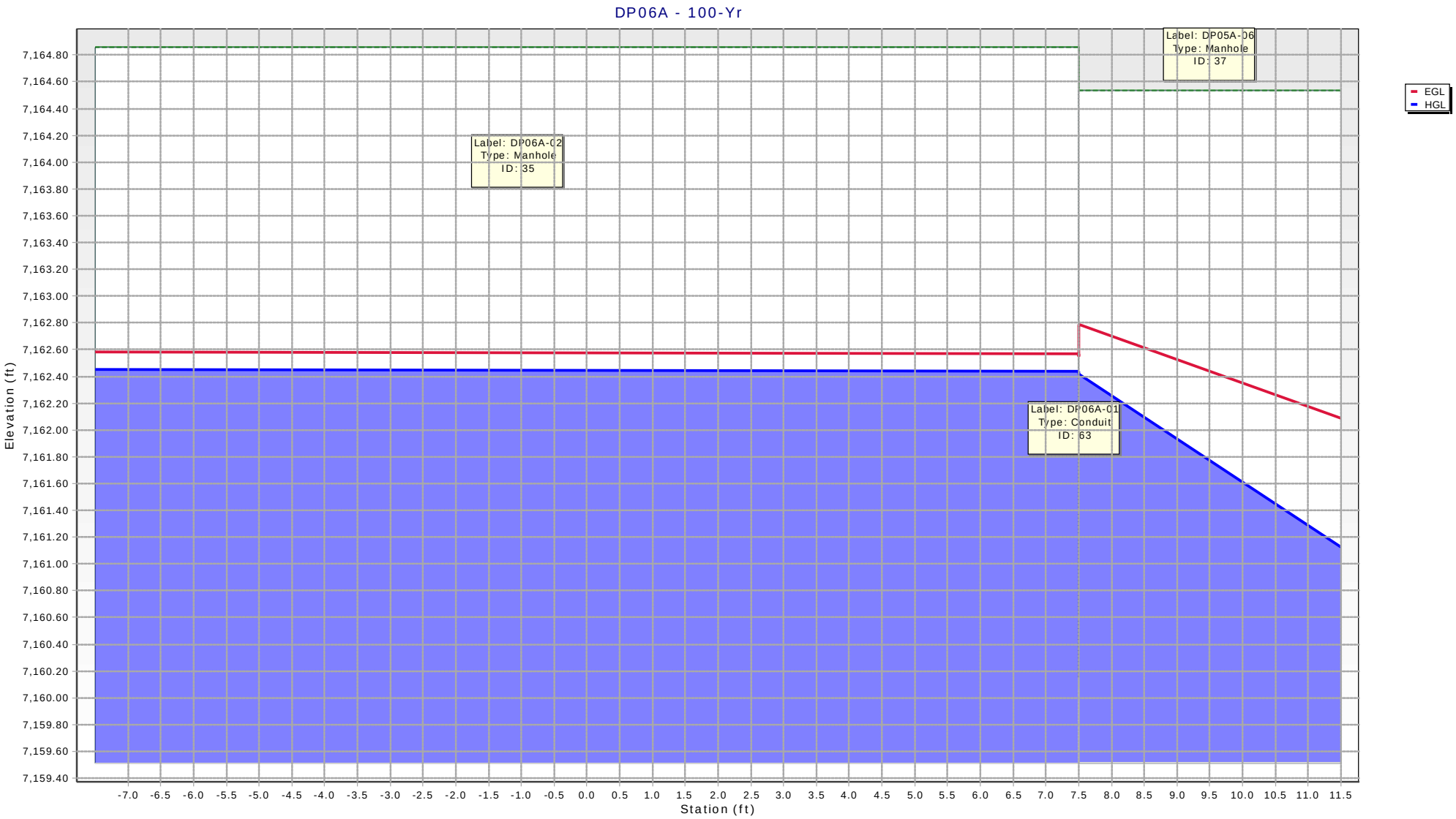

DP01A - 100-Yr
Label: DP01A-03
Type: Manhole
ID: 58
Label: DP01A-01
Type: Outfall
ID: 97
Label: DP01A-02
Type: Conduit
ID: 86
EGL
HGL
Elevation (ft)
7,134.50
7,134.00
7,133.50
7,133.00
7,132.50
7,132.00
7,131.50
7,131.00
7,130.50
7,130.00
7,129.50
7,129.00
7,128.50
7,128.00
7,127.50
7,127.00
7,126.50
7,126.00
7,125.50
7,125.00
7,124.50
7,124.00
7,123.50
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0
100.0
105.0
110.0
Station (ft)


DP02A - 100-Yr
Elevation (ft)
Station (ft)
EGL
HGL
Label: DP02A-01
Type: Outfall
ID: 87
Label: DP02A-02
Type: Conduit
ID: 80
Label: DP02A-03
Type: Manhole
ID: 51
Label: DP02A-04
Type: Conduit
ID: 79
Label: DP02A-05
Type: Manhole
ID: 54
Label: DP02A-06
Type: Conduit
Label: DP02A-07
Type: Manhole
ID: 50
Label: DP02A-08
Type: Conduit
ID: 74
Label: DP02A-09
Type: Manhole
ID: 46
Label: DP02A-10
Type: Conduit
ID: 72
Label: DP02A-11
Type: Manhole
ID: 44
Label: DP02A-12
Type: Conduit
ID: 70
Label: DP02A-13
Type: Manhole
ID: 42
Label: DP02A-14
Type: Conduit
ID: 67
Label: DP02A-15
Type: Manhole
ID: 39
Label: DP02A-16
Type: Conduit
ID: 66
Label: DP02A-17
Type: Manhole
ID: 38

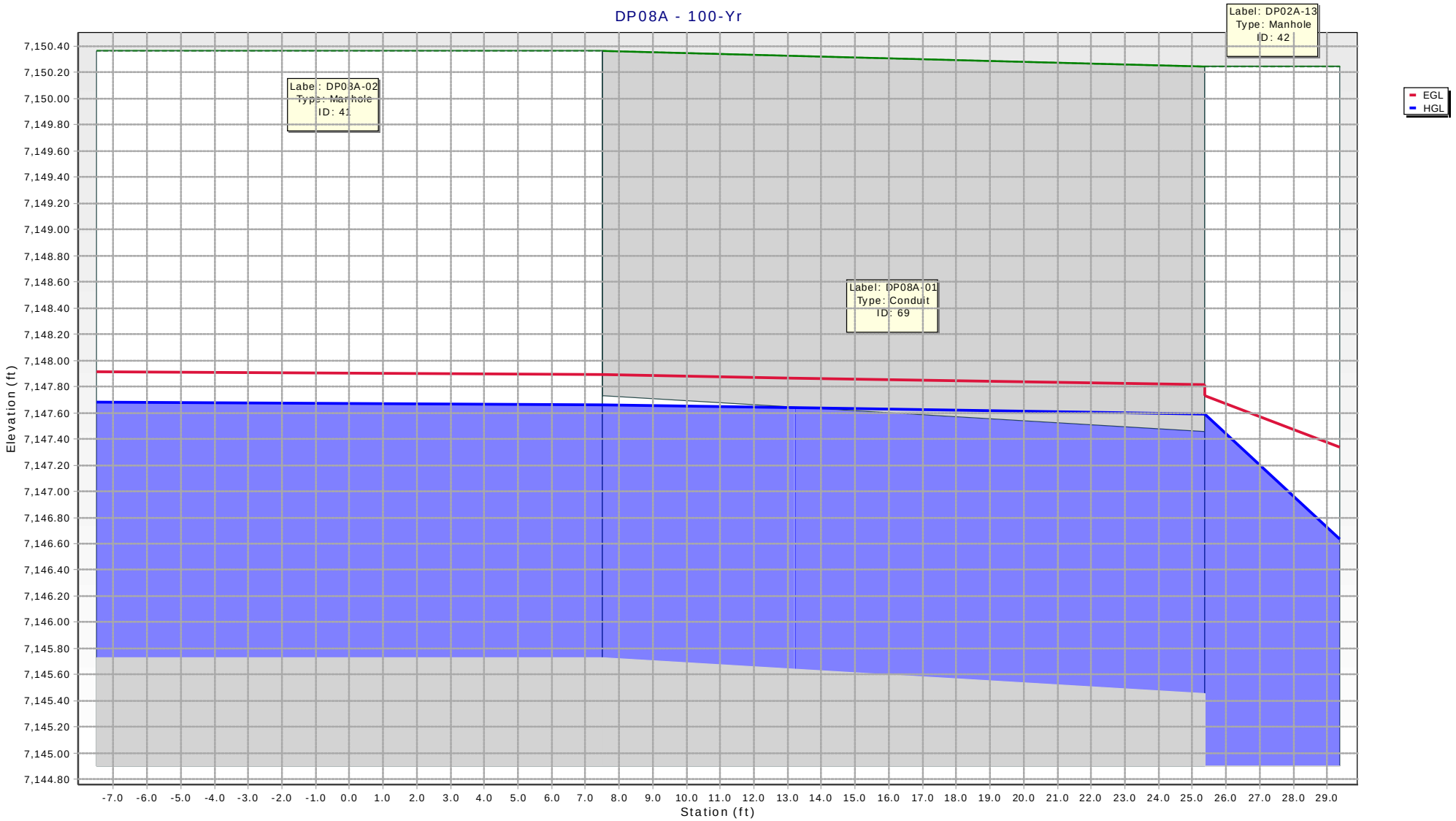

DP03A - 100-Yr
Label: DP02A-05
Type: Manhole
ID: 54
Label: DP03A-02
Type: Manhole
ID: 52
Label: DP03A-01
Type: Conduit
ID: 81
EGL
HGL
Elevation (ft)
Station (ft)
7,139.40
7,139.20
7,139.00
7,138.80
7,138.60
7,138.40
7,138.20
7,138.00
7,137.80
7,137.60
7,137.40
7,137.20
7,137.00
7,136.80
7,136.60
7,136.40
7,136.20
7,136.00
7,135.80
7,135.60
7,135.40
7,135.20
7,135.00
7,134.80
7,134.60
7,134.40
7,134.20
7,134.00
7,133.80
7,133.60
7,133.40
7,133.20
7,133.00
7,132.80
7,132.60
7,132.40
7,132.20
7,132.00
7,131.80
7,131.60
7,131.40
7,131.20
7,131.00
7,130.80
7,130.60
7,130.40
7,130.20
7,130.00
7,129.80
7,129.60
7,129.40
-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 24.0 25.0 26.0 27.0 28.0 29.0 30.0 31.0 32.0 33.0 34.0 35.0 36.0

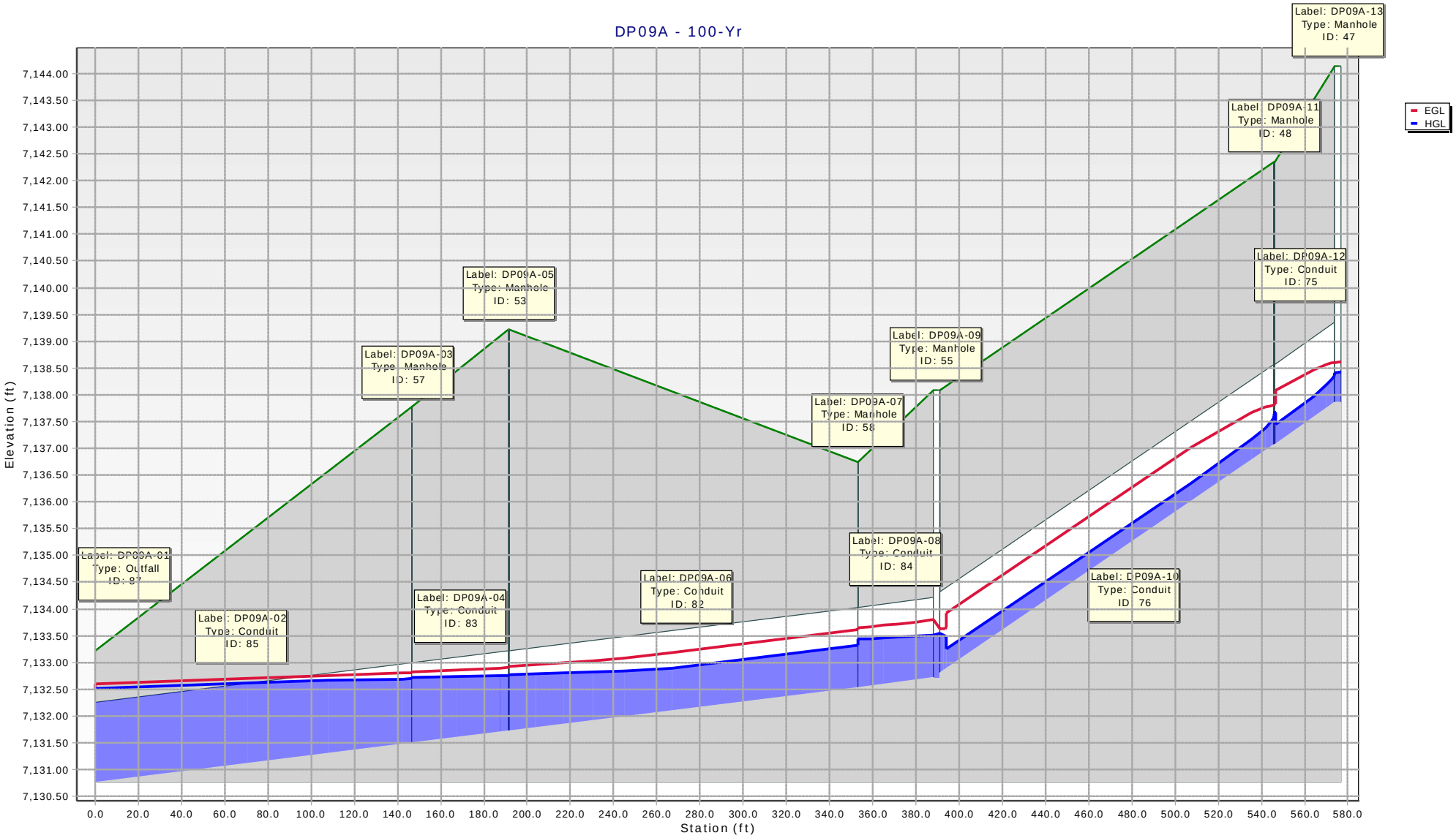

DP04A - 100-Yr
Label: DP02A-07
Type: Manhole
ID: 50
Label: DP04A-01
Type: Manhole
ID: 49
Label: DP04A-01
Type: Conduit
ID: 77
EGL
HGL
Elevation (ft)
7,141.20
7,141.00
7,140.80
7,140.60
7,140.40
7,140.20
7,140.00
7,139.80
7,139.60
7,139.40
7,139.20
7,139.00
7,138.80
7,138.60
7,138.40
7,138.20
7,138.00
7,137.80
7,137.60
7,137.40
7,137.20
7,137.00
7,136.80
7,136.60
7,136.40
7,136.20
7,136.00
7,135.80
7,135.60
7,135.40
7,135.20
7,135.00
7,134.80
7,134.60
7,134.40
7,134.20
7,134.00
7,133.80
7,133.60
7,133.40
7,133.20
7,133.00
7,132.80
7,132.60
-7.0 -6.0 -5.0 -4.0 -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 24.0 25.0 26.0 27.0 28.0 29.0 30.0
Station (ft)


DP05A - 100-Yr
Elevation (ft)
Station (ft)
EGL
HGL
Label: DP05A-06
Type: Manhole
ID: 37
Label: DP05A-08
Type: Manhole
ID: 36
Label: DP05A-04
Type: Manhole
ID: 40
Label: DP02A-09
Type: Manhole
ID: 46
Label: DP05A-02
Type: Manhole
ID: 43
Label: DP05A-05
Type: Conduit
ID: 65
Label: DP05A-07
Type: Conduit
ID: 64
Label: DP05A-03
Type: Conduit
ID: 68
Label: DP05A-01
Type: Conduit
ID: 71


DP06A - 100-Yr
Label: DP05A-06
Type: Manhole
ID: 37
Label: DP06A-02
Type: Manhole
ID: 35
Label: DP06A-01
Type: Conduit
ID: 63
EGL
HGL
Elevation (ft)
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
7,161.00
7,160.80
7,160.60
7,160.40
7,160.20
7,160.00
7,159.80
7,159.60
7,159.40
-7.0 -6.5 -6.0 -5.5 -5.0 -4.5 -4.0 -3.5 -3.0 -2.5 -2.0 -1.5 -1.0 -0.5 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5
Station (ft)


DP07A - 100-Yr
Label: DP02A-11
Type: Manhole
ID: 44
Label: DP07A-02
Type: Manhole
ID: 45
Label: DP07A-01
Type: Conduit
ID: 73
EGL
HGL
Elevation (ft)
Station (ft)
7,148.60
7,148.40
7,148.20
7,148.00
7,147.80
7,147.60
7,147.40
7,147.20
7,147.00
7,146.80
7,146.60
7,146.40
7,146.20
7,146.00
7,145.80
7,145.60
7,145.40
7,145.20
7,145.00
7,144.80
7,144.60
7,144.40
7,144.20
7,144.00
7,143.80
7,143.60
7,143.40
7,143.20
7,143.00
7,142.80
7,142.60
7,142.40
7,142.20
-7.0 -6.5 -6.0 -5.5 -5.0 -4.5 -4.0 -3.5 -3.0 -2.5 -2.0 -1.5 -1.0 -0.5 0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10.0 10.5 11.0 11.5 12.0 12.5


DP08A - 100-Yr
Label: DP02A-13
Type: Manhole
ID: 42
Label: DP08A-02
Type: Manhole
ID: 41
Label: DP08A-01
Type: Conduit
ID: 69
EGL
HGL
Elevation (ft)
7,150.40
7,150.20
7,150.00
7,149.80
7,149.60
7,149.40
7,149.20
7,149.00
7,148.80
7,148.60
7,148.40
7,148.20
7,148.00
7,147.80
7,147.60
7,147.40
7,147.20
7,147.00
7,146.80
7,146.60
7,146.40
7,146.20
7,146.00
7,145.80
7,145.60
7,145.40
7,145.20
7,145.00
7,144.80
-7.0 -6.0 -5.0 -4.0 -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 24.0 25.0 26.0 27.0 28.0 29.0
Station (ft)

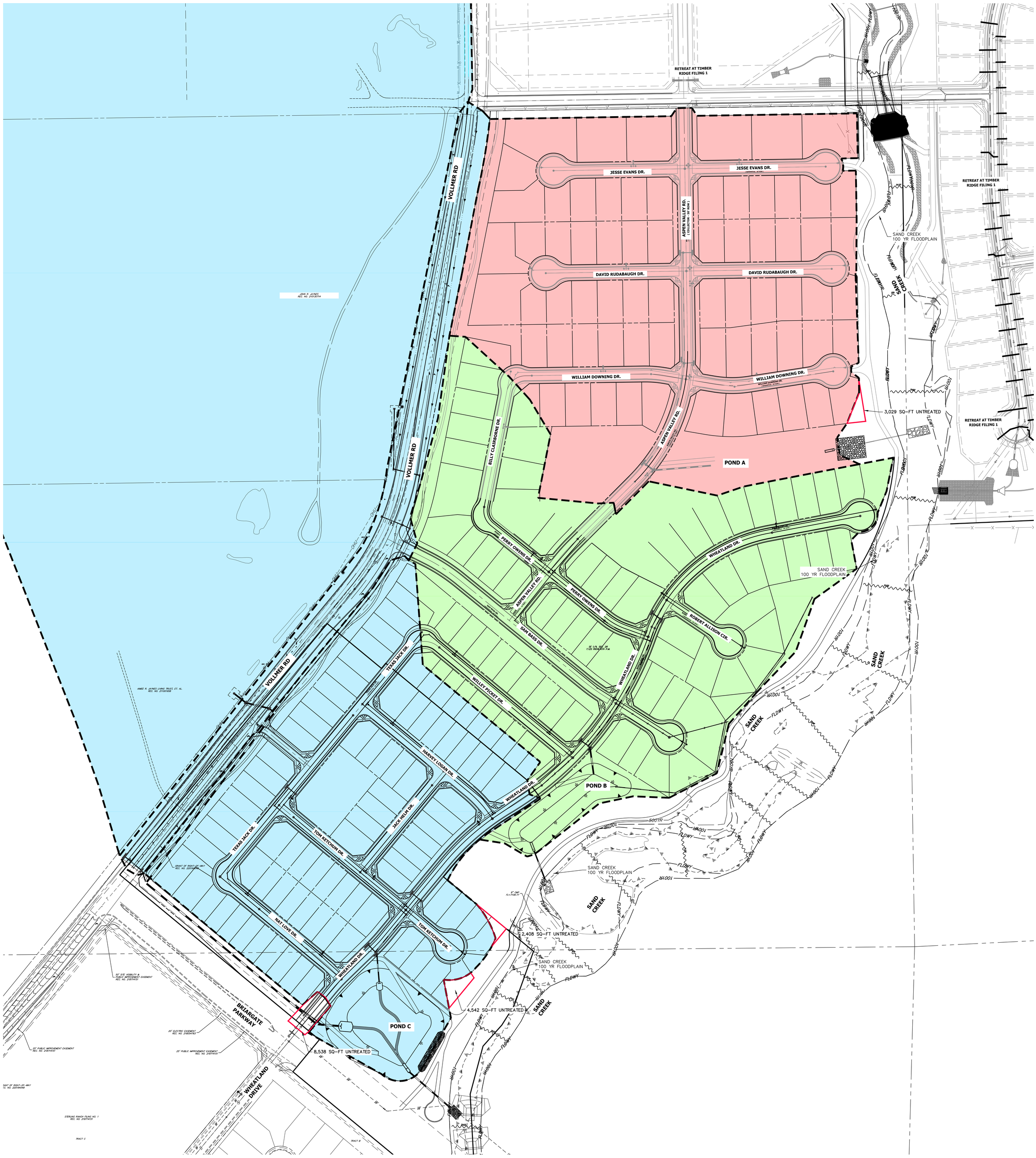

DP09A - 100-Yr
Label: DP09A-13
Type: Manhole
ID: 47
Label: DP09A-11
Type: Manhole
ID: 48
Label: DP09A-12
Type: Conduit
ID: 75
Label: DP09A-09
Type: Manhole
ID: 55
Label: DP09A-05
Type: Manhole
ID: 53
Label: DP09A-03
Type: Manhole
ID: 57
Label: DP09A-07
Type: Manhole
ID: 58
Label: DP09A-08
Type: Conduit
ID: 84
Label: DP09A-06
Type: Conduit
ID: 82
Label: DP09A-10
Type: Conduit
ID: 76
Label: DP09A-04
Type: Conduit
ID: 83
Label: DP09A-02
Type: Conduit
ID: 85
Label: DP09A-01
Type: Outfall
ID: 87
EGL
HGL
Elevation (ft)
7,144.00
7,143.50
7,143.00
7,142.50
7,142.00
7,141.50
7,141.00
7,140.50
7,140.00
7,139.50
7,139.00
7,138.50
7,138.00
7,137.50
7,137.00
7,136.50
7,136.00
7,135.50
7,135.00
7,134.50
7,134.00
7,133.50
7,133.00
7,132.50
7,132.00
7,131.50
7,131.00
7,130.50
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
220.0
240.0
260.0
280.0
300.0
320.0
340.0
360.0
380.0
400.0
420.0
440.0
460.0
480.0
500.0
520.0
540.0
560.0
580.0
Station (ft)

Homestead North Filing No. 2- 100-year Model Results																			
Upstream Structure	Label	Flow (cfs)	Capacity (Full Flow) (cfs)	Diameter (in)	Number of Barrels	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)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Upstream Structure Headloss Coefficient	Manning's n	Headloss (ft)
DP01A-03	DP01A-02	30	47.06	36	1	110.5	0.005	7.06	7,125.60	7,125.05	7,134.34	7,128.56	7,127.37	7,126.79	7,128.11	7,127.56	0.1	0.013	0.58
DP02A-03	DP02A-02	72.6	201.61	48	1	58.7	0.02	14.73	7,128.68	7,127.52	7,139.24	7,134.11	7,132.66	7,132.51	7,133.18	7,133.03	0.1	0.013	0.15
DP02A-05	DP02A-04	63.5	87.71	36	1	7.5	0.017	13.52	7,129.81	7,129.68	7,139.12	7,139.24	7,132.77	7,132.71	7,134.03	7,133.97	1.35	0.013	0.06
DP02A-07	DP02A-06	42.8	93.96	36	1	105.3	0.02	12.98	7,132.92	7,130.83	7,140.83	7,139.12	7,135.05	7,134.47	7,136.04	7,135.04	1.35	0.013	0.58
DP02A-09	DP02A-08	32	111.06	36	1	277.9	0.028	13.58	7,141.63	7,133.92	7,147.65	7,140.83	7,143.46	7,136.38	7,144.24	7,136.80	1.35	0.013	7.08
DP02A-11	DP02A-10	26	114.51	36	1	24.4	0.029	13.11	7,142.45	7,141.73	7,148.56	7,147.65	7,144.23	7,144.51	7,144.78	7,144.74	1.35	0.013	-0.28
DP02A-13	DP02A-12	16.8	40.92	24	1	52	0.033	12.38	7,145.15	7,143.45	7,150.25	7,148.56	7,146.63	7,144.97	7,147.34	7,145.64	1.35	0.013	1.66
DP02A-15	DP02A-14	5.3	13.73	18	1	198.4	0.017	7.27	7,149.04	7,145.65	7,153.69	7,150.25	7,149.93	7,147.59	7,150.30	7,147.73	1.35	0.013	2.34
DP02A-17	DP02A-16	5.3	14.85	18	1	8.5	0.02	7.7	7,149.51	7,149.34	7,153.99	7,153.69	7,150.40	7,150.43	7,150.77	7,150.66	0.1	0.013	-0.03
DP03A-02	DP03A-01	22.5	23.28	24	1	28.9	0.011	7.16	7,132.12	7,131.81	7,139.24	7,139.12	7,134.76	7,134.47	7,135.56	7,135.27	0.1	0.013	0.29
DP04A-01	DP04A-01	13.8	22.62	24	1	27.3	0.01	7.56	7,135.20	7,134.92	7,141.03	7,140.83	7,136.54	7,136.38	7,137.13	7,136.87	0.1	0.013	0.15
DP05A-02	DP05A-01	13.2	13.35	18	1	87.3	0.016	8.61	7,144.53	7,143.12	7,149.07	7,147.65	7,145.89	7,144.51	7,146.84	7,145.44	0.11	0.013	1.38
DP05A-04	DP05A-03	13.2	21.72	18	1	70.2	0.043	12.88	7,147.63	7,144.63	7,152.13	7,149.07	7,148.99	7,145.99	7,149.94	7,146.94	0.11	0.013	2.99
DP05A-06	DP05A-05	13.2	20.02	18	1	331.3	0.036	12.1	7,159.77	7,147.73	7,164.53	7,152.13	7,161.13	7,149.09	7,162.08	7,150.04	1.35	0.013	12.03
DP05A-08	DP05A-07	8.6	10.5	18	1	27	0.01	4.87	7,160.34	7,160.07	7,164.86	7,164.53	7,162.60	7,162.42	7,162.97	7,162.79	0.1	0.013	0.18
DP06A-02	DP06A-01	5.1	10.19	18	1	8.5	0.009	2.89	7,160.15	7,160.07	7,164.86	7,164.53	7,162.44	7,162.42	7,162.57	7,162.55	0.1	0.013	0.02
DP07A-02	DP07A-01	9.7	3.58	18	1	8.6	-0.001	5.49	7,143.45	7,143.46	7,148.53	7,148.56	7,145.05	7,144.97	7,145.51	7,145.44	0.1	0.013	0.07
DP08A-02	DP08A-01	12	22.62	24	1	27.4	0.01	7.31	7,145.73	7,145.45	7,150.37	7,150.25	7,147.66	7,147.59	7,147.89	7,147.81	0.1	0.013	0.07
DP09A-03	DP09A-02	4.1	7.43	18	1	146.6	0.005	4.31	7,131.50	7,130.76	7,137.78	7,133.21	7,132.70	7,132.51	7,132.81	7,132.59	0.14	0.013	0.19
DP09A-05	DP09A-04	4.1	7.43	18	1	44.9	0.005	4.31	7,131.72	7,131.50	7,139.22	7,137.78	7,132.75	7,132.71	7,132.91	7,132.82	0.14	0.013	0.04
DP09A-07	DP09A-06	4.1	7.43	18	1	161.6	0.005	4.31	7,132.53	7,131.72	7,136.74	7,139.22	7,133.33	7,132.77	7,133.61	7,132.92	0.4	0.013	0.55
DP09A-09	DP09A-08	4.1	7.43	18	1	36.4	0.005	4.31	7,132.71	7,132.53	7,138.08	7,136.74	7,133.51	7,133.44	7,133.80	7,133.65	0.1	0.013	0.07
DP09A-11	DP09A-10	2.05	17.31	18	1	156.5	0.027	6.58	7,137.07	7,132.81	7,142.34	7,138.08	7,137.61	7,133.54	7,137.81	7,133.63	0.4	0.013	4.06
DP09A-13	DP09A-12	2.05	17.31	18	1	29.4	0.027	6.58	7,137.86	7,137.07	7,144.14	7,142.34	7,138.40	7,137.69	7,138.60	7,137.82	0.1	0.013	0.72

Appendix D
Reference Material

WATER QUALITY CAPTURE PLAN

HOMESTEAD NORTH



POND A 30.26 ACRES, 46.5% IMPERVIOUS

POND B 27.86 ACRES, 50.0% IMPERVIOUS

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 13,517 SQ-FT ON SITE IS LEFT UNTREATED.**
3. **POND C TREATS THE IMPROVEMENTS TO VOLLMER ROAD AND THE OFFSITE TRIBUTARY AREA**

WQ – PONDS
HOMESTEAD NORTH
JOB NO. 25188.00
1-07-2022
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

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

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

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	7.2	16.5
1.2	24.1	49.4
6a	10.7	18.5
1.3	44.2	95.9
8a	11.3	19.9
1.4	45.0	97.6
9A	21.6	104.4
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	13.3
3.1	6.5	11.7
4C	18.9	42.0
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	31.6	63.3
5C	4.1	8.8
3.5	34.7	69.9
6C	2.5	8.8
3.6	41.4	79.2
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	3.27	56%	0.54	0.67	13.8	6.4	13.3
A3	4.79	50%	0.49	0.63	13.9	8.5	18.4
A4	3.95	54%	0.52	0.65	14.2	7.4	15.6
A5	5.43	50%	0.49	0.62	11.1	10.5	22.6
A6	3.94	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	12.0	12.1	25.9
C4.2	3.44	59%	0.46	0.61	12.6	5.9	13.3
C5	0.16	81%	0.74	0.84	6.4	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

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

DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
1/7/22
SHEET 1 OF 2

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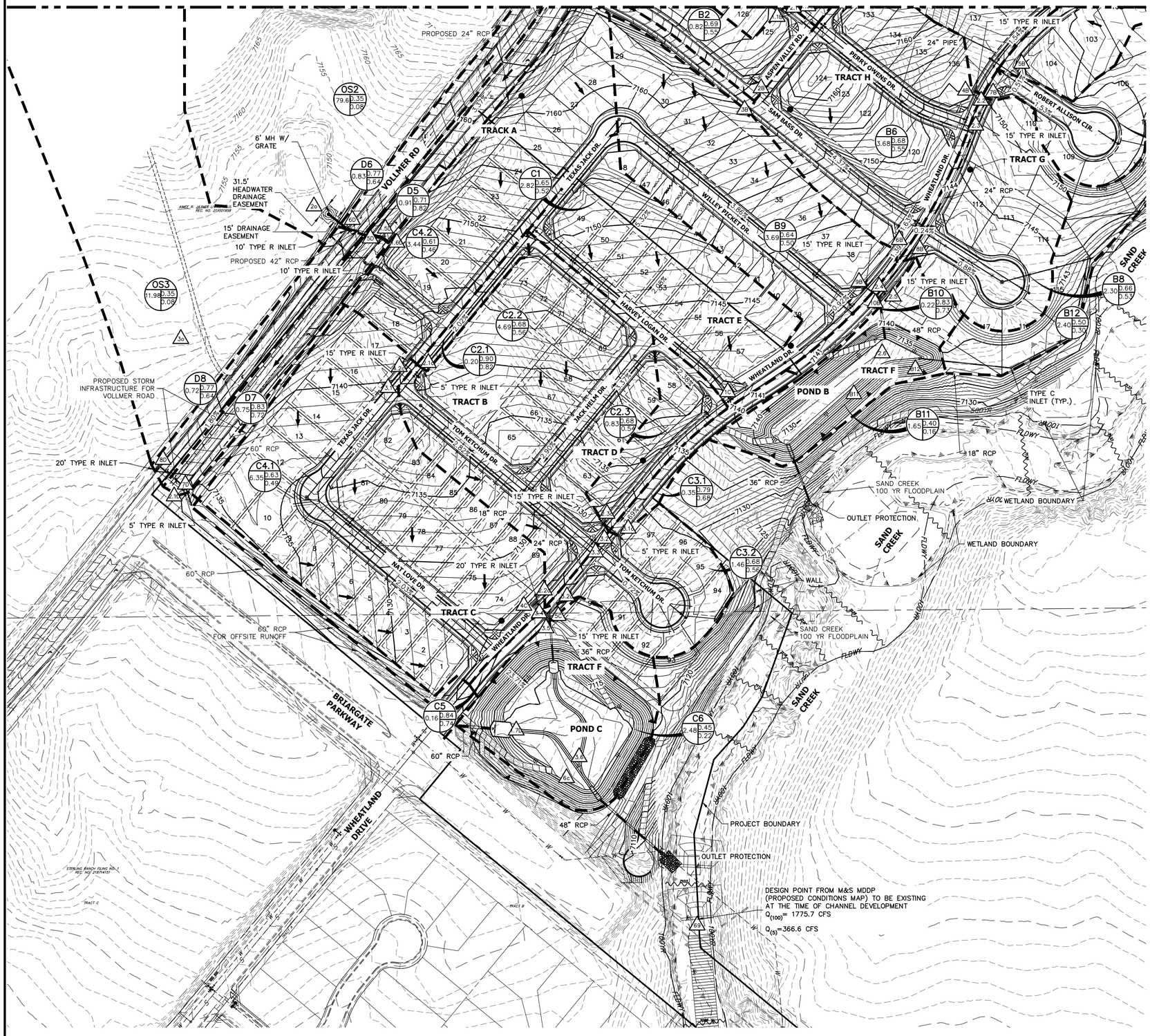
DRAINAGE MAP



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

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	7.2	16.5
1.2	24.1	49.4
6a	10.7	18.5
1.3	44.2	95.9
8a	11.3	19.9
1.4	45.0	97.6
9A	21.6	104.4
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	13.3
3.1	6.5	11.7
4C	18.9	42.0
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	31.6	63.3
5C	4.1	8.8
3.5	34.7	69.9
6C	2.5	8.8
3.6	41.4	79.2
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	3.27	56%	0.54	0.67	13.8	6.4	13.3
A3	4.79	50%	0.49	0.63	13.9	8.5	18.4
A4	3.95	54%	0.52	0.65	14.2	7.4	15.6
A5	5.43	50%	0.49	0.62	11.1	10.5	22.6
A6	3.94	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	12.0	12.1	25.9
C4.2	3.44	59%	0.46	0.61	12.6	5.9	13.3
C5	0.16	81%	0.74	0.84	6.4	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

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

DRAINAGE MAP
HOMESTEAD NORTH
JOB NO. 25188.00
1/7/22
SHEET 2 OF 2

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FOR INFORMATION ONLY

SAND CREEK RESTORATION WORK MAP

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

HEC-RAS WORK MAP
SAND CREEK RESTORATION
STERLING RANCH, CO
DATE: 10.02.2020
SHEET 1 OF 1

Appendix E
Drainage Maps

HOMESTEAD NORTH AT STERLING RANCH FILING NO. 2

EXISTING DRAINAGE MAP

LEGEND

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

DESIGN POINT

EXISTING FLOW DIRECTION

BASIN DRAINAGE AREA

EXISTING STORM SEWER

EXISTING PROPERTY LINE

ROW EXISTING

FL EXISTING

SIDEWALK EXISTING

DRAINAGE ACCESS & MAINTENANCE EASEMENT

EXISTING

6100

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
H-1	5.36	3%	0.09	0.35	32.7	1.1	7.5
H-2	49.40	2%	0.08	0.35	32.5	9.3	68.5

DESIGN POINT

DP	Q5 Total	Q100 Total
1h	1.1	7.5
2h	9.3	68.5

EXISTING DRAINAGE MAP
HOMESTEAD NORTH AT STERLING RANCH FIING NO. 2
JOB NO. 25188.10
02–24–2022
SHEET 1 OF 1

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

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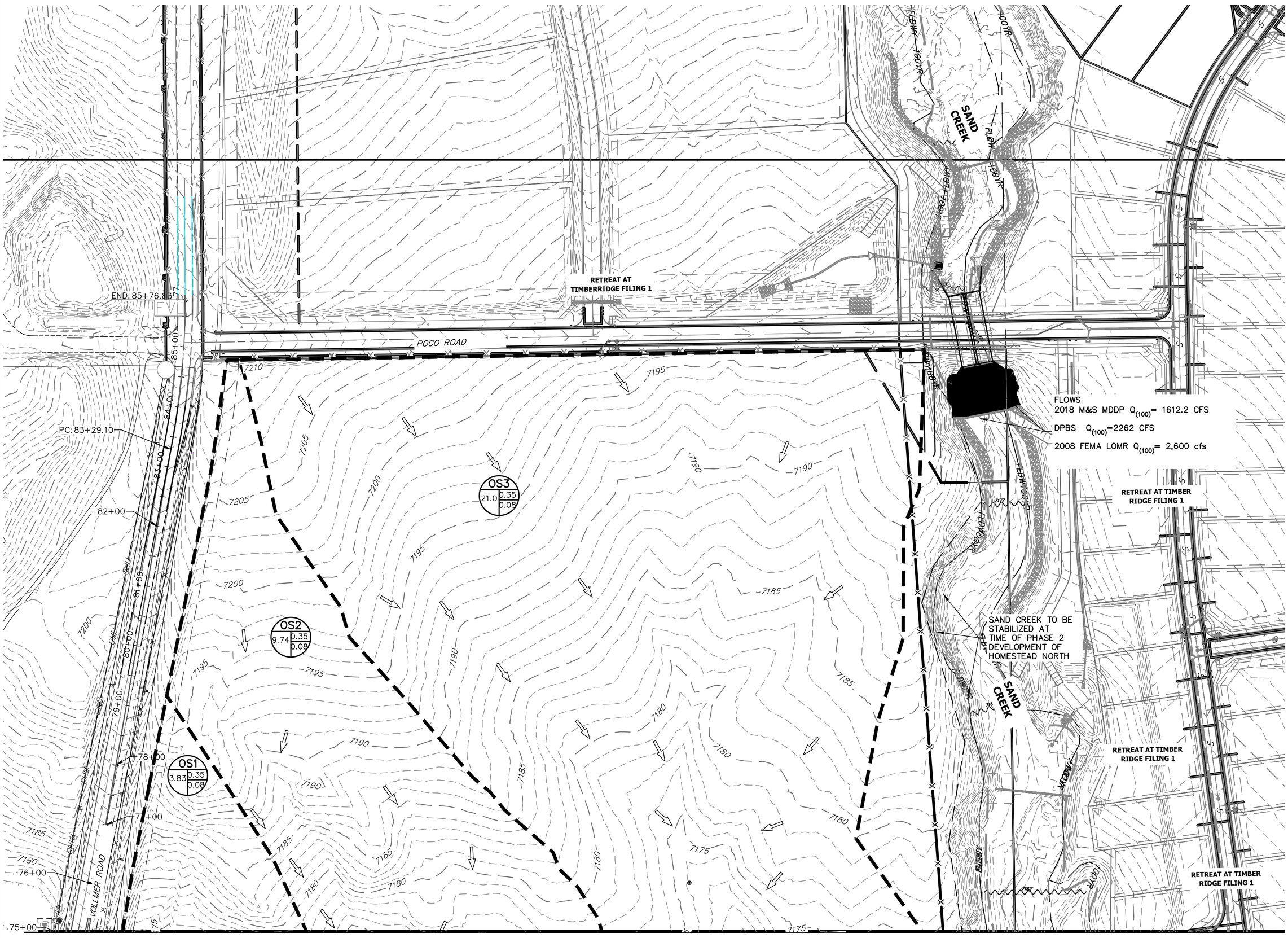
HOMESTEAD NORTH AT STERLING RANCH FILING NO. 2

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

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)
OS1	3.83	2%	0.08	0.35	15.7	1.1	7.8
OS2	9.74	2%	0.08	0.35	27.9	2.0	14.8
OS3	21.02	2%	0.08	0.35	31.1	4.1	30.0
B1.1	1.24	52%	0.51	0.64	11.4	2.5	5.3
B1.2	0.38	51%	0.49	0.64	7.9	0.9	1.8
B1.3	0.45	47%	0.46	0.62	8.1	0.9	2.1
B2	0.86	58%	0.55	0.68	5.0	2.4	5.1
B3	0.23	78%	0.72	0.82	5.0	0.9	1.6
B4	3.51	46%	0.46	0.61	9.1	6.9	15.2
B5	1.11	61%	0.58	0.70	6.8	3.1	6.2
B6	3.61	58%	0.55	0.68	6.5	9.5	19.8
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%	0.49	0.63	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	4.4
B12	2.18	36%	0.28	0.48	16.6	2.1	5.9
B13	0.43	54%	0.38	0.55	5.0	0.9	2.1
B14	0.42	45%	0.33	0.51	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	9.4	2.1	5.0

DESIGN POINT SUMMARY TABLE

DP	Q5 Total	Q100 Total
O.2	2.0	14.8
O.3	6.0	43.9
1.1b	2.5	5.3
1.1i	2.5	5.3
O.1	1.1	7.8
1.2b	1.7	9.2
1.2i	1.7	8.5
2.1	3.9	13.1
1.3b	0.9	2.2
2b	3.0	5.6
3b	0.9	1.6
4b	6.9	15.2
4i	6.9	11.7
6b	12.7	23.2
6i	7.5	9.9
9b	11.8	26.4
5b	3.1	6.2
5i	3.1	5.0
2.2	3.1	5.0
7b	4.0	9.1
7i	4.0	7.7
2.3	9.6	16.2
2.4	13.2	23.5
2.5	13.7	30.0
8b	4.7	11.1
2.6	18.0	37.4
2.7	27.2	61.6
10b	5.4	12.4
2.8	31.2	70.8
11b	1.0	4.4
C.1	1.8	3.9
C.2	2.1	5.0
12b	2.1	5.9
3.1	2.1	5.9
13b	0.9	2.1
3.2	2.6	7.3
14b	0.7	1.7
4	36.5	81.7

Know what's **below.** **Call** before you dig.

100 50 0 100 200

ORIGINAL SCALE: 1" = 100'

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

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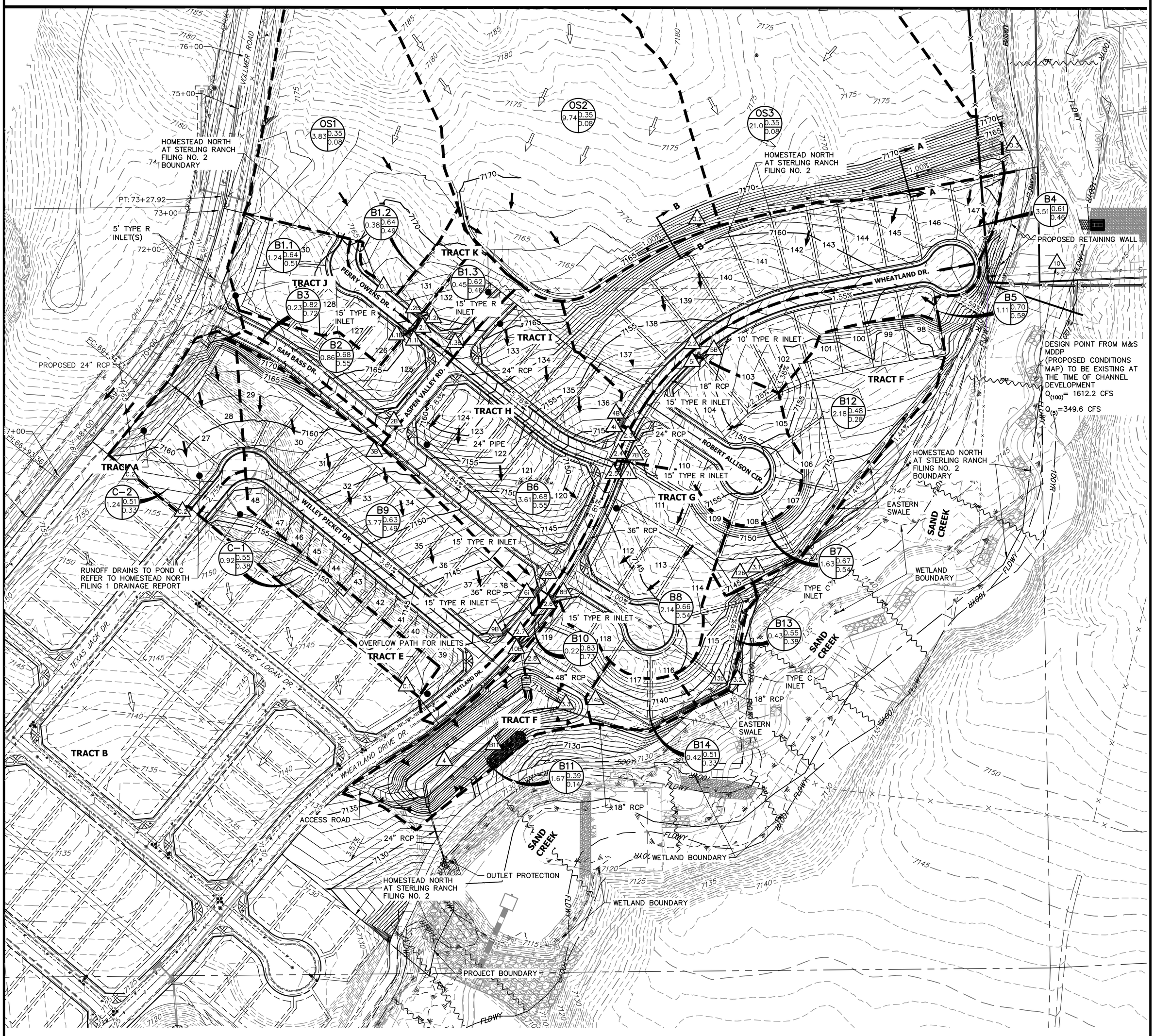
HOMESTEAD NORTH AT STERLING RANCH FILING NO. 2

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

SWALE SECTION A–A
TYPICAL DETAIL
SCALE: NTS

SWALE SECTION B–B
TYPICAL DETAIL
SCALE: NTS

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C5	C100	tc (min)	Q5 (cfs)	Q100 (cfs)
OS1	3.83	2%	0.08	0.35	15.7	1.1	7.8
OS2	9.74	2%	0.08	0.35	27.9	2.0	14.8
OS3	21.02	2%	0.08	0.35	31.1	4.1	30.0
B1.1	1.24	52%	0.51	0.64	11.4	2.5	5.3
B1.2	0.38	51%	0.49	0.64	7.9	0.9	1.8
B1.3	0.45	47%	0.46	0.62	8.1	0.9	2.1
B2	0.86	58%	0.55	0.68	5.0	2.4	5.1
B3	0.23	78%	0.72	0.82	5.0	0.9	1.6
B4	3.51	46%	0.46	0.61	9.1	6.9	15.2
B5	1.11	61%	0.58	0.70	6.8	3.1	6.2
B6	3.61	58%	0.55	0.68	6.5	9.5	19.8
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%	0.49	0.63	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	4.4
B12	2.18	36%	0.28	0.48	16.6	2.1	5.9
B13	0.43	54%	0.38	0.55	5.0	0.9	2.1
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C-1	0.92	67%	0.48	0.61	10.1	1.8	3.9
C-2	1.24	52%	0.40	0.57	9.4	2.1	5.0

DESIGN POINT SUMMARY TABLE

DP	Q5 Total	Q100 Total
O.2	2.0	14.8
O.3	6.0	43.9
1.1b	2.5	5.3
1.1i	2.5	5.3
O.1	1.1	7.8
1.2b	1.7	9.2
1.2i	1.7	8.5
2.1	3.9	13.1
1.3b	0.9	2.2
2b	3.0	5.6
3b	0.9	1.6
4b	6.9	15.2
4i	6.9	11.7
6b	12.7	23.2
6i	7.5	9.9
9b	11.8	26.4
5b	3.1	6.2
5i	3.1	5.0
2.2	3.1	5.0
7b	4.0	9.1
7i	4.0	7.7
2.3	9.6	16.2
2.4	13.2	23.5
2.5	13.7	30.0
8b	4.7	11.1
2.6	18.0	37.4
2.7	27.2	61.6
10b	5.4	12.4
2.8	31.2	70.8
11b	1.0	4.4
C.1	1.8	3.9
C.2	2.1	5.0
12b	2.1	5.9
3.1	2.1	5.9
13b	0.9	2.1
3.2	2.6	7.3
14b	0.7	1.7
4	36.5	81.7

Know what's **below.**
Call before you dig.

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

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

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