

**FINAL DRAINAGE REPORT FOR
COPPER CHASE AT STERLING RANCH

EL PASO COUNTY, COLORADO**

APRIL 2023

Prepared for:

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Prepared by:



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Project #09-014
PCD Project # PUDSP222

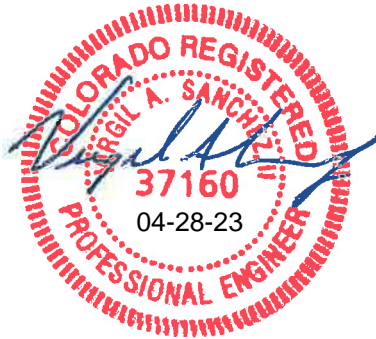
**FINAL DRAINAGE REPORT FOR
COPPER CHASE AT STERLING RANCH**

DRAINAGE PLAN STATEMENTS

ENGINEERS STATEMENT

The attached drainage plan and report was 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 the County for drainage reports and said report is in conformity with the master plan of the drainage basin.

Virgil A. Sanchez, P.E. #37160
For and on Behalf of M&S Civil Consultants, Inc



DEVELOPER'S STATEMENT

I, the developer, have read and will comply with all the requirements specified in this drainage report and plan.

BY: 

Jim Byers, VP of Community Development

TITLE: _____
DATE: 04-28-23

ADDRESS: Challenger Communities, LLC
8605 Explorer Drive, Suite 250
Colorado Springs, CO 80920

EL PASO COUNTY'S STATEMENT

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

BY: _____ DATE: _____
Josh Palmer, P.E.
County Engineer / ECM Administrator

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FINAL DRAINAGE REPORT FOR COPPER CHASE AT STERLING RANCH

PURPOSE

This document is the Final Drainage Report for Copper Chase at Sterling Ranch. This site was previously discussed, in the approved "Final Drainage Report for Sterling Ranch Filing No. 2" prepared by JR Engineering, approved November 2021. The purpose of this document is to identify and analyze the on and offsite drainage patterns and to ensure that post development runoff is routed through the site safely and in a manner that satisfies the requirements set forth by the El Paso County Drainage Criteria Manual.

GENERAL LOCATION AND DESCRIPTION

Copper Chase at Sterling Ranch is located within the Southeast quarter of Section 32 and within the Southwest quarter of Section 33, Township 12 south, Range 65 West and a portion of the Northeast quarter of Section 5, Township 13, Range 65 West, all west of the 6th Principal Meridian, in unincorporated El Paso County, Colorado. Sterling Ranch Filing No. 2 infrastructure encompasses the boundary of the site. The site is bound to the north by under-construction Vollmer Road, Alzada Drive, and Bynum Drive. The site is bound to the southwest by existing Marksheffel Road and to the southeast by existing Sterling Ranch Road. Copper Chase at Sterling Ranch lies within the Sand Creek Drainage Basin. Flows from this site are tributary to Sand Creek.

Copper Chase at Sterling Ranch consists of 19.65 acres and is presently undeveloped. Vegetation is sparse, consisting of native grasses. Existing site terrain generally slopes from north to southeast at grade rates that vary between 1.9% and 4.4%.

Copper Chase at Sterling Ranch is currently zoned RS-5000 for Residential Sub-Urban and is proposed to be PUD, or Planned Unit Development. Improvements proposed for the site include paved streets, utilities, and storm drainage improvements, as normally constructed for a planned unit development.

SOILS

Soils for this project are delineated by the map in the appendix as Blakeland Loamy Sand (8) and Columbine Gravelly Sandy Loam (19). Both are characterized as Hydrologic Soil Types "A". Soils in the study area are shown as mapped by S.C.S. in the "Soils Survey of El Paso County Area". Due to recent bulk grading activities, vegetation is sparse, consisting of native grasses and weeds.

HYDROLOGIC CALCULATIONS

Hydrologic calculations were performed using the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual and where applicable the Urban Storm Drainage Criteria Manual. The Rational Method was used to estimate stormwater runoff anticipated from design storms with 5-year and 100-year recurrence intervals.

HYDRAULIC CALCULATIONS

Hydraulic calculations were estimated using the Manning's Formula and the methods described in the El Paso County and City of Colorado Springs Storm Drainage Design Criteria manual. The relevant data sheets are included in the appendix of this report.

FLOODPLAIN STATEMENT

No portion of this site is within a designated F.E.M.A. floodplain as determined by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel No. 08041C0533 G, effective date December 7th, 2018.

DRAINAGE CRITERIA

This drainage analysis has been prepared in accordance with the current El Paso County Drainage Criteria Manual, Volumes I & II, dated October 31, 2018, City of Colorado Springs Drainage Criteria Manual, Volumes I & II, dated May 2014, including subsequent updates. El Paso County has also adopted Chapter 6 and Section 3.2.1 of Chapter 13 in the City of Colorado Springs & El Paso County Drainage Criteria Manual Volumes I and II, dated May 2014. (Appendix I of the El Paso County's Engineering Criteria Manual (ECM), Adopted January 2015). In addition to the ECM, the Urban Storm Drainage Criteria Manuals, Volumes 1-3, published by the Urban Drainage and Flood Control District (Volumes 1 & 2 dated January 2016, Volume 3 dated November 2010 and updates). Calculations were performed to determine runoff quantities for the 5-year and 100-year frequency storms for developed conditions using the Rational Method.

EXISTING DRAINAGE CONDITIONS

The Copper Chase at Sterling Ranch site consists of 19.65 acres and is situated west of the Sand Creek Channel. This area was previously studied in the "Sand Creek Drainage Basin Planning Study" (DBPS) prepared by Kiowa Corporation, revised March 1996. More recently the area was studied in the "Final Drainage Report for Sterling Ranch Filing No. 2" prepared by JR Engineering, LLC, approved November 2021 (henceforth referred to as "Sterling Ranch Filing No. 2 FDR"), and "Master Development Drainage Report for Sterling Ranch Filing Nos. 1 & 2", prepared by M&S Civil Consultants, dated December 2017. Copper Chase at Sterling Ranch and portions of the surrounding areas (with the exception of the existing Barbarick Subdivision), have already been bulk graded (refer to Sterling Ranch Filing No. 2: Grading, Erosion, and Stormwater Quality Control Plan, dated March 2018). Offsite flows in this condition are diverted by the exterior roadways and do not enter the site. Refer to the Final Drainage Report for Sterling Ranch Filing No 2 by JR Engineering, LLC for information on historic conditions and overlot drainage patterns and analysis. The existing condition discussion, calculations, and maps for this site come directly from the proposed condition discussion, calculations, and maps within the Sterling Ranch Filing No. 2 FDR. Supporting text, calculation, and map excerpts for the existing conditions can be found in the appendix under the following sections: "Existing Drainage Conditions Discussion", "Existing Hydrologic Calculations", "Existing Hydraulic Calculations", "Background", and "Existing Drainage Maps".

FOUR STEP PROCESS

Step 1 Employ Runoff Reduction Practices - Roof drains will be directed to side yard swales and, whenever possible, to grass lined swales to aid in minimizing direct connection of impervious surfaces. Residential lots are proposed to include open spaces and lawn areas, which helps minimize directly connected impervious areas and therefore reduces runoff volumes.

Step 2 Treat And Slowly Release the WQCV (Stabilize Drainageways) –at rates less than pre-development conditions. With the offsite, sub-regional, full spectrum detention facility (Pond W-5) in place, the runoff from the proposed planned unit development and other areas of Sterling Ranch developments (see Pond W-5 tributary area in Appendix) will be treated and reduced to predevelopment conditions. The developed discharge from the site is not anticipated to have negative effects on downstream drainageways.

Step 3 Stabilize Stream Channels Provide Water Quality Capture Volume (WQCV) - An existing Full Spectrum Detention Facility was planned and constructed to handle tributary flows for this site (see Sterling Ranch Filing No 2 FDR with PCD Filing No. SF1820, Pond W-5) which will incorporate water quality capture volumes that are intended to slowly drain in 40 hours and excess urban runoff volumes that are intended to drain within 72 hours. Channel stabilization has been provided at the outlet of the aforementioned pond.

Step 4 Consider Need for Selecting Industrial and Commercial BMP's – A Stormwater Management Plan will be implemented which will include property housekeeping practices, spill containment procedures, and coverage of storage/handling areas to mitigate the potential for erosion across the site and protect downstream waters. Specialized BMP's are not required since there aren't commercial/industrial areas being implemented with this project.

PROPOSED DRAINAGE CHARACTERISTICS

General Concept Drainage Discussion

The following is a description of the onsite basins, offsite flows and the overall drainage characteristics for the development of Copper Chase at Sterling Ranch. The development of Copper Chase at Sterling Ranch consists of paved streets, parking, and lots typical of a Planned Unit Development (PUD). Surface runoff is routed via roof drains and side lot swales between the lots to either the back or front of the lots. Surface runoff from the back of the lots and open spaces is directed by swales to low points within area drainage basins. Surface runoff directed to the front of the lots is conveyed within the streets to proposed CDOT Type R at-grade inlets or to low points equipped with proposed CDOT Type R sump inlets. In the event of clogging or inlet failure at low points, emergency overflow routes have been designed to convey runoff to either a downstream inlet, existing Bynum Drive, or Sterling Ranch Road (see the Proposed Drainage Map for emergency overflow arrows and general drainage patterns). Runoff captured by area drainage inlets or CDOT Type R inlets is conveyed underground by a proposed private storm sewer system to the southern corner of the parcel. Ultimately, the proposed storm sewer system ties into an existing Type I manhole within the right of way of Sterling Ranch Road. All existing storm drainage improvements within Sterling Ranch Road are being constructed with the Sterling Ranch Filing No. 2 infrastructure. Ultimately, runoff from the proposed development is conveyed to existing Sterling ranch Pond W-5, a subregional Full spectrum Detention Facility constructed along the southern boundary of

Sterling Ranch. (Refer to Pond W4 & W5 Tributary Area Exhibit by JR Engineering, included in the Background section of the Appendix). A final analysis of Pond W-5 will be included with the final plat submittal.

The following detailed drainage discussion provides an overview of the proposed development and ensures that no major modification of the proposed improvements is necessary due to the assumptions meeting that of the previously submitted Final Drainage Report for Sterling Ranch Filing No 2. Surface flow is designated as Design Points (DP). Captured flow within the storm sewer system is designated as Pipe Runs (PR). Flow bypassing the inlets is designated as flowby (FB).

Detailed Drainage Discussion (Design Points)

Design Point 1 (Q5=4.4 cfs, Q100=11.8 cfs)

Basin A consists of 3.59 acres of residential lots and paved roadway. Runoff produced within this basin (Q5=4.4 and Q100=11.8 cfs) flows from north to south through the lots and onto Blue Feather Loop, a public roadway. The flow is conveyed to the southwest within the curb and gutter to a proposed 5' at-grade CDOT Type R inlet (**IN-1, Q5=2.5 and Q100=3.8 cfs**) where a portion enters **PR1**, a proposed private 18" RCP storm sewer. Flowby bypassing this inlet (Q5=1.9 cfs, Q100=8.0 cfs) continues to downstream infrastructure.

Design Point 2 (Q5=4.9 cfs, Q100=11.4 cfs)

Basin B consists of 3.40 acres of residential lots and paved roadway. Runoff produced within this basin (Q5=4.9 and Q100=11.4 cfs) flows from the lots and onto Blue Feather Loop and Lost Trail Drive (two public roadways). The flow is conveyed within the streets via curb and gutter to a proposed 15' at-grade CDOT Type R inlet (**IN-2, Q5=4.9 and Q100=9.7 cfs**) where it enters **PR2**, a proposed private 18" RCP storm sewer. **PR1** and **PR2** join flows and are directed southeast within **PR3**, an 18" RCP private storm sewer. Flowby bypassing this inlet (Q5=0.0 cfs, Q100=1.7 cfs) continues to downstream infrastructure.

Design Point 3 (Q5=3.7 cfs, Q100=11.8 cfs)

Basin C consists of 1.02 acres of residential lots and paved roadway. Runoff produced within this basin (Q5=1.8 and Q100=3.9 cfs) flows from the lots and onto Blue Feather Loop, a public roadway. The flow is conveyed southeast in the curb and gutter, combining with **FB-IN1**, to a proposed 5' at-grade CDOT Type R inlet (**IN-3, Q5=2.3 and Q100=3.9 cfs**). Intercepted flow enters **PR4**, a proposed private 18" RCP storm sewer. Flowby bypassing this inlet (Q5=1.4 cfs, Q100=7.9 cfs) continues to downstream infrastructure.

Design Point 4 (Q5=4.7 cfs, Q100=12.0 cfs)

Basin D consists of 2.90 acres of residential lots and paved roadway. Runoff produced within this basin (Q5=4.8 and Q100=10.5 cfs) flows from the lots and onto Salt Fork Drive, a public roadway. The flow is conveyed southeast in the curb and gutter, combining with **FB-IN2**, to a proposed 15' at-grade CDOT Type R inlet (**IN-4, Q5=4.7 and Q100=10.0 cfs**). Intercepted flow enters **PR5**, a proposed private 18" RCP storm sewer. **PR3**, **PR4**, and **PR5** join flows and continue southeast in **PR12**, a proposed 24" RCP private storm sewer. Flowby bypassing this inlet (Q5=0.0 cfs, Q100= 2.0 cfs) continues to downstream infrastructure.

Design Point 5 (Q5=1.8 cfs, Q100=5.6 cfs)

Basin E consists of 0.89 acres of residential lots and paved roadway. Runoff produced within this basin (Q5=2.1 and Q100=4.2 cfs) flows from north to south through the lots and onto Blue Feather Loop, a public roadway. The flow is conveyed southeast in the curb and gutter, combining with **FB-IN4**, to a proposed 15' sump CDOT Type R at **Design Point 9**.

Design Point 6 (Q5=4.2 cfs, Q100=10.0 cfs)

Basin F consists of 2.58 acres of residential lots and paved roadway. Runoff produced within this basin (Q5=4.2 and Q100=10.0 cfs) flows from the lots and onto Blue Feather Loop, a public roadway. The flow is conveyed southeast in the curb and gutter to a proposed 15' at-grade CDOT Type R inlet (**IN-6, Q5=4.2 and Q100=8.9 cfs**) where it enters **PR6** to **PR9**, a proposed private 18" RCP storm sewer segment. Flowby bypassing this inlet (Q5=0.0 cfs, Q100=1.1 cfs) continues east to downstream infrastructure located offsite on Bynum Drive.

Design Point 7 (Q5=4.9 cfs, Q100=20.0 cfs)

Basin G consists of 1.65 acres of paved roadway and residential lots. Runoff produced within this basin (Q5=4.3 and Q100=8.7 cfs) flows to the curb and gutter of Bynum Drive, a public roadway, and combines with **FB-IN6, FB-INA1, FB-INA4, and FB-INA3** for peak rates of Q5=4.9 and Q100=20.0 cfs in the 5 and 100 year events, respectively. A portion of the flow is then captured by an existing 15' at-grade CDOT Type R inlet (**IN-A5, Q5=4.9 and Q100=13.3 cfs**) where it enters **1.3A**, an existing public 30" RCP storm sewer. A manhole redirects the flow south into **1.3**, a public 36" RCP storm sewer. Flowby bypassing this inlet (Q5=0.0 cfs, Q100=6.7 cfs) continues to downstream infrastructure located on existing Sterling Ranch Road.

Design Point 8 (Q5= 1.0 cfs, Q100=3.9 cfs)

Basin H consists of 1.22 acres of residential lots, open space, and landscaping. Runoff produced within this basin (Q5=1.0 and Q100=3.9 cfs) flows from north to south through the lots, entering a proposed triangular, earthen swale. This 2' deep swale with 3:1 side slopes directs the flow southeast, where it enters a proposed 3' CDOT Type C at grade area inlet (**IN-8, Q5=1.0 and Q100=3.9 cfs**) at its end. Design calculations for this swale shall be provided with the Final Drainage Report and Final Plat submittal. **PR10**, a proposed 18" RCP private storm sewer directs intercepted flows south. In the case of inlet failure or clogging, the inundated area will overflow southeast onto Blue Feather Loop and be conveyed to the sump inlet (**IN-5**) at **DP 9**. A weir-orifice analysis for this grate is provided in the Appendix.

Design Point 9 (Q5=4.0 cfs, Q100=10.5 cfs)

Basin I consists of 1.40 acres of residential lots and paved roadway. Runoff produced within this basin (Q5=2.4 and Q100=5.2 cfs) drains from northwest to southeast to the curb and gutter of Salt Fork Drive, a public roadway, combining with surface flows from **Design Point 5** at peak rates of 4.0 and 10.5 cfs in the 5 and 100 year events, respectively. The flow is then captured by proposed 15' sump CDOT Type R inlet (**IN-5, Q5=4.0 and Q100=10.5 cfs**). Intercepted flows enter **PR11**, a proposed private 24" RCP storm sewer. In the case of inlet failure or clogging, flows would overtop the crown of the road, enter **IN-9**, then overtop the curb and gutter to flow through Tract E.

Design Point 10 (Q5=2.2 cfs, Q100=4.3 cfs)

Basin J consists of 0.89 acres of residential lots and paved roadway. Runoff produced within this basin (Q5=2.2 and Q100=4.3 cfs) drains to the curb and gutter of Blue Feather Loop, a public roadway. The flow is then directed south and captured by proposed 15' sump CDOT Type R inlet at **Design Point 11**.

Design Point 11 (Q5=5.4 cfs, Q100=16.7 cfs)

Basin K consists of 1.07 acres of residential lots and paved roadway. Runoff produced within this basin (Q5=1.9 and Q100=4.2 cfs) drains from west to east to the curb and gutter of Blue Feather Loop. The flow is conveyed in the curb and gutter where it combines with flows from **Design Point 10** and **FB-IN3** and is captured by proposed 15' sump CDOT Type R inlet (**IN-9, Q5=5.4 and Q100=16.7 cfs**). Intercepted flow enters **PR13**, a proposed private 30" RCP storm sewer where flows from **PR9** and **PR12** combine at a Type I junction manhole. Flows continue south in **PR14**, a proposed 42" RCP private storm sewer that ties into the existing 42" RCP storm sewer (private) and Type I manhole in the right of way of Sterling Ranch Road (**PR14: Q5=26.0, Q100=60.5 cfs**). Flows anticipated in the FDR for Sterling Ranch Filing No. 2 by JR Engineering at this pipe location are Q5=27.5 cfs and Q100=60.6 cfs.

Design Point 12 (Q5=1.1 cfs, Q100=3.3 cfs)

Basin L consists of 1.21 acres of residential lots and open space at the rear of the lots. Runoff produced within this basin (Q5=1.1 and Q100=3.3 cfs) drains to the curb and gutter of Bynum Drive and Sterling Ranch Road, public roadways. The flow is then directed southeast and is captured by an existing 15' CDOT Type R at grade inlet (**IN-A8**) at **Design Point 15** and enters **1.5**, a public 48" RCP storm sewer.

Design Point 13 (Q5=0.3 cfs, Q100=1.6 cfs)

Basin M consists of 0.64 acres of residential lots and open space. Runoff produced within this basin (Q5=0.3 and Q100=1.6 cfs) drains to the curb and gutter of Sterling Ranch Road, an under-construction public roadway. The flow is then directed southeast and is captured by existing 15' CDOT Type R at grade inlet (**IN-A11**) on Marksheffel Road.

Design Point 14 (Q5=3.0 cfs, Q100=5.4 cfs)

Basin A4 consists of 0.64 acres of public roadway (Alzada Drive). Runoff produced within this basin (Q5=3.0 and Q100=5.4 cfs) drains from northwest to southeast to an existing 10' CDOT Type R at grade inlet (**IN-A4: Q5=3.0, Q100=4.8 cfs**). Flow bypassing this inlet (Q5=0.0 cfs, Q100=0.6 cfs) continues to downstream infrastructure.

Design Point 15 (Q5=5.1 cfs, Q100=19.8 cfs)

Basin A8 consists of 0.75 acres of public roadway. Runoff produced within this basin (Q5=3.0 and Q100=5.5 cfs) drains within the curb and gutter of Sterling Ranch Road, combining with **FB-INA6, FB-INA15, DP 12, and FB-INA5**. **Basin A6** consists of 1.37 acres of public roadway and existing residential lots. A majority of the flow is intercepted by a 15' CDOT Type R inlet (**IN-A6: Q5=3.3, Q100=5.4 cfs**) and enter the system through a 24" RCP public storm sewer, discharging into **1.3A**. 100 yr flowby of 1.3 cfs bypasses the inlet and is intercepted by downstream infrastructure at **Design Point 15**. **Basin A6A** consists of 0.53 acres of area with a similar imperviousness to commercial areas. Runoff from this basin (Q5=2.2, Q100=4.1 cfs) drains to the curb and gutter of Sterling Ranch Road and combines with the aforementioned flows at peak rates of Q5=5.1 and Q100=19.8 cfs in the 5 and 100 year events, respectively. Runoff is collected in an existing 15' CDOT Type R at grade inlet (**IN-A8: Q5=5.1, Q100=13.6 cfs**). JR Engineering anticipated surface flows of Q5=3.0 cfs and Q100=12.5 cfs, and intercepted and pipe flows of Q5=3.0 cfs, and Q100=10.6 cfs. Flow bypassing this inlet (Q5=0.0 cfs, Q100=6.2 cfs) continues to downstream infrastructure.

Design Point 16 (Q5=7.7 cfs, Q100=22.8 cfs)

Basin A11 consists of 2.79 acres of public roadway and landscaped right of way of Marksheffel Road. Runoff produced within this basin (Q5=7.4 and Q100=14.2 cfs) drains from northwest to southeast in the curb and gutter combining with **DP13, FB-INA8 and FB-INA9** at peak rates of Q5=7.7 and Q100=20.5

cfs in the 5 and 100 year events, respectively. Runoff is collected at the existing 15' CDOT Type R at grade inlet (IN-A11: Q5=7.6, Q100=14.7 cfs). JR Engineering anticipated surface flows of Q5=9.5 cfs and Q100=18.1 cfs at this location, and intercepted flows of Q5=8.9 cfs and Q100=13.8 cfs. Intercepted flow enters pipe run 1.7, and combines with flows from 1.6 in 1.8 at peak rates of Q5=60.8 cfs and Q100=124.8 cfs. Pipe flows of Q5=68.8 cfs and Q100=125.0 cfs were originally anticipated. Flows bypassing the inlet (Q5=0.1 cfs, Q100=8.1 cfs) continue to downstream infrastructure. Flows previously anticipated by this inlet prior to Copper Chase development by JR Engineering were Q5=0.6 cfs & Q100=6.1 cfs, representing a 33% increase. Downstream pipe sizes are greater than 54" past this point (up to 78" prior to discharging into Pond W-5). Based on JR's 125.0 cfs, 100 yr design flow of 1.8, the increase in bypassed flows represents a 1.6% downstream increase. This increase has been determined to be well within the ~5% human error potentially introduced into the calculations along with other conservative factors built in to the equations. The calculated HGL by JR at the manhole tie in location is 6982.33', and is located 5.83' below finished grade. As such, the downstream facilities leading to Pond W-5 are anticipated to accommodate the additional bypass. A conveyance exhibit is provided for reference from JR's report in the Drainage Map section of the Appendix.

EROSION CONTROL

It is the policy of the El Paso County that a grading and erosion control plan be submitted with the drainage report. Bulk grading was completed with approval of "Sterling Ranch Filing No. 2: Grading, Erosion, and Stormwater Quality Plan", dated March 2018. Grading and Erosion control operations are currently finished. A Grading and Erosion Control plan for the proposed development is being concurrently submitted with this report.

CONSTRUCTION COST OPINION – COPPER CHASE AT STERLING RANCH

Drainage Facilities:

Construction Cost Estimate (Non-Reimbursable)				
Item	Amount	Unit	Unit Cost	Total Cost
5' CDOT Type R Inlet	2	EA	\$ 6,500.00	\$ 13,000.00
15' CDOT Type R Inlet	5	EA	\$ 13,000.00	\$ 65,000.00
Type I MH	1	EA	\$ 9,800.00	\$ 9,800.00
Type II MH	5	EA	\$ 6,000.00	\$ 30,000.00
3' CDOT Type C Inlet	1	EA	\$ 5,000.00	\$ 5,000.00
18" RCP	905	LF	\$ 45.00	\$ 40,725.00
24" RCP	443	LF	\$ 81.00	\$ 35,883.00
30" RCP	20	LF	\$ 100.00	\$ 2,000.00
42" RCP	37	LF	\$ 166.00	\$ 6,142.00
Total Cost:				\$ 207,550.00

DRAINAGE & BRIDGE FEES – COPPER CHASE AT STERLING RANCH

Use 2023 fees

This site is within the Sand Creek Drainage Basin. The 2022 Drainage and Bridge Fees per El Paso County for the Copper Chase at Sterling Ranch site are as follows:

DRAINAGE AND BRIDGE FEES HAVE BEEN UPDATED TO THE CURRENT 2023 FEES

Per Copper Chase at Sterling Ranch Site Boundary – **Total Area = 19.651 Acres**

COPPER CHASE AT STERLING RANCH FEES:

Drainage Fees:	19.651	x	58.7%	\$21,814	=	\$ 251,627.48
Bridge Fees:	19.651	x	58.7%	\$8,923	=	<u>\$ 102,928.03</u>
				Total		\$ 354,555.51

It should be noted that these fees are provided in this Final Drainage Report for informational purposes only.

M & S Civil Consultants, Inc. (M & S) cannot and does not guarantee the construction cost will not vary from these opinions of probable costs. These opinions represent our best judgment as design professionals familiar with the construction industry and this development in particular. The above is only an estimate of the facility cost and drainage basin fee amounts in 2022.

SUMMARY

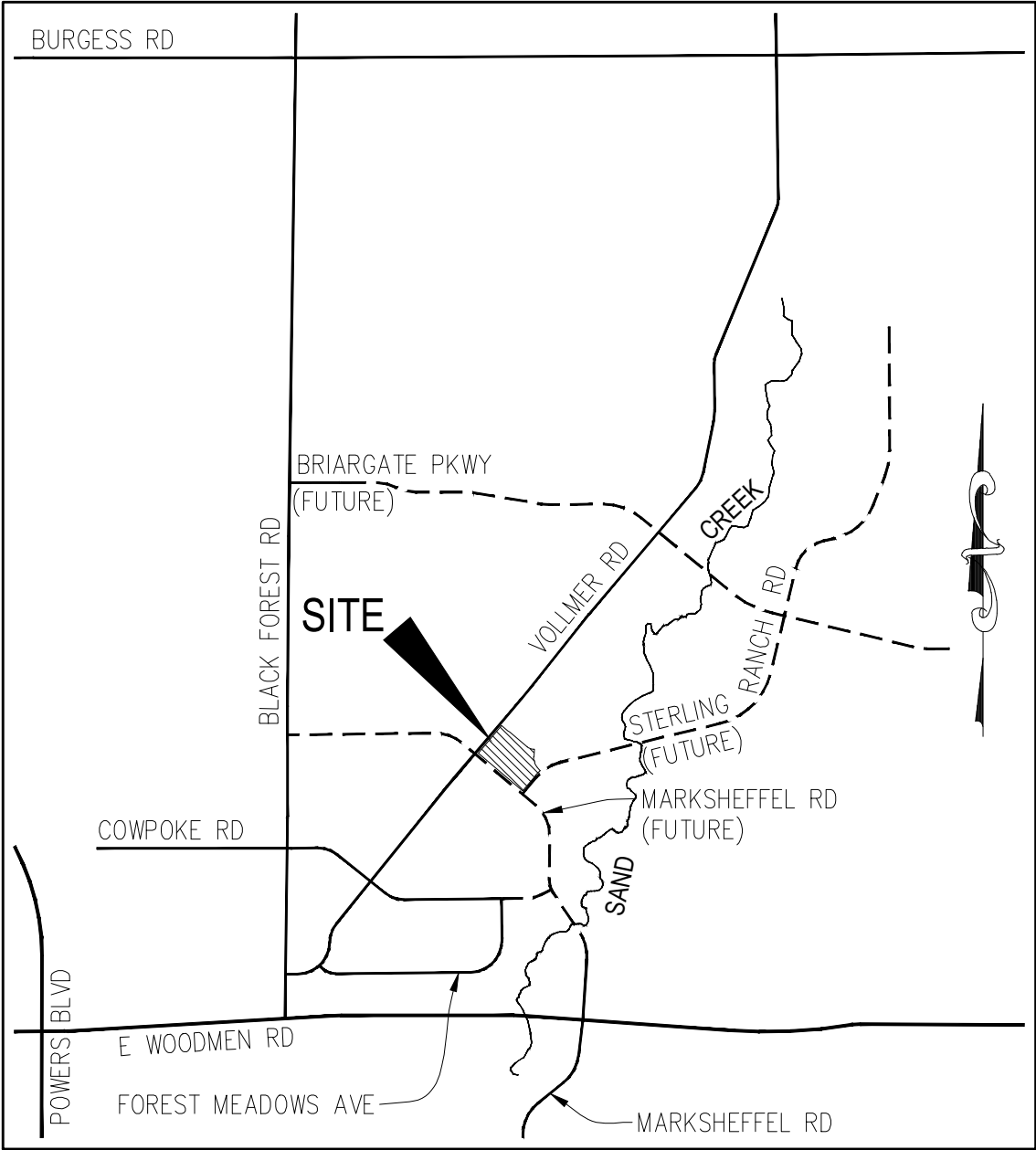
Development of this site will not adversely affect the surrounding developments per this final drainage report with no negative impacts to the neighboring developments. The proposed and existing drainage facilities will adequately convey, detain, and route runoff from tributary and onsite flows to the Sand Creek Drainage channel via proposed onsite and existing offsite drainage improvements. Full Spectrum Detention and Water Quality Ponds will be used to discharge developed flows into Sand Creek per the Urban Drainage criteria flow rates. Sterling Ranch Metropolitan District No. 1 will own and maintain the private facilities. Care will be taken during construction to accommodate overland flow routes onsite and temporary drainage conditions. The development of the Copper Chase at Sterling Ranch project shall not adversely affect adjacent or downstream property.

REFERENCES

- 1.) "El Paso County and City of Colorado Springs Drainage Criteria Manual, Vol I & II".
- 2.) "Urban Storm Drainage Criteria Manuals, Volumes 1-3".
- 3.) NRSC Web Soil Survey Map for El Paso County. <http://websoilsurvey.nrcs.usda.gov>. Accessed September 29th, 2020.
- 4.) Flood Insurance Rate Map (FIRM), Federal Emergency Management Agency, Effective date December 7th, 2018. Accessed October 4th, 2021.
- 5.) "Sand Creek Drainage Basin Planning Study" (DBPS) prepared by Kiowa Corporation, revised March 1996
- 6.) "Final Drainage Report for Sterling Ranch Filing No. 2", dated November 2021, by JR Engineering
- 7.) "Master Development Drainage Plan for Sterling Ranch", (MDDP) prepared by M&S Civil Consultants, Inc., dated December 2017.

APPENDIX

VICINITY MAP

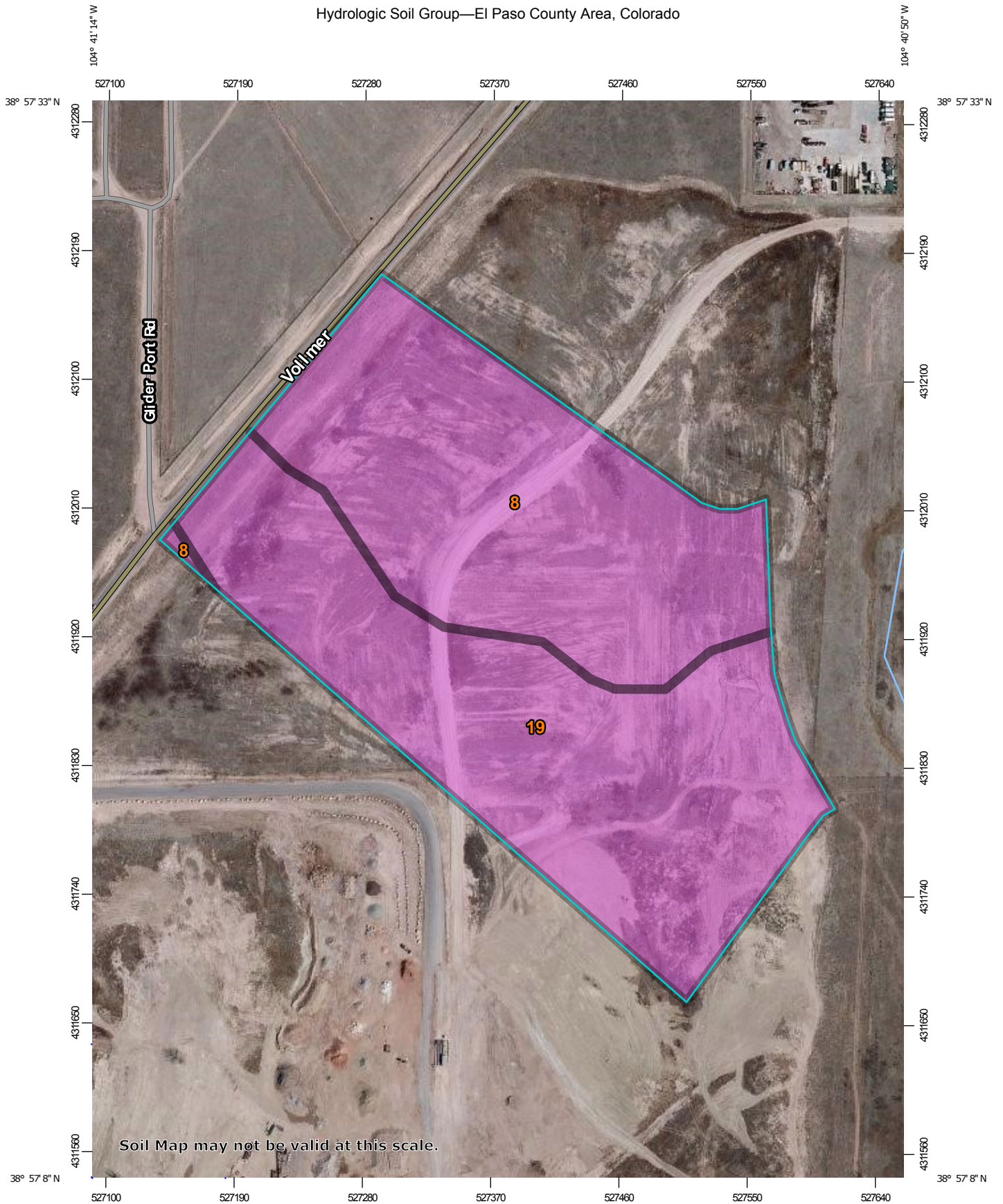


VICINITY MAP

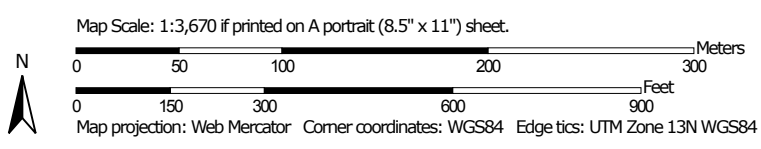
N.T.S.

SOILS MAP

Hydrologic Soil Group—El Paso County Area, Colorado



Soil Map may not be valid at this scale.



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 14, Sep 23, 2016

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

Date(s) aerial images were photographed: Apr 15, 2011—Sep 22, 2011

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

Hydrologic Soil Group— Summary by Map Unit — El Paso County Area, Colorado (CO625)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	13.7	46.4%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	15.8	53.6%
Totals for Area of Interest			29.5	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

FIRM PANEL

**EXISTING DRAINAGE CONDITIONS DISCUSSION
(BY J.R. ENGINEERING, APPROVED NOVEMBER 2021)**

Basin A consists of Sub-Basins A1-A22 combining for a total of 123.19 acres. This basin represents all 49.5387 acres of the proposed Sterling Ranch Filing 2 development. This basin is primarily single-family residential, roadway and minor open space. This basin also contains future commercial sites, the future Sterling Ranch Phase 2 development, the proposed Copper Chase at Sterling Ranch Development and a proposed school site. Stormwater runoff is conveyed via public streets where it is captured via a series of on-grade and sump inlets. Runoff is then piped to a proposed onsite Full Spectrum Detention Pond W5. From the detention pond, the treated flows are then released directly into the Sand Creek Drainageway at below historic rates.

Off-Site Conveyance

The existing drainage patterns on the west side of Vollmer Road will not change due to the development of Sterling Ranch. Vollmer Road construction will address the roadside ditch flows along the west side of the road and will install drainage culverts where indicated in this report. The majority of the flows from the west side of Vollmer Road are to be routed in the historical direction to the southwest along the roadway to proposed Pond W-4. Runoff produced from the remaining off-site watershed located along the west edge of the existing development will be routed along the west side of Vollmer Road to the southwest corner of the existing development and a proposed Pond W-4. At the northwest corner of Tahiti Drive and Vollmer Road a 54" RCP will be installed to collect and convey runoff under proposed Marksheffel Road before ultimately discharging into Sand Creek. Runoff reaching the development along the south boundary line of the Barbarick Subdivision will be conveyed through and around the proposed site by proposed temporary swales and proposed storm sewer until it ultimately reaches Pond W-5. At the time of final for Sterling Ranch Filing No. 2 Phase 2, JR will coordinate with Barbarick to determine a more specific design solution for conveying the flows from their site. In general, the sand filter and double barrel 24" RCP will discharge onto the Sterling Ranch Phase 2 site where it will be picked up in a sump inlet structure and conveyed through a 48" RCP through the Sterling Ranch Storm system to Pond W5. The eastern Barbarick EDB discharge pipe will be connected into a structure and into a 36" RCP where the flows will be routed to Pond W5. Specific design details can be found within the Sterling Ranch Phase 2 drainage report. Runoff reaching the northern boundary of Phase I at proposed Briargate Parkway will be redirected around the site via a temporary swale to Sand Creek. BMP's will be installed to prevent erosion of the temporary swale. The intention of the drainage design for Sterling Ranch is to not adversely affect any adjacent property within the developed flows from Sterling Ranch.

Sub-basin A1 ($Q_5=4.4$ cfs, $Q_{100}=9.4$ cfs) consists of approximately 2.06 acres and is the northern most portion of the Sterling Ranch Filing No. 2 Phase 1 development. This basin is primarily single-family residential and minor open space. Runoff from this sub-basin will be conveyed via sheet flow and curb and gutter then captured by a 10' on-grade inlet at DP 1. From here, the flow is piped to Pond W5.

Sub-basin A2 ($Q_5=1.9$ cfs, $Q_{100}=3.9$ cfs) consists of approximately 0.82 acres and is the north eastern most portion of the Sterling Ranch Filing No. 2 Phase 1 development. This basin is primarily singlefamily residential and minor open space. Runoff from this sub-basin will be conveyed via sheet flow and curb and gutter then captured by a 10' Type R on-grade inlet at DP 2. From here, the flow is piped to Pond W5.

Sub-basin A3 ($Q_5=11.1$ cfs, $Q_{100}=24.7$ cfs) consists of approximately 6.76 acres and is the north western most portion of the Sterling Ranch Filing No. 2 Phase 1 development. This basin is primarily single-family residential and minor open space. Runoff from this sub-basin will be conveyed via sheet flow and curb and gutter to a 15' Type-R on-grade inlet at DP 3. From here, the flow is piped to Pond W5 along with the flows from Sub-basin A1 & A2.

Sub-basin A4 ($Q_5=3.7$ cfs, $Q_{100}=7.4$ cfs) consists of approximately 1.51 acres and is the southern portion of Alzada Drive and this basin is primarily single-family residential(Copper Chase at Sterling Ranch) and proposed roadway. Runoff from this sub-basin will be conveyed via sheet flow and curb and gutter to a 10' Type-R on-grade inlet at DP 4. From here, the flow is piped to Pond W5 along with the flows from Sub-basin A1-A3.

Sub-basin A5 ($Q_5=4.1$ cfs, $Q_{100}=8.3$ cfs) consists of approximately 1.70 acres and is the western portion of Bynum Drive. This basin is primarily single-family residential and proposed roadway. Runoff from this sub-basin will be conveyed via sheet flow and curb and gutter to a 15' Type R on-grade inlet at DP 5. From here, the flow is piped to Pond W5 along with the flows from Sub-basin A1-A4.

Sub-basin A6A ($Q_5=2.2$ cfs, $Q_{100}=4.1$ cfs) consists of approximately 0.53 acres. This basin will serve as a tract including mail kiosks, parking, landscaping and sidewalks. Runoff from this sub-basin will sheet flow to DP 6A where it flows via curb and gutter to the 15' Type R inlet at DP6. From here, the flow is piped to Pond W5 along with the flows from Sub-basin A1-A5.

Sub-basin A6 ($Q_5=3.3$ cfs, $Q_{100}=6.6$ cfs) consists of approximately 1.37 acres and is the eastern portion of Bynum Drive. This basin is primarily single-family residential and proposed roadway. Runoff from this sub-basin will be conveyed via sheet flow and curb and gutter to a 15' Type R inlet on-grade inlet at DP 6. From here, the flow is piped to Pond W5 along with the flows from Sub-basin A1-A6A.

Sub-basin A7 ($Q_5=27.5$ cfs, $Q_{100}=60.6$ cfs) represents the future Copper Chase at Sterling Ranch development and consists of approximately 19.00 acres. This basin is primarily single-family residential and open space. Runoff from this sub-basin will be conveyed via sheet flow and curb and gutter to a 36" RCP storm sewer stub at DP 7 with sediment control structure. From here, the flow is piped to Pond W5 along with the flows from Sub-basin A1-A6. Prior to being developed, storm runoff from this sub-basin will overland flow to temporary swales, where the flows will be captured by an interim 36" FES and piped to Pond W5.

Sub-basin A8 ($Q_5=3.0$ cfs, $Q_{100}=6.3$ cfs) consists of approximately 1.48 acres and is the south western portion of Sterling Ranch Road. This basin is primarily single-family residential and proposed roadway. Runoff from this sub-basin will be conveyed via sheet flow and curb and gutter to a 15' Type R on-grade inlet at DP 8. From here, the flow is piped to Pond W5 along with the flows from Sub-basin A1-A7.

Sub-basin A9 ($Q_5=1.9$ cfs, $Q_{100}=3.7$ cfs) consists of approximately 0.61 acres and is the south eastern portion of Sterling Ranch Road. This basin is comprised primarily of the proposed roadway. Runoff from this sub-basin will be conveyed via sheet flow and curb and gutter to a 15' Type R on-grade inlet at DP 9. From here, the flow is piped to Pond W5 along with the flows from Sub-basin A1-A8.

Sub-basin A10 ($Q_5=9.2$ cfs, $Q_{100}=17.3$ cfs) consists of approximately 2.61 acres and is the south eastern portion of Marksheffel Road. This basin is comprised primarily of the proposed roadway. Runoff from this sub-basin will be conveyed via sheet flow and curb and gutter to a 15' Type R on-grade inlet at DP 10. From here, the flow is piped to Pond W5 along with the flows from Sub-basin A1-A9.

Sub-basin A11 ($Q_5=9.5$ cfs, $Q_{100}=18.1$ cfs) consists of approximately 2.89 acres and is the north portion of Marksheffel Road. This basin is comprised primarily of the proposed roadway. Runoff from this sub-basin will be conveyed via sheet flow and curb and gutter to a 15' Type R on-grade inlet at DP 11. From here, the flow is piped to Pond W5 along with the flows from Sub-basin A1-A10.

Sub-basin A12 ($Q_5=1.9$ cfs, $Q_{100}=9.5$ cfs) consists of approximately 3.87 acres and represents the open space area between the Sterling Ranch Filing No. 2 Phases 1 & 2 developments. This basin is primarily open space. This basin also contains a 50' and 30' gas easement that contain 3 major gas lines. Runoff from this sub-basin will be conveyed via sheet flow and earthen swale to an area inlet at DP 12. From here, the flow is piped to Pond W5 along with the flows from Sub-basin A1-A11.

Sub-basin A13 ($Q_5=15.7$ cfs, $Q_{100}=34.6$ cfs) consists of approximately 9.65 acres and is the northern portion of the future Sterling Ranch Phase 2 development. This basin is primarily single-family residential and minor open space. Runoff from this sub-basin will be captured by a storm sewer stub at DP 13. From here, the flow is piped to Pond W5 along with the flows from Sub-basin A1-A12. Prior to being developed, storm runoff from this sub-basin will overland flow to temporary swales, where the flows will be captured by an interim 36" FES and piped to Pond W5.

Sub-basin A14 ($Q_5=16.0$ cfs, $Q_{100}=37.9$ cfs) consists of approximately 11.76 acres and is the proposed future school site on the northern side of Sterling Ranch Road. Runoff from this sub-basin will be routed to a 36" RCP storm sewer stub at DP 14. From here, the flow is piped to Pond W5 along with the flows from Sub-basin A1-A13. Prior to being developed, storm runoff from this sub-basin will overland flow to Sterling Ranch Road, where the flows will be captured by inlets and piped to Pond W5.

Sub-basin A15 ($Q_5=5.4$ cfs, $Q_{100}=11.7$ cfs) consists of approximately 2.91 acres and is the north eastern portion of Sterling Ranch Road. This basin is primarily single-family residential and proposed roadway. Runoff from this sub-basin will be conveyed via sheet flow and curb and gutter to a 15' Type R on-grade inlet at DP 15. From here, the flow is piped to Pond W5 along with the flows from Sub-basin A1-A14.

Sub-basin A16 ($Q_5=4.4$ cfs, $Q_{100}=9.6$ cfs) consists of approximately 2.34 acres and is the south eastern portion of Sterling Ranch Road. This basin is primarily single-family residential and proposed roadway. Runoff from this sub-basin will be conveyed via sheet flow and curb and gutter to a 15' Type R on-grade inlet at DP 16. From here, the flow is piped to Pond W5 along with the flows from Sub-basin A1-A15.

Sub-basin A17 ($Q_5=1.4$ cfs, $Q_{100}=4.7$ cfs) consists of approximately 1.76 acres and is the open space located along the western portion of the Sterling Ranch Phase 2 development south of Sterling Ranch Road. This basin is primarily single-family open space with a small amount of lot runoff. Runoff from this sub-basin will be captured by a future Type C inlet at DP 17 and conveyed via sheet flow

**EXISTING HYDROLOGIC CALCULATIONS
(BY J.R. ENGINEERING, APPROVED NOVEMBER 2021)**

EXISTING CONDITIONS COMPOSITE % IMPERVIOUS & RUNOFF COEFFICIENT SUMMARY BY J.R. ENGINEERING (APPROVED NOVEMBER 2021)

Subdivision: Sterling Ranch Filing No. 2
 Location: El Paso County

Project Name: Sterling Ranch Subdivision
 Project No.: 25188.01
 Calculated By: AAM
 Checked By: _____
 Date: 8/16/21

Basin ID	Total Area (ac)	Streets (100% Impervious)				Residential (65% Impervious) Neighborhood Area (70% Impervious) 2.5 Acre Residential (9% Impervious)				Light Industrial (80% Impervious) Commercial (95% Impervious) Gravel (80% Impervious)				Lawns/Pasture (0% Impervious) School (55% Impervious) Open Space (12%)				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	Area (ac)	Weighted % Imp.	C ₅	C ₁₀₀	
A1	2.06	0.90	0.96	0.48	23.3%	0.45	0.59	1.34	42.3%	0.59	0.70	0.00	0.0%	0.08	0.35	0.24	0.0%	0.51	0.65	65.6%
A2	0.82	0.90	0.96	0.20	24.4%	0.45	0.59	0.56	44.4%	0.59	0.70	0.00	0.0%	0.08	0.35	0.06	0.0%	0.53	0.66	68.8%
A3	6.76	0.90	0.96	1.32	19.5%	0.45	0.59	4.16	40.0%	0.59	0.70	0.00	0.0%	0.08	0.35	1.28	0.0%	0.47	0.62	59.5%
A4	1.51	0.90	0.96	0.51	33.8%	0.45	0.59	1.00	43.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.60	0.71	76.8%
A5	1.70	0.90	0.96	0.51	30.0%	0.45	0.59	1.19	45.5%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.59	0.70	75.5%
A6	1.37	0.90	0.96	0.39	28.5%	0.45	0.59	0.98	46.5%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.58	0.70	75.0%
A6A	0.53	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.81	0.88	0.53	95.0%	0.08	0.35	0.00	0.0%	0.81	0.88	95.0%
A7	19.00	0.90	0.96	0.00	0.0%	0.45	0.59	19.00	65.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.45	0.59	65.0%
A8	1.48	0.90	0.96	0.74	50.0%	0.45	0.59	0.29	12.7%	0.59	0.70	0.00	0.0%	0.08	0.35	0.45	0.0%	0.56	0.70	62.7%
A9	0.61	0.90	0.96	0.48	78.7%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.13	0.0%	0.73	0.83	78.7%
A10	2.61	0.90	0.96	2.25	86.2%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.36	0.0%	0.79	0.88	86.2%
A11	2.89	0.90	0.96	2.40	83.0%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.49	0.0%	0.76	0.86	83.0%
A12	3.87	0.90	0.96	0.00	0.0%	0.45	0.59	0.50	8.4%	0.59	0.70	0.00	0.0%	0.08	0.35	3.37	0.0%	0.13	0.38	8.4%
A13	9.65	0.90	0.96	0.00	0.0%	0.45	0.59	9.65	65.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.45	0.59	65.0%
A14	11.76	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.81	0.88	0.00	0.0%	0.39	0.55	11.76	55.0%	0.39	0.55	55.0%
A15	2.91	0.90	0.96	1.57	54.0%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	1.34	0.0%	0.52	0.68	54.0%
A16	2.34	0.90	0.96	1.30	55.6%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	1.04	0.0%	0.54	0.69	55.6%
A17	1.76	0.90	0.96	0.00	0.0%	0.45	0.59	0.64	23.6%	0.59	0.70	0.00	0.0%	0.08	0.35	1.12	0.0%	0.21	0.44	23.6%
A18	5.27	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.81	0.88	1.18	21.3%	0.08	0.35	4.09	0.0%	0.24	0.47	21.3%
A19	31.85	0.90	0.96	0.00	0.0%	0.45	0.59	31.85	67.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.00	0.0%	0.45	0.59	67.0%
A20	1.83	0.90	0.96	1.63	89.1%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.20	0.0%	0.81	0.89	89.1%
A21	1.93	0.90	0.96	1.73	89.6%	0.45	0.59	0.00	0.0%	0.59	0.70	0.00	0.0%	0.08	0.35	0.20	0.0%	0.82	0.90	89.6%
A22	8.68	0.90	0.96	0.00	0.0%	0.45	0.59	0.70	5.2%	0.59	0.70	0.00	0.0%	0.08	0.35	7.98	0.0%	0.11	0.37	5.2%
B1	2.98	0.90	0.96	2.98	100.0%	0.59	0.70	0.00	0.0%	0.20	0.44	0.00	0.0%	0.08	0.35	0.00	0.0%	0.90	0.96	100.0%
B2	3.89	0.90	0.96	3.89	100.0%	0.59	0.70	0.00	0.0%	0.20	0.44	0.00	0.0%	0.08	0.35	0.00	0.0%	0.90	0.96	100.0%
B3	1.53	0.90	0.96	1.53	100.0%	0.59	0.70	0.00	0.0%	0.20	0.44	0.00	0.0%	0.08	0.35	0.00	0.0%	0.90	0.96	100.0%
B4	1.50	0.90	0.96	1.50	100.0%	0.59	0.70	0.00	0.0%	0.20	0.44	0.00	0.0%	0.08	0.35	0.00	0.0%	0.90	0.96	100.0%
B5	2.91	0.90	0.96	0.00	0.0%	0.59	0.70	0.00	0.0%	0.20	0.44	0.00	0.0%	0.08	0.35	2.91	0.0%	0.08	0.35	0.0%

**EXISTING CONDITIONS COMPOSITE % IMPERVIOUS & RUNOFF COEFFICIENT SUMMARY
BY J.R. ENGINEERING (APPROVED NOVEMBER 2021)**

Basin ID	Total Area (ac)	Streets (100% Impervious)				Residential (65% Impervious) Neighborhood Area (70% Impervious) 2.5 Acre Residential (9% Impervious)				Light Industrial (80% Impervious) Commercial (95% Impervious) Gravel (80% Impervious)				Lawns/Pasture (0% Impervious) School (55% Impervious) Open Space (12%)				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	Area (ac)	Weighted % Imp.	C ₅	C ₁₀₀	
C1	8.01	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.81	0.88	8.01	95.0%	0.08	0.35	0.00	0.0%	0.81	0.88	95.0%
C2	5.06	0.90	0.96	0.00	0.0%	0.45	0.59	0.00	0.0%	0.81	0.88	5.06	95.0%	0.08	0.35	0.00	0.0%	0.81	0.88	95.0%
D1	0.45	0.90	0.96	0.45	100.0%	0.45	0.59	0.00	0.0%	0.81	0.88	0.00	0.0%	0.08	0.35	0.00	0.0%	0.90	0.96	100.0%
D2	0.43	0.90	0.96	0.43	100.0%	0.45	0.59	0.00	0.0%	0.81	0.88	0.00	0.0%	0.08	0.35	0.00	0.0%	0.90	0.96	100.0%
OS20	308.00	0.90	0.96	3.36	1.1%	0.59	0.70	157.32	4.6%	0.20	0.44	2.38	0.6%	0.09	0.36	144.94	0.0%	0.13	0.40	6.3%
OS21A	20.26	0.90	0.96	1.13	5.6%	0.59	0.70	19.13	8.5%	0.20	0.44	0.00	0.0%	0.09	0.36	0.00	0.0%	0.13	0.40	14.1%
OS21B	8.71	0.90	0.96	0.00	0.0%	0.59	0.70	8.71	9.0%	0.20	0.44	0.00	0.0%	0.09	0.36	0.00	0.0%	0.13	0.40	9.0%
OS2	17.00	0.90	0.96	0.00	0.0%	0.49	0.62	17.00	70.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.00	0.0%	0.49	0.62	70.0%
OS3	28.70	0.90	0.96	0.00	0.0%	0.49	0.62	28.70	70.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.00	0.0%	0.49	0.62	70.0%
OS4	5.08	0.90	0.96	0.00	0.0%	0.20	0.40	5.08	15.0%	0.59	0.70	0.00	0.0%	0.09	0.36	0.00	0.0%	0.20	0.40	15.0%
TOTAL (A1-A22,OS2-4)	173.97																			57.6%
TOTAL (B1-B5, OS20-21B)	349.78																			9.4%
TOTAL (C1-C2)	13.07																			95.0%
TOTAL	537.70																			27.9%

EXISTING CONDITIONS AREA RUNOFF COEFFICIENT & AREA DRAINAGE SUMMARY BY J.R. ENGINEERING (APPROVED NOVEMBER 2021)

STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Sterling Ranch Filing No. 2
Location: El Paso County

Project Name: Sterling Ranch Subdivision
Project No.: 25188.01
Calculated By: AAM
Checked By: _____
Date: 8/16/21

SUB-BASIN DATA						INITIAL/OVERLAND (T _i)			TRAVEL TIME (T _t)					t _c CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C _s	C ₁₀₀	L (ft)	S _o (%)	t _i (min)	L _t (ft)	S _t (%)	K	VEL. (ft/s)	t _t (min)	COMP. t _c (min)	TOTAL LENGTH (ft)	Urbanized t _c (min)	t _c (min)
A1	2.06	A	66%	0.51	0.65	100	2.5%	7.8	388	3.0%	20.0	3.5	1.9	9.7	488.0	16.9	9.7
A2	0.82	A	69%	0.53	0.66	100	2.5%	7.6	183	1.0%	20.0	2.0	1.5	9.1	283.0	15.9	9.1
A3	6.76	A	60%	0.47	0.62	100	2.5%	8.4	1186	2.3%	20.0	3.0	6.5	15.0	1286.0	23.4	15.0
A4	1.51	A	77%	0.60	0.71	78	2.0%	6.3	795	2.9%	20.0	3.4	3.9	10.2	873.0	16.9	10.2
A5	1.70	A	76%	0.59	0.70	100	2.5%	6.9	645	3.1%	20.0	3.5	3.1	9.9	745.0	16.3	9.9
A6	1.37	A	75%	0.58	0.70	100	2.5%	7.0	632	3.1%	20.0	3.5	3.0	10.0	732.0	16.3	10.0
A6A	0.53	A	95%	0.81	0.88	100	2.0%	4.2	30	2.0%	20.0	2.8	0.2	4.3	130.0	10.0	5.0
A7	19.00	A	65%	0.45	0.59	100	2.5%	8.7	1419	1.5%	20.0	2.4	9.7	18.3	1519.0	25.6	18.3
A8	1.48	A	63%	0.56	0.70	80	2.0%	6.9	646	0.6%	20.0	1.5	7.0	13.9	726.0	23.2	13.9
A9	0.61	A	79%	0.73	0.83	15	2.0%	2.1	661	0.7%	20.0	1.7	6.6	8.7	676.0	19.2	8.7
A10	2.61	A	86%	0.79	0.88	15	2.0%	1.7	1357	3.4%	20.0	3.7	6.1	7.9	1372.0	17.2	7.9
A11	2.89	A	83%	0.76	0.86	16	2.0%	1.9	1357	2.8%	20.0	3.3	6.8	8.7	1373.0	18.4	8.7
A12	3.87	A	8%	0.13	0.38	100	5.0%	10.3	267	3.4%	15.0	2.8	1.6	11.9	367.0	26.9	11.9
A13	9.65	A	65%	0.45	0.59	100	2.5%	8.7	934	2.1%	20.0	2.9	5.4	14.0	1033.6	20.9	14.0
A14	11.76	A	55%	0.39	0.55	100	2.0%	10.2	867	2.0%	20.0	2.8	5.1	15.3	967.0	22.8	15.3
A15	2.91	A	54%	0.52	0.68	34	2.0%	4.8	1621	1.8%	20.0	2.7	10.1	14.9	1655.0	29.0	14.9
A16	2.34	A	56%	0.54	0.69	35	2.0%	4.8	1594	1.8%	20.0	2.7	9.9	14.7	1629.0	28.4	14.7
A17	1.76	A	24%	0.21	0.44	100	5.0%	9.4	403	1.1%	15.0	1.6	4.3	13.7	503.0	27.2	13.7
A18	5.27	A	21%	0.24	0.47	100	2.0%	12.3	703	2.0%	20.0	2.8	4.1	16.4	803.0	29.3	16.4
A19	31.85	A	67%	0.45	0.59	100	2.5%	8.7	2675	1.7%	20.0	2.6	17.1	25.8	2775.0	33.2	25.8
A20	1.83	A	89%	0.81	0.89	15	2.0%	1.6	936	1.5%	20.0	2.4	6.4	8.0	951.0	16.8	8.0
A21	1.93	A	90%	0.82	0.90	15	2.0%	1.6	1049	1.5%	20.0	2.4	7.1	8.7	1064.0	17.4	8.7
A22	8.68	A	5%	0.11	0.37	185	3.0%	16.9	540	0.5%	20.0	1.4	6.4	23.3	725.0	38.2	23.3
B1	2.98	A	100%	0.90	0.96	17	2.0%	1.2	2561	1.7%	20.0	2.6	16.4	17.6	2578.0	23.2	17.6
B2	3.89	A	100%	0.90	0.96	17	2.0%	1.2	2561	1.7%	20.0	2.6	16.4	17.6	2578.0	23.2	17.6
B3	1.53	A	100%	0.90	0.96	17	2.0%	1.2	1394	2.0%	20.0	2.8	8.2	9.4	1411.0	16.1	9.4
B4	1.50	A	100%	0.90	0.96	17	2.0%	1.2	1394	2.0%	20.0	2.8	8.2	9.4	1411.0	16.1	9.4

EXISTING CONDITIONS AREA RUNOFF COEFFICIENT & AREA DRAINAGE SUMMARY BY J.R. ENGINEERING (APPROVED NOVEMBER 2021)

STANDARD FORM SF-2 TIME OF CONCENTRATION

Subdivision: Sterling Ranch Filing No. 2
Location: El Paso County

Project Name: Sterling Ranch Subdivision
Project No.: 25188.01
Calculated By: AAM
Checked By:
Date: 8/16/21

SUB-BASIN						INITIAL/OVERLAND			TRAVEL TIME					t _c CHECK			FINAL
DATA						(T _i)			(T _t)					(URBANIZED BASINS)			
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C _s	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)	
B5	2.91	A	0%	0.08	0.35	170	14.0%	10.1	259	0.5%	20.0	1.4	3.1	13.1	429.0	32.8	13.1
C1	8.01	A	95%	0.81	0.88	100	2.0%	4.2	965	2.0%	20.0	2.8	5.7	9.9	1065.0	14.9	9.9
C2	5.06	A	95%	0.81	0.88	100	2.0%	4.2	627	2.0%	20.0	2.8	3.7	7.9	727.0	13.2	7.9
D1	0.45	A	95%	0.81	0.88	17	2.0%	1.7	180	0.1%	20.0	0.6	5.3	7.0	197.0	14.6	7.0
D2	0.43	A	95%	0.81	0.88	17	2.0%	1.7	180	0.1%	20.0	0.6	5.3	7.0	197.0	14.6	7.0
OS20	308.00	A	6%	0.13	0.40	300	4.0%	19.2	6670	5.0%	10.0	2.2	49.7	68.9	6970.0	75.2	68.9
OS21A	20.26	A	14%	0.13	0.40	300	2.0%	24.1	2673	2.0%	10.0	1.4	31.5	55.6	2973.0	52.3	52.3
OS21B	8.71	A	9%	0.13	0.40	100	2.0%	13.9	1167	1.5%	15.0	1.8	10.6	24.5	1267.0	39.9	24.5
OS2	17.00	A	70%	0.49	0.62	300	1.0%	19.1	3020	1.5%	15.0	1.8	27.4	46.5	3320.0	36.0	36.0
OS3	28.70	A	70%	0.49	0.62	300	1.0%	19.1	4340	1.0%	15.0	1.5	48.2	67.3	4640.0	52.6	52.6
OS4	5.08	A	15%	0.20	0.40	300	1.0%	28.1	900	5.0%	10.0	2.2	6.7	34.9	1200.0	29.5	29.5

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).

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$

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√S_o

K = NRCS conveyance factor (see Table 6-2).

Equation 6-2

$$t_i = \frac{0.395(1.1 - C_s)\sqrt{L_i}}{S_o^{0.333}}$$

Where:

t_i = overland (initial) flow time (minutes)

C_s = 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 6-4

$$t_t = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Where:

t_t = 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).

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

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.

EXISTING CONDITIONS SURFACE & PIPE ROUTING SUMMARY (5 YEAR) BY J.R. ENGINEERING (APPROVED NOVEMBER 2021)

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

Subdivision: Sterling Ranch Filing No. 2
Location: El Paso County
Design Storm: 5-Year

Project Name: Sterling Ranch Subdivision
Project No.: 25188.01
Calculated By: AAM
Checked By:
Date: 8/16/21

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS		
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (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 _c (min)			
	1	A1	2.06	0.51	9.7	1.05	4.17	4.4					0.2	0.04	3.3	4.2	1.01	2.0	18	652	3.6	3.0	0.0	On-grade inlet, carryover flow to DP 5 Piped to DP 1.0	
	2	A2	0.82	0.53	9.1	0.44	4.27	1.9								1.9	0.44	2.0	18	27	5.8	0.1	0.0	On-grade inlet Piped to DP 1.0	
	1.0								9.7	1.45	4.17	6.0				6.0	1.45	3.0	18	335	9.1	0.6	0.0	Sum of DP 1 & DP 2, piped to DP 1.2	
	3	A3	6.76	0.47	15.0	3.16	3.53	11.1					1.6	0.47	2.9	9.5	2.69	4.7	18	426	3.4	2.1	0.0	On-grade inlet, carryover flow to DP 5 Piped to DP 1.1	
	4	A4	1.51	0.60	10.2	0.91	4.10	3.7					0.1	0.03	2.9	3.6	0.88	4.7	18	395	3.4	1.9	0.0	On-grade inlet, carryover flow to DP 5 Piped to DP 1.1	
	1.1								15.0	3.57	3.52	12.6				12.6	3.57	1.0	24	74	7.4	0.2	0.0	Sum of DP 3 & DP 4, piped to DP 1.2	
	1.2								15.2	5.02	3.50	17.6				17.6	5.02	3.3	24	319	12.5	0.4	0.0	Sum of DP 1.0 & DP 1.1, piped to DP 1.3	
	6A	A6A	0.53	0.81	5.0	0.43	5.17	2.2																Overland Flow to DP1.3A	
	6	A6	1.37	0.58	10.0	0.79	4.14	3.3								3.3	0.79	2.0	18	0	6.7	0.0	0.0	Sum of Sub-basin A6 & Carryover flow from DP 2, Piped to DP 1.3A	
	1.3A								10.0	1.22	4.14	5.0				5.0	1.22	1.0	24	36	5.7	0.1	0.0	Sum of DP 6 & DP 6A, piped to DP 1.3	
	5	A5	1.70	0.59	9.9	0.99	4.14	4.1	17.0	1.53	3.33	5.1				5.1	1.53	2.0	18	0	7.6	0.0	0.0	Sum of Sub-basin A5 & Carryover flows from DP 1, P 3 & DP 4. Piped to DP 1.3	
	1.3								17.0	7.77	3.33	25.9				25.9	7.77	1.1	36	620	9.2	1.1	0.0	Sum of DP 1.2, 1.3A & DP 5, piped to DP 1.4	
	7	A7	19.00	0.45	18.3	8.55	3.22	27.5								27.5	8.55	1.5	42	20	10.3	0.0	0.0	Future storm infrastructure from Copper Chase Subdivision Piped to DP 1.4	
	1.4								18.4	16.32	3.22	52.5				52.5	16.32	0.5	48	26	8.2	0.1	0.0	Sum of DP 1.3 & DP 7, piped to DP 1.5	
	8	A8	1.48	0.56	13.9	0.83	3.63	3.0								3.0	0.83	2.0	18	20	6.6	0.1	0.0	On-grade inlet, carryover flow to DP 11 Piped to DP 1.5	
	1.5								18.4	17.15	3.21	55.1				55.1	17.15	0.5	48	91	8.3	0.2	0.0	Sum of DP 1.4 & DP 8, piped to DP 1.6	
	9	A9	0.61	0.73	8.7	0.44	4.34	1.9	8.7	0.48	4.34	2.1				2.1	0.48	2.0	18	13	5.8	0.0	0.0	On-grade inlet Sum of Sub-basin A9 & carryover flows from DP 16, piped to DP 1.6	
	1.6								18.6	17.63	3.20	56.4				56.4	17.63	0.5	48	95	8.3	0.2	0.0	Sum of DP 1.5 & DP 9, piped to DP 1.8	
	10	A10	2.61	0.79	7.9	2.05	4.49	9.2					0.5	0.11	1.5	8.7	1.94	2.5	18	955	2.4	6.5	0.2	0.0	On-grade inlet, carryover flow to DP 20 Piped to DP 1.7
	11	A11	2.89	0.76	8.7	2.20	4.34	9.5					0.6	0.15	1.5	8.9	2.05	2.5	18	1049	2.4	7.1	0.0	0.0	On-grade inlet, carryover flow to DP 21 Piped to DP 1.7
	1.7								8.7	3.99	4.34	17.3				17.3	3.99	1.0	24	8	7.9	0.0	0.0	Sum of DP 10 & DP 11, piped to DP 1.8	
	1.8								18.8	21.63	3.18	68.8				68.8	21.63	2.0	54	517	14.4	0.6	0.0	Sum of DP 1.6 & DP 1.7, piped to DP 2.7	
	OS2	OS2	17.00	0.49	14.0	6.25	2.20	13.8								13.8	6.25	1.0	30	787	7.5	1.7	0.0	Future flow released from Barbarick Subdivision Piped to DP 2.0	
	12	A12	3.87	0.13	11.9	0.49	3.86	1.9								1.9	0.49	2.0	18	17	5.6	0.1	0.0	Type C Inlet Piped to DP 2.0	
	2.0								15.7	6.74	3.45	23.2				23.2	6.74	1.0	48	52	8.4	0.1	0.0	Sum of DP OS2 & DP 12, Piped to DP 2.1	
	13	A13	9.65	0.45	14.0	4.34	3.62	15.7								15.7	4.34	1.5	30	200	9.1	0.4	0.0	Future storm infrastructure from Sterling Ranch Phase 2 Piped to DP 2.1	

EXISTING CONDITIONS SURFACE & PIPE ROUTING SUMMARY (5 YEAR) BY J.R. ENGINEERING (APPROVED NOVEMBER 2021)

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

Subdivision: Sterling Ranch Filing No. 2
Location: El Paso County
Design Storm: 5-Year

Project Name: Sterling Ranch Subdivision
Project No.: 25188.01
Calculated By: AAM
Checked By:
Date: 8/16/21

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (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 _c (min)	
	2.1							15.9	11.08	3.44	38.1				38.1	11.08	1.6	48	65	11.4	0.1	Sum of DP 2.0 & DP 13, piped to DP 2.5	
	OS3	OS3	28.70	0.49	19.0	14.06	1.25	17.6							17.6	14.06	1.0	30	719	8.0	1.5	Future flow released from Barbarick Subdivision Piped to DP 2.2	
	14	A14	11.76	0.39	15.3	4.59	3.49	16.0							16.0	4.59	1.0	30	20	7.8	0.0	Future flow released from School Site Piped to DP 2.2	
	2.2							20.5	18.65	3.05	56.9				56.9	18.65	1.5	48	773	12.4	1.0	Sum of DP OS3 & DP 14, piped to DP 2.3	
	15	A15	2.91	0.52	14.9	1.52	3.53	5.4							5.4	1.52	1.3	18	35	6.5	0.1	On-grade inlet Piped to DP 2.3	
	16	A16	2.34	0.54	14.7	1.25	3.55	4.4				0.1	0.04	0.8	4.3	1.21	2.0	18	697	1.8	6.5	On-grade inlet, carryover flow to DP 9 Piped to DP 2.3	
	2.3							15.0	2.73	3.52	9.6				9.6	2.73	1.6	48	51	7.6	0.1	Sum of DP 15 & DP 16, piped to DP 2.4	
	2.4							21.5	21.38	2.98	63.7				63.7	21.38	1.6	48	19	13.1	0.0	Sum of DP 2.2 & DP 2.3, piped to DP 2.5	
	2.5							21.6	32.46	2.98	96.6				96.6	32.46	2.0	60	839	15.8	0.9	Sum of DP 2.1 & DP 2.4 piped to DP 2.6	
	17	A17	1.76	0.21	13.7	0.38	3.66	1.4							1.4	0.38	1.0	18	24	4.1	0.1	Type C inlet Piped to DP 2.6	
	2.6							21.6	32.84	2.98	97.8				97.8	32.84	2.0	60	32	15.8	0.0	Sum of DP 2.5 & DP 17, piped to DP 2.7	
	2.7							21.6	54.47	2.97	162.0				162.0	54.47	0.6	78	220	11.5	0.3	Sum of DP 1.8 & DP 2.6, piped to DP 2.8	
	18	A18	5.27	0.24	16.4	1.28	3.38	4.3							4.3	1.28	1.0	18	24	5.6	0.1	Area inlet Piped to DP 2.6	
	19	A19	31.85	0.45	25.8	14.33	2.71	38.8							38.8	14.33	1.0	18	24	22.0	0.0	Area inlet Piped to DP 2.6	
	2.8							25.8	70.08	2.71	189.8				189.8	70.08	0.6	78	145	12.1	0.2	Sum of DP 2.7, DP 18 & DP 19, piped to DP 3.0.	
	3.0							25.8	70.08	2.71	189.8	189.8	70.08	0.5					584	1.4	6.9	Detention Pond Trickle channel conveyance to DP 3.2	
	20	A20	1.83	0.81	8.0	1.48	4.47	6.6	8.0	1.59	4.47	7.1			7.1	1.59	1.0	24	105	6.4	0.3	On-grade inlet Sum of Sub-basin A20 & carryover flow from DP 10, piped to DP 3.0	
	21	A21	1.93	0.82	8.7	1.57	4.33	6.8	8.7	1.72	4.33	7.4	0.1	0.03	7.3	1.68	2.5	18	0	9.0	0.0	On-grade inlet Sum of Sub-basin A21 & carryover flow from DP 11, piped to DP 2.9	
	2.9							8.7	3.27	4.33	14.2				14.2	3.27	2.0	24	58	9.8	0.1	Sum of DP 20 & DP 21, piped to DP 3.1	
	3.1							8.7	3.27	4.33	14.2	14.2	3.27	0.5					568	1.4	6.7	Detention Pond Trickle channel conveyance to DP 3.2	
	22	A22	8.68	0.11	23.3	0.95	2.86	2.7														Detention Pond Overland flow to DP 3.2	
	OS4	OS4	5.08	0.20	29.5	1.02	2.51	2.6				2.6	1.02	13.0					113	5.4	0.3	Existing topography Overland flow to DP 4.1	
	3.2							29.8	75.32	2.49	187.5											Outlet Structure Sum of DP 3.0, DP 3.1, DP 22 & DP OS4, outlet structure release to DP 4.8	
	Pond W5							29.8	1.45	2.49	3.6				3.6	1.45	2.0	48	58	6.2	0.2	Outlet structure release to DP 4.8	
	23	B1	2.98	0.90	17.6	2.68	3.29	8.8				0.4	0.12	2.0	8.4	2.56	0.5	30	1399	2.0	12.0	On-grade inlet Piped to DP 4.0	

EXISTING CONDITIONS SURFACE & PIPE ROUTING SUMMARY (100 YEAR) BY J.R. ENGINEERING (APPROVED NOVEMBER 2021)

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

Subdivision: Sterling Ranch Filing No. 2
 Location: El Paso County
 Design Storm: 100-Year

Project Name: Sterling Ranch Subdivision
 Project No.: 25188.01
 Calculated By: AAM
 Checked By:
 Date: 8/16/21

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)	t _c (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)	
	1	A1	2.06	0.65	9.7	1.34	7.01	9.4					2.8	0.40	3.3	6.6	0.94	2.0	18	652	3.6	3.0	On-grade inlet, carryover flow to DP 5 Piped to DP 1.0
	2	A2	0.82	0.66	9.1	0.54	7.17	3.9					0.1	0.01	3.3	3.8	0.53	2.0	18	639	3.6	2.9	On-grade inlet, carryover flow to DP 6 Piped to DP 1.0
	1.0								9.7	1.47	7.00	10.3				10.3	1.47	3.0	18	335	10.6	0.5	Sum of DP 1 & DP 2, piped to DP 1.2
	3	A3	6.76	0.62	15.0	4.17	5.92	24.7					10.0	1.69	2.9	14.7	2.48	4.7	18	426	3.4	2.1	On-grade inlet, carryover flow to DP 5 Piped to DP 1.1
	4	A4	1.51	0.71	10.2	1.08	6.88	7.4					1.6	0.24	2.9	5.8	0.84	4.7	18	395	3.4	1.9	On-grade inlet, carryover flow to DP 5 Piped to DP 1.1
	1.1								15.0	3.33	5.91	19.7				19.7	3.33	1.0	24	74	8.1	0.2	Sum of DP 3 & DP 4, piped to DP 1.2
	1.2								15.1	4.80	5.89	28.2				28.2	4.80	3.3	24	319	13.9	0.4	Sum of DP 1.0 & DP 1.1, piped to DP 1.3
	6A	A6A	0.53	0.88	5.0	0.47	8.68	4.1					1.3	0.18	0.7								Overland Flow to DP1.3A
	6	A6	1.37	0.70	10.0	0.95	6.94	6.6	10.0	0.96	6.94	6.7				5.4	0.78	2.0	18	696	1.7	7.0	On-grade inlet, carryover flow to DP 8 Sum of Sub-basin A6 & Carryover flow from DP 2, Piped to DP 1.3A
	1.3A								10.0	1.25	6.94	8.7				8.7	1.25	1.0	24	36	6.7	0.1	Sum of DP 6 & DP 6A, piped to DP 1.3
	5	A5	1.70	0.70	9.9	1.19	6.95	8.3	17.0	3.51	5.59	19.6	6.5	1.17	0.7	13.1	2.34	2.0	18	664	1.7	6.6	On-grade inlet, carryover flow to DP 8 Sum of Sub-basin A5 & Carryover flows from DP 1, P 3 & DP 4. Piped to DP 1.3
	1.3								17.0	8.39	5.59	46.9				46.9	8.39	1.1	36	620	10.7	1.0	Sum of DP 1.2, 1.3A & DP 5, piped to DP 1.4
	7	A7	19.00	0.59	18.3	11.21	5.41	60.6								60.6	11.21	1.5	42	20	12.7	0.0	Future storm infrastructure from Copper Chase Subdivision Piped to DP 1.4
	1.4								18.4	19.60	5.40	105.9				105.9	19.60	0.5	48	26	9.2	0.0	Sum of DP 1.3 & DP 7, piped to DP 1.5
	8	A8	1.48	0.70	13.9	1.04	6.10	6.3	23.7	2.63	4.76	12.5	1.9	0.41	0.7	10.6	2.23	2.0	18	195	1.7	1.9	On-grade inlet, carryover flow to DP 11 Sum of Sub-basin A8 & Carryover flows from DP5, DP 6 & DP 15, Piped to DP 1.5
	1.5								23.7	21.83	4.76	103.9				103.9	21.83	0.5	48	91	9.2	0.2	Sum of DP 1.4 & DP 8, piped to DP 1.6
	9	A9	0.61	0.83	8.7	0.51	7.29	3.7	21.2	0.95	5.04	4.8	0.3	0.05	0.7	4.5	0.89	2.0	18	140	1.7	1.4	On-grade inlet, carryover flow to DP 11 Sum of Sub-basin A9 & carryover flows from DP 16, piped to DP 1.6
	1.6								23.9	22.72	4.74	107.7				107.7	22.72	0.5	48	95	9.1	0.2	Sum of DP 1.5 & DP 9, piped to DP 1.8
	10	A10	2.61	0.88	7.9	2.29	7.53	17.3					4.5	0.59	1.5	12.8	1.70	2.5	18	955	2.4	6.5	On-grade inlet, carryover flow to DP 20 Piped to DP 1.7
	11	A11	2.89	0.86	8.7	2.48	7.28	18.1	10.6	2.94	6.77	19.9	6.1	0.90	1.5	13.8	2.04	2.5	18	118	10.3	0.2	On-grade inlet, carryover flow to DP 21 Sum of Sub-basin A11 & carryover flows from DP 8 & DP 9, piped to DP 1.7
	1.7								10.6	3.74	6.77	25.3				25.3	3.74	1.0	24	1049	2.4	7.1	On-grade inlet, carryover flow to DP 21 Sum of Sub-basin A11 & carryover flows from DP 8 & DP 9, piped to DP 1.7
	1.8								24.0	26.45	4.72	125.0				125.0	26.45	2.0	54	8	8.1	0.0	Sum of DP 10 & DP 11, piped to DP 1.8
	OS2	OS2	17.00	0.62	12.0	10.54	3.71	39.1								39.1	10.54	1.0	30	787	9.5	1.4	Future flow released from Barbarick Subdivision Piped to DP 2.0
	12	A12	3.87	0.38	11.9	1.47	6.49	9.5								9.5	1.47	2.0	18	17	8.9	0.0	Type C inlet Piped to DP 2.0
	2.0								13.4	12.01	6.20	74.5				74.5	12.01	1.0	48	52	11.6	0.1	Sum of DP OS2 & DP 12, Piped to DP 2.1
	13	A13	9.65	0.59	14.0	5.69	6.08	34.6								34.6	5.69	1.5	30	200	11.0	0.3	Future storm infrastructure from Sterling Ranch Phase 2 Piped to DP 2.1

EXISTING CONDITIONS SURFACE & PIPE ROUTING SUMMARY (100 YEAR) BY J.R. ENGINEERING (APPROVED NOVEMBER 2021)

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

Subdivision: Sterling Ranch Filing No. 2
 Location: El Paso County
 Design Storm: 100-Year

Project Name: Sterling Ranch Subdivision
 Project No.: 25188.01
 Calculated By: AAM
 Checked By:
 Date: 8/16/21

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)	t _c (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)	
	2.1							14.3	17.70	6.02	106.6				106.6	17.70	1.6	48	65	15.1	0.1	Sum of DP 2.0 & DP 13, piped to DP 2.5
	OS3	OS3	28.70	0.62	15.0	17.79	2.75	48.9							48.9	17.79	1.0	30	719	10.0	1.2	Future flow released from Barbarick Subdivision Piped to DP 2.2
	14	A14	11.76	0.55	15.3	6.47	5.86	37.9							37.9	6.47	1.0	30	20	9.5	0.0	Future flow released from School Site Piped to DP 2.2
	2.2							16.2	24.26	5.72	138.7				138.7	24.26	1.5	48	773	15.5	0.8	Sum of DP OS3 & DP 14, piped to DP 2.3
	15	A15	2.91	0.68	14.9	1.98	5.93	11.7				1.4	0.24	0.7	10.3	1.74	1.3	18	724	1.7	7.2	On-grade inlet, carryover flow to DP 8 Piped to DP 2.3
	16	A16	2.34	0.69	14.7	1.61	5.96	9.6				2.6	0.44	0.8	7.0	1.17	2.0	18	697	1.8	6.5	On-grade inlet, carryover flow to DP 9 Piped to DP 2.3
	2.3							15.0	2.91	5.91	17.2				17.2	2.91	1.6	48	15	9.0	0.0	Sum of DP 15 & DP 16, piped to DP 2.4
	2.4							17.0	27.17	5.59	151.9				151.9	27.17	1.6	48	19	16.2	0.0	Sum of DP 2.2 & DP 2.3, piped to DP 2.5
	2.5							17.1	44.87	5.59	250.7				250.7	44.87	2.0	60	839	20.1	0.7	Sum of DP 2.1 & DP 2.4 piped to DP 2.6
	17	A17	1.76	0.44	13.7	0.77	6.14	4.7							4.7	0.77	1.0	18	24	5.7	0.1	Type C inlet Piped to DP 2.6
	2.6							17.7	45.64	5.49	250.4				250.4	45.64	2.0	60	32	20.2	0.0	Sum of DP 2.5 & DP 17, piped to DP 2.7
	2.7							24.5	72.10	4.67	336.8				336.8	72.10	0.6	78	220	13.7	0.3	Sum of DP 1.8 & DP 2.6, piped to DP 2.8
	18	A18	5.27	0.47	16.4	2.47	5.68	14.0							14.0	2.47	1.0	18	24	7.9	0.1	Area inlet Piped to DP 2.6
	19	A19	31.85	0.59	25.8	18.79	4.55	85.4							85.4	18.79	1.0	18	24	48.4	0.0	Area inlet Piped to DP 2.6
	2.8							25.8	93.36	4.55	424.4				424.4	93.36	0.6	78	145	13.9	0.2	Sum of DP 2.7, DP 18 & DP 19, piped to DP 3.0.
	3.0							25.8	93.36	4.55	424.4	424.4	93.36	0.5					564	1.4	6.6	Detention Pond Trickle channel conveyance to DP 3.2
	20	A20	1.83	0.89	8.0	1.63	7.50	12.2	14.4	2.22	6.02	13.4			11.1	1.84	1.0	24	105	7.2	0.2	On-grade inlet Sum of Sub-basin A20 & carryover flow from DP 10, piped to DP 3.0
	21	A21	1.93	0.90	8.7	1.73	7.28	12.6	15.8	2.63	5.77	15.2			11.9	2.06	2.5	18	0	10.2	0.0	On-grade inlet Sum of Sub-basin A21 & carryover flow from DP 11, piped to DP 2.9
	2.9							15.8	3.91	5.77	22.5				22.5	3.91	2.0	24	58	11.0	0.1	Sum of DP 20 & DP 21, piped to DP 3.1
	3.1							15.8	3.91	5.77	22.5	22.5	3.91	0.5					568	1.4	6.7	Detention Pond Trickle channel conveyance to DP 3.2
	22	A22	8.68	0.37	23.3	3.21	4.80	15.4														Detention Pond Overland flow to DP 3.2
	OS4	OS4	5.08	0.40	29.5	2.03	4.21	8.5				8.5	2.03	13.0					113	5.4	0.3	Existing topography Overland flow to DP 3.2
	3.2							29.8	102.50	4.18	428.2											Outlet Structure Sum of DP 3.0, DP 3.1, DP 22 & DP OS4, outlet structure release to DP 4.8
	Pond W5							29.8	34.84	4.18	145.5				145.5	34.84	2.0	48	58	17.5	0.1	Outlet structure release to DP 4.8
	23	B1	2.98	0.96	17.6	2.86	5.51	15.8				3.6	0.65	2.0	12.2	2.21	0.5	30	1394	2.1	11.0	On-grade inlet Piped to DP 4.0
	24	B2	3.89	0.96	17.6	3.73	5.51	20.6				6.5	1.17	2.0	14.1	2.56	2.0	30	1394	2.1	11.0	On-grade inlet Piped to DP 4.0

PROPOSED HYDROLOGIC CALCULATIONS

COPPER CHASE AT STERLING RANCH
PROPOSED CONDITIONS
(Area Runoff Coefficient Summary)

BASIN	TOTAL AREA (SF)	TOTAL AREA (Acres)	STREETS			DEVELOPMENT			OPEN SPACE / LANDSCAPING			C ₅	C ₁₀₀
			AREA (Acres)	C ₅	C ₁₀₀	AREA (Acres)	C ₅	C ₁₀₀	AREA (Acres)	C ₅	C ₁₀₀		
A	156397.009	3.59	0.00	0.90	0.96	2.28	0.45	0.59	1.31	0.09	0.36	0.32	0.51
B	148304.6808	3.40	0.00	0.90	0.96	3.00	0.45	0.59	0.40	0.09	0.36	0.41	0.56
C	44335.8117	1.02	0.00	0.90	0.96	1.02	0.45	0.59	0.00	0.09	0.36	0.45	0.59
D	126236.9571	2.90	0.00	0.90	0.96	2.90	0.45	0.59	0.00	0.09	0.36	0.45	0.59
E	38846.7466	0.89	0.21	0.90	0.96	0.68	0.45	0.59	0.00	0.09	0.36	0.56	0.68
F	112434.6262	2.58	0.00	0.90	0.96	2.18	0.45	0.59	0.40	0.09	0.36	0.39	0.55
G	71700.54	1.65	0.44	0.90	0.96	1.21	0.45	0.59	0.00	0.09	0.36	0.57	0.69
H	53106.3075	1.22	0.00	0.90	0.96	0.39	0.45	0.83	0.83	0.12	0.39	0.23	0.53
I	60953.98	1.40	0.00	0.90	0.96	1.40	0.45	0.59	0.00	0.09	0.36	0.45	0.59
J	38881.001	0.89	0.30	0.90	0.96	0.59	0.45	0.59	0.00	0.09	0.36	0.60	0.71
K	46538.1625	1.07	0.00	0.90	0.96	1.07	0.45	0.59	0.00	0.09	0.36	0.45	0.59
L	52574.1933	1.21	0.00	0.90	0.96	0.52	0.45	0.59	0.69	0.09	0.36	0.24	0.46
M	28034.2781	0.64	0.00	0.90	0.96	0.06	0.45	0.59	0.58	0.09	0.36	0.12	0.38
A4	24837.432	0.64	0.64	0.90	0.96	0.00	0.45	0.59	0.00	0.09	0.36	0.90	0.96
A6	N/A	1.37										0.58	0.70
A6A	N/A	0.53										0.81	0.88
A8	32551.5217	0.75	0.75	0.90	0.96	0.00	0.45	0.59	0.00	0.09	0.39	0.90	0.96
A11	121476.1738	2.79	2.22	0.90	0.96	0.00	0.45	0.59	0.57	0.09	0.39	0.73	0.84

COPPER CHASE AT STERLING RANCH
PROPOSED CONDITIONS
(Area Drainage Summary)

From Area Runoff Coefficient Summary				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T _t)		INTENSITY *		TOTAL FLOWS					
BASIN	AREA TOTAL (Acres)	C ₅	C ₁₀₀	C ₅	Length (ft)	Height (ft)	T _c (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	CHECK (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)				
		From DCM Table 5-1																			
<i>A</i>	3.59	0.32	0.51	0.32	100	10.5	6.5	860	1.7%	2.6	5.4	11.9	15.3	3.9	6.5	4.4	11.8				
<i>B</i>	3.40	0.41	0.56	0.41	100	1.4	11.2	735	1.6%	2.5	4.9	16.1	14.6	3.6	6.0	4.9	11.4				
<i>C</i>	1.02	0.45	0.59	0.45	100	2.0	9.3	520	2.5%	3.2	2.7	12.1	13.4	3.8	6.5	1.8	3.9				
<i>D</i>	2.90	0.45	0.59	0.45	100	2.2	9.0	795	1.9%	2.8	4.7	13.8	15.0	3.6	6.1	4.8	10.5				
<i>E</i>	0.89	0.56	0.68	0.56	100	2.0	7.8	340	1.9%	2.8	2.0	9.9	12.4	4.1	7.0	2.1	4.2				
<i>F</i>	2.58	0.39	0.55	0.39	100	13.0	5.5	855	2.7%	3.3	4.3	9.8	15.3	4.2	7.0	4.2	10.0				
<i>G</i>	1.65	0.57	0.69	0.57	100	4.0	6.1	290	2.8%	3.4	1.4	7.5	12.2	4.6	7.7	4.3	8.7				
<i>H</i>	1.22	0.23	0.53	0.23	100	3.3	10.6	655	2.1%	2.2	5.0	15.6	14.2	3.6	6.0	1.0	3.9				
<i>I</i>	1.40	0.45	0.59	0.45	100	2.7	8.5	760	2.1%	2.9	4.4	12.8	14.8	3.8	6.3	2.4	5.2				
<i>J</i>	0.89	0.60	0.71	0.60	100	2.0	7.2	470	1.4%	2.4	3.3	10.5	13.2	4.1	6.8	2.2	4.3				
<i>K</i>	1.07	0.45	0.59	0.45	100	3.0	8.2	460	2.0%	2.8	2.7	10.9	13.1	4.0	6.7	1.9	4.2				
<i>L</i>	1.21	0.24	0.46	0.24	100	3.5	10.2	655	1.2%	2.2	4.9	15.2	14.2	3.6	6.0	1.1	3.3				
<i>M</i>	0.64	0.12	0.38	0.12	100	4.0	11.2	195	3.2%	1.3	2.6	13.7	11.6	3.9	6.6	0.3	1.6				
<i>A4</i>	0.64	0.90	0.96	0.90	100	1.8	3.0	350	2.3%	3.0	1.9	4.9	12.5	5.2	8.7	3.0	5.4				
<i>A6</i>	1.37	0.58	0.70					REFER TO "FINAL DRAINAGE REPORT FOR STERLING RANCH NO. 2" FOR DETAILS										3.3	6.6		
<i>A6A</i>	0.53	0.81	0.88					REFER TO "FINAL DRAINAGE REPORT FOR STERLING RANCH NO. 2" FOR DETAILS												2.2	4.1
<i>A8</i>	0.75	0.90	0.96	0.90	100	1.5	3.2	600	1.2%	2.2	4.5	7.7	13.9	4.5	7.6	3.0	5.5				
<i>A11</i>	2.79	0.73	0.84	0.73	100	0.9	6.8	1315	2.2%	3.0	7.3	14.2	17.9	3.6	6.1	7.4	14.2				

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: CVW _____
Date: 12/8/2021 _____
Checked by: VAS _____

COPPER CHASE AT STERLING RANCH
PROPOSED CONDITIONS
(Surface Routing Summary)

<i>From Area Runoff Coefficient Summary</i>				OVERLAND				PIPE / CHANNEL FLOW				Time of Travel (T_T)	INTENSITY *		TOTAL FLOWS		COMMENTS	
DESIGN POINT	CONTRIBUTING BASINS	CA ₅	CA ₁₀₀	C ₅	Length (ft)	Height (ft)	T _C (min)	Length (ft)	Slope (%)	Velocity (fps)	T ₁ (min)	TOTAL (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)		
1	Basin A	1.14	1.82	Basin A Tc was used				11.9					11.9	3.9	6.5	4.4	11.8	CDOT TYPE R AT-GRADE 5' INLET (IN-1)
2	Basin B	1.39	1.92	Basin B Tc was used				14.6					14.6	3.6	6.0	4.9	11.4	CDOT TYPE R AT-GRADE 15' INLET (IN-2)
3	Basin C	0.46	0.60	Basin C Tc was used				12.1					12.1	3.8	6.5	3.7	11.8	CDOT TYPE R AT-GRADE 5' INLET (IN-3)
	FB-IN1	0.50	1.23															
	Sum:	0.96	1.83															
4	Basin D	1.30	1.71	Design Point 2 Tc was used				14.6					14.6	3.6	6.0	4.7	12.0	CDOT TYPE R AT-GRADE 15' INLET (IN-4)
	FB-IN2	0.0	0.29															
	Sum:	1.31	2.00															
5	Basin E	0.50	0.60	Design Point 4 was used				14.6					14.6	3.6	6.0	1.8	5.6	CDOT TYPE R SUMP 15' INLET (IN-5)
	FB-IN4	0.0	0.33															
	Sum:	0.50	0.93															
6	Basin F	1.02	1.43	Basin F Tc was used				9.8					9.8	4.2	7.0	4.2	10.0	CDOT TYPE R 15' AT-GRADE INLET (IN-6)
7	Basin G	0.94	1.13	Weighted Tc was used				16.0					16.0	3.4	5.7	4.9	20.0	EX CDOT TYPE R 15' AT-GRADE INLET (IN-A5)
	FB-IN6	0.00	0.16															
	FB-INA1	0.05	0.40															
	FB-INA4	0.00	0.10															
	FB-INA3	0.45	1.69															
8	Basin H	0.27	0.65	Basin H Tc was used				14.2					14.2	3.6	6.0	1.0	3.9	BEEHIVE GRATE SUMP INLET (IN-8)
9	Basin I	0.63	0.83	Design Point 5 Tc was used				14.6					14.6	3.6	6.0	4.0	10.5	CDOT TYPE R SUMP 15' INLET (IN-5)
	DP 5	0.50	0.93															
	Sum:	1.13	1.76															
10	Basin J	0.54	0.64	Basin J Tc was used				10.5					10.5	4.1	6.8	2.2	4.3	
11	Basin K	0.48	0.63	Design Point 3 was used				12.1					12.1	3.8	6.5	5.4	16.7	CDOT TYPE R SUMP 15' INLET (IN-9)
	FB-IN3	0.4	1.32															
	DP 10	0.54	0.64															
	Sum:	1.40	2.59															
12	Basin L	0.29	0.55	Basin L Tc was used				14.2					14.2	3.6	6.0	1.1	3.3	
13	Basin M	0.08	0.25	Basin M Tc was used				11.6					11.6	3.9	6.6	0.3	1.6	
14	Basin A4	0.58	0.62	Basin A4 Tc was used				5.0					5.0	5.2	8.7	3.0	5.4	EX CDOT TYPE R 10' AT-GRADE INLET (IN-A4)

COPPER CHASE AT STERLING RANCH
PROPOSED CONDITIONS
(Surface Routing Summary)

<i>From Area Runoff Coefficient Summary</i>				OVERLAND				PIPE / CHANNEL FLOW				Time of Travel (T_t)	INTENSITY *		TOTAL FLOWS		COMMENTS		
DESIGN POINT	CONTRIBUTING BASINS	CA ₅	CA ₁₀₀	C _s	Length (ft)	Height (ft)	T _c (min)	Length (ft)	Slope (%)	Velocity (fps)	T _t (min)	TOTAL (min)	I ₅ (in/hr)	I ₁₀₀ (in/hr)	Q ₅ (c.f.s.)	Q ₁₀₀ (c.f.s.)			
15	Basin A8	0.67	0.72	Basin A8 Tc was used				13.9					13.9	3.6	6.1	5.1	19.8	EX CDOT TYPE R 15' AT-GRADE INLET (IN-A8)	
	FB-INA6	0.00	0.17																
	Basin A6A	0.43	0.47																
	FB-INA15	0.00	0.24																
	DP 12	0.29	0.55																
	FB-INA5	0.01	1.10																
		1.40	3.25																
16	Basin A11	2.05	2.35	Basin A11 Tc was used				14.2					14.2	3.6	6.1	7.7	22.8	EX CDOT TYPE R 15' AT-GRADE INLET (IN-A11)	
	FB-INA8	0.00	1.11																
	DP 13	0.08	0.25																
	FB-INA9	0.00	0.06																
			2.13	3.77															

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: CVW

Date: 6/16/2022

Checked by: VAS

COPPER CHASE AT STERLING RANCH
PROPOSED CONDITIONS
(Storm Sewer Routing Summary)

PIPE	Contributing Pipes/Design Points	Equivalent CA ₅	Equivalent CA ₁₀₀	Maximum T _C	Intensity*		Flow	
					I ₅	I ₁₀₀	Q ₅	Q ₁₀₀
PR1	DP1 (IN-1)	0.65	0.59	11.9	3.9	6.5	2.5	3.8
PR2	DP2 (IN-2)	1.38	1.62	14.6	3.6	6.0	4.9	9.7
PR3	PR1, PR2	2.02	2.21	14.4	3.6	6.0	7.3	13.3
PR4	DP3 (IN-3)	0.64	0.65	14.6	3.6	6.0	2.3	3.9
PR5	DP4 (IN-4)	1.31	1.67	14.6	3.6	6.0	4.7	10.0
PR6	DP6 (IN-6)	1.01	1.27	10.0	4.1	6.9	4.2	8.8
PR7	PR6	1.01	1.27	10.3	4.1	6.9	4.1	8.7
PR8	PR7	1.01	1.27	10.5	4.1	6.8	4.1	8.7
PR9	PR8	1.01	1.27	10.8	4.0	6.7	4.1	8.6
PR10	DP8 (IN-8)	0.27	0.65	14.2	3.6	6.0	1.0	3.9
PR11	PR10, DP9 (IN-5)	1.39	2.38	14.2	3.6	6.0	5.0	14.4
PR12	PR3, PR4, PR5	3.98	4.53	15.3	3.5	5.9	13.9	26.6
PR13	PR11, DP11 (IN-9)	2.79	4.97	12.1	3.8	6.5	10.7	32.1
PR14	PR9, PR12, PR13	7.78	10.78	16.9	3.3	5.6	26.0	60.5
I.0	IN-A1, IN-A2	1.45	1.47	9.7	4.2	7.0	6.1	10.3
I.1	IN-A4, IN-A3	3.27	3.10	15.5	3.5	5.8	11.4	18.1
I.2	I.0, I.1	4.72	4.57	14.1	3.6	6.1	17.1	27.7
I.3A	I.2, IN-A5, IN-A6	6.87	7.54	15.4	3.5	5.8	23.9	44.1
I.3	I.3A	6.87	7.54	15.4	3.5	5.8	23.9	44.1
I.4	I.3, PR14	14.65	18.32	17.0	3.3	5.6	48.8	102.5
I.5	DP15 (IN-A8), I.4	16.05	20.75	17.1	3.3	5.6	53.4	115.8
I.6	IN-A9, I.5	16.69	21.48	17.4	3.3	5.5	55.1	119.0
I.7	DP16 (IN-A11), IN-A10	4.95	4.98	17.5	3.3	5.5	16.3	27.5
I.8	I.7, I.6	21.65	26.46	24.1	2.8	4.7	60.8	124.8

* Intensity equations assume a minimum travel time of 5 minutes.

DP - Design Point
EX - Existing Design Point
PR - Pipe Run

FB- Flow By from Design Point
IN- Proposed Inlet
IN-A(#)- Existing Inlet

Calculated by: CVW

Date: 6/16/2022

Checked by: VAS

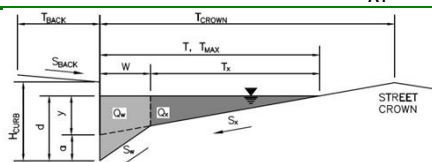
Overall Imperviousness of Copper Chase at Sterling Ranch				
Contributing Basins	Area (Acres)	C₅	Impervious % (I)	(Acres)*(I)
<i>A</i>	3.59	0.32	44	157.39
<i>B</i>	3.40	0.41	58	198.10
<i>C</i>	1.02	0.45	65	66.16
<i>D</i>	2.90	0.45	65	188.37
<i>E</i>	0.89	0.56	73	65.32
<i>F</i>	2.58	0.39	56	144.57
<i>G (on site portion)</i>	0.47	0.57	260	122.39
<i>H</i>	1.22	0.23	26	31.15
<i>I</i>	1.40	0.45	65	90.96
<i>J</i>	0.89	0.60	77	68.52
<i>K</i>	1.07	0.45	65	69.44
<i>L</i>	1.21	0.24	32	38.43
<i>M</i>	0.64	0.12	12	7.99
Totals	21.3			1248.79
Imperviousness of Site	58.7	%		

**EXISTING HYDRAULIC CALCULATIONS
(BY J.R. ENGINEERING, APPROVED NOVEMBER 2021)**

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

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

Project: Sterling Ranch Filing No. 2
 Inlet ID: A1



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

$T_{BACK} = 8.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.016$

Height of Curb at Gutter Flow Line
 Distance from Curb Face to Street Crown
 Gutter Width
 Street Transverse Slope
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
 Street Longitudinal Slope - Enter 0 for sump condition
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 17.0$ ft
 $W = 1.17$ ft
 $S_X = 0.020$ ft/ft
 $S_W = 0.083$ ft/ft
 $S_0 = 0.027$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	15.8	17.0	ft
$d_{MAX} =$	4.6	7.8	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

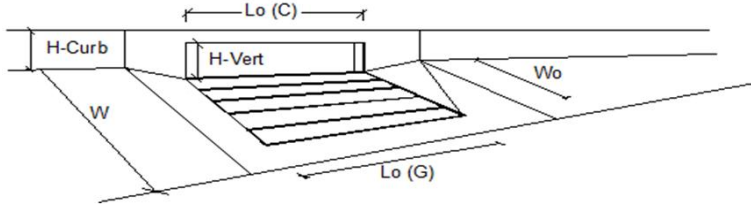
MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Spread Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	13.1	16.7	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

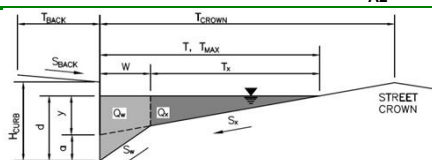


Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity.			
Total Inlet Interception Capacity	4.2	6.6	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.2	2.8	cfs
Capture Percentage = Q_c/Q_o =	95	70	%

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

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

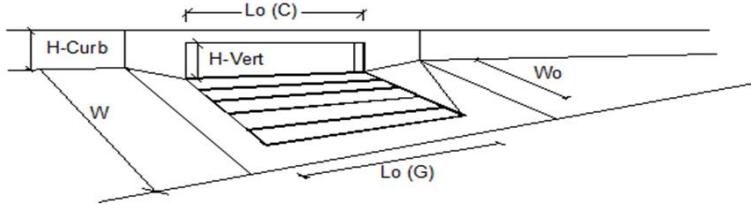
Project: Sterling Ranch Filing No. 2
 Inlet ID: A2



Gutter Geometry (Enter data in the blue cells)													
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 8.0$ ft												
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft												
Manning's Roughness Behind Curb (typically between 0.012 and 0.020) <input type="checkbox"/>	$n_{BACK} = 0.016$												
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches												
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ 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	$S_0 = 0.027$ ft/ft												
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$												
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>$T_{MAX} =$</td> <td>15.8</td> <td>17.0</td> <td>ft</td> </tr> <tr> <td>$d_{MAX} =$</td> <td>4.6</td> <td>7.8</td> <td>inches</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$T_{MAX} =$	15.8	17.0	ft	$d_{MAX} =$	4.6	7.8	inches
	Minor Storm	Major Storm											
$T_{MAX} =$	15.8	17.0	ft										
$d_{MAX} =$	4.6	7.8	inches										
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm													
Allow Flow Depth at Street Crown (leave blank for no) <input type="checkbox"/>	check = yes												
MINOR STORM Allowable Capacity is based on Depth Criterion													
MAJOR STORM Allowable Capacity is based on Spread Criterion													
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'													
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'													
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	Minor Storm	Major Storm											
$Q_{allow} =$	13.1	16.7	cfs										

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity.			
Total Inlet Interception Capacity	1.9	3.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	0.1	cfs
Capture Percentage = Q_c/Q_o =	100	97	%

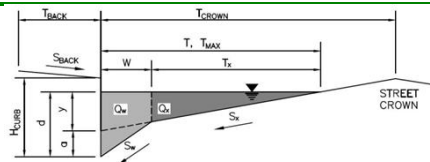
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project:
Inlet ID:

Sterling Ranch Filing No. 2

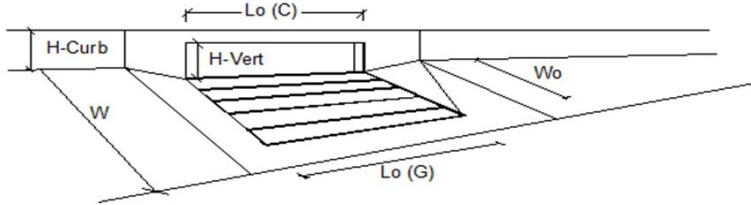
A3



Gutter Geometry (Enter data in the blue cells)													
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 8.0$ ft												
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft												
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.016$												
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches												
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ ft												
Gutter Width	$W = 1.17$ 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	$S_0 = 0.026$ ft/ft												
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$												
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>$T_{MAX} =$</td> <td>15.8</td> <td>17.0</td> <td>ft</td> </tr> <tr> <td>$d_{MAX} =$</td> <td>4.6</td> <td>7.8</td> <td>inches</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$T_{MAX} =$	15.8	17.0	ft	$d_{MAX} =$	4.6	7.8	inches
	Minor Storm	Major Storm											
$T_{MAX} =$	15.8	17.0	ft										
$d_{MAX} =$	4.6	7.8	inches										
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm													
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> <input checked="" type="checkbox"/> check = yes												
MINOR STORM Allowable Capacity is based on Depth Criterion													
MAJOR STORM Allowable Capacity is based on Depth Criterion													
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'													
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	Minor Storm	Major Storm											
$Q_{allow} =$	12.9	41.5	cfs										

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017

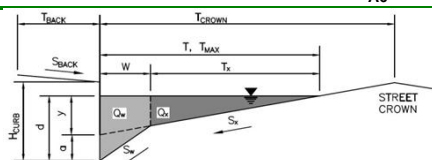


Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity.			
Total Inlet Interception Capacity	9.5	14.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	1.6	10.0	cfs
Capture Percentage = Q_i/Q_o =	86	60	%

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

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

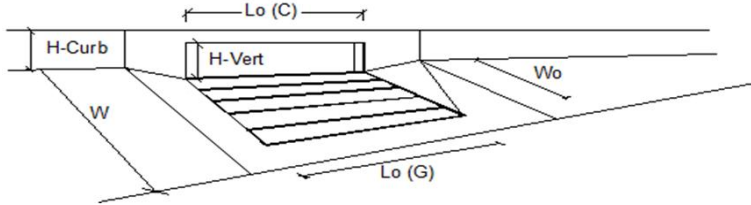
Project: Sterling Ranch Filing No. 2
 Inlet ID: A6



Gutter Geometry (Enter data in the blue cells)							
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 8.0$ ft						
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft						
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.016$						
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches						
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ ft						
Gutter Width	$W = 1.17$ 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	$S_0 = 0.026$ ft/ft						
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$						
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <thead> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>15.8</td> <td>17.0</td> <td>ft</td> </tr> </tbody> </table>	Minor Storm	Major Storm		15.8	17.0	ft
Minor Storm	Major Storm						
15.8	17.0	ft					
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1"> <thead> <tr> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>4.6</td> <td>7.8</td> <td>inches</td> </tr> </tbody> </table>	Minor Storm	Major Storm		4.6	7.8	inches
Minor Storm	Major Storm						
4.6	7.8	inches					
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> <input checked="" type="checkbox"/> check = yes						
MINOR STORM Allowable Capacity is based on Depth Criterion							
MAJOR STORM Allowable Capacity is based on Depth Criterion							
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'							
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'							
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Minor Storm	Major Storm						
12.9	41.5	cfs					

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	10.00	10.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity.			
Total Inlet Interception Capacity	3.3	5.4	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	1.3	cfs
Capture Percentage = Q_a/Q_o =	100	81	%

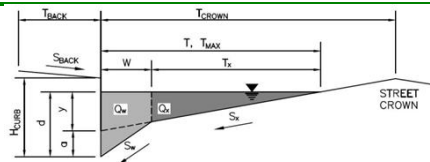
ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

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

Project:
Inlet ID:

Sterling Ranch Filing No. 2

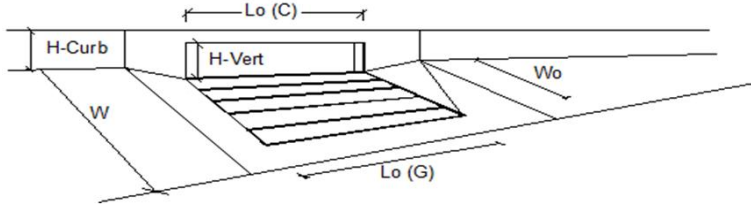
A8



Gutter Geometry (Enter data in the blue cells)													
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 7.0$ ft												
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft												
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.016$												
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches												
Distance from Curb Face to Street Crown	$T_{CROWN} = 26.0$ ft												
Gutter Width	$W = 2.00$ ft												
Street Transverse Slope	$S_X = 0.020$ ft/ft												
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_W = 0.083$ ft/ft												
Street Longitudinal Slope - Enter 0 for sump condition	$S_0 = 0.007$ ft/ft												
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$												
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>$T_{MAX} =$</td> <td>19.3</td> <td>26.0</td> <td>ft</td> </tr> <tr> <td>$d_{MAX} =$</td> <td>6.0</td> <td>7.7</td> <td>inches</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$T_{MAX} =$	19.3	26.0	ft	$d_{MAX} =$	6.0	7.7	inches
	Minor Storm	Major Storm											
$T_{MAX} =$	19.3	26.0	ft										
$d_{MAX} =$	6.0	7.7	inches										
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm													
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> <input type="checkbox"/> check = yes												
MINOR STORM Allowable Capacity is based on Depth Criterion													
MAJOR STORM Allowable Capacity is based on Depth Criterion													
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'													
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'													
	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>$Q_{allow} =$</td> <td>11.5</td> <td>26.7</td> <td>cfs</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$Q_{allow} =$	11.5	26.7	cfs				
	Minor Storm	Major Storm											
$Q_{allow} =$	11.5	26.7	cfs										

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017

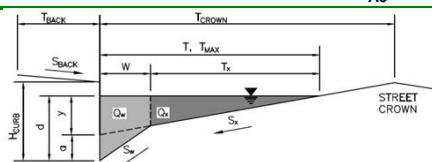


Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening	
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL} =$	3.0	3.0
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o =$	15.00	15.00
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o =$	N/A	N/A
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_r-G =$	N/A	N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_r-C =$	0.10	0.10
Street Hydraulics: OK - $Q < Q_{allowable}$ Street Capacity.				
Total Inlet Interception Capacity		$Q =$	3.0	10.6
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_b =$	0.0	1.9
Capture Percentage = $Q_c/Q_o =$		C% =	100	85
				cfs
				cfs
				%

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

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

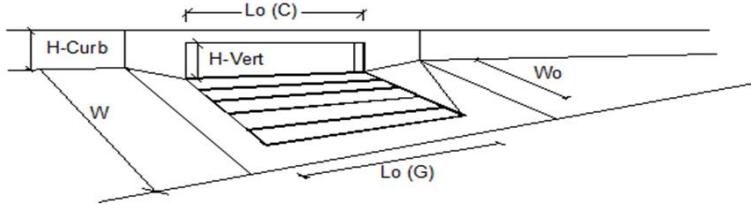
Project: Sterling Ranch Filing No. 2
 Inlet ID: A9



Gutter Geometry (Enter data in the blue cells)													
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 7.0$ ft												
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft												
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.016$												
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches												
Distance from Curb Face to Street Crown	$T_{CROWN} = 26.0$ ft												
Gutter Width	$W = 2.00$ ft												
Street Transverse Slope	$S_x = 0.020$ ft/ft												
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_w = 0.083$ ft/ft												
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.007$ ft/ft												
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$												
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>$T_{MAX} =$</td> <td>19.3</td> <td>26.0</td> <td>ft</td> </tr> <tr> <td>$d_{MAX} =$</td> <td>6.0</td> <td>7.7</td> <td>inches</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$T_{MAX} =$	19.3	26.0	ft	$d_{MAX} =$	6.0	7.7	inches
	Minor Storm	Major Storm											
$T_{MAX} =$	19.3	26.0	ft										
$d_{MAX} =$	6.0	7.7	inches										
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm													
Allow Flow Depth at Street Crown (leave blank for no)	<input type="checkbox"/> <input type="checkbox"/> check = yes												
MINOR STORM Allowable Capacity is based on Depth Criterion													
MAJOR STORM Allowable Capacity is based on Depth Criterion													
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'													
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'													
	<table border="1"> <thead> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> </thead> <tbody> <tr> <td>$Q_{allow} =$</td> <td>11.5</td> <td>26.9</td> <td>cfs</td> </tr> </tbody> </table>		Minor Storm	Major Storm		$Q_{allow} =$	11.5	26.9	cfs				
	Minor Storm	Major Storm											
$Q_{allow} =$	11.5	26.9	cfs										

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



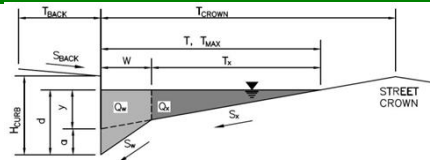
Design Information (Input)	CDOT Type R Curb Opening	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening	
Local Depression (additional to continuous gutter depression 'a')		$a_{LOCAL} =$	3.0	3.0
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1
Length of a Single Unit Inlet (Grate or Curb Opening)		$L_o =$	10.00	10.00
Width of a Unit Grate (cannot be greater than W, Gutter Width)		$W_o =$	N/A	N/A
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		$C_r-G =$	N/A	N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		$C_r-C =$	0.10	0.10
Street Hydraulics: OK - $Q < Q_{allowable}$ Street Capacity.				
Total Inlet Interception Capacity		$Q =$	2.1	4.5
Total Inlet Carry-Over Flow (flow bypassing inlet)		$Q_b =$	0.0	0.3
Capture Percentage = $Q_c/Q_o =$		C% =	100	94
				%

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

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

Project: Sterling Ranch Filing No. 2

Inlet ID: A10



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

$T_{BACK} = 15.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.016$

Height of Curb at Gutter Flow Line
 Distance from Curb Face to Street Crown
 Gutter Width
 Street Transverse Slope
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
 Street Longitudinal Slope - Enter 0 for sump condition
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 38.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.012$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	33.0	38.0	ft
$d_{MAX} =$	6.0	9.1	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

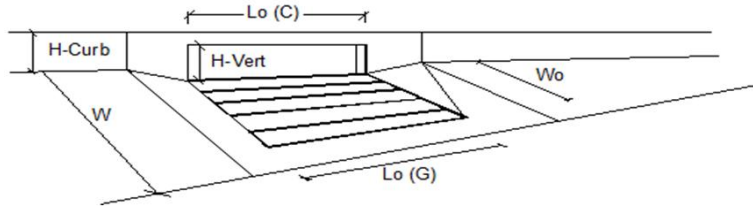
MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	15.2	63.8	cfs

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



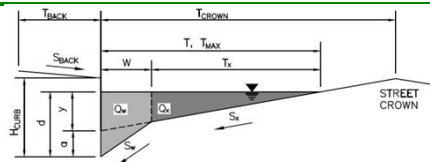
Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity.			
Total Inlet Interception Capacity	8.7	12.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.5	4.5	cfs
Capture Percentage = Q_a/Q_o =	94	74	%

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

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

Project: Sterling Ranch Filing No. 2

Inlet ID: A15



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

$T_{BACK} = 7.0$ ft
 $S_{BACK} = 0.020$ ft/ft
 $n_{BACK} = 0.016$

Height of Curb at Gutter Flow Line
 Distance from Curb Face to Street Crown
 Gutter Width
 Street Transverse Slope
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
 Street Longitudinal Slope - Enter 0 for sump condition
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

$H_{CURB} = 6.00$ inches
 $T_{CROWN} = 26.0$ ft
 $W = 2.00$ ft
 $S_x = 0.020$ ft/ft
 $S_w = 0.083$ ft/ft
 $S_o = 0.023$ ft/ft
 $n_{STREET} = 0.016$

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Allow Flow Depth at Street Crown (leave blank for no)

	Minor Storm	Major Storm	
$T_{MAX} =$	19.3	26.0	ft
$d_{MAX} =$	6.0	7.7	inches
	<input type="checkbox"/>	<input type="checkbox"/>	check = yes

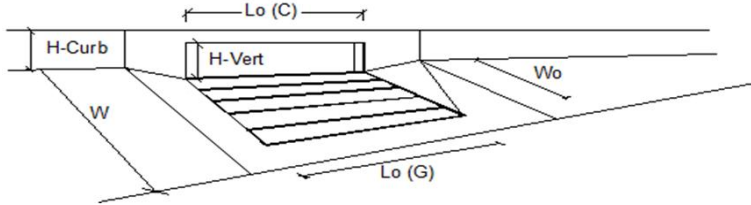
MINOR STORM Allowable Capacity is based on Depth Criterion
MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
$Q_{allow} =$	19.2	36.4	cfs

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

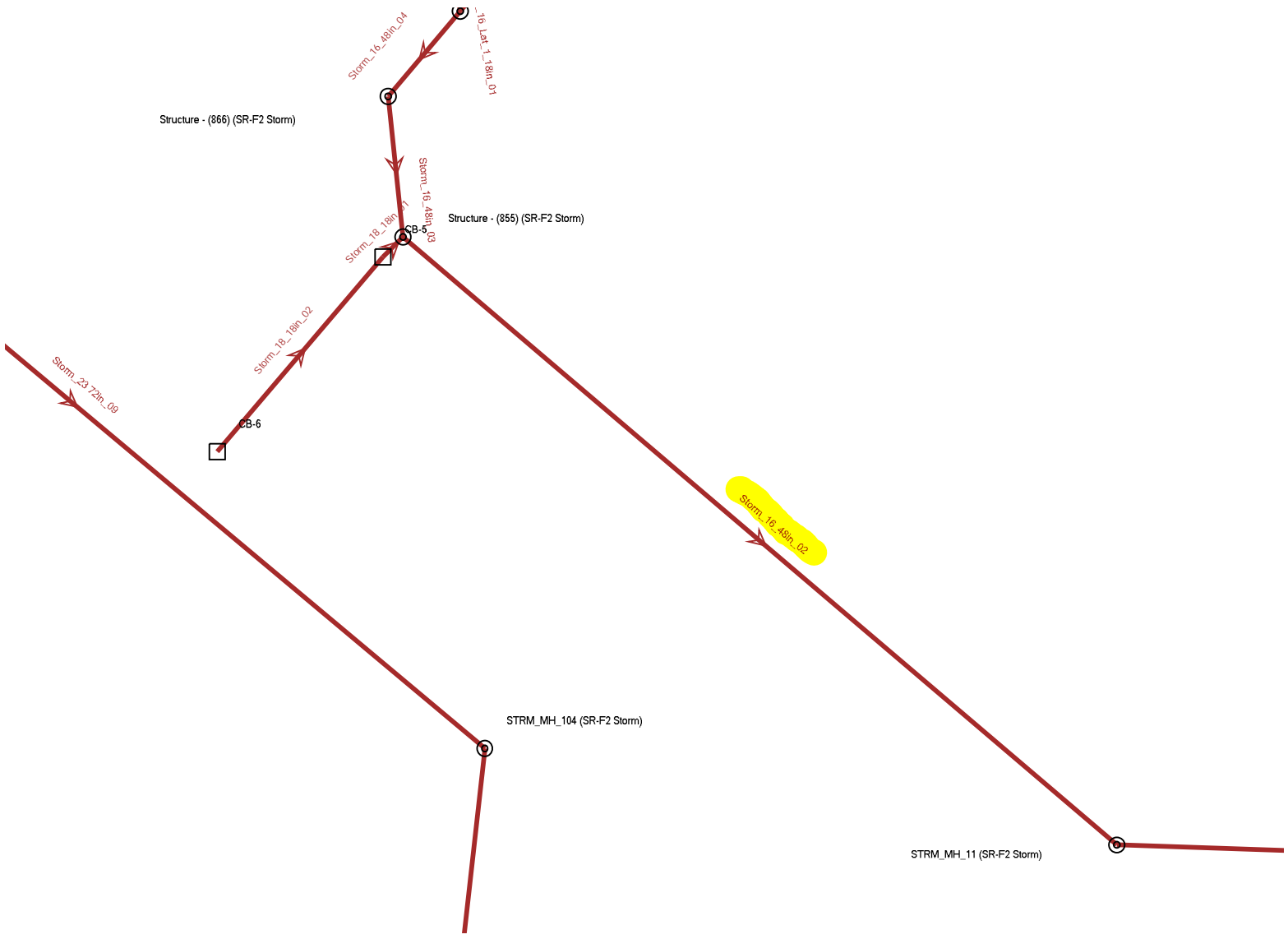
INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity.			
Total Inlet Interception Capacity	5.4	10.3	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	1.4	cfs
Capture Percentage = Q_i/Q_o =	100	88	%

Sterling Ranch 5yr

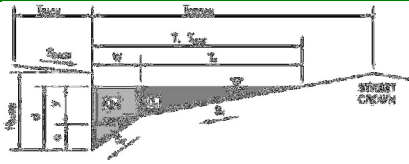


PROPOSED HYDRAULIC CALCULATIONS

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

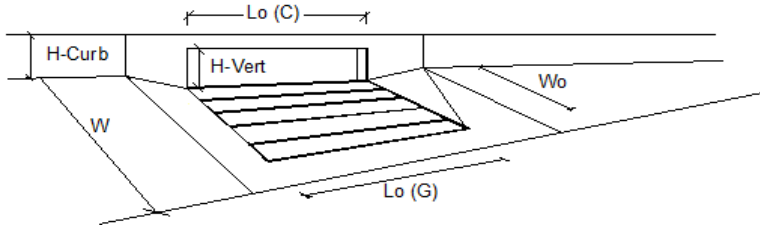
Inlet ID: **IN-1**



Gutter Geometry:													
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	$S_D = 0.014$ ft/ft												
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$												
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> <tr> <td>$T_{MAX} =$</td> <td>16.2</td> <td>16.2</td> <td>ft</td> </tr> <tr> <td>$d_{MAX} =$</td> <td>4.8</td> <td>7.8</td> <td>inches</td> </tr> </table>		Minor Storm	Major Storm		$T_{MAX} =$	16.2	16.2	ft	$d_{MAX} =$	4.8	7.8	inches
	Minor Storm	Major Storm											
$T_{MAX} =$	16.2	16.2	ft										
$d_{MAX} =$	4.8	7.8	inches										
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm													
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	<input type="checkbox"/> <input checked="" type="checkbox"/>												
MINOR STORM Allowable Capacity is based on Spread Criterion													
MAJOR STORM Allowable Capacity is based on Depth Criterion													
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'	<table border="1"> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> <tr> <td>$Q_{allow} =$</td> <td>10.6</td> <td>44.0</td> <td>cfs</td> </tr> </table>		Minor Storm	Major Storm		$Q_{allow} =$	10.6	44.0	cfs				
	Minor Storm	Major Storm											
$Q_{allow} =$	10.6	44.0	cfs										
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'													

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

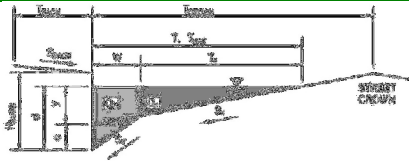


Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity			
Total Inlet Interception Capacity	2.5	3.8	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	1.9	8.0	cfs
Capture Percentage = Q_i/Q_o =	57	33	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

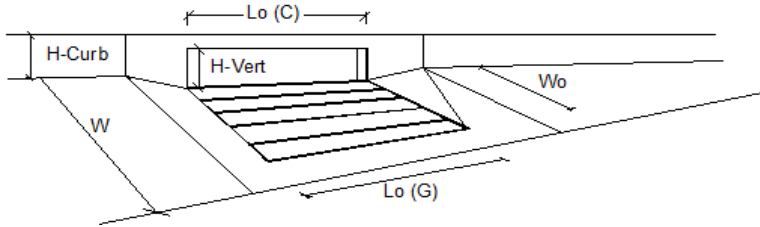
Inlet ID: **IN-2**



Gutter Geometry:					
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 = 0.014 ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n _{STREET} = 0.016				
Max. Allowable Spread for Minor & Major Storm	T _{MAX} = <table border="1"><tr><th>Minor Storm</th><th>Major Storm</th></tr><tr><td>16.2</td><td>16.2</td></tr></table> ft	Minor Storm	Major Storm	16.2	16.2
Minor Storm	Major Storm				
16.2	16.2				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d _{MAX} = <table border="1"><tr><th>Minor Storm</th><th>Major Storm</th></tr><tr><td>4.8</td><td>7.8</td></tr></table> inches	Minor Storm	Major Storm	4.8	7.8
Minor Storm	Major Storm				
4.8	7.8				
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	<input type="checkbox"/> <input checked="" type="checkbox"/>				
MINOR STORM Allowable Capacity is based on Spread Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'	Q _{allow} = <table border="1"><tr><th>Minor Storm</th><th>Major Storm</th></tr><tr><td>10.6</td><td>44.0</td></tr></table> cfs	Minor Storm	Major Storm	10.6	44.0
Minor Storm	Major Storm				
10.6	44.0				
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'					

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

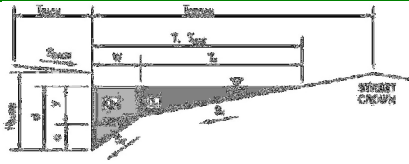


Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity			
Total Inlet Interception Capacity	4.9	9.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	1.7	cfs
Capture Percentage = Q_i/Q_o =	100	85	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

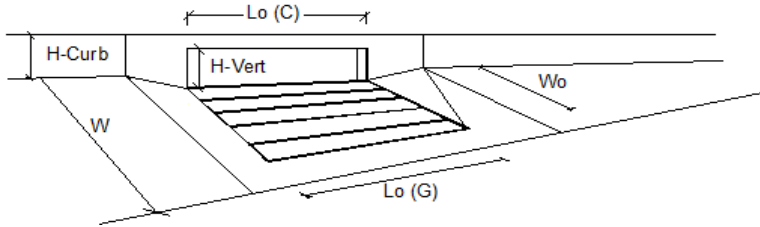
Inlet ID: **IN-3**



Gutter Geometry:									
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	$S_D = 0.020$ ft/ft								
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$								
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <tr> <td></td> <td>Minor Storm</td> <td>Major Storm</td> <td></td> </tr> <tr> <td>$T_{MAX} =$</td> <td>16.2</td> <td>16.2</td> <td>ft</td> </tr> </table>		Minor Storm	Major Storm		$T_{MAX} =$	16.2	16.2	ft
	Minor Storm	Major Storm							
$T_{MAX} =$	16.2	16.2	ft						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1"> <tr> <td></td> <td>Minor Storm</td> <td>Major Storm</td> <td></td> </tr> <tr> <td>$d_{MAX} =$</td> <td>4.8</td> <td>7.8</td> <td>inches</td> </tr> </table>		Minor Storm	Major Storm		$d_{MAX} =$	4.8	7.8	inches
	Minor Storm	Major Storm							
$d_{MAX} =$	4.8	7.8	inches						
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	<table border="1"> <tr> <td></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td></td> </tr> </table>		<input type="checkbox"/>	<input checked="" type="checkbox"/>					
	<input type="checkbox"/>	<input checked="" type="checkbox"/>							
MINOR STORM Allowable Capacity is based on Spread Criterion									
MAJOR STORM Allowable Capacity is based on Depth Criterion									
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'	<table border="1"> <tr> <td></td> <td>Minor Storm</td> <td>Major Storm</td> <td></td> </tr> <tr> <td>$Q_{allow} =$</td> <td>12.7</td> <td>43.8</td> <td>cfs</td> </tr> </table>		Minor Storm	Major Storm		$Q_{allow} =$	12.7	43.8	cfs
	Minor Storm	Major Storm							
$Q_{allow} =$	12.7	43.8	cfs						
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'									

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

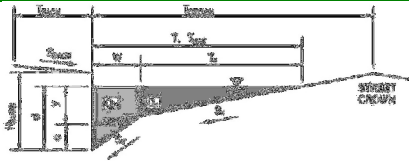


Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity			
Total Inlet Interception Capacity	2.3	3.9	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	1.4	7.9	cfs
Capture Percentage = Q_i/Q_o =	63	33	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

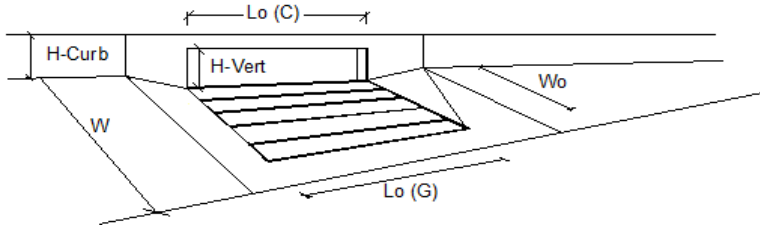
Inlet ID: **IN-4**



Gutter Geometry:					
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 = 0.020 ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n _{STREET} = 0.016				
Max. Allowable Spread for Minor & Major Storm	T _{MAX} = <table border="1"><tr><th>Minor Storm</th><th>Major Storm</th></tr><tr><td>16.2</td><td>16.2</td></tr></table> ft	Minor Storm	Major Storm	16.2	16.2
Minor Storm	Major Storm				
16.2	16.2				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d _{MAX} = <table border="1"><tr><th>Minor Storm</th><th>Major Storm</th></tr><tr><td>4.8</td><td>7.8</td></tr></table> inches	Minor Storm	Major Storm	4.8	7.8
Minor Storm	Major Storm				
4.8	7.8				
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	<input type="checkbox"/> <input checked="" type="checkbox"/>				
MINOR STORM Allowable Capacity is based on Spread Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'	Q _{allow} = <table border="1"><tr><th>Minor Storm</th><th>Major Storm</th></tr><tr><td>12.7</td><td>43.8</td></tr></table> cfs	Minor Storm	Major Storm	12.7	43.8
Minor Storm	Major Storm				
12.7	43.8				
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'					

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



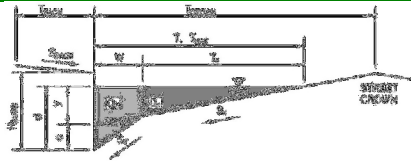
Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity			
Total Inlet Interception Capacity	4.7	10.0	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	2.0	cfs
Capture Percentage = Q_i/Q_o =	100	83	%

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

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

Project:

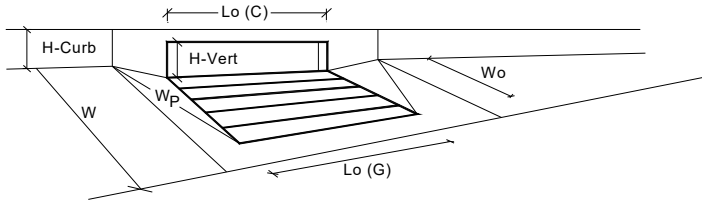
Inlet ID: IN-5



Gutter Geometry:							
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	$S_o = 0.000$ ft/ft						
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$						
Max. Allowable Spread for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td></td> </tr> <tr> <td style="text-align: center;">16.2</td> <td style="text-align: center;">16.2</td> <td style="text-align: right;">ft</td> </tr> </table>	Minor Storm	Major Storm		16.2	16.2	ft
Minor Storm	Major Storm						
16.2	16.2	ft					
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td></td> </tr> <tr> <td style="text-align: center;">4.8</td> <td style="text-align: center;">7.8</td> <td style="text-align: right;">inches</td> </tr> </table>	Minor Storm	Major Storm		4.8	7.8	inches
Minor Storm	Major Storm						
4.8	7.8	inches					
Check boxes are not applicable in SUMP conditions	<input type="checkbox"/> <input type="checkbox"/>						
MINOR STORM Allowable Capacity is based on Depth Criterion							
MAJOR STORM Allowable Capacity is based on Depth Criterion							
Q_{allow} =	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <td style="text-align: center;">Minor Storm</td> <td style="text-align: center;">Major Storm</td> <td></td> </tr> <tr> <td style="text-align: center;">SUMP</td> <td style="text-align: center;">SUMP</td> <td style="text-align: right;">cfs</td> </tr> </table>	Minor Storm	Major Storm		SUMP	SUMP	cfs
Minor Storm	Major Storm						
SUMP	SUMP	cfs					

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)

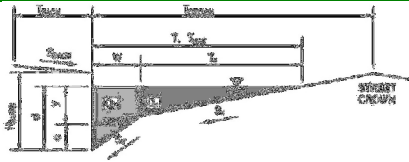


		MINOR	MAJOR	
Design Information (Input)				
Type of Inlet	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		1	1	
Water Depth at Flowline (outside of local depression)		4.8	7.8	inches
Grate Information				<input checked="" type="checkbox"/> Override Depths
Length of a Unit Grate		N/A	N/A	feet
Width of a Unit Grate		N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)		N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		N/A	N/A	
Curb Opening Information				
Length of a Unit Curb Opening		15.00	15.00	feet
Height of Vertical Curb Opening in Inches		6.00	6.00	inches
Height of Curb Orifice Throat in Inches		6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)		63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		1.17	1.17	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		0.67	0.67	
Low Head Performance Reduction (Calculated)				
Depth for Grate Midwidth		N/A	N/A	ft
Depth for Curb Opening Weir Equation		0.30	0.55	ft
Combination Inlet Performance Reduction Factor for Long Inlets		0.45	0.74	
Curb Opening Performance Reduction Factor for Long Inlets		0.70	0.88	
Grated Inlet Performance Reduction Factor for Long Inlets		N/A	N/A	
Total Inlet Interception Capacity (assumes clogged condition)				
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)				
		6.8	21.4	cfs
Q PEAK REQUIRED		4.0	10.5	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

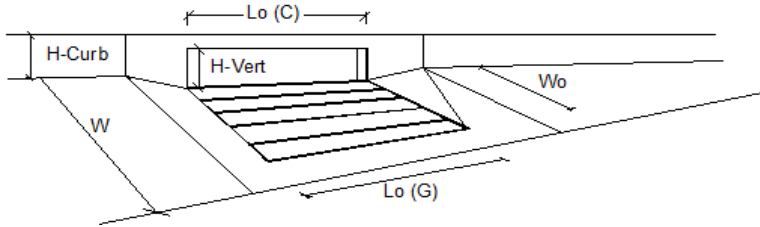
Inlet ID: **IN-6**



Gutter Geometry:													
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	$S_D = 0.009$ ft/ft												
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$												
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> <th></th> </tr> <tr> <td>$T_{MAX} =$</td> <td>16.2</td> <td>16.2</td> <td>ft</td> </tr> <tr> <td>$d_{MAX} =$</td> <td>4.8</td> <td>7.8</td> <td>inches</td> </tr> </table>		Minor Storm	Major Storm		$T_{MAX} =$	16.2	16.2	ft	$d_{MAX} =$	4.8	7.8	inches
	Minor Storm	Major Storm											
$T_{MAX} =$	16.2	16.2	ft										
$d_{MAX} =$	4.8	7.8	inches										
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm													
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	<table border="1"> <tr> <th></th> <th>Minor Storm</th> <th>Major Storm</th> </tr> <tr> <td></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> </tr> </table>		Minor Storm	Major Storm		<input type="checkbox"/>	<input checked="" type="checkbox"/>						
	Minor Storm	Major Storm											
	<input type="checkbox"/>	<input checked="" type="checkbox"/>											
MINOR STORM Allowable Capacity is based on Spread Criterion													
MAJOR STORM Allowable Capacity is based on Depth Criterion													
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'	$Q_{allow} = 8.5$ cfs												
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'	$Q_{allow} = 35.3$ cfs												

INLET ON A CONTINUOUS GRADE

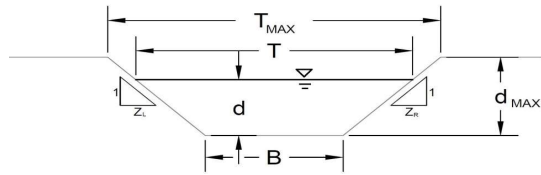
MHFD-Inlet, Version 5.01 (April 2021)



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	15.00	15.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity			
Total Inlet Interception Capacity	4.2	8.9	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	0.0	1.1	cfs
Capture Percentage = Q_i/Q_o =	100	89	%

MHFD-Inlet, Version 5.01 (April 2021)
AREA INLET IN A SWALE

IN-8



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 ₀ =	0.0050 ft/ft				
Bottom Width	B =	0.00 ft				
Left Side Slope	Z ₁ =	4.00 ft/ft				
Right Side Slope	Z ₂ =	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:						
<input type="radio"/> Non-Cohesive						
<input checked="" type="radio"/> Cohesive						
<input type="radio"/> Paved						
Maximum Allowable Top Width of Channel for Minor & Major Storm	T _{MAX} =	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> </tr> <tr> <td>12.00</td> <td>15.00</td> </tr> </table> ft	Minor Storm	Major Storm	12.00	15.00
Minor Storm	Major Storm					
12.00	15.00					
Maximum Allowable Water Depth in Channel for Minor & Major Storm	d _{MAX} =	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> </tr> <tr> <td>1.00</td> <td>1.50</td> </tr> </table> ft	Minor Storm	Major Storm	1.00	1.50
Minor Storm	Major Storm					
1.00	1.50					
Allowable Channel Capacity Based On Channel Geometry						
MINOR STORM Allowable Capacity is based on Depth Criterion						
MAJOR STORM Allowable Capacity is based on Depth Criterion						
Water Depth in Channel Based On Design Peak Flow	Q _o =	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> </tr> <tr> <td>7.4</td> <td>21.9</td> </tr> </table> cfs	Minor Storm	Major Storm	7.4	21.9
Minor Storm	Major Storm					
7.4	21.9					
Design Peak Flow	d =	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> </tr> <tr> <td>1.00</td> <td>1.50</td> </tr> </table> ft	Minor Storm	Major Storm	1.00	1.50
Minor Storm	Major Storm					
1.00	1.50					
Water Depth	Q _o =	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> </tr> <tr> <td>1.0</td> <td>3.9</td> </tr> </table> cfs	Minor Storm	Major Storm	1.0	3.9
Minor Storm	Major Storm					
1.0	3.9					
	d =	<table border="1"> <tr> <th>Minor Storm</th> <th>Major Storm</th> </tr> <tr> <td>0.47</td> <td>0.79</td> </tr> </table> ft	Minor Storm	Major Storm	0.47	0.79
Minor Storm	Major Storm					
0.47	0.79					
<p>Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'</p> <p>Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'</p>						

MHFD-Inlet, Version 5.01 (April 2021)
AREA INLET IN A SWALE

IN-8

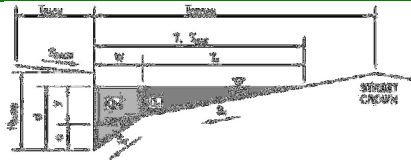
Inlet Design Information (Input)																					
Type of Inlet	CDOT Type C																				
Inlet Type =	CDOT Type C																				
Angle of Inclined Grate (must be <= 30 degrees)	$\theta = 0.00$ degrees																				
Width of Grate	$W = 3.00$ ft																				
Length of Grate	$L = 3.00$ 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	$C_w = 2.05$																				
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	<table border="1"> <thead> <tr> <th></th> <th>MINOR</th> <th>MAJOR</th> <th></th> </tr> </thead> <tbody> <tr> <td>$d =$</td> <td>0.47</td> <td>0.79</td> <td></td> </tr> <tr> <td>$Q_a =$</td> <td>6.0</td> <td>12.9</td> <td>cfs</td> </tr> <tr> <td>$Q_b =$</td> <td>0.0</td> <td>0.0</td> <td>cfs</td> </tr> <tr> <td>$C\% =$</td> <td>100</td> <td>100</td> <td>%</td> </tr> </tbody> </table>		MINOR	MAJOR		$d =$	0.47	0.79		$Q_a =$	6.0	12.9	cfs	$Q_b =$	0.0	0.0	cfs	$C\% =$	100	100	%
	MINOR	MAJOR																			
$d =$	0.47	0.79																			
$Q_a =$	6.0	12.9	cfs																		
$Q_b =$	0.0	0.0	cfs																		
$C\% =$	100	100	%																		
Total Inlet Interception Capacity (assumes clogged condition)																					
Bypassed Flow																					
Capture Percentage = Q_a/Q_o																					

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

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

Project:

Inlet ID: **IN-9**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

T _{BACK} =	7.5	ft
S _{BACK} =	0.020	ft/ft
n _{BACK} =	0.020	

Height of Curb at Gutter Flow Line
 Distance from Curb Face to Street Crown
 Gutter Width
 Street Transverse Slope
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
 Street Longitudinal Slope - Enter 0 for sump condition
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

H _{CURB} =	6.00	inches
T _{CROWN} =	16.2	ft
W =	1.17	ft
S _X =	0.020	ft/ft
S _W =	0.083	ft/ft
S _D =	0.000	ft/ft
n _{STREET} =	0.016	

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Check boxes are not applicable in SUMP conditions

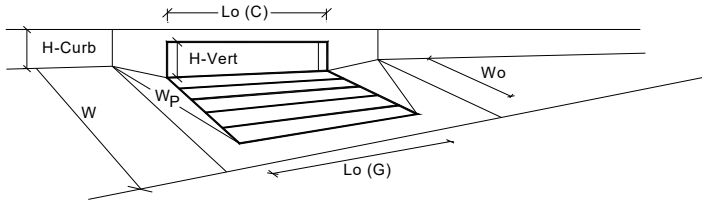
	Minor Storm	Major Storm	
T _{MAX} =	16.2	16.2	ft
d _{MAX} =	4.8	7.8	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

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

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

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.01 (April 2021)

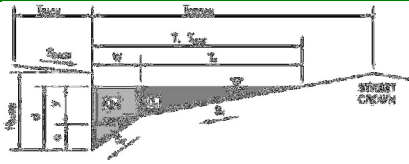


		MINOR	MAJOR	
Design Information (Input)				
Type of Inlet	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a' from above)		$a_{local} = 3.00$	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		$N_o = 1$	1	
Water Depth at Flowline (outside of local depression)		Ponding Depth = 4.8	7.8	inches
Grate Information				<input checked="" type="checkbox"/> 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				
Length of a Unit Curb Opening		$L_o (C) = 15.00$	15.00	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)		$W_p = 1.17$	1.17	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)				
Depth for Grate Midwidth		$d_{Grate} = N/A$	N/A	ft
Depth for Curb Opening Weir Equation		$d_{Curb} = 0.30$	0.55	ft
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination} = 0.45$	0.74	
Curb Opening Performance Reduction Factor for Long Inlets		$RF_{Curb} = 0.70$	0.88	
Grated Inlet Performance Reduction Factor for Long Inlets		$RF_{Grate} = N/A$	N/A	
Total Inlet Interception Capacity (assumes clogged condition)		$Q_a = 6.8$	21.4	cfs
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)		$Q_{PEAK REQUIRED} = 5.4$	16.7	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

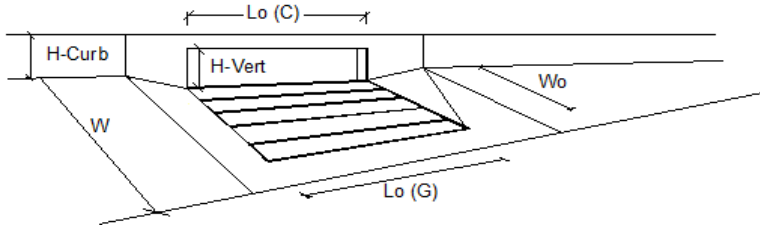
Inlet ID: **IN-A4**



Gutter Geometry:									
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 8.0$ ft								
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft								
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.016$								
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches								
Distance from Curb Face to Street Crown	$T_{CROWN} = 17.0$ ft								
Gutter Width	$W = 1.17$ 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	$S_D = 0.035$ ft/ft								
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$								
Max. Allowable Spread for Minor & Major Storm	<table border="1"> <tr> <td></td> <td>Minor Storm</td> <td>Major Storm</td> <td></td> </tr> <tr> <td>$T_{MAX} =$</td> <td>15.8</td> <td>17.0</td> <td>ft</td> </tr> </table>		Minor Storm	Major Storm		$T_{MAX} =$	15.8	17.0	ft
	Minor Storm	Major Storm							
$T_{MAX} =$	15.8	17.0	ft						
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1"> <tr> <td></td> <td>Minor Storm</td> <td>Major Storm</td> <td></td> </tr> <tr> <td>$d_{MAX} =$</td> <td>4.6</td> <td>7.8</td> <td>inches</td> </tr> </table>		Minor Storm	Major Storm		$d_{MAX} =$	4.6	7.8	inches
	Minor Storm	Major Storm							
$d_{MAX} =$	4.6	7.8	inches						
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	<table border="1"> <tr> <td></td> <td><input type="checkbox"/></td> <td><input checked="" type="checkbox"/></td> <td></td> </tr> </table>		<input type="checkbox"/>	<input checked="" type="checkbox"/>					
	<input type="checkbox"/>	<input checked="" type="checkbox"/>							
MINOR STORM Allowable Capacity is based on Depth Criterion									
MAJOR STORM Allowable Capacity is based on Depth Criterion									
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'	<table border="1"> <tr> <td></td> <td>Minor Storm</td> <td>Major Storm</td> <td></td> </tr> <tr> <td>$Q_{allow} =$</td> <td>15.0</td> <td>38.0</td> <td>cfs</td> </tr> </table>		Minor Storm	Major Storm		$Q_{allow} =$	15.0	38.0	cfs
	Minor Storm	Major Storm							
$Q_{allow} =$	15.0	38.0	cfs						
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'									

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

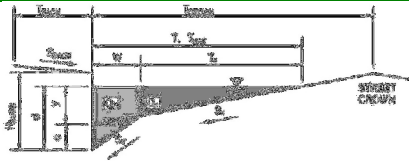


Design Information (Input)	MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a')	Type =	CDOT Type R Curb Opening		
Total Number of Units in the Inlet (Grate or Curb Opening)	a_{LOCAL} =	3.0	3.0	inches
Length of a Single Unit Inlet (Grate or Curb Opening)	No =	1	1	
Width of a Unit Grate (cannot be greater than W, Gutter Width)	L_o =	10.00	10.00	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_r-G =	N/A	N/A	
Street Hydraulics: OK - Q < Allowable Street Capacity'	C_r-C =	0.10	0.10	
Total Inlet Interception Capacity	MINOR		MAJOR	
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q =	3.0	4.8	cfs
Capture Percentage = $Q_o/Q_o =$	Q_o =	0.0	0.6	cfs
	C% =	100	89	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

Inlet ID: **IN-A5**



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb
 Side Slope Behind Curb (leave blank for no conveyance credit behind curb)
 Manning's Roughness Behind Curb (typically between 0.012 and 0.020)

T _{BACK} =	8.0	ft
S _{BACK} =	0.020	ft/ft
n _{BACK} =	0.016	

Height of Curb at Gutter Flow Line
 Distance from Curb Face to Street Crown
 Gutter Width
 Street Transverse Slope
 Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)
 Street Longitudinal Slope - Enter 0 for sump condition
 Manning's Roughness for Street Section (typically between 0.012 and 0.020)

H _{CURB} =	6.00	inches
T _{CROWN} =	17.0	ft
W =	1.17	ft
S _X =	0.020	ft/ft
S _W =	0.083	ft/ft
S _O =	0.029	ft/ft
n _{STREET} =	0.016	

Max. Allowable Spread for Minor & Major Storm
 Max. Allowable Depth at Gutter Flowline for Minor & Major Storm
 Allow Flow Depth at Street Crown (check box for yes, leave blank for no)

	Minor Storm	Major Storm	
T _{MAX} =	15.8	17.0	ft
d _{MAX} =	4.6	7.8	inches
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	

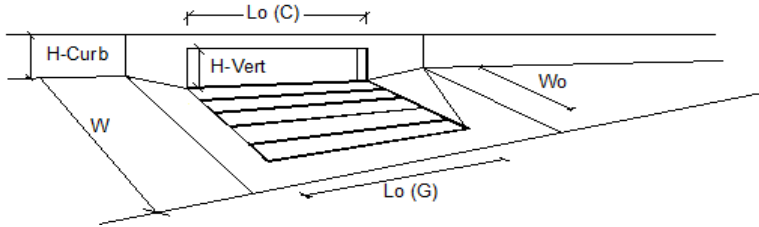
MINOR STORM Allowable Capacity is based on Depth Criterion
 MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q _{allow} =	13.6	40.2	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

MHFD-Inlet, Version 5.01 (April 2021)

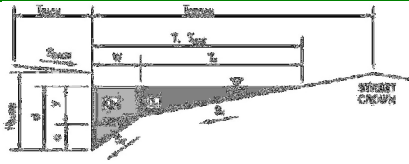


Design Information (Input)	MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a')	Type =	CDOT Type R Curb Opening		
Total Number of Units in the Inlet (Grate or Curb Opening)	a_{LOCAL} =	3.0	3.0	inches
Length of a Single Unit Inlet (Grate or Curb Opening)	No =	1	1	
Width of a Unit Grate (cannot be greater than W, Gutter Width)	L_o =	15.00	15.00	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_r-G =	N/A	N/A	
Street Hydraulics: OK - Q < Allowable Street Capacity	C_r-C =	0.10	0.10	
Total Inlet Interception Capacity	MINOR		MAJOR	
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q =	4.9	13.1	cfs
Capture Percentage = $Q_o/Q_o =$	Q_o =	0.0	6.5	cfs
	C% =	100	67	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

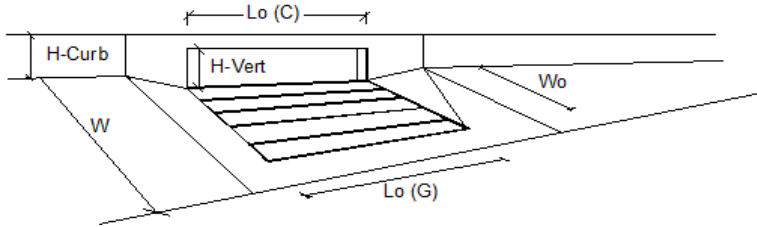
Inlet ID: **IN-A8**



Gutter Geometry:	
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 7.0$ ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.016$
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches
Distance from Curb Face to Street Crown	$T_{CROWN} = 26.0$ ft
Gutter Width	$W = 2.00$ ft
Street Transverse Slope	$S_X = 0.020$ ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	$S_W = 0.083$ ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	$S_O = 0.007$ ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$
Max. Allowable Spread for Minor & Major Storm	$T_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 19.3 & 26.0 \end{matrix}$ ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	$d_{MAX} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 6.0 & 7.7 \end{matrix}$ inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	<input type="checkbox"/> <input type="checkbox"/>
MINOR STORM Allowable Capacity is based on Depth Criterion	
MAJOR STORM Allowable Capacity is based on Depth Criterion	
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'	
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'	
	$Q_{allow} = \begin{matrix} \text{Minor Storm} & \text{Major Storm} \\ 11.5 & 26.9 \end{matrix}$ cfs

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

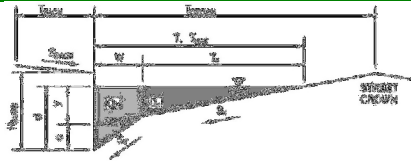


Design Information (Input)	MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a')	Type =	CDOT Type R Curb Opening		
Total Number of Units in the Inlet (Grate or Curb Opening)	a_{LOCAL} =	3.0	3.0	inches
Length of a Single Unit Inlet (Grate or Curb Opening)	No =	1	1	
Width of a Unit Grate (cannot be greater than W, Gutter Width)	L_o =	15.00	15.00	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_r-G =	N/A	N/A	
Street Hydraulics: OK - Q < Allowable Street Capacity'	C_r-C =	0.10	0.10	
Total Inlet Interception Capacity	MINOR		MAJOR	
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q =	5.1	13.6	cfs
Capture Percentage = Q_i/Q_o =	Q_o =	0.0	6.2	cfs
	C% =	100	69	%

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)
 (Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:

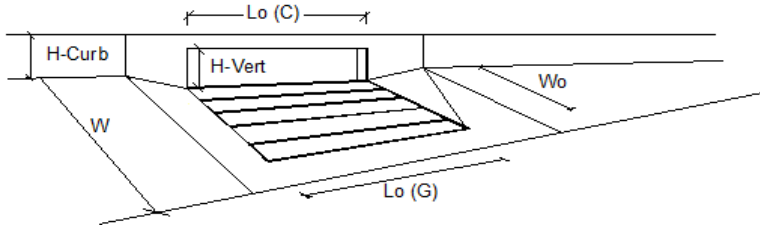
Inlet ID: **IN-A11**



Gutter Geometry:					
Maximum Allowable Width for Spread Behind Curb	T _{BACK} = 15.0 ft				
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S _{BACK} = 0.020 ft/ft				
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n _{BACK} = 0.016				
Height of Curb at Gutter Flow Line	H _{CURB} = 6.00 inches				
Distance from Curb Face to Street Crown	T _{CROWN} = 38.0 ft				
Gutter Width	W = 2.00 ft				
Street Transverse Slope	S _X = 0.020 ft/ft				
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S _W = 0.083 ft/ft				
Street Longitudinal Slope - Enter 0 for sump condition	S _O = 0.012 ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n _{STREET} = 0.016				
Max. Allowable Spread for Minor & Major Storm	T _{MAX} = <table border="1"><tr><th>Minor Storm</th><th>Major Storm</th></tr><tr><td>33.0</td><td>38.0</td></tr></table> ft	Minor Storm	Major Storm	33.0	38.0
Minor Storm	Major Storm				
33.0	38.0				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d _{MAX} = <table border="1"><tr><th>Minor Storm</th><th>Major Storm</th></tr><tr><td>6.0</td><td>9.1</td></tr></table> inches	Minor Storm	Major Storm	6.0	9.1
Minor Storm	Major Storm				
6.0	9.1				
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	<input type="checkbox"/> <input type="checkbox"/>				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'	Q _{allow} = <table border="1"><tr><th>Minor Storm</th><th>Major Storm</th></tr><tr><td>15.1</td><td>63.3</td></tr></table> cfs	Minor Storm	Major Storm	15.1	63.3
Minor Storm	Major Storm				
15.1	63.3				
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'					

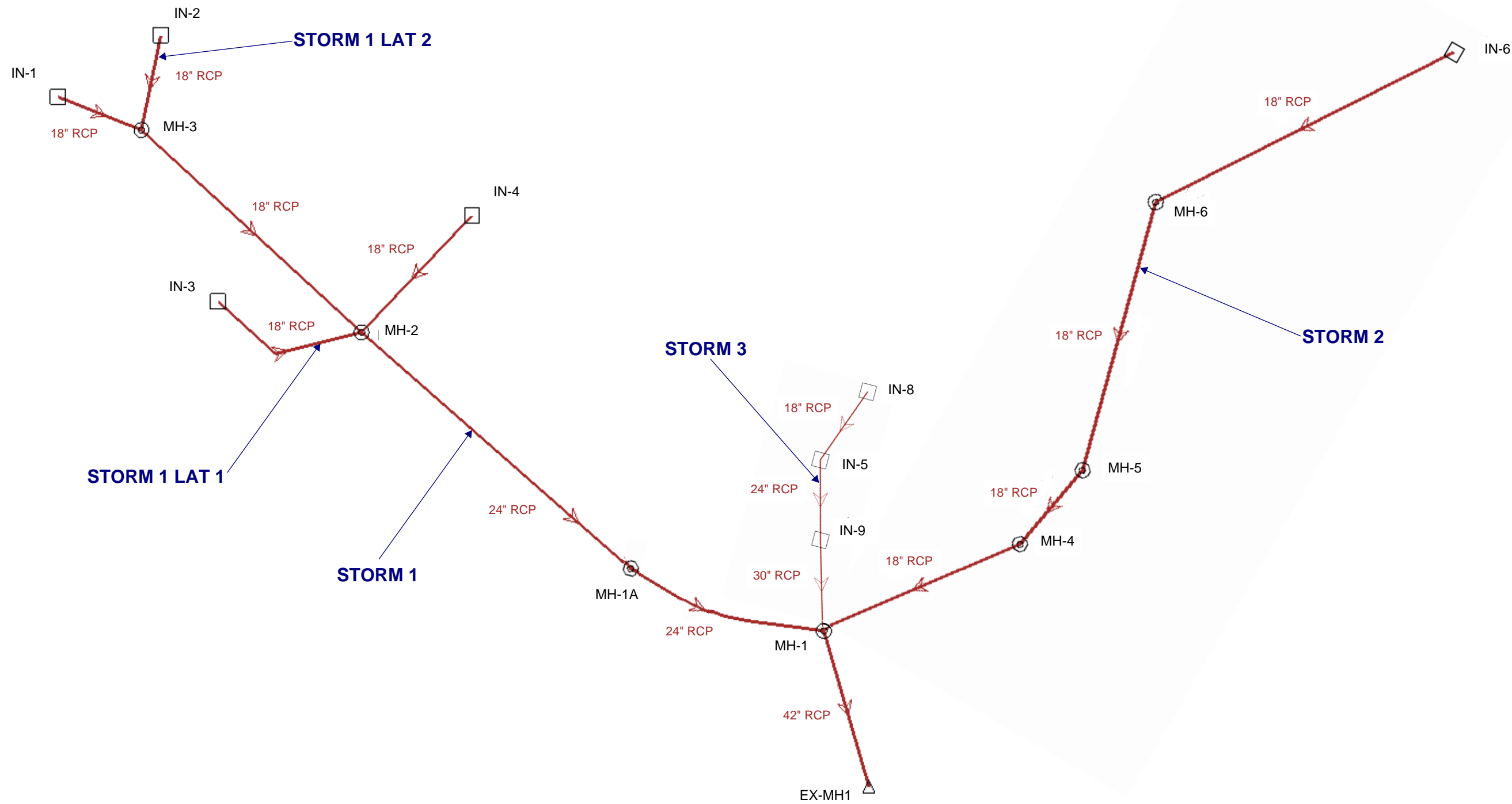
INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)

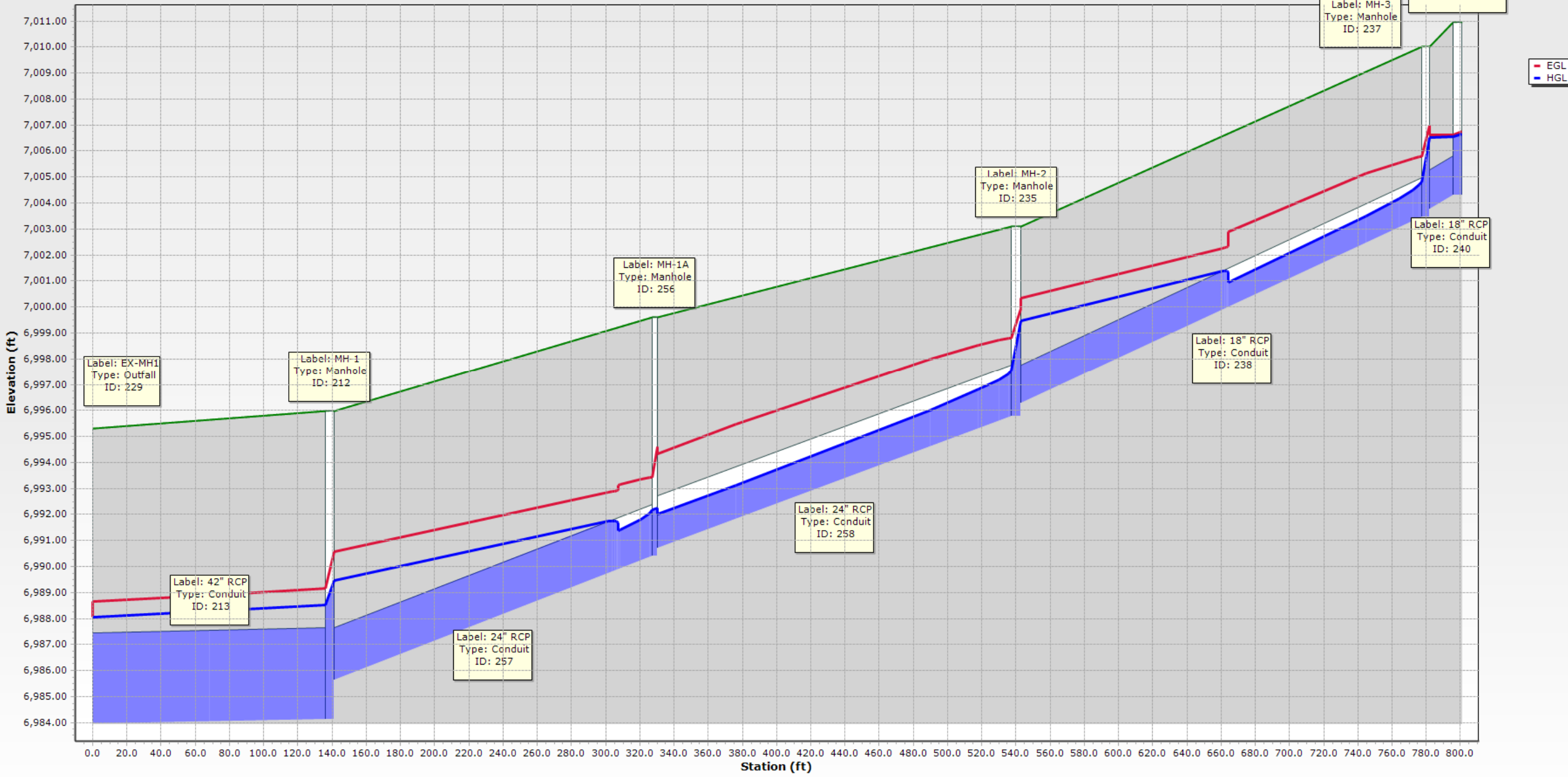


Design Information (Input)	MINOR		MAJOR	
Type of Inlet	CDOT Type R Curb Opening			
Local Depression (additional to continuous gutter depression 'a')	$a_{LOCAL} =$	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	$L_o =$	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)	$C_r-G =$	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C_r-C =$	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity				
Total Inlet Interception Capacity	$Q =$	7.6	14.7	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_o =$	0.1	8.1	cfs
Capture Percentage = $Q_i/Q_o =$	$C\% =$	98	65	%

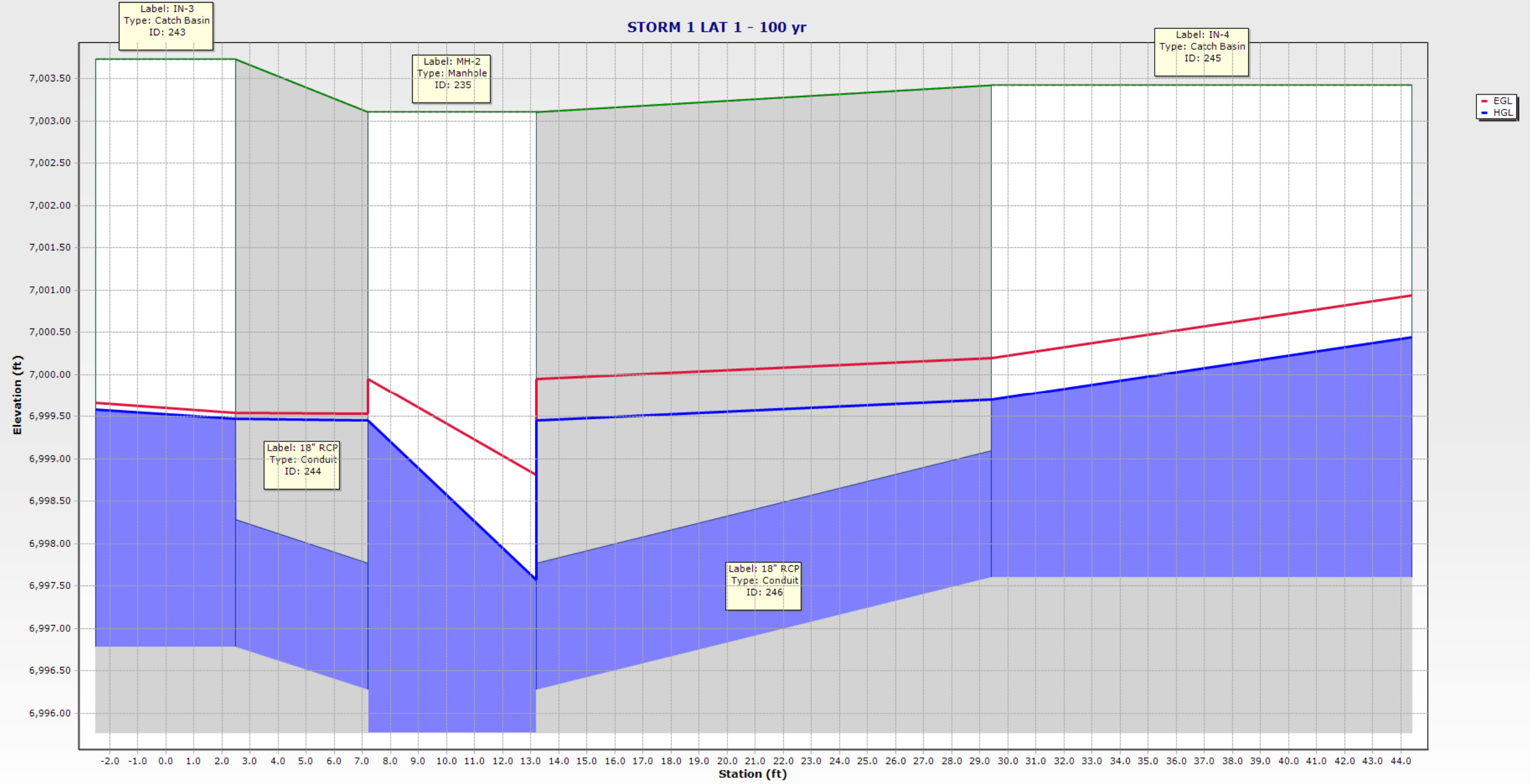
STORM NETWORK LAYOUT



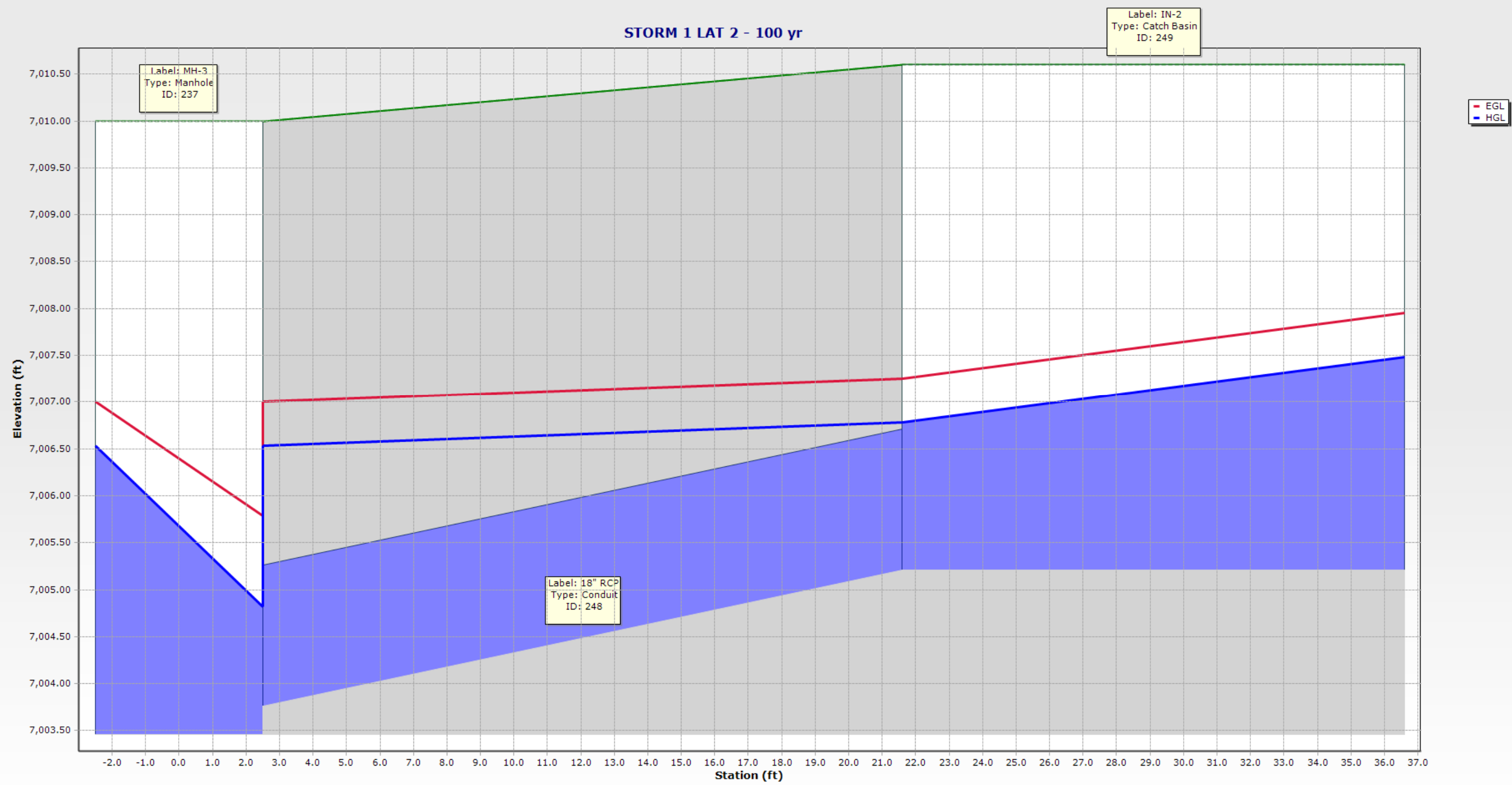
STORM 1 - 100 yr



STORM 1 LAT 1 - 100 yr



STORM 1 LAT 2 - 100 yr

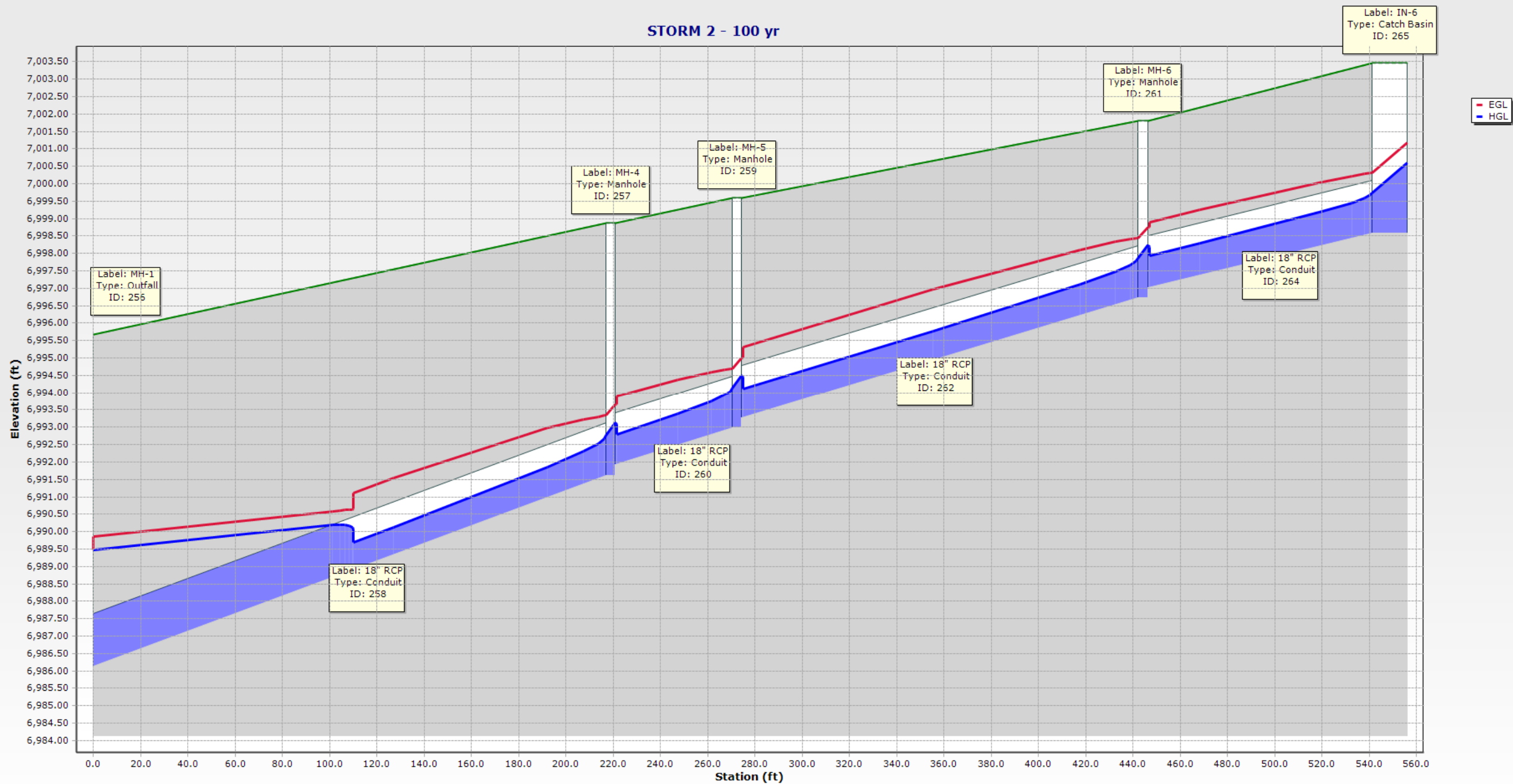


STORM 1: 100 YR FLEX TABLE

Conduit FlexTable: STRM 1,2,3 - 100YR

Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number	Depth (Normal) (ft)	Depth (Critical) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)
18" RCP	238	MH-3	13.30	73.1	239.5	11.25	(N/A)	0.95	1.36	7,005.79	7,000.33	7,004.82	6,999.45	5.37
18" RCP	240	IN-1	3.80	21.1	18.7	2.15	(N/A)	0.47	0.75	7,006.63	7,006.61	7,006.56	7,006.53	0.02
18" RCP	244	IN-3	3.90	16.6	10.2	2.21	(N/A)	0.41	0.76	6,999.54	6,999.53	6,999.47	6,999.45	0.01
18" RCP	246	IN-4	10.00	42.7	26.7	5.66	(N/A)	0.68	1.22	7,000.19	6,999.95	6,999.70	6,999.45	0.24
18" RCP	248	IN-2	9.70	41.4	29.1	5.49	(N/A)	0.67	1.20	7,007.25	7,007.00	7,006.78	7,006.53	0.25
24" RCP	257	MH-1A	26.60	74.3	190.2	12.48	(N/A)	1.28	1.80	6,993.44	6,990.59	6,992.20	6,989.48	2.72
24" RCP	258	MH-2	26.60	76.0	211.3	12.26	(N/A)	1.30	1.80	6,998.81	6,994.35	6,997.57	6,992.01	5.56
42" RCP	213	MH-1	60.50	166.9	138.6	6.29	(N/A)	(N/A)	2.44	6,989.16	6,988.65	6,988.54	6,988.04	0.50
Upstream Structure Hydraulic Grade Line (In) (ft)	Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Conduit Description						
7,006.53	5.49	1.770	1.71	7,003.11	7,010.00	6,996.27	7,003.46	Circle - 18.0 in						
7,006.67	2.15	1.500	0.11	7,010.00	7,010.95	7,003.76	7,004.31	Circle - 18.0 in						
6,999.58	2.21	1.500	0.11	7,003.11	7,003.73	6,996.27	6,996.78	Circle - 18.0 in						
7,000.44	5.66	1.500	0.75	7,003.11	7,003.42	6,996.27	6,997.60	Circle - 18.0 in						
7,007.49	5.49	1.500	0.70	7,010.00	7,010.60	7,003.76	7,005.21	Circle - 18.0 in						
6,992.26	12.26	0.050	0.06	6,995.98	6,999.59	6,985.64	6,990.40	Circle - 24.0 in						
6,999.45	5.66	1.520	1.88	6,999.59	7,003.11	6,990.71	6,995.77	Circle - 24.0 in						
6,989.48	8.47	1.520	0.93	6,995.29	6,995.98	6,983.96	6,984.14	Circle - 42.0 in						

STORM 2 - 100 yr

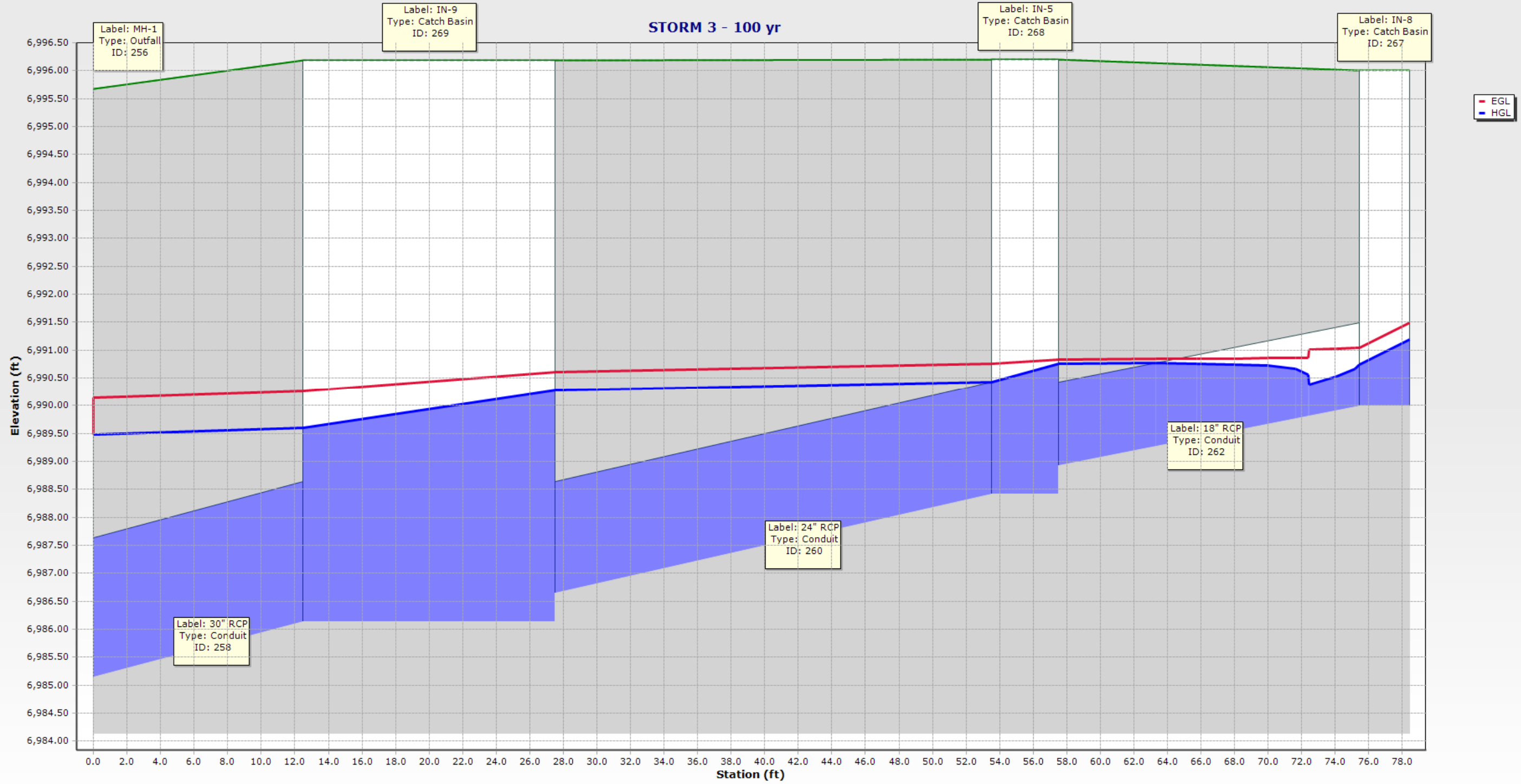


STORM 2: 100 YR FLEX TABLE

Conduit FlexTable: STRM 1,2,3 - 100YR

Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number	Depth (Normal) (ft)	Depth (Critical) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)
18" RCP	258	MH-4	8.80	53.0	219.0	9.54	(N/A)	0.78	1.15	6,993.34	6,989.87	6,992.77	6,989.48	3.29
18" RCP	260	MH-5	8.80	59.5	53.4	8.74	(N/A)	0.83	1.15	6,994.70	6,993.65	6,994.13	6,993.13	0.99
18" RCP	262	MH-6	8.80	59.2	171.8	8.76	(N/A)	0.83	1.15	6,998.44	6,995.01	6,997.87	6,994.49	3.38
18" RCP	264	IN-6	8.80	68.3	104.4	7.85	(N/A)	0.91	1.15	7,000.31	6,998.75	6,999.74	6,998.23	1.50
Upstream Structure Hydraulic Grade Line (In) (ft)	Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Conduit Description						
6,993.13	5.74	0.640	0.37	6,995.68	6,998.87	6,986.14	6,991.62	Circle - 18.0 in						
6,994.49	5.74	0.640	0.37	6,998.87	6,999.60	6,991.92	6,992.98	Circle - 18.0 in						
6,998.23	5.74	0.640	0.37	6,999.60	7,001.80	6,993.28	6,996.72	Circle - 18.0 in						
7,000.59	6.06	1.500	0.86	7,001.80	7,003.46	6,997.02	6,998.59	Circle - 18.0 in						

STORM 3 - 100 yr



STORM 3: 100 YR FLEX TABLE

Conduit FlexTable: STRM 1,2,3 - 100YR

Label	ID	Upstream Structure	Flow (cfs)	Flow / Capacity (Design) (%)	Length (Unified) (ft)	Velocity (ft/s)	Froude Number	Depth (Normal) (ft)	Depth (Critical) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss (ft)
18" RCP	262	IN-8	3.90	16.6	21.4	9.84	(N/A)	0.41	0.76	6,991.04	6,990.83	6,990.75	6,990.76	-0.01
24" RCP	260	IN-5	14.40	28.4	35.5	4.58	(N/A)	0.73	1.37	6,990.75	6,990.61	6,990.42	6,990.28	0.14
30" RCP	258	IN-9	32.10	35.0	20.0	6.54	(N/A)	1.02	1.93	6,990.27	6,990.14	6,989.60	6,989.48	0.12
Upstream Structure Hydraulic Grade Line (In) (ft)	Upstream Structure Velocity (In-Governing) (ft/s)	Upstream Structure Headloss Coefficient	Upstream Structure Headloss (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Conduit Description						
6,991.19	4.37	1.500	0.45	6,996.20	6,996.00	6,988.92	6,989.99	Circle - 18.0 in						
6,990.76	2.21	1.020	0.33	6,996.19	6,996.20	6,986.64	6,988.42	Circle - 24.0 in						
6,990.28	4.58	1.020	0.68	6,995.68	6,996.19	6,985.14	6,986.14	Circle - 30.0 in						

BACKGROUND

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

Subdivision: Sterling Ranch Filing No. 2
 Location: El Paso County
 Design Storm: 5-Year

Project Name: Sterling Ranch Subdivision
 Project No.: 25188.01
 Calculated By: AAM
 Checked By:
 Date: 1/5/21

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE			TRAVEL TIME			REMARKS	
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (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)
	1	A1	2.06	0.51	9.7	1.05	4.17	4.4				0.2	0.04	3.3	4.2	1.01	2.0	18	652	3.6	3.0	0.0	On-grade inlet, carryover flow to DP 5 Piped to DP 1.0
	2	A2	0.82	0.53	9.1	0.44	4.27	1.9							1.9	0.44	2.0	18	27	5.8	0.1	0.0	On-grade inlet Piped to DP 1.0
	1.0								9.7	1.45	4.17	6.0			6.0	1.45	3.0	18	335	9.1	0.6	0.0	Sum of DP 1 & DP 2, piped to DP 1.2
	3	A3	6.76	0.47	15.0	3.16	3.53	11.1				1.6	0.47	2.9	9.5	2.69	4.7	18	426	3.4	2.1	0.0	On-grade inlet, carryover flow to DP 5 Piped to DP 1.1
	4	A4	1.51	0.60	10.2	0.91	4.10	3.7				0.1	0.03	2.9	3.6	0.88	4.7	18	395	3.4	1.9	0.0	On-grade inlet, carryover flow to DP 5 Piped to DP 1.1
	1.1								15.0	3.57	3.52	12.6			12.6	3.57	1.0	24	74	7.4	0.2	0.0	Sum of DP 3 & DP 4, piped to DP 1.2
	1.2								15.2	5.02	3.50	17.6			17.6	5.02	3.3	24	319	12.5	0.4	0.0	Sum of DP 1.0 & DP 1.1, piped to DP 1.3
	6A	A6A	0.53	0.81	5.0	0.43	5.17	2.2															Overland Flow to DP1.3A
	6	A6	1.37	0.58	10.0	0.79	4.14	3.3							3.3	0.79	2.0	18	0	6.7	0.0	0.0	On-grade inlet Sum of Sub-basin A6 & Carryover flow from DP 2, Piped to DP 1.3A
	1.3A								10.0	1.22	4.14	5.0			5.0	1.22	1.0	24	36	5.7	0.1	0.0	Sum of DP 6 & DP 6A, piped to DP 1.3
	5	A5	1.70	0.59	9.9	0.99	4.14	4.1	17.0	1.53	3.33	5.1			5.1	1.53	2.0	18	0	7.6	0.0	0.0	On-grade inlet Sum of Sub-basin A5 & Carryover flows from DP 1, P 3 & DP 4. Piped to DP 1.3
	1.3								17.0	7.77	3.33	25.9			25.9	7.77	1.1	36	620	9.2	1.1	0.0	Sum of DP 1.2, 1.3A & DP 5, piped to DP 1.4
	7	A7	19.00	0.45	18.3	8.55	3.22	27.5							27.5	8.55	1.5	42	20	10.3	0.0	0.0	Future storm infrastructure from Copper Chase Subdivision Piped to DP 1.4
	1.4								18.4	16.32	3.22	52.5			52.5	16.32	0.5	48	26	8.2	0.1	0.0	Sum of DP 1.3 & DP 7, piped to DP 1.5
	8	A8	1.48	0.56	13.9	0.83	3.63	3.0							3.0	0.83	2.0	18	20	6.6	0.1	0.0	On-grade inlet, carryover flow to DP 11 Piped to DP 1.5
	1.5								18.4	17.15	3.21	55.1			55.1	17.15	0.5	48	91	8.3	0.2	0.0	Sum of DP 1.4 & DP 8, piped to DP 1.6
	9	A9	0.61	0.73	8.7	0.44	4.34	1.9	8.7	0.48	4.34	2.1			2.1	0.48	2.0	18	13	5.8	0.0	0.0	On-grade inlet Sum of Sub-basin A9 & carryover flows from DP 16, piped to DP 1.6
	1.6								18.6	17.63	3.20	56.4			56.4	17.63	0.5	48	95	8.3	0.2	0.0	Sum of DP 1.5 & DP 9, piped to DP 1.8
	10	A10	2.61	0.79	7.9	2.05	4.49	9.2				0.5	0.11	1.5	8.7	1.94	2.5	18	955	2.4	6.5	0.2	On-grade inlet, carryover flow to DP 20 Piped to DP 1.7
	11	A11	2.89	0.76	8.7	2.20	4.34	9.5				0.6	0.15	1.5	8.9	2.05	2.5	18	1049	2.4	7.1	0.0	On-grade inlet, carryover flow to DP 21 Piped to DP 1.7
	1.7								8.7	3.99	4.34	17.3			17.3	3.99	1.0	24	8	7.9	0.0	0.0	Sum of DP 10 & DP 11, piped to DP 1.8
	1.8								18.8	21.63	3.18	68.8			68.8	21.63	2.0	54	517	14.4	0.6	0.0	Sum of DP 1.6 & DP 1.7, piped to DP 2.7
	OS2	OS2	17.00	0.49	14.0	6.25	2.20	13.8							13.8	6.25	1.0	30	787	7.5	1.7	0.0	Future flow released from Barbarick Subdivision Piped to DP 2.0
	12	A12	3.87	0.13	11.9	0.49	3.86	1.9							1.9	0.49	2.0	18	17	5.6	0.1	0.0	Type C Inlet Piped to DP 2.0
	2.0								15.7	6.74	3.45	23.2			23.2	6.74	1.0	48	52	8.4	0.1	0.0	Sum of DP OS2 & DP 12, Piped to DP 2.1
	13	A13	9.65	0.45	14.0	4.34	3.62	15.7							15.7	4.34	1.5	30	200	9.1	0.4	0.0	Future storm infrastructure from Sterling Ranch Phase 2 Piped to DP 2.1

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

Subdivision: Sterling Ranch Filing No. 2
 Location: El Paso County
 Design Storm: 5-Year

Project Name: Sterling Ranch Subdivision
 Project No.: 25188.01
 Calculated By: AAM
 Checked By:
 Date: 8/16/21

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (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 _c (min)	
	2.1							15.9	11.08	3.44	38.1				38.1	11.08	1.6	48	65	11.4	0.1	Sum of DP 2.0 & DP 13, piped to DP 2.5	
	OS3	OS3	28.70	0.49	19.0	14.06	1.25	17.6							17.6	14.06	1.0	30	719	8.0	1.5	Future flow released from Barbarick Subdivision Piped to DP 2.2	
	14	A14	11.76	0.39	15.3	4.59	3.49	16.0							16.0	4.59	1.0	30	20	7.8	0.0	Future flow released from School Site Piped to DP 2.2	
	2.2							20.5	18.65	3.05	56.9				56.9	18.65	1.5	48	773	12.4	1.0	Sum of DP OS3 & DP 14, piped to DP 2.3	
	15	A15	2.91	0.52	14.9	1.52	3.53	5.4							5.4	1.52	1.3	18	35	6.5	0.1	On-grade inlet Piped to DP 2.3	
	16	A16	2.34	0.54	14.7	1.25	3.55	4.4				0.1	0.04	0.8	4.3	1.21	2.0	18	697	1.8	6.5	On-grade inlet, carryover flow to DP 9 Piped to DP 2.3	
	2.3							15.0	2.73	3.52	9.6				9.6	2.73	1.6	48	51	7.6	0.1	Sum of DP 15 & DP 16, piped to DP 2.4	
	2.4							21.5	21.38	2.98	63.7				63.7	21.38	1.6	48	19	13.1	0.0	Sum of DP 2.2 & DP 2.3, piped to DP 2.5	
	2.5							21.6	32.46	2.98	96.6				96.6	32.46	2.0	60	839	15.8	0.9	Sum of DP 2.1 & DP 2.4 piped to DP 2.6	
	17	A17	1.76	0.21	13.7	0.38	3.66	1.4							1.4	0.38	1.0	18	24	4.1	0.1	Type C inlet Piped to DP 2.6	
	2.6							21.6	32.84	2.98	97.8				97.8	32.84	2.0	60	32	15.8	0.0	Sum of DP 2.5 & DP 17, piped to DP 2.7	
	2.7							21.6	54.47	2.97	162.0				162.0	54.47	0.6	78	220	11.5	0.3	Sum of DP 1.8 & DP 2.6, piped to DP 2.8	
	18	A18	5.27	0.24	16.4	1.28	3.38	4.3							4.3	1.28	1.0	18	24	5.6	0.1	Area inlet Piped to DP 2.6	
	19	A19	31.85	0.45	25.8	14.33	2.71	38.8							38.8	14.33	1.0	18	24	22.0	0.0	Area inlet Piped to DP 2.6	
	2.8							25.8	70.08	2.71	189.8				189.8	70.08	0.6	78	145	12.1	0.2	Sum of DP 2.7, DP 18 & DP 19, piped to DP 3.0.	
	3.0							25.8	70.08	2.71	189.8	189.8	70.08	0.5					584	1.4	6.9	Detention Pond Trickle channel conveyance to DP 3.2	
	20	A20	1.83	0.81	8.0	1.48	4.47	6.6	8.0	1.59	4.47	7.1			7.1	1.59	1.0	24	105	6.4	0.3	On-grade inlet Sum of Sub-basin A20 & carryover flow from DP 10, piped to DP 3.0	
	21	A21	1.93	0.82	8.7	1.57	4.33	6.8	8.7	1.72	4.33	7.4	0.1	0.03	7.3	1.68	2.5	18	0	9.0	0.0	On-grade inlet Sum of Sub-basin A21 & carryover flow from DP 11, piped to DP 2.9	
	2.9							8.7	3.27	4.33	14.2				14.2	3.27	2.0	24	58	9.8	0.1	Sum of DP 20 & DP 21, piped to DP 3.1	
	3.1							8.7	3.27	4.33	14.2	14.2	3.27	0.5					568	1.4	6.7	Detention Pond Trickle channel conveyance to DP 3.2	
	22	A22	8.68	0.11	23.3	0.95	2.86	2.7														Detention Pond Overland flow to DP 3.2	
	OS4	OS4	5.08	0.20	29.5	1.02	2.51	2.6				2.6	1.02	13.0					113	5.4	0.3	Existing topography Overland flow to DP 4.1	
	3.2							29.8	75.32	2.49	187.5											Outlet Structure Sum of DP 3.0, DP 3.1, DP 22 & DP OS4, outlet structure release to DP 4.8	
	Pond W5							29.8	1.45	2.49	3.6				3.6	1.45	2.0	48	58	6.2	0.2	Outlet structure release to DP 4.8	
	23	B1	2.98	0.90	17.6	2.68	3.29	8.8				0.4	0.12	2.0	8.4	2.56	0.5	30	1399	2.0	12.0	On-grade inlet Piped to DP 4.0	

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

Subdivision: Sterling Ranch Filing No. 2
 Location: El Paso County
 Design Storm: 100-Year

Project Name: Sterling Ranch Subdivision
 Project No.: 25188.01
 Calculated By: AAM
 Checked By:
 Date: 1/5/21

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 _r (in/hr)	Q (cfs)	t _c (min)	C*A (ac)	I _r (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 _c (min)	
	1	A1	2.06	0.65	9.7	1.34	7.01	9.4					2.8	0.40	3.3	6.6	0.94	2.0	18	652	3.6	3.0	On-grade inlet, carryover flow to DP 5 Piped to DP 1.0
	2	A2	0.82	0.66	9.1	0.54	7.17	3.9					0.1	0.01	3.3	3.8	0.53	2.0	18	639	3.6	2.9	On-grade inlet, carryover flow to DP 6 Piped to DP 1.0
	1.0								9.7	1.47	7.00	10.3				10.3	1.47	3.0	18	335	10.6	0.5	Sum of DP 1 & DP 2, piped to DP 1.2
	3	A3	6.76	0.62	15.0	4.17	5.92	24.7					10.0	1.69	2.9	14.7	2.48	4.7	18	426	3.4	2.1	On-grade inlet, carryover flow to DP 5 Piped to DP 1.1
	4	A4	1.51	0.71	10.2	1.08	6.88	7.4					1.6	0.24	2.9	5.8	0.84	4.7	18	395	3.4	1.9	On-grade inlet, carryover flow to DP 5 Piped to DP 1.1
	1.1								15.0	3.33	5.91	19.7				19.7	3.33	1.0	24	74	8.1	0.2	Sum of DP 3 & DP 4, piped to DP 1.2
	1.2								15.1	4.80	5.89	28.2				28.2	4.80	3.3	24	319	13.9	0.4	Sum of DP 1.0 & DP 1.1, piped to DP 1.3
	6A	A6A	0.53	0.88	5.0	0.47	8.68	4.1															Overland Flow to DP1.3A
	6	A6	1.37	0.70	10.0	0.95	6.94	6.6	10.0	0.96	6.94	6.7	1.3	0.18	0.7	5.4	0.78	2.0	18	696	1.7	7.0	On-grade inlet, carryover flow to DP 8 Sum of Sub-basin A6 & Carryover flow from DP 2, Piped to DP 1.3A
	1.3A								10.0	1.25	6.94	8.7				8.7	1.25	1.0	24	36	6.7	0.1	Sum of DP 6 & DP 6A, piped to DP 1.3
	5	A5	1.70	0.70	9.9	1.19	6.95	8.3	17.0	3.51	5.59	19.6	6.5	1.17	0.7	13.1	2.34	2.0	18	664	1.7	6.6	On-grade inlet, carryover flow to DP 8 Sum of Sub-basin A5 & Carryover flows from DP 1, P 3 & DP 4. Piped to DP 1.3
	1.3								17.0	8.39	5.59	46.9				46.9	8.39	1.1	36	620	10.7	1.0	Sum of DP 1.2, 1.3A & DP 5, piped to DP 1.4
	7	A7	19.00	0.59	18.3	11.21	5.41	60.6								60.6	11.21	1.5	42	20	12.7	0.0	Future storm infrastructure from Copper Chase Subdivision Piped to DP 1.4
	1.4								18.4	19.60	5.40	105.9				105.9	19.60	0.5	48	26	9.2	0.0	Sum of DP 1.3 & DP 7, piped to DP 1.5
	8	A8	1.48	0.70	13.9	1.04	6.10	6.3	23.7	2.63	4.76	12.5	1.9	0.41	0.7	10.6	2.23	2.0	18	195	1.7	1.9	On-grade inlet, carryover flow to DP 11 Sum of Sub-basin A8 & Carryover flows from DP5, DP 6 & DP 15, Piped to DP 1.5
	1.5								23.7	21.83	4.76	103.9				103.9	21.83	0.5	48	91	9.2	0.2	Sum of DP 1.4 & DP 8, piped to DP 1.6
	9	A9	0.61	0.83	8.7	0.51	7.29	3.7	21.2	0.95	5.04	4.8	0.3	0.05	0.7	4.5	0.89	2.0	18	140	1.7	1.4	On-grade inlet, carryover flow to DP 11 Sum of Sub-basin A9 & carryover flows from DP 16, piped to DP 1.6
	1.6								23.9	22.72	4.74	107.7				107.7	22.72	0.5	48	95	9.1	0.2	Sum of DP 1.5 & DP 9, piped to DP 1.8
	10	A10	2.61	0.88	7.9	2.29	7.53	17.3					4.5	0.59	1.5	12.8	1.70	2.5	18	955	2.4	6.5	On-grade inlet, carryover flow to DP 20 Piped to DP 1.7
	11	A11	2.89	0.86	8.7	2.48	7.28	18.1	10.6	2.94	6.77	19.9	6.1	0.90	1.5	13.8	2.04	2.5	18	118	10.3	0.2	On-grade inlet, carryover flow to DP 21 Sum of Sub-basin A11 & carryover flows from DP 8 & DP 9, piped to DP 1.7
	1.7								10.6	3.74	6.77	25.3				25.3	3.74	1.0	24	8	8.1	0.0	Sum of DP 10 & DP 11, piped to DP 1.8
	1.8								24.0	26.45	4.72	125.0				125.0	26.45	2.0	54	517	17.0	0.5	Sum of DP 1.6 & DP 1.7, piped to DP 2.7
	OS2	OS2	17.00	0.62	12.0	10.54	3.71	39.1								39.1	10.54	1.0	30	787	9.5	1.4	Future flow released from Barbarick Subdivision Piped to DP 2.0
	12	A12	3.87	0.38	11.9	1.47	6.49	9.5								9.5	1.47	2.0	18	17	8.9	0.0	Type C inlet Piped to DP 2.0
	2.0								13.4	12.01	6.20	74.5				74.5	12.01	1.0	48	52	11.6	0.1	Sum of DP OS2 & DP 12, Piped to DP 2.1
	13	A13	9.65	0.59	14.0	5.69	6.08	34.6								34.6	5.69	1.5	30	200	11.0	0.3	Future storm infrastructure from Sterling Ranch Phase 2 Piped to DP 2.1

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

Subdivision: Sterling Ranch Filing No. 2
 Location: El Paso County
 Design Storm: 100-Year

Project Name: Sterling Ranch Subdivision
 Project No.: 25188.01
 Calculated By: AAM
 Checked By:
 Date: 8/16/21

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)	t _c (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)	
	2.1							14.3	17.70	6.02	106.6				106.6	17.70	1.6	48	65	15.1	0.1	Sum of DP 2.0 & DP 13, piped to DP 2.5
	OS3	OS3	28.70	0.62	15.0	17.79	2.75	48.9							48.9	17.79	1.0	30	719	10.0	1.2	Future flow released from Barbarick Subdivision Piped to DP 2.2
	14	A14	11.76	0.55	15.3	6.47	5.86	37.9							37.9	6.47	1.0	30	20	9.5	0.0	Future flow released from School Site Piped to DP 2.2
	2.2							16.2	24.26	5.72	138.7				138.7	24.26	1.5	48	773	15.5	0.8	Sum of DP OS3 & DP 14, piped to DP 2.3
	15	A15	2.91	0.68	14.9	1.98	5.93	11.7				1.4	0.24	0.7	10.3	1.74	1.3	18	35	7.6	0.1	On-grade inlet, carryover flow to DP 8 Piped to DP 2.3
	16	A16	2.34	0.69	14.7	1.61	5.96	9.6				2.6	0.44	0.8	7.0	1.17	2.0	18	12	8.2	0.0	On-grade inlet, carryover flow to DP 9 Piped to DP 2.3
	2.3							15.0	2.91	5.91	17.2				17.2	2.91	1.6	48	15	9.0	0.0	Sum of DP 15 & DP 16, piped to DP 2.4
	2.4							17.0	27.17	5.59	151.9				151.9	27.17	1.6	48	19	16.2	0.0	Sum of DP 2.2 & DP 2.3, piped to DP 2.5
	2.5							17.1	44.87	5.59	250.7				250.7	44.87	2.0	60	839	20.1	0.7	Sum of DP 2.1 & DP 2.4 piped to DP 2.6
	17	A17	1.76	0.44	13.7	0.77	6.14	4.7							4.7	0.77	1.0	18	24	5.7	0.1	Type C inlet Piped to DP 2.6
	2.6							17.7	45.64	5.49	250.4				250.4	45.64	2.0	60	32	20.2	0.0	Sum of DP 2.5 & DP 17, piped to DP 2.7
	2.7							24.5	72.10	4.67	336.8				336.8	72.10	0.6	78	220	13.7	0.3	Sum of DP 1.8 & DP 2.6, piped to DP 2.8
	18	A18	5.27	0.47	16.4	2.47	5.68	14.0							14.0	2.47	1.0	18	24	7.9	0.1	Area inlet Piped to DP 2.6
	19	A19	31.85	0.59	25.8	18.79	4.55	85.4							85.4	18.79	1.0	18	24	48.4	0.0	Area inlet Piped to DP 2.6
	2.8							25.8	93.36	4.55	424.4				424.4	93.36	0.6	78	145	13.9	0.2	Sum of DP 2.7, DP 18 & DP 19, piped to DP 3.0.
	3.0							25.8	93.36	4.55	424.4	424.4	93.36	0.5					564	1.4	6.6	Detention Pond Trickle channel conveyance to DP 3.2
	20	A20	1.83	0.89	8.0	1.63	7.50	12.2	14.4	2.22	6.02	13.4			11.1	1.84	1.0	24	105	7.2	0.2	On-grade inlet Sum of Sub-basin A20 & carryover flow from DP 10, piped to DP 3.0
	21	A21	1.93	0.90	8.7	1.73	7.28	12.6	15.8	2.63	5.77	15.2			11.9	2.06	2.5	18	0	10.2	0.0	On-grade inlet Sum of Sub-basin A21 & carryover flow from DP 11, piped to DP 2.9
	2.9							15.8	3.91	5.77	22.5				22.5	3.91	2.0	24	58	11.0	0.1	Sum of DP 20 & DP 21, piped to DP 3.1
	3.1							15.8	3.91	5.77	22.5	22.5	3.91	0.5					568	1.4	6.7	Detention Pond Trickle channel conveyance to DP 3.2
	22	A22	8.68	0.37	23.3	3.21	4.80	15.4														Detention Pond Overland flow to DP 3.2
	OS4	OS4	5.08	0.40	29.5	2.03	4.21	8.5				8.5	2.03	13.0					113	5.4	0.3	Existing topography Overland flow to DP 3.2
	3.2							29.8	102.50	4.18	428.2											Outlet Structure Sum of DP 3.0, DP 3.1, DP 22 & DP OS4, outlet structure release to DP 4.8
	Pond W5							29.8	34.84	4.18	145.5				145.5	34.84	2.0	48	58	17.5	0.1	Outlet structure release to DP 4.8
	23	B1	2.98	0.96	17.6	2.86	5.51	15.8				3.6	0.65	2.0	12.2	2.21	0.5	30	1394	2.1	11.0	On-grade inlet Piped to DP 4.0
	24	B2	3.89	0.96	17.6	3.73	5.51	20.6				6.5	1.17	2.0	14.1	2.56	2.0	30	1394	2.1	11.0	On-grade inlet Piped to DP 4.0

EXISTING CONDITIONS PIPE ROUTING FOR COMPARISON (5 YEAR) BY J.R. ENGINEERING (APPROVED NOVEMBER 2021)

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

Subdivision: Sterling Ranch Filing No. 2
Location: El Paso County
Design Storm: 5-Year

Project Name: Sterling Ranch Subdivision
Project No.: 25188.01
Calculated By: AAM
Checked By:
Date: 1/5/21

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET/SWALE			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t _c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	t _c (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 _c (min)	
	1	A1	2.06	0.51	9.7	1.05	4.17	4.4				0.2	0.04	3.3	4.2	1.01	2.0	18	652	3.6	3.0	0.0	On-grade inlet, carryover flow to DP 5 Piped to DP 1.0
	2	A2	0.82	0.53	9.1	0.44	4.27	1.9							1.9	0.44	2.0	18	27	5.8	0.1	0.0	On-grade inlet Piped to DP 1.0
	1.0								9.7	1.45	4.17	6.0			6.0	1.45	3.0	18	335	9.1	0.6	0.0	Sum of DP 1 & DP 2, piped to DP 1.2
	3	A3	6.76	0.47	15.0	3.16	3.53	11.1				1.6	0.47	2.9	9.5	2.69	4.7	18	426	3.4	2.1	0.0	On-grade inlet, carryover flow to DP 5 Piped to DP 1.1
	4	A4	1.51	0.60	10.2	0.91	4.10	3.7				0.1	0.03	2.9	3.6	0.88	4.7	18	395	3.4	1.9	0.0	On-grade inlet, carryover flow to DP 5 Piped to DP 1.1
	1.1								15.0	3.57	3.52	12.6			12.6	3.57	1.0	24	74	7.4	0.2	0.0	Sum of DP 3 & DP 4, piped to DP 1.2
	1.2								15.2	5.02	3.50	17.6			17.6	5.02	3.3	24	319	12.5	0.4	0.0	Sum of DP 1.0 & DP 1.1, piped to DP 1.3
	6A	A6A	0.53	0.81	5.0	0.43	5.17	2.2															Overland Flow to DP1.3A
	6	A6	1.37	0.58	10.0	0.79	4.14	3.3							3.3	0.79	2.0	18	0	6.7	0.0	0.0	On-grade inlet Sum of Sub-basin A6 & Carryover flow from DP 2, Piped to DP 1.3A
	1.3A								10.0	1.22	4.14	5.0			5.0	1.22	1.0	24	36	5.7	0.1	0.0	Sum of DP 6 & DP 6A, piped to DP 1.3
	5	A5	1.70	0.59	9.9	0.99	4.14	4.1	17.0	1.53	3.33	5.1			5.1	1.53	2.0	18	0	7.6	0.0	0.0	On-grade inlet Sum of Sub-basin A5 & Carryover flows from DP 1, P 3 & DP 4. Piped to DP 1.3
	1.3								17.0	7.77	3.33	25.9			25.9	7.77	1.1	36	620	9.2	1.1	0.0	Sum of DP 1.2, 1.3A & DP 5, piped to DP 1.4
	7	A7	19.00	0.45	18.3	8.55	3.22	27.5							27.5	8.55	1.5	42	20	10.3	0.0	0.0	Future storm infrastructure from Copper Chase Subdivision Piped to DP 1.4
	1.4								18.4	16.32	3.22	52.5			52.5	16.32	0.5	48	26	8.2	0.1	0.0	Sum of DP 1.3 & DP 7, piped to DP 1.5
	8	A8	1.48	0.56	13.9	0.83	3.63	3.0							3.0	0.83	2.0	18	20	6.6	0.1	0.0	On-grade inlet, carryover flow to DP 11 Piped to DP 1.5
	1.5								18.4	17.15	3.21	55.1			55.1	17.15	0.5	48	91	8.3	0.2	0.0	Sum of DP 1.4 & DP 8, piped to DP 1.6
	9	A9	0.61	0.73	8.7	0.44	4.34	1.9	8.7	0.48	4.34	2.1			2.1	0.48	2.0	18	13	5.8	0.0	0.0	On-grade inlet Sum of Sub-basin A9 & carryover flows from DP 16, piped to DP 1.6
	1.6								18.6	17.63	3.20	56.4			56.4	17.63	0.5	48	95	8.3	0.2	0.0	Sum of DP 1.5 & DP 9, piped to DP 1.8
	10	A10	2.61	0.79	7.9	2.05	4.49	9.2				0.5	0.11	1.5	8.7	1.94	2.5	18	955	2.4	6.5	0.2	On-grade inlet, carryover flow to DP 20 Piped to DP 1.7
	11	A11	2.89	0.76	8.7	2.20	4.34	9.5				0.6	0.15	1.5	8.9	2.05	2.5	18	1049	2.4	7.1	0.0	On-grade inlet, carryover flow to DP 21 Piped to DP 1.7
	1.7								8.7	3.99	4.34	17.3			17.3	3.99	1.0	24	8	7.9	0.0	0.0	Sum of DP 10 & DP 11, piped to DP 1.8
	1.8								18.8	21.63	3.18	68.8			68.8	21.63	2.0	54	517	14.4	0.6	0.0	Sum of DP 1.6 & DP 1.7, piped to DP 2.7
	OS2	OS2	17.00	0.49	14.0	6.25	2.20	13.8							13.8	6.25	1.0	30	787	7.5	1.7	0.0	Future flow released from Barbarick Subdivision Piped to DP 2.0
	12	A12	3.87	0.13	11.9	0.49	3.86	1.9							1.9	0.49	2.0	18	17	5.6	0.1	0.0	Type C inlet Piped to DP 2.0
	2.0								15.7	6.74	3.45	23.2			23.2	6.74	1.0	48	52	8.4	0.1	0.0	Sum of DP OS2 & DP 12, Piped to DP 2.1
	13	A13	9.65	0.45	14.0	4.34	3.62	15.7							15.7	4.34	1.5	30	200	9.1	0.4	0.0	Future storm infrastructure from Sterling Ranch Phase 2 Piped to DP 2.1

EXISTING CONDITIONS PIPE ROUTING FOR COMPARISON (100 YEAR) BY J.R. ENGINEERING (APPROVED NOVEMBER 2021)

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

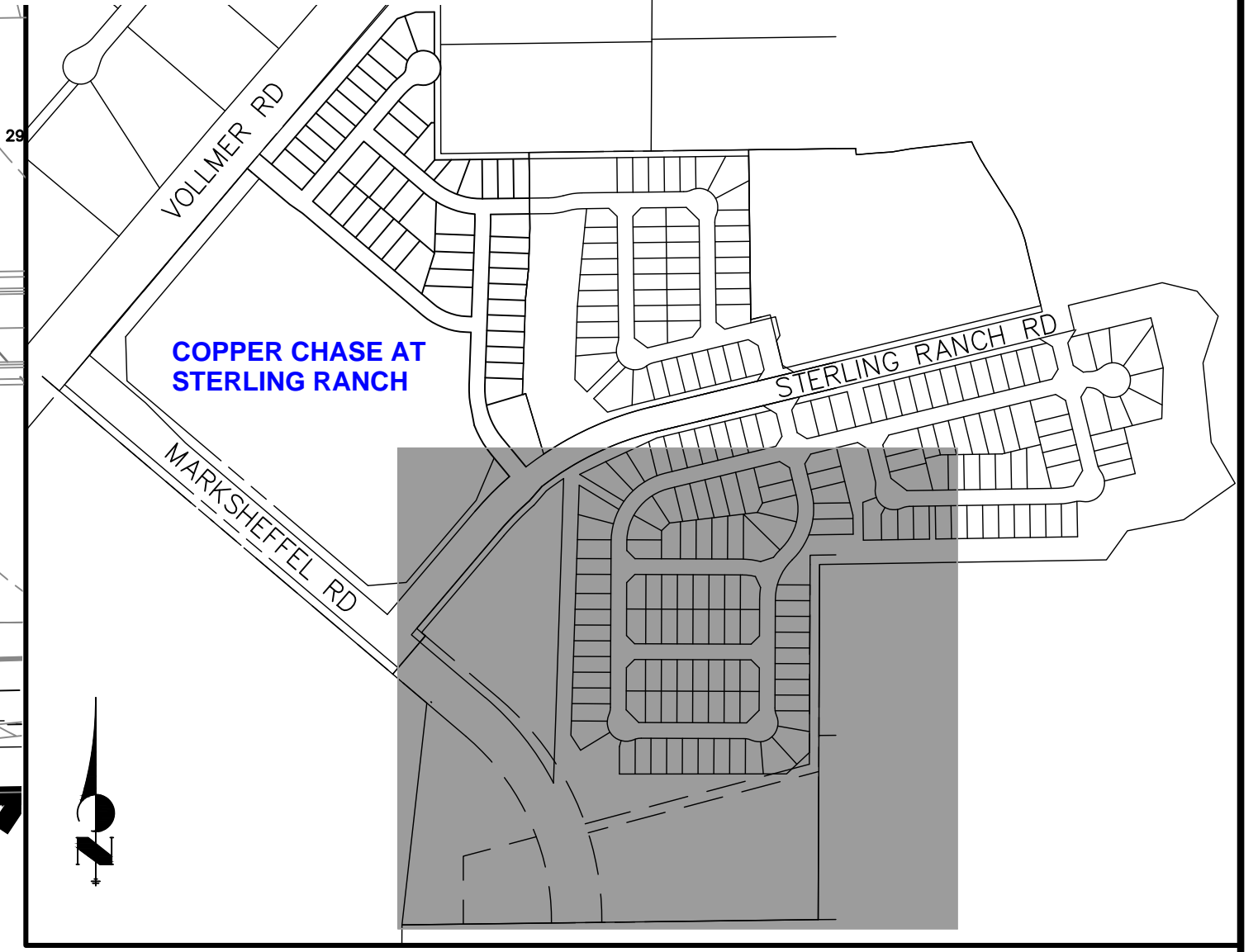
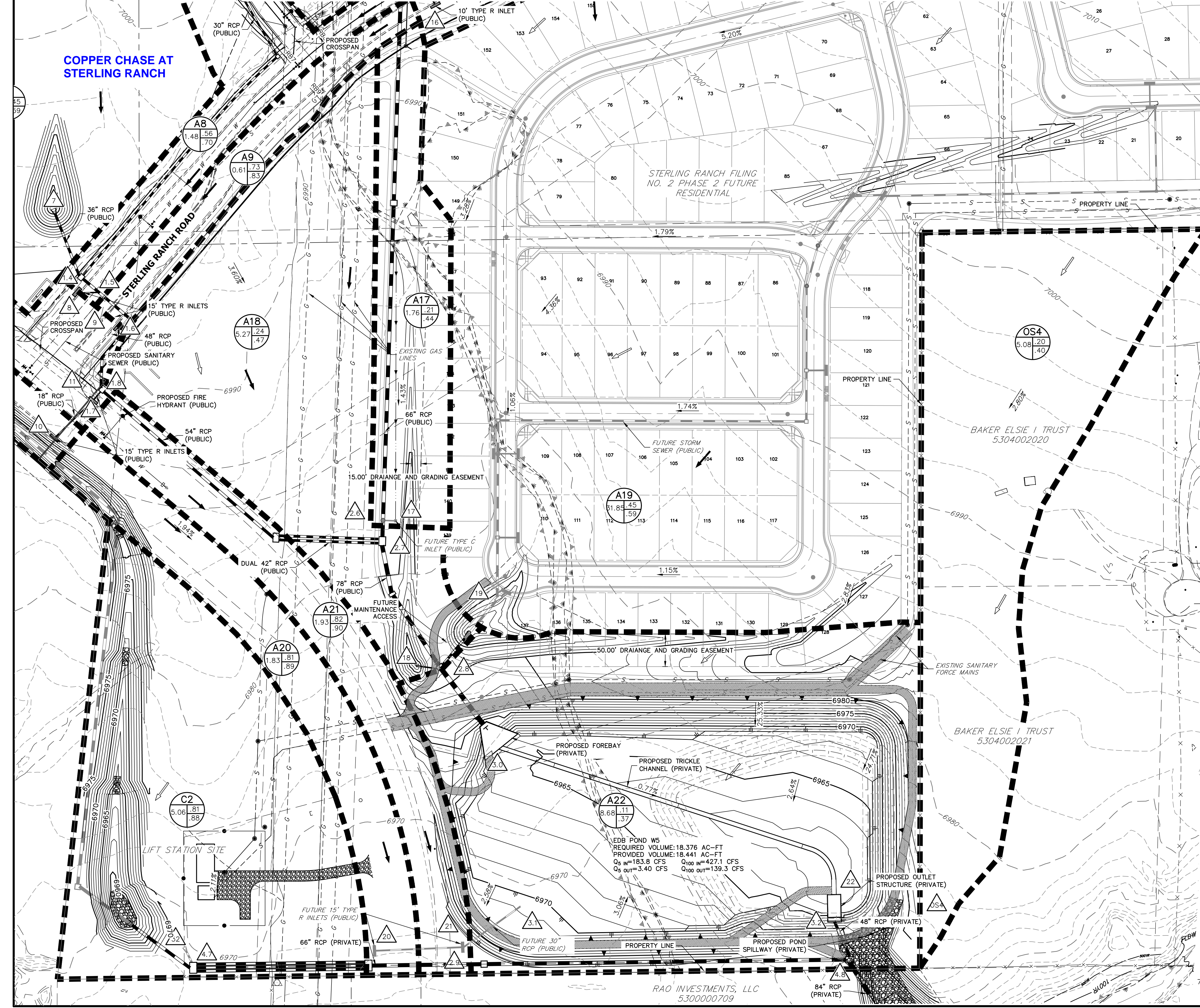
Subdivision: Sterling Ranch Filing No. 2
 Location: El Paso County
 Design Storm: 100-Year

Project Name: Sterling Ranch Subdivision
 Project No.: 25188.01
 Calculated By: AAM
 Checked By:
 Date: 1/5/21

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)	t _c (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)	
	1	A1	2.06	0.65	9.7	1.34	7.01	9.4					2.8	0.40	3.3	6.6	0.94	2.0	18	652	3.6	3.0	On-grade inlet, carryover flow to DP 5 Piped to DP 1.0
	2	A2	0.82	0.66	9.1	0.54	7.17	3.9					0.1	0.01	3.3	3.8	0.53	2.0	18	639	3.6	2.9	On-grade inlet, carryover flow to DP 6 Piped to DP 1.0
	1.0								9.7	1.47	7.00	10.3				10.3	1.47	3.0	18	335	10.6	0.5	Sum of DP 1 & DP 2, piped to DP 1.2
	3	A3	6.76	0.62	15.0	4.17	5.92	24.7					10.0	1.69	2.9	14.7	2.48	4.7	18	426	3.4	2.1	On-grade inlet, carryover flow to DP 5 Piped to DP 1.1
	4	A4	1.51	0.71	10.2	1.08	6.88	7.4					1.6	0.24	2.9	5.8	0.84	4.7	18	395	3.4	1.9	On-grade inlet, carryover flow to DP 5 Piped to DP 1.1
	1.1								15.0	3.33	5.91	19.7				19.7	3.33	1.0	24	74	8.1	0.2	Sum of DP 3 & DP 4, piped to DP 1.2
	1.2								15.1	4.80	5.89	28.2				28.2	4.80	3.3	24	319	13.9	0.4	Sum of DP 1.0 & DP 1.1, piped to DP 1.3
	6A	A6A	0.53	0.88	5.0	0.47	8.68	4.1					1.3	0.18	0.7								Overland Flow to DP1.3A
	6	A6	1.37	0.70	10.0	0.95	6.94	6.6	10.0	0.96	6.94	6.7				5.4	0.78	2.0	18	696	1.7	7.0	On-grade inlet, carryover flow to DP 8 Sum of Sub-basin A6 & Carryover flow from DP 2, Piped to DP 1.3A
	1.3A								10.0	1.25	6.94	8.7				8.7	1.25	1.0	24	36	6.7	0.1	Sum of DP 6 & DP 6A, piped to DP 1.3
	5	A5	1.70	0.70	9.9	1.19	6.95	8.3	17.0	3.51	5.59	19.6	6.5	1.17	0.7	13.1	2.34	2.0	18	664	1.7	6.6	On-grade inlet, carryover flow to DP 8 Sum of Sub-basin A5 & Carryover flows from DP 1, P 3 & DP 4. Piped to DP 1.3
	1.3								17.0	8.39	5.59	46.9				46.9	8.39	1.1	36	620	10.7	1.0	Sum of DP 1.2, 1.3A & DP 5, piped to DP 1.4
	7	A7	19.00	0.59	18.3	11.21	5.41	60.6								60.6	11.21	1.5	42	20	12.7	0.0	Future storm infrastructure from Copper Chase Subdivision Piped to DP 1.4
	1.4								18.4	19.60	5.40	105.9				105.9	19.60	0.5	48	26	9.2	0.0	Sum of DP 1.3 & DP 7, piped to DP 1.5
	8	A8	1.48	0.70	13.9	1.04	6.10	6.3	23.7	2.63	4.76	12.5	1.9	0.41	0.7	10.6	2.23	2.0	18	195	1.7	1.9	On-grade inlet, carryover flow to DP 11 Sum of Sub-basin A8 & Carryover flows from DP5, DP 6 & DP 15, Piped to DP 1.5
	1.5								23.7	21.83	4.76	103.9				103.9	21.83	0.5	48	91	9.2	0.2	Sum of DP 1.4 & DP 8, piped to DP 1.6
	9	A9	0.61	0.83	8.7	0.51	7.29	3.7	21.2	0.95	5.04	4.8	0.3	0.05	0.7	4.5	0.89	2.0	18	140	1.7	1.4	On-grade inlet, carryover flow to DP 11 Sum of Sub-basin A9 & carryover flows from DP 16, piped to DP 1.6
	1.6								23.9	22.72	4.74	107.7				107.7	22.72	0.5	48	95	9.1	0.2	Sum of DP 1.5 & DP 9, piped to DP 1.8
	10	A10	2.61	0.88	7.9	2.29	7.53	17.3					4.5	0.59	1.5	12.8	1.70	2.5	18	955	2.4	6.5	On-grade inlet, carryover flow to DP 20 Piped to DP 1.7
	11	A11	2.89	0.86	8.7	2.48	7.28	18.1	10.6	2.94	6.77	19.9	6.1	0.90	1.5	13.8	2.04	2.5	18	118	10.3	0.2	On-grade inlet, carryover flow to DP 21 Sum of Sub-basin A11 & carryover flows from DP 8 & DP 9, piped to DP 1.7
	1.7								10.6	3.74	6.77	25.3				25.3	3.74	1.0	24	1049	2.4	7.1	On-grade inlet, carryover flow to DP 21 Sum of Sub-basin A11 & carryover flows from DP 8 & DP 9, piped to DP 1.7
	1.8								24.0	26.45	4.72	125.0				125.0	26.45	2.0	54	517	17.0	0.5	Sum of DP 1.6 & DP 1.7, piped to DP 2.7
	OS2	OS2	17.00	0.62	12.0	10.54	3.71	39.1								39.1	10.54	1.0	30	787	9.5	1.4	Future flow released from Barbarick Subdivision Piped to DP 2.0
	12	A12	3.87	0.38	11.9	1.47	6.49	9.5								9.5	1.47	2.0	18	17	8.9	0.0	Type C inlet Piped to DP 2.0
	2.0								13.4	12.01	6.20	74.5				74.5	12.01	1.0	48	52	11.6	0.1	Sum of DP OS2 & DP 12, Piped to DP 2.1
	13	A13	9.65	0.59	14.0	5.69	6.08	34.6								34.6	5.69	1.5	30	200	11.0	0.3	Future storm infrastructure from Sterling Ranch Phase 2 Piped to DP 2.1

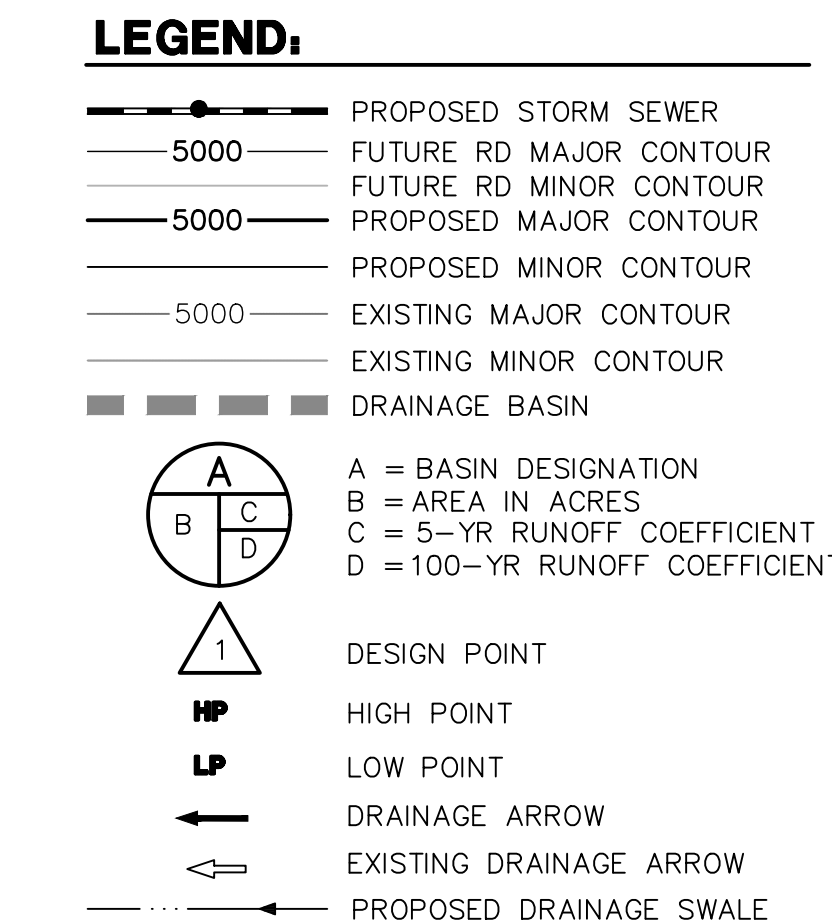
**EXISTING DRAINAGE MAP
(BY J.R. ENGINEERING, APPROVED NOVEMBER 2021)**

DOWNSTREAM CONVEYANCE EXHIBIT EXCERPT



DESIGN POINT	Q5	Q100
1	4.4	9.4
2	1.9	3.9
3	15.1	24.7
4	3.7	7.4
5	4.1	19.6
6	3.3	6.7
6A	2.2	4.1
7	27.5	60.0
8	3.0	12.5
9	1.9	4.8
10	9.2	17.3
11	9.5	19.9
12	1.9	9.5
13	15.7	34.6
14	16.0	37.9
15	5.4	11.7
16	4.4	9.6
17	1.4	4.7
18	4.3	14.0
19	9.65	65%
20	7.1	13.4
21	7.4	15.2
22	2.7	15.4
23	8.8	15.8
24	11.5	20.6
25	63.0	310.0
26	4.3	22.4
27	6.3	11.7
28	6.9	14.4
29	3.1	16.3
30	0.9	6.4
31	2.0	15.0
32	1.4	10.0
1.0	6.0	10.3
1.1	12.6	19.7
1.2	17.6	28.2
1.3	25.9	46.9
1.3A	5.0	8.7
1.4	52.5	105.9
1.5	55.1	109.9
1.6	56.4	107.7
1.7	17.3	25.3
1.8	68.8	125.0
2.0	23.2	74.5
2.1	38.1	106.6
2.2	56.9	138.7
2.3	9.6	17.2
2.4	63.7	151.9
2.5	96.6	250.7
2.6	97.8	250.4
2.7	162.0	336.8
2.8	189.8	424.4
2.9	14.2	23.5
3.0	189.8	424.4
3.2	187.5	428.2
4.0	15.4	26.1
4.1	56.2	264.7
4.2	12.7	26.0
4.3	49.1	291.2
4.4	3.1	3.1
4.5	51.1	51.1
4.6	56.5	245.8
4.7	58.4	248.6
4.8	59.8	320.3
052	13.8	39.1
053	17.6	48.9
054	2.6	8.5
01	3.31	8.20
02	1.63	2.97

BASIN SUMMARY TABLE									
Tributary Sub-basin	Area (acres)	Percent Impervious	C_p	C_{100}	t_c (min)	Q_c (cfs)	Q_{100} (cfs)	C_{50}	C_{100}
A1	2.06	66%	0.51	0.65	9.7	4.4	9.4		
A2	0.82	69%	0.53	0.66	9.1	1.9	3.9		
A3	6.76	60%	0.47	0.62	15.0	11.1	24.7		
A4	1.51	77%	0.60	0.71	10.2	3.7	7.4		
A5	1.70	76%	0.59	0.70	9.9	4.1	8.3		
A6	1.37	75%	0.58	0.70	10.0	3.3	6.6		
A6A	0.53	95%	0.81	0.88	5.0	2.2	4.1		
A7	19.00	65%	0.45	0.59	18.3	27.5	60.6		
A8	1.48	63%	0.56	0.70	13.9	3.0	6.3		
A9	0.61	79%	0.73	0.83	8.7	1.9	3.7		
A10	2.61	86%	0.79	0.88	7.9	9.2	17.3		
A11	2.89	83%	0.76	0.86	8.7	9.5	18.1		
A12	3.87	8%	0.13	0.38	11.9	1.9	9.5		
A13	9.65	65%	0.45	0.59	14.0	15.7	34.6		
A14	11.76	55%	0.39	0.55	15.3	16.0	37.9		
A15	2.91	54%	0.52	0.68	14.9	5.4	11.7		
A16	2.34	56%	0.54	0.69	14.7	4.4	9.6		
A17	1.76	24%	0.21	0.44	13.7	1.4	4.7		
A18	5.27	21%	0.24	0.47	16.4	4.3	14.0		
A19	31.85	67%	0.45	0.59	25.8	38.8	85.4		
A20	1.83	89%	0.81	0.89	8.0	6.6	12.2		
A21	1.93	90%	0.82	0.90	8.7	6.8	12.6		
A22	8.68	5%	0.11	0.37	23.3	2.7	15.4		
B1	2.98	100%	0.90	0.96	17.6	8.8	15.8		
B2	3.89	100%	0.90	0.96	17.6	11.5	20.5		
B3	1.53	100%	0.90	0.96	9.4	5.8	10.4		
B4	1.50	100%	0.90	0.96	9.4	5.7	10.2		
B5	2.91	0%	0.08	0.35	13.1	0.9	6.4		
C1	8.01	95%	0.81	0.88	9.9	2.0	15.0		
C2	5.06	95%	0.81	0.88	7.9	1.4	10.0		
OS20	308.00	6%	0.13	0.40	68.9	61.0	310.0		
OS21A	20.26	14%	0.13	0.40	52.3	4.3	22.4		
OS21B	8.71	9%	0.13	0.40	24.5	3.1	16.3		
OS2	17.00	70%	0.49	0.62	36.0	13.8	39.1		
OS3	28.70	70%	0.49	0.62	52.6	17.6	48.9		
OS4	5.08	15%	0.20	0.40	29.5	2.6	8.5		
D1	0.45	95%	0.81	0.88	7.0	1.7	3.1		
D2	0.43	95%	0.81	0.88	7.0	1.6	3.0		



NOTE
SEDIMENT CONTROL TO BE PROVIDED AT THE STUBS UNTIL THE TIME THOSE PARCELS DEVELOP

RAO INVESTMENTS, LLC
530000709

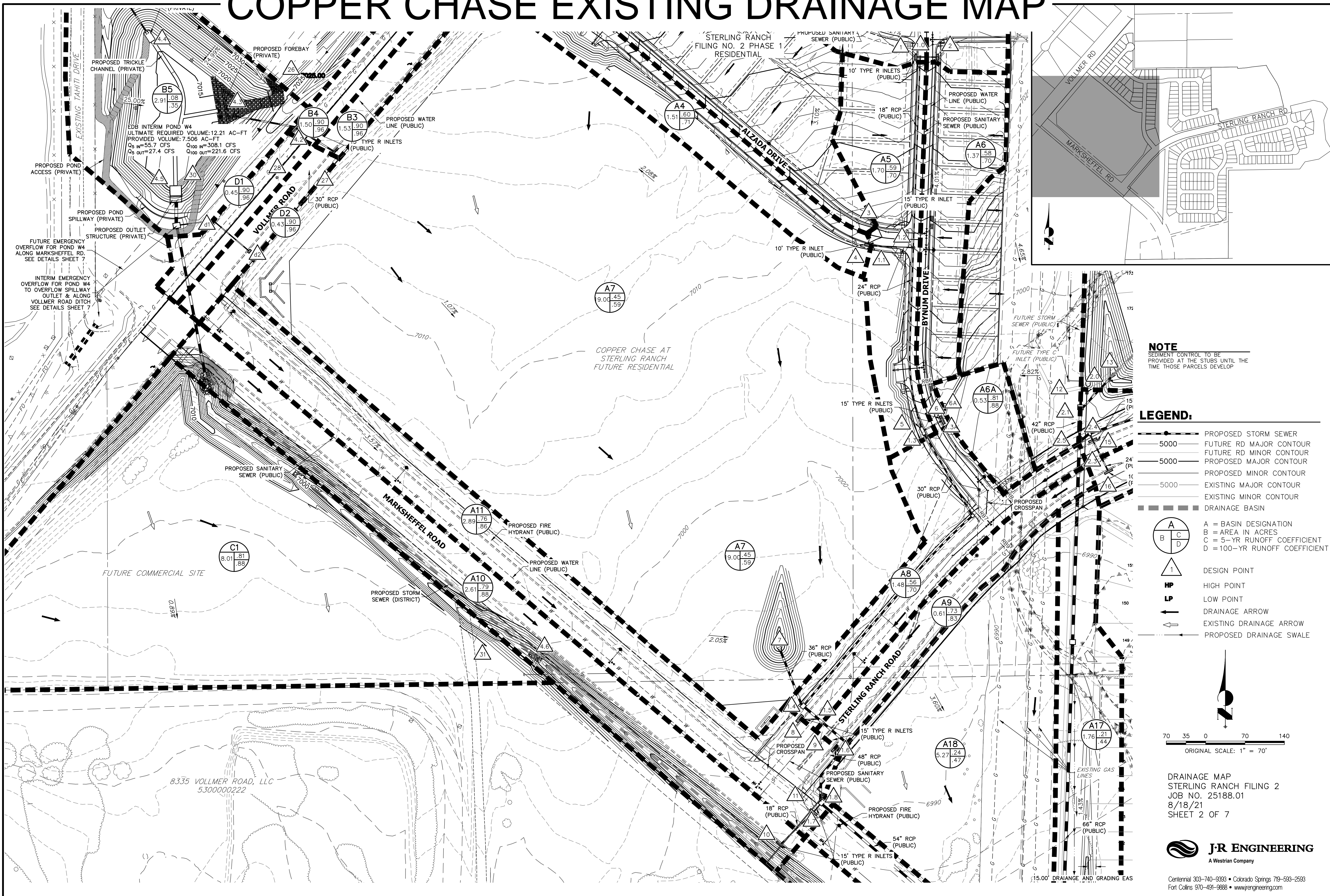
ORIGINAL SCALE: 1" = 70'

DRAINAGE MAP
STERLING RANCH FILING 2
JOB NO. 25188.01
8/18/21
SHEET 1 OF 7

J-R ENGINEERING
A Westran Company

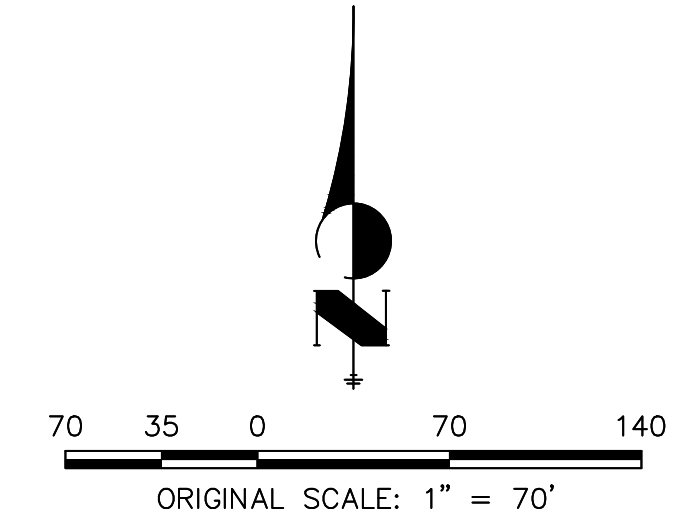
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COPPER CHASE EXISTING DRAINAGE MAP



NOTE
 SEDIMENT CONTROL TO BE PROVIDED AT THE STUBS UNTIL THE TIME THOSE PARCELS DEVELOP

- LEGEND:**
- PROPOSED STORM SEWER
 - FUTURE RD MAJOR CONTOUR
 - FUTURE RD MINOR CONTOUR
 - PROPOSED MAJOR CONTOUR
 - PROPOSED MINOR CONTOUR
 - EXISTING MAJOR CONTOUR
 - EXISTING MINOR CONTOUR
 - DRAINAGE BASIN
 - A = BASIN DESIGNATION
 B = AREA IN ACRES
 C = 5-YR RUNOFF COEFFICIENT
 D = 100-YR RUNOFF COEFFICIENT
 - DESIGN POINT
 - HIGH POINT
 - LOW POINT
 - DRAINAGE ARROW
 - EXISTING DRAINAGE ARROW
 - PROPOSED DRAINAGE SWALE



DRAINAGE MAP
 STERLING RANCH FILING 2
 JOB NO. 25188.01
 8/18/21
 SHEET 2 OF 7



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EDB INTERIM POND W4
 ULTIMATE REQUIRED VOLUME: 12.21 AC-FT
 PROVIDED VOLUME: 7.506 AC-FT
 Qs in=55.7 CFS Q100 in=308.1 CFS
 Qs out=27.4 CFS Q100 out=221.6 CFS

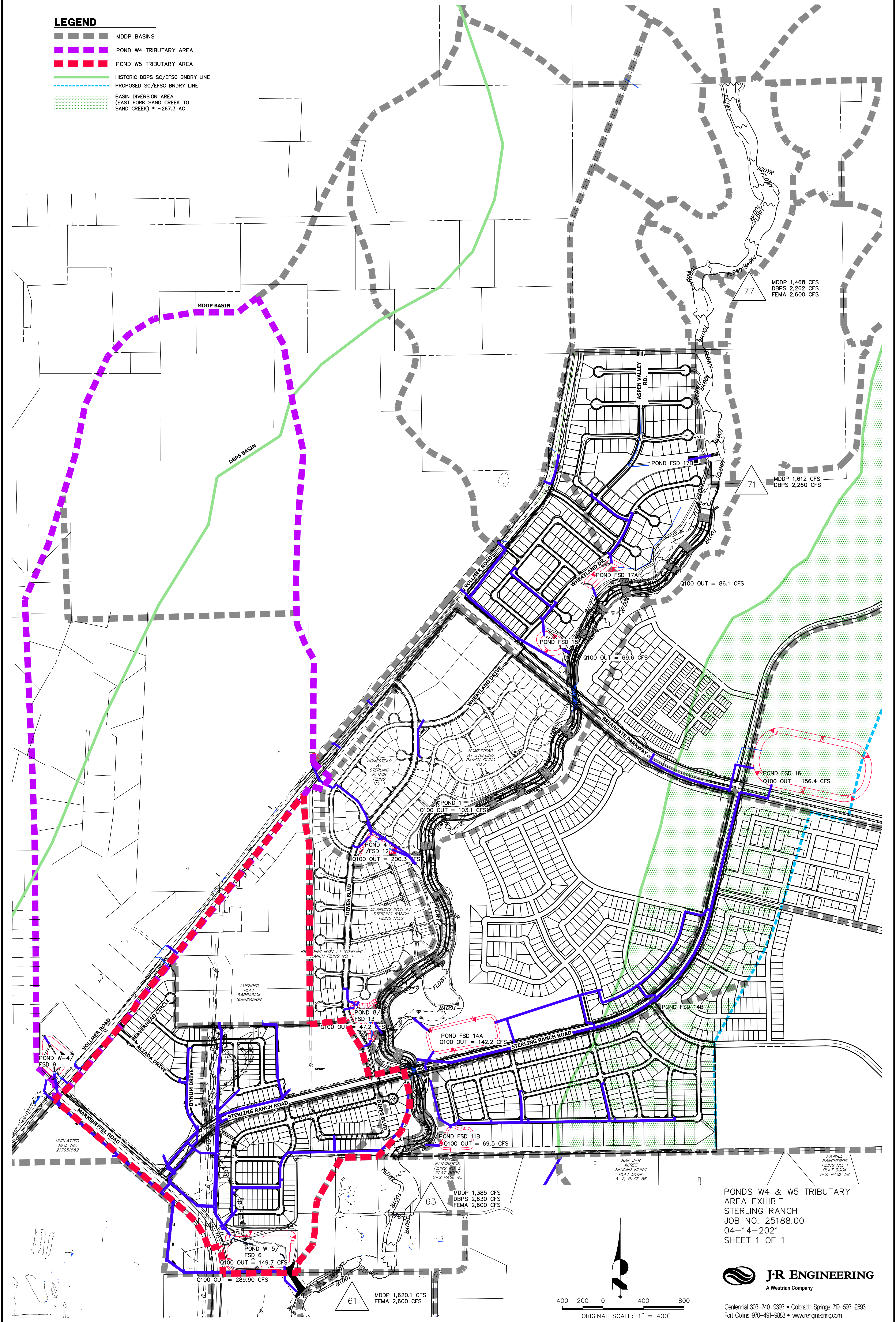
8335 VOLLMER ROAD, LLC
 5300000222

15.00' DRAINAGE AND GRADING EAS

STERLING RANCH PONDS W4 & W5 TRIBUTARY AREA EXHIBIT

LEGEND

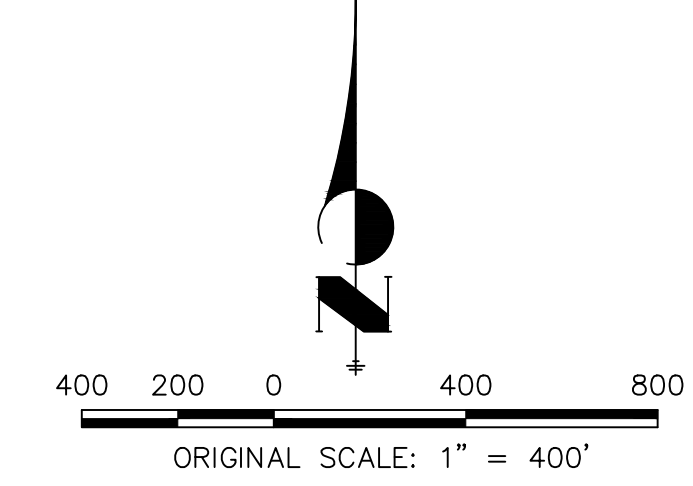
- MDDP BASINS
- POND W4 TRIBUTARY AREA
- POND W5 TRIBUTARY AREA
- HISTORIC DBPS SC/EFSC BNDRY LINE
- PROPOSED SC/EFSC BNDRY LINE
- BASIN DIVERSION AREA (EAST FORK SAND CREEK TO SAND CREEK) * ~267.3 AC



PONDS W4 & W5 TRIBUTARY
AREA EXHIBIT
STERLING RANCH
JOB NO. 25188.00
04-14-2021
SHEET 1 OF 1



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X:\25188\000\Drawings\Presentations\2021-4-14 Ponds W4 & W5 Tributary Area.dwg, 24:08 Title Portal, 6/23/2021 12:23:00 PM, FC

PROPOSED DRAINAGE MAP

COPPER CHASE AT STERLING RANCH

COUNTY OF EL PASO, STATE OF COLORADO

PROPOSED DRAINAGE MAP

APRIL 2023

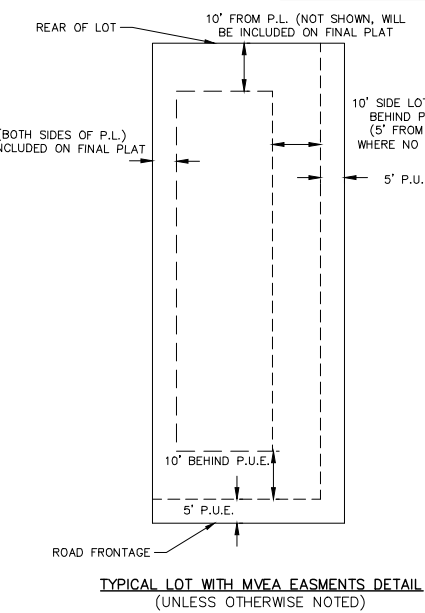
LEGEND

	BASIN DESIGNATION		PROP MAJ CONT		INLET
	ACRES		PROP MIN CONT		EXISTING FLOW DIRECTION
	PIPE RUN REFERENCE LABEL		EXIST MAJ CONT		EMERGENCY OVERFLOW DIRECTION
	SURFACE DESIGN POINT		EXIST MIN CONT		PROPOSED FLOW DIRECTION
	BASIN BOUNDARY		EXISTING STORM SEWER PIPE		FLARED END SECTION
	SITE BOUNDARY		PROPOSED PRIVATE UTILITY EASEMENT		HIGH POINT
	PROP STORM SEWER PIPE		PROPOSED MVEA EASEMENT		LOW POINT
			PROPOSED DRAINAGE SWALE		EXISTING SANITARY MANHOLE
			EXISTING FIRE HYDRANT		EXISTING SIGN
					EX. WATER VALVE
					CROSSSPAN

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q ₅	Q ₁₀₀
A	3.59	4.4	11.8
B	3.40	4.9	11.4
C	1.02	1.8	3.9
D	2.90	4.8	10.5
E	0.89	2.1	4.2
F	2.58	4.2	10.0
G	1.65	4.3	8.7
H	1.22	1.0	3.9
I	1.40	2.4	5.2
J	0.89	2.2	4.3
K	1.07	1.9	4.2
L	1.21	1.1	3.3
M	0.64	0.3	1.6
A4	0.64	3.0	5.4
A6	1.37	3.3	6.6
A6A	0.53	2.2	4.1
A8	0.75	3.0	5.5
A11	2.79	7.4	14.2

DESIGN POINT SUMMARY				
DESIGN POINT	Q ₅	Q ₁₀₀	BASIN/DP	STRUCTURE
1	4.4	11.8	A	5' CDOT TYPE R AT-GRADE INLET (IN-1)
2	4.9	11.4	B	15' CDOT TYPE R AT-GRADE INLET (IN-2)
3	3.7	11.8	C, FB-IN1	5' CDOT TYPE R AT-GRADE INLET (IN-3)
4	4.7	12.0	D, FB-IN2	15' CDOT TYPE R AT-GRADE INLET (IN-4)
5	1.8	5.6	E, FB-IN4	
6	4.2	10.0	F	15' CDOT TYPE R AT-GRADE INLET (IN-6)
7	4.9	20.0	G, FB-IN6, FB-IN4, FB-IN3	EX 15' CDOT TYPE R AT-GRADE INLET (IN-A5)
8	1.0	3.9	H	BEEHIVE GRATE SUMP INLET (IN-8)
9	4.0	10.5	I, DP5	15' CDOT TYPE R SUMP INLET (IN-5)
10	2.2	4.3	J	
11	5.4	16.7	K, DP 10, FB-IN3	15' CDOT TYPE R SUMP INLET (IN-9)
12	1.1	3.3	L	
13	0.3	1.6	M	
14	3.0	5.4	A4	EX 10' CDOT TYPE R AT-GRADE INLET (IN-A4)
15	5.1	19.8	A8, FB-IN6, A6A, FB-IN4, FB-IN3, DP12	EX 15' CDOT TYPE R AT-GRADE INLET (IN-A8)
16	7.7	22.8	A11, FB-IN8, DP13, FB-IN8	EX 15' CDOT TYPE R AT-GRADE INLET (IN-A11)

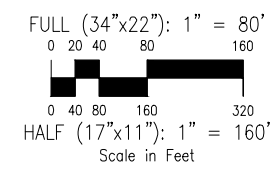
STORM SEWER SUMMARY				
PIPE RUN	Q ₅	Q ₁₀₀	PIPE SIZE	CONTRIBUTING PIPES & DESIGN POINTS
PR1	2.5	3.8	18" RCP	DP1 (IN-1)
PR2	4.9	9.7	18" RCP	DP2 (IN-2)
PR3	7.3	13.3	18" RCP	PR1, PR2
PR4	2.3	3.9	18" RCP	DP3 (IN-3)
PR5	4.7	10.0	18" RCP	DP4 (IN-4)
PR6	4.2	8.8	18" RCP	DP6 (IN-6)
PR7	4.1	8.7	18" RCP	PR6
PR8	4.1	8.7	18" RCP	PR7
PR9	4.1	8.6	18" RCP	PR8
PR10	1.0	3.9	18" RCP	DP8 (IN-8)
PR11	5.0	14.4	24" RCP	PR10, DP9 (IN-5)
PR12	13.9	26.6	24" RCP	PR3, PR4, PR5
PR13	10.7	32.1	30" RCP	PR11, DP11 (IN-9)
PR14	26.0	60.5	42" RCP	PR9, PR12, PR13
1.0	6.1	10.3	18" RCP	EX-IN4, EX-IN2
1.1	11.4	18.1	18" RCP	EX-IN4, EX-IN3
1.2	17.1	27.7	24" RCP	1.0, 1.1
1.3A	23.9	44.1	30" RCP	1.2, EXIN-A5, EXIN-A6
1.3	23.9	44.1	36" RCP	1.3A
1.4	48.8	102.5	48" RCP	1.3, PR14
1.5	53.4	115.8	48" RCP	DP15 (EX-IN8), 1.4
1.6	55.1	119.0	48" RCP	EX-IN9, 1.5
1.7	16.3	27.5	18" RCP	DP16, (EX-IN11), EX-IN10
1.8	60.8	124.8	54" RCP	1.7, 1.6



THERE ARE NO INLETS THERE ANYMORE. THE RETAINING WALL HAS BEEN REMOVED AND REPLACED BY STEP GRADING.

Provide design calcs for inlets

Change to ROW THE EASEMENT LABEL HAS BEEN ADJUSTED TO R.O.W.



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212 N. WAHSATCH AVE., STE 305
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

COPPER CHASE AT STERLING RANCH
PROPOSED DRAINAGE MAP

PROJECT NO. 09-014	SCALE: HORIZONTAL: 1"=80' VERTICAL: N/A	DATE: 04/28/2023
DESIGNED BY: CVW	DRAWN BY: CVW	CHECKED BY: VAS
SHEET 1 OF 1		PDM

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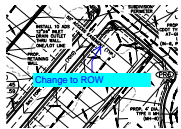
V_1 Drainage.pdf Markup Summary

Callout (3)

BASE AT STERLING RANCI
Use 2023 fees
he 2022 Drainage and Bridge Fees
flows:

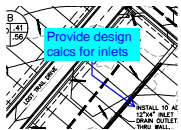
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Use 2023 fees



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Change to ROW



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Provide design calcs for inlets