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Eastonville Road – Londonderry Drive to Rex Road
Segment 1 Improvements
Stationing 14+19.69 – 47+66.51

Final Drainage Report

August 2024

HR Green Project No: 201662.08

Prepared For:

D.R. Horton

Contact: Riley Hillen, P.E.

9555 S. Kingston Ct.

Englewood, CO 80112

Prepared By:

HR Green Development, LLC

Contact: Colleen Monahan, P.E., LEED AP

cmonahan@hrgreen.com

(719) 394-2433

EDARP File No.: CDR2321

Engineer's Statement:

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

COLORADO LICENSED
COLLEEN MONAHAN
56067
8/25/2024
PROFESSIONAL ENGINEER

Colleen Monahan, P.E., LEED AP Date

State of Colorado No. 56067

For and on behalf of HR Green Development, LLC

Owner/Developer's Statement:

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

By:

Authorized Signature Date

Address: D.R. Horton

9555 S. Kingston Court

Englewood, CO

El Paso County Statement

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

Joshua Palmer, P.E. Date

County Engineer/ECM Administrator

Conditions:

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I. General Purpose, Location and Description

a. Purpose

The purpose of this Final Drainage Report (FDR) for the Eastonville Road from Londonderry Drive to Rex Road Segment 1 Improvements is to describe the onsite and offsite drainage patterns, size drainage infrastructure to safely capture and convey developed runoff to water quality and detention facilities, and to safely route detained stormwater to adequate outfalls. This drainage report will detail the improvements of Eastonville Road from Londonderry Drive to Grandview Filing No. 1 (Stations 14+55.00 to 47+00.00). Stations 47+00.00 to 79+32.00 contain the Segment 2 Improvements for the Eastonville Road from Londonderry Drive to Rex Road for the portion of the project north of Grandview Filing No. 1. The project is all one project, however, the plan set has been broken into two segments to align with the Grandview Reserve Filings. A separate FDR describes Segment 2 of the project.

b. Location

Eastonville Road from Londonderry Drive to Grandview Filing No. 1, referred to as 'the site' herein, is an existing 26' wide treated gravel road in El Paso County, Colorado. The site lies in existing 60' wide El Paso County Right-of-Way within Sections 21 and 28, Township 12 South, Range 64 West of the 6th Principal Meridian, in El Paso County, State of Colorado.

The site is bound by undeveloped land to the east and west that has historically been used as ranching lands. Falcon Regional Park, which contains ballparks and parking, and Falcon High School also border the site to the west. All lands to the east and west of the site are unplatted. A vicinity map is presented in Appendix A.

c. Description of Property

The site is approximately 0.61 miles (2.06 acres) of existing treated gravel roadway north of Londonderry Drive and south of Grandview Reserve Filing No. 1. Per field inspection the existing Eastonville Road section is treated gravel and therefore described as 'temporary' for the purpose of this report. The existing treated gravel width for the length of the project is 26' wide. There are 4' wide gravel shoulders and native landscaped swales are located on both sides of the roadway. Offsite stormwater is bypassed under the road through a series of existing culverts. See Appendix A for an existing conditions photo.

The existing roadway has slopes ranging from 0.3% up to approximately 4%. The general topography of the surrounding area is typical of high desert, short prairie grass with gently rolling hillside with slopes ranging from 2% to 4%. The project site drains generally from the west to the east and is tributary to Black Squirrel Creek.

Per a NRCS soil survey, the site is made up of Type A Columbine gravelly sandy loam, Type A Blakeland loamy sand and Type B Stapleton sandy loam. The NRCS soil survey is presented in Appendix A.

Gieck Ranch Tributary #1 (Channel A) is the only drainageway that traverses the site in the west to east direction through an existing culvert under Eastonville Road that is just north of Segment 1. The channel is a mapped wetland and a wetland permit will be required for Segment 2 of this Eastonville Road improvement project. Channel A is not within a FEMA floodplain.

Existing utilities include an underground gas line that runs along the east and west sides of Eastonville, an existing raw water line that follows the west side of Eastonville north of Falcon Regional Park, an existing underground electric line along the west side of Eastonville Road, and an existing aboveground electrical line along the east side of Eastonville Road. An existing drainage map with these facilities is presented in Appendix F.

d. Floodplain Statement

Based on FEMA Firm map 08041C0552G December 7, 2018, the site is not located in any FEMA designated floodplain. See FEMA Firm Map in Appendix A. There is a Zone A floodplain north of the site and a Zone AE south of the site, both of which will not be altered with the associated Eastonville Road Segment 1 improvements.

II. Drainage Design Criteria

a. Drainage Criteria

Hydrologic data and calculations were performed using Drainage Criteria Manual Volume 1 of El Paso County (EPCDCM), with County adopted Chapter 6 and Section 3.2.1 of Chapter 13 of the City of Colorado Springs Drainage Criteria Manual (CCSDCM), May 2014 revised January 2021.

Onsite drainage improvements are designed for the 5-year storm (minor event) and 100-year storm (major event) using rainfall values from the NOAA Atlas 14 Point Precipitation Frequency Data Server. Runoff was calculated per CCSDCM Section 6.3.0 - Rational Method. Public, full spectrum pond design was completed using the latest version of Mile High Flood District's (MHFD) UD-Detention per CCSDCM Section 13.3.2.1 – Public, full spectrum Detention. The detention pond allowable release rate will be limited to less than historic rates.

Rainfall Depths per NOAA Atlas 14		
Return Period (yr)	5	100
1-hr Rainfall Depth (in)	1.21	2.49

Inlet sizing was performed per the methods described in EPCDCM Section III Chapter 7 – Street Drainage and Storm Water Inlets. Storm sewer sizing was performed per the methods described in EPCDCM Section III Chapter 8 – Storm Drains and Appurtenances.

III. Drainage Basins and Subbasins

a. Major Basin Description

The site is located within the Gieck Ranch Drainage Basin. The site's drainage characteristics were previously studied in the following reports:

1. "Gieck Ranch Drainage Basin Planning Study" prepared by Drexel, Barrel & Co, February 2010.
2. "Master Development Drainage Plan Meridian Ranch" prepared by Tech Contractors, July 2021.
3. "Final Drainage Report for The Sanctuary Filing 1 at Meridian Ranch" by Tech Contractors, August 2022.

Gieck Ranch Drainage Basin is a 22.05 square mile watershed located in El Paso County, Colorado. Gieck Ranch Drainage Basin is tributary to Black Squirrel Creek which drains to the Arkansas River. The majority of the basin is undeveloped and is rolling range land typical of Colorado's semi-arid climates.

Within the Gieck Ranch Drainage Basin, ranching has historically been the predominant land use, with rolling topography between 2%-4% slopes. Recently urbanization is occurring within the drainage basin, most notably for this project are Meridian Ranch and Latigo Trails Developments. Both are single family residential neighborhoods located upstream to the west and northwest of the Eastonville Segment 1 Improvements project site.

b. Existing Subbasin Description

Basin E1 is 0.45 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 0.7 cfs Q_{100} = 1.7 cfs) is conveyed by an existing roadside swale on the northwest edge of Eastonville Road to DP1. Flows at DP1 then drain across Eastonville Road through an existing public 36” CMP culvert to DP2.

Basin E2.1 is 1.82 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 1.2 cfs Q_{100} = 4.8 cfs) is conveyed by an existing swale on the southeast edge of Eastonville Road to DP2. Flows at DP2 then drain southeast offsite in historic drainage patterns.

Basin E2.2 is 0.40 acres of treated gravel from the Eastonville Road roadway and existing native landscaped area. Stormwater from this basin (Q_5 = 0.1 cfs Q_{100} = 1.0 cfs) is conveyed by an existing swale on the southeast edge of Eastonville Road to DP2.2. Flows at DP2.2 then drain southwest offsite in historic drainage patterns.

Basin E3 is 0.72 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 1.0 cfs Q_{100} = 2.5 cfs) is conveyed by an existing roadside swale on the northwest edge of Eastonville Road to DP3. Flows at DP3 then drain across Eastonville Road through an existing public 24” CMP culvert do DP4.

Basin E4 is 3.17 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 1.9 cfs Q_{100} = 7.8 cfs) is conveyed by an existing swale on the southeast edge of Eastonville Road to DP4. Flows at DP4 then drain southeast offsite in historic drainage patterns.

Basin E5 is 0.23 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 0.5 cfs Q_{100} = 1.1 cfs) is conveyed by an existing roadside swale on the northwest edge of Eastonville Road to DP5. Flows at DP5 then drain across Eastonville Road through an existing public 18” CMP culvert to DP6.

Basin E6 is 0.79 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 0.7 cfs Q_{100} = 2.6 cfs) is conveyed by an existing swale on the southeast edge of Eastonville Road to DP6. Flows at DP6 then drain southeast offsite in historic drainage patterns ultimately to the Gieck Ranch Tributary #1.

Basin E7 is 0.23 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 0.5 cfs Q_{100} = 1.2 cfs) is conveyed by an existing roadside swale on the northwest edge of Eastonville Road to DP7.1. Flows at DP7.1 then drain across Eastonville Road through an existing public 18” CMP culvert to DP8.1.

Basin E8 is 0.70 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 0.6 cfs Q_{100} = 2.1 cfs) is conveyed by an existing swale on the southeast edge of Eastonville Road to DP8.1. Flows at DP8.1 then drain southeast offsite in historic drainage patterns ultimately to the Gieck Ranch Tributary #1.

Basin E9 is 0.73 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 1.2 cfs Q_{100} = 2.8 cfs) is conveyed by an existing roadside swale on the northwest edge of Eastonville Road to DP7.2. Flows at DP7.2 then drain across Eastonville Road through an existing public 18" CMP culvert to DP8.2.

Basin E10.1 is 2.61 acres of treated gravel to the crown of Eastonville Road roadway and existing swale native landscaped area. Stormwater from this basin (Q_5 = 1.9 cfs Q_{100} = 7.0 cfs) is conveyed by an existing swale on the southeast edge of Eastonville Road to DP8.2. Flows at DP8.2 then drain southeast offsite in historic drainage patterns ultimately to the Gieck Ranch Tributary #1.

Basin E10.2 is 1.89 acres of existing native landscaped area. Stormwater from this basin (Q_5 = 0.7 cfs Q_{100} = 4.4 cfs) is conveyed via sheet flow southeast of Eastonville Road to DP8.3. Flows at DP8.3 then drain southeast offsite in historic drainage patterns ultimately to the Gieck Ranch Tributary #1.

Basin OS1 is 1.58 acres of offsite undeveloped area. Stormwater from this basin (Q_5 = 0.5 cfs Q_{100} = 3.6 cfs) drains via sheet flow into an existing roadside swale on the northwest side of Eastonville Road. Stormwater then drains to DP1. Flows at DP1 then drain across Eastonville Road through an existing public 36" CMP culvert to DP2. Flows at DP2 then drain southeast offsite in historic drainage patterns.

Basin OS2 is 12.21 acres of offsite undeveloped area. Stormwater from this basin (Q_5 = 3.6 cfs Q_{100} = 24.3 cfs) drains via sheet flow into an existing roadside swale on the northwest side of Eastonville Road. Stormwater then drains to DP3. Flows at DP3 then drain across Eastonville Road through an existing public 24" CMP culvert to DP4. Flows at DP4 then drain southeast offsite in historic drainage patterns.

Basin OS3.1 is 1.51 acres of offsite undeveloped area. Stormwater from this basin (Q_5 = 0.5 cfs Q_{100} = 3.6 cfs) drains via sheet flow into an existing roadside swale on the northwest side of Eastonville Road. Stormwater then drains to DP5. Flows at DP5 then drain across Eastonville Road through an existing public 18" CMP culvert to DP6. Flows at DP6 then drain southeast offsite in historic drainage patterns ultimately to the Gieck Ranch Tributary #1.

Basin OS3.2 is 2.86 acres of offsite undeveloped area. Stormwater from this basin (Q_5 = 1.0 cfs Q_{100} = 6.6 cfs) drains via sheet flow into an existing roadside swale on the northwest side of Eastonville Road. Stormwater then drains to DP7.1. Flows at DP7.1 then drain across Eastonville Road through an existing public 18" CMP culvert to DP8.1. Flows at DP8.1 then drain southeast offsite in historic drainage patterns ultimately to the Gieck Ranch Tributary #1.

Basin OS3.3 is 21.12 acres of offsite undeveloped area. Stormwater from this basin (Q_5 = 6.4 cfs Q_{100} = 42.7 cfs) drains via sheet flow into an existing roadside swale on the northwest side of Eastonville Road. Stormwater then drains to DP7.2. Flows at DP7.2 then drain across Eastonville Road through an existing public 18" CMP culvert to DP8.2. Flows at DP8.2 then drain southeast offsite in historic drainage patterns ultimately to the Gieck Ranch Tributary #1.

On the drainage maps, delineate these 3 seperate basins. The map still shows just one basin for all of OS3.

Unresolved concept since Review 1:

All 3 "offsite" basins (OS1, OS2, and OS3) have proposed disturbances in them that need to have WQ treatment accounted for via a PCM and/or WQ exclusions. These disturbances are no different than disturbances anywhere else on this project. Please call me to if you'd like to discuss this so it gets resolved with the next submittal.

Review 2 comment provided at the top of the next page for reference.

Unresolved comment from Review 1:
Basins OS1, OS2, OS3, and the unnamed basins that are east of Eastonville Rd all have proposed soil disturbances within them, which all must be accounted for via WQ treatment or an applicable WQ exclusion. So please address this in the respective Basin paragraphs and create new proposed sub-basins as necessary.
Review 2 update: these 3 "offsite undeveloped areas" are still shown on the drainage map as having proposed disturbances. Meaning that they are neither "offsite" or "undeveloped." Please revise map and descriptions to add onsite basins for the areas of disturbance and discuss WQ treatment or applicable WQ exclusions. Just stating that infiltration is occuring is not enough. You'll need to show Runoff Reduction calcs for RPAs and/or SPAs or an applicable exclusion.

c. Proposed Subbasin Description

Description of Proposed Project

The proposed project includes improvements to Eastonville Road from Londonderry Drive to the north part of Grandview Filing No. 1. As described above, the current condition of the existing roadway in this area consists of 26' wide treated gravel roadway with 4' wide gravel shoulders and native landscaped swales located on both sides of the roadway. Offsite stormwater is bypassed under the proposed roadway via proposed public RCP culverts.

The proposed improvements to Eastonville Road from Londonderry Drive to the north part of Grandview Filing No. 1 include removal of the 26' wide treated gravel and replacing the road with a Modified Urban Minor Arterial Roadway Cross-Section consisting of 48' pavement and Type A EPC curb (53' back of curb to back of curb).

Eastonville Road Basins

Basin EA1 is 0.62 acres of proposed pavement to the crown of Eastonville Road and proposed landscaped area. Stormwater (Q_5 = 2.6 cfs Q_{100} = 4.7 cfs) is conveyed by curb & gutter on the northwest side of Eastonville Road. Runoff is then captured in an on grade public 15' CDOT Type R Inlet at DP9. Flows from DP9 are conveyed through a proposed public storm sewer system which outfalls into SFB D. SFB D is located southeast of the proposed Eastonville Road Segment 1 improvements outside of the proposed right-of-way within a proposed drainage easement.

Basin EA2 is 1.21 acres of proposed pavement to the crown of Eastonville Road and proposed landscaped area. Stormwater (Q_5 = 2.5 cfs Q_{100} = 5.6 cfs) is conveyed by curb & gutter on the southeast side of Eastonville Road. Runoff is then captured in an on grade public 15' CDOT Type R Inlet at DP10. Flows from DP10 are conveyed through a proposed public storm sewer system which outfalls into Sand Filter Basin D. Sand Filter Basin D is located southeast of the proposed Eastonville Road Segment 1 improvements outside of the proposed right-of-way within a proposed drainage easement.

Basin EA3 is 0.44 acres of proposed pavement to the crown of Eastonville Road and proposed landscaped area. Stormwater (Q_5 = 1.8 cfs Q_{100} = 3.0 cfs) is conveyed by curb & gutter on the northwest side of Eastonville Road. Runoff is then captured in an on grade public 10' CDOT Type R Inlet at DP13. Flows at DP13 are conveyed across Eastonville Road through a public storm sewer system to Sand Filter Basin A. Sand Filter Basin A is located southeast of the proposed Eastonville Road Segment 1 improvements outside of the proposed right-of-way within a proposed drainage easement.

DP14

Basin EA4 is 0.77 acres of proposed pavement to the crown of Eastonville Road and proposed landscaped area. Stormwater (Q_5 = 1.7 cfs Q_{100} = 2.9 cfs) is conveyed by curb & gutter on the southeast side of Eastonville Road. Runoff is then captured in an on grade public 10' CDOT Type R Inlet at DP10. Flows at DP14 are conveyed through a public storm sewer system to Sand Filter Basin A. Sand Filter Basin A is located southeast of the proposed Eastonville Road Segment 1 improvements outside of the proposed right-of-way within a proposed drainage easement.

Basin EA5.1 is 0.37 acres of landscaped area, gravel access road, and contains the public full spectrum sand filter basin A. Stormwater (Q_5 = 0.3 cfs Q_{100} = 0.4 cfs) from this basin sheet flows directly into Sand Filter Basin A. Sand Filter Basin A is located southeast of the proposed Eastonville Road Segment 1 improvements outside of the proposed right-of-way within a proposed drainage easement.

Revise these paragraphs per my comment on the Runoff Reduction calcs.

And clarify that these are treated via SPAs so it's clear that these areas are not actual PBMPs (ie: don't need to be inspected every 5-yrs post-construction.

Basin EA5.2 is 0.52 acres of landscaped area and the overflow path from SFB A. Stormwater (Q_5 = 0.2 cfs Q_{100} = 0.3 cfs) from this basin is conveyed via an existing drainage swale west to design point 4. Water quality will be accounted for via runoff reduction swales & grass buffers. This basin will ultimately be detained and treated by the Waterbury development. UD-BMP calculations for the disturbed area within this basin have been provided in the appendix.

1.21 per drainage maps

Basin EA5.3 is 0.52 acres of landscaped area on the east side of Eastonville Rd. Stormwater (Q_5 = 0.4 cfs Q_{100} = 2.9 cfs) from this basin is conveyed via an existing drainage swale east to design point 4.1. Water quality will be accounted for via runoff reduction swales & grass buffers. This basin will ultimately be detained and treated by the Waterbury development. UD-BMP calculations for the disturbed area within this basin have been provided in the appendix.

Basin EA5.4 is 0.41 acres of landscaped area on the east side of Eastonville Rd. Stormwater (Q_5 = 0.1 cfs Q_{100} = 1.0 cfs) from this basin is conveyed via an existing drainage swale east to design point 6. Water quality will be accounted for via runoff reduction swales & grass buffers. This basin will ultimately be detained and treated by the Waterbury development. UD-BMP calculations for the disturbed area within this basin have been provided in the appendix.

Basin EA6 is 1.09 acres of proposed pavement to the crown of Eastonville Road and proposed landscaped area. Stormwater (Q_5 = 3.1 cfs Q_{100} = 5.2 cfs) is conveyed by curb & gutter on the west side of Eastonville Road. Runoff is then captured in a sump public 10' CDOT Type R Inlet at DP16. Flows at DP16 are conveyed across Eastonville Road through a public storm sewer system to Extended Detention Basin B. Extended Detention Basin B is located northeast of the proposed Eastonville Road Segment 1 improvements outside of the proposed right-of-way within a proposed drainage easement.

Basin EA7 is 1.92 acres of proposed pavement to the crown of Eastonville Road and proposed landscaped area. Stormwater (Q_5 = 3.2 cfs Q_{100} = 5.4 cfs) is conveyed by curb & gutter on the east side of Eastonville Road. Runoff is then captured in a sump public 10' CDOT Type R Inlet at DP17. Flows at DP17 are conveyed through a public storm sewer system to Extended Detention Basin B. Extended Detention Basin B is located northeast of the proposed Eastonville Road Segment 1 improvements outside of the proposed right-of-way within a proposed drainage easement.

Basin EA8 is 0.94 acres of landscaped area, gravel access road, and contains extended detention basin B. Stormwater (Q_5 = 0.5 cfs Q_{100} = 0.9 cfs) from this basin sheet flows directly into Extended Detention Basin B. Extended Detention Basin B is located northeast of the proposed Eastonville Road Segment 1 improvements outside of the proposed right-of-way within a proposed drainage easement.

Basin EA9 is 0.88 acres of landscaped area. Stormwater (Q_5 = 0.4 cfs Q_{100} = 0.6 cfs) from this basin sheet flows directly offsite towards DP20. Water quality will be accounted for via runoff reduction swales & grass buffers.

add "for the disturbed area" to clarify that the whole basin area isn't being treated via RR.

Basin EA10.1 is 0.36 acres of landscaped area and concrete/gravel trail. Stormwater (Q_5 = 0.4 cfs Q_{100} = 0.6 cfs) from this basin sheet flows directly offsite towards DP21. Water quality will be accounted for via runoff reduction swales & grass buffers. This basin will ultimately be detained and treated by the Grandview Reserve development. UD-BMP calculations for the disturbed area within this basin have been provided in the appendix.

Basin EA10.2 is 1.06 acres of landscaped area and concrete/gravel trail. Stormwater (Q_5 = 1.4 cfs Q_{100} = 4.4 cfs) from this basin sheet flows directly offsite towards DP8.2. Water quality will be accounted for via runoff

EA11 is not shown on drainage maps.

Basin EA13 is not included in the RR calcs. Please add it.

add "for the disturbed area" to clarify that the whole basin area isn't being treated via RR.

reduction swales & grass buffers. This basin will ultimately be detained and treated by the Grandview Reserve development. UD-BMP calculations for the disturbed area within this basin have been provided in the appendix.

Basin EA11 is 1.23 acres of landscaped area. Stormwater (Q_5 = 0.5 cfs Q_{100} = 0.9 cfs) from this basin sheet flows directly offsite towards DP22. Water quality will be accounted for via runoff reduction swales & grass buffers. This basin will ultimately be detained and treated by the Grandview Reserve development. UD-BMP calculations for the disturbed area within this basin have been provided in the appendix.

Basin EA12 is 0.47 acres of landscaped area and gravel maintenance access road. Stormwater (Q_5 = 0.6 cfs Q_{100} = 1.7 cfs) from this basin sheet flows directly into SFB D.

Basin EA13 is 0.21 acres of landscaped area. Stormwater (Q_5 = 0.3 cfs Q_{100} = 0.7 cfs) from this basin sheet flows directly offsite towards DP12. Water quality will be accounted for via runoff reduction swales & grass buffers. This basin will ultimately be detained and treated by the Waterbury development.

Basin OS1 is 1.63 acres of offsite undeveloped area. Stormwater from this basin (Q_5 = 0.5 cfs Q_{100} = 3.6 cfs) drains via sheet flow into a proposed roadside swale on the northwest side of Eastonville Road. Stormwater then drains to DP1. Flows at DP1 then drain across Eastonville Road through a proposed public 18" RCP culvert to DP2. Flows at DP2 then drain southeast offsite in historic drainage patterns. Water quality treatment for the disturbed area within this basin is accounted for by infiltration by grass overland flow.

include in RR calcs

12.18 per drainage map

Basin OS2 is 12.33 acres of offsite undeveloped area. Stormwater from this basin (Q_5 = 3.7 cfs Q_{100} = 24.5 cfs) drains via sheet flow into a proposed roadside swale on the northwest side of Eastonville Road. Stormwater then drains to DP3. Flows at DP3 then drain across Eastonville Road through a proposed public 30" RCP culvert to DP4. Flows at DP4 then drain southeast offsite in historic drainage patterns. Water quality treatment for the disturbed area within this basin is accounted for by infiltration by grass overland flow. UD-BMP calculations for the disturbed area within this basin have been provided in the appendix.

25.50 per drainage map

Basin OS3 is 25.35 acres of offsite undeveloped area. Stormwater from this basin (Q_5 = 7.9 cfs Q_{100} = 53.3 cfs) drains via sheet flow into a proposed roadside swale on the northwest side of Eastonville Road. Stormwater then drains to a proposed public CDOT type D inlet at DP7. Flows at DP7 then drain across Eastonville Road through a proposed public storm sewer system. This storm sewer system outfalls at DP8 into the Gieck Ranch Tributary #1 where drainage will follow historic patterns. Water quality treatment for the disturbed area within this basin is accounted for by infiltration by grass overland flow. UD-BMP calculations for the disturbed area within this basin have been provided in the appendix.

IV. Drainage Facility Design

Also list area of disturbance that needs to be treated.

a. General Concept

The proposed improvements to Eastonville Road from Londonderry Drive to the north part of Grandview Filing No. 1 include removal of the 26' wide treated gravel and replacing the road with a Modified Urban Minor Arterial Roadway Cross-Section consisting of 48' pavement and Type A EPC curb (53' back of curb to back of curb). Inlets will be placed at low points. Stormwater from this roadway will be piped to either a full spectrum detention basin or full spectrum sand filters. All detention basins and water quality features will discharge at less than historic rates. Runoff generated from the site will release at historic design points at less than historic flow rates. A flow comparison of existing/proposed stormwater release rates offsite from the project is below:

Table 1 – Flow Comparison				
DESIGN POINT	EX Q_5 (cfs)	PR Q_5 (cfs)	EX Q_{100} (cfs)	PR Q_{100} (cfs)
DP2	2.3	0.7	9.3	5.0
DP4	6.3	4.1	33.9	26.2
DP6	1.5	0.4	6.7	2.0
DP8 (8.1, 8.2, & 8.3)	11.8	11.5	65.4	62.7
DP2.2/12	0.1	0.3	1.0	0.7
TOTAL	**22.0**	**17.0**	**116.0**	**96.6**

You can delete this column from all 3 of these tables and then create a new table similar to these 3 but with this column and every basin listed in rows with their total area and total proposed disturbed area. It would be a table for "Runoff Reduction WQ Treatment Summary Table."

If needed, add a column to any of these now 4 tables for areas with applicable WQ exclusions.

b. Water Quality & Detention

53% per MHFD calcs

Sand Filter Basin A (Full Spectrum SFB).

Water quality and stormwater detention for Basins EA3-EA5 is provided in Sand Filter Basin A. SFB A is a public county owned, full spectrum sand filter basin within the ACM ALF VIII JV SUB II LLC (Waterbury) property within a proposed drainage easement. In SFB A, a total of 1.58 acres of disturbed area from the proposed project at 55% composite imperviousness will be detained and treated for water quality. The WQCV is 0.023 ac-ft, the EURV is 0.090 ac-ft, and the 100-year detention volume is 0.154 ac-ft. The WQCV, EURV and 100-year storms are released in 12, 40 and 52 hours, respectively. A 15' access and maintenance road is provided to the bottom of the pond to facilitate maintenance of the pond facilities. A 5' emergency overflow spillway is provided that conveys the developed, peak 100-yr flow rate with 1.0' of freeboard south toward DP4. SFB A outfalls towards DP4 at historic runoff rates. Runoff from DP4 will follow historic drainage patterns and not exceed historic flow rates.

SFB A Water Quality Treatment Summary Table				
Basin ID	**Total Area (ac)**	**Total Proposed Disturbed Area (ac)**	**Area Trib to SFB A (ac)**	**Disturbed Area Treated via Runoff Reduction (ac)**
EA3	0.44	0.44	0.44	0
EA4	0.77	0.77	0.77	0
EA5.1	0.37	0.37	0.37	0
Total	1.58	1.58	1.58	0

Extended Detention Basin B (Full Spectrum EDB)

Water quality and detention for Basins EA6 – EA8 is provided in Extended Detention Basin B; a public county owned, full spectrum extended detention basin within Filing No. 1 of Grandview Reserve within a proposed drainage easement. A total of 3.95 acres of disturbed area from the proposed project at 53% composite imperviousness will be treated and detained by EDB B for this phase of the Eastonville Road Improvements. The pond has been sized with consideration for the future segments of Eastonville Road and provides water quality and detention for the ultimate conditions at a future date. The ultimate conditions of EDB B

0.524 per MHFD calcs

calculations have been provided in the Appendix of this report. Ultimate conditions include fully built sections of Eastonville Road from Londonderry Road to Rex Road and is anticipated for Spring 2025. The ultimate condition of EDB B is further described and analyzed in the segment 2 report. Interim condition pond sizing calculations have also been provided in the Appendix of this report. Interim conditions only include Eastonville road from Londonderry to Grandview Filing No.1. The interim conditions WQCV is 0.071 ac-ft, the EURV is 0.245 ac-ft, and the 100-year detention volume is 0.384 ac-ft. The WQCV, EURV and 100-year storms are released in 43, 68 and 69 hours, respectively. A forebay is located at the outfall into the pond and a 40" trickle channel conveys flow towards the outlet structure. A 15' access and maintenance road is provided to the bottom of the pond to facilitate maintenance of the pond facilities. A 15.5' emergency overflow spillway is provided that conveys the developed, peak 100-yr flow rate with 1.0' of freeboard towards Gieck Ranch Tributary #1. EDB B outfalls towards DP8 at historic runoff rates. Runoff from DP8 will follow historic drainage patterns and not exceed historic flow rates.

EDB B Water Quality Treatment Summary Table

Basin ID	Total Area (ac)	Total Proposed Disturbed Area (ac)	Area Trib to SFB A (ac)	Disturbed Area Treated via Runoff Reduction (ac)
EA6	1.09	1.09	1.09	0
EA7	1.92	1.92	1.92	0
EA8	0.94	0.94	0.94	0
Total	3.95	3.95	3.95	0

Clearly label that this table represents EDB B's "interim" condition. And then in the Segment 2 FDR, include this same type of table for EDB B but show the "ultimate" condition. Currently there is no table like this in the Segment 2 FDR for EDB B.

<u>Sand Filter Basin D (Full Spectrum SFB).</u>

Water quality and stormwater detention for Basins EA1-EA2, EA12, & OS1 is provided in Sand Filter Basin D. SFB D is a public county owned, full spectrum sand filter basin the ACM ALF VIII JV SUB II LLC (previous Waterbury) property within a proposed drainage easement. In SFB D, a total of 3.93 acres of disturbed area from the proposed project at 34% composite imperviousness will be detained and treated for water quality. The WQCV is 0.043 ac-ft, the EURV is 0.139 ac-ft, and the 100-year detention volume is 0.282 ac-ft. The WQCV, EURV and 100-year storms are released in 14, 42 and 54 hours, respectively. A 15' access and maintenance road is provided to the bottom of the pond to facilitate maintenance of the pond facilities. A 4' emergency overflow spillway is provided that conveys the developed, peak 100-yr flow rate with 1.0' of freeboard south toward DP2. SFB D outfalls towards DP2 at historic runoff rates. Runoff from DP2 will follow historic drainage patterns and not exceed historic flow rates

Include discussion if coordination with PPRTA Pond E has been done.

SFB D Water Quality Treatment Summary Table

Basin ID	Total Area (ac)	Total Proposed Disturbed Area (ac)	Area Trib to SFB A (ac)	Disturbed Area Treated via Runoff Reduction (ac)
EA1	0.62	0.62	0.62	0
EA2	1.21	1.21	1.21	0
EA12	0.47	0.47	0.47	0
OS1	1.63	1.63	1.63	0

Total	3.93	3.93	3.93	0

c. Inspection and Maintenance

After completion of construction and upon the Board of County Commissioners acceptance, it is anticipated that all drainage facilities within the public Right-of-Way are to be owned and maintained by El Paso County.

All public detention ponds are to be owned and maintained by the Grandview Reserve Metropolitan District NO. 2 (DISTRICT), once established, unless an agreement is reached stating otherwise. Maintenance access for all full spectrum detention facilities will be provided from public Right-of-Way. Maintenance access for the drainageways will be provided through the proposed tracts.

V. Wetlands Mitigation

There are no wetlands in Segment 1 of the project and therefore no wetland permit is required for Segment 1.

VI. Four Step Method to Minimize Adverse Impacts of Urbanization

Step 1 – Reducing Runoff Volumes: Low impact development (LID) practices are utilized to reduce runoff at the source. Storm sewer outfalls have been designed at the upstream end of detention basins. This practice promotes infiltration in the detention basins and reduces peak runoff rates prior to runoff reaching outlet structures.

Step 2 – Treat and slowly release the WQCV: This step utilizes full spectrum water quality and detention to capture the WQCV and slowly release runoff from the site. Onsite full spectrum sand filter basins & an extended detention basin provide water quality treatment for the site. The WQCV is released over a period of at least 12 hours for SFBs and 40 hours for EDBs while the EURV is released over a period of 40-44 hours for SFBs and 68 - 72 hours for EDBs.

Step 3 – Stabilize stream channels: This step establishes practices to stabilize drainageways and provide scour protection at stormwater outfalls. Erosion protection is provided at all concentrated stormwater discharge points in the form of riprap pads. No impact will be made to the Gieck Ranch Tributary #1 by this project that requires additional stream stabilization.

Step 4 – Consider the need for source controls: No industrial or commercial uses are proposed within this development and therefore no source controls are proposed.

VII. Drainage and Bridge Fees

Gieck Ranch drainage basin has not been established as a fee basin within El Paso County. Therefore, no drainage basin fees are due at time of platting.

VIII. Opinion of Probable Cost

An engineer’s opinion of probable cost has been provided below for public drainage infrastructure improvements. This includes cost estimates for the public full spectrum sand filter basin A, public full spectrum sand filter basin D and the public full spectrum extended detention basin B. All required stormwater infrastructure will be installed per El Paso County Requirements. The unit cost includes both materials and labor.

Public Infrastructure Cost Estimate				
Line Item	**Quantity**	**Unit Price**		**Cost**
18" Reinforced Concrete Pipe	226.5	$76	LF	$17,214
24" Reinforced Concrete Pipe	609	$91	LF	$55,419
36" Reinforced Concrete Pipe	42	$114	LF	$4,788
42" Reinforced Concrete Pipe	736	$187	LF	$137,632
24" CDOT FES	2	$684	EA	$1,368
42" CDOT FES	1	$912	EA	$912
6' DIA Storm Manhole	9	$7,734	EA	$69,606
10' CDOT Type R Inlet	4	$7,000	EA	$28,000
15' CDOT Type R Inlet	2	$7,500	EA	$15,000
CDOT Type C Inlet	1	$5,000	EA	$5,000
CDOT Type D Inlet	1	$6,931	EA	$6,931
Rip Rap, d50 size from 6"-24"	5	$97	Tons	$485
10% Contingency				$34,236
TOTAL:				**$376,591**

Revise to "slotted"

Public SFB A Cost Estimate				
Line Item	**Quantity**	**Unit Price**		**Cost**
Rip Rap, d50 size from 6"-24" (Inflow)	2	$97	Tons	$194
Sand Filter Media	78	$100	/CY	$7,800
4" Perforated PVC Underdrain	100	$10	/LF	$1,000
12" ABC Maintenance Access	25	$40	/CY	$1,000
Outlet Structure w/ Orifice Plate	1	$5,000	EA	$5,000
Rip Rap, d50 size from 6"-24" (Spillway)	60.5	$97	Tons	$5,869
12" RCP Outlet Pipe	42.5	$60	/LF	$2,550
12" RCP FES	1	$350	EA	$350
10% Contingency				$2,376
TOTAL:				**$26,139**

These values have to match what is shown in Section 1 of the FAE for each PBMP/PCM

Public EDB B Cost Estimate				
Line Item	**Quantity**	**Unit Price**		**Cost**
Concrete Forebay	1	$5,000	EA	$5,000
Rip Rap, d50 size from 6"-24" (Inflow)	2.75	$97	Tons	$267
Concrete Trickle Channel	36	$100	/SY	$3,600

12" ABC Maintenance Access	147	$40	/CY	$5,880
Outlet Structure w/ Micropool, Trash Rack, Railng, Orifice Plate	1	$8,000	EA	$8,000
Rip Rap, d50 size from 6"-24" (Spillway)	87	$97	Tons	$8,439
18" RCP Outlet Pipe	31	$76	/LF	$2,356
10% Contingency				$3,354
TOTAL:				**$36,896**

Revise to "slotted"

Public SFB D Cost Estimate				
Line Item	**Quantity**	**Unit Price**		**Cost**
Rip Rap, d50 size from 6"-24" (Inflow)	2	$97	Tons	$194
Sand Filter Media	78	$100	/CY	$7,800
4" Perforated PVC Underdrain	86	$10	/LF	$860
12" ABC Maintenance Access	107	$40	/CY	$4,280
Outlet Structure w/ Orifice Plate	1	$5,000	EA	$5,000
Rip Rap, d50 size from 6"-24" (Spillway)	25	$97	Tons	$2,425
12" RCP Outlet Pipe	54	$60	/LF	$3,240
12" RCP FES	1	$350	EA	$350
10% Contingency				$2,415
TOTAL:				**$26,564**

These values have to match what is shown in Section 1 of the FAE for each PBMP/PCM

IX. Hydraulic Grade Line Analysis

Hydraulic grade line analysis and final pipe sizes were analyzed, and calculations are provided in Appendix C. All proposed storm sewer has been designed in accordance with El Paso County Drainage Criteria Manuals.

X. Summary

Eastonville Road lies within the Gieck Ranch Drainage Basin. Water quality and detention for the proposed improvements is provided in full spectrum extended detention basins and two full spectrum sand filter basins, both within proposed drainage easements. There is one major drainageway that traverses north of the Segment 1 site: Gieck Ranch Tributary 1. This major drainage way will not be impacted by the proposed improvements. The water quality and detention ponds will be owned and maintained by El Paso County. All drainage facilities were sized per the El Paso County Drainage Criteria Manuals.

The development of this project will not adversely affect downstream properties.

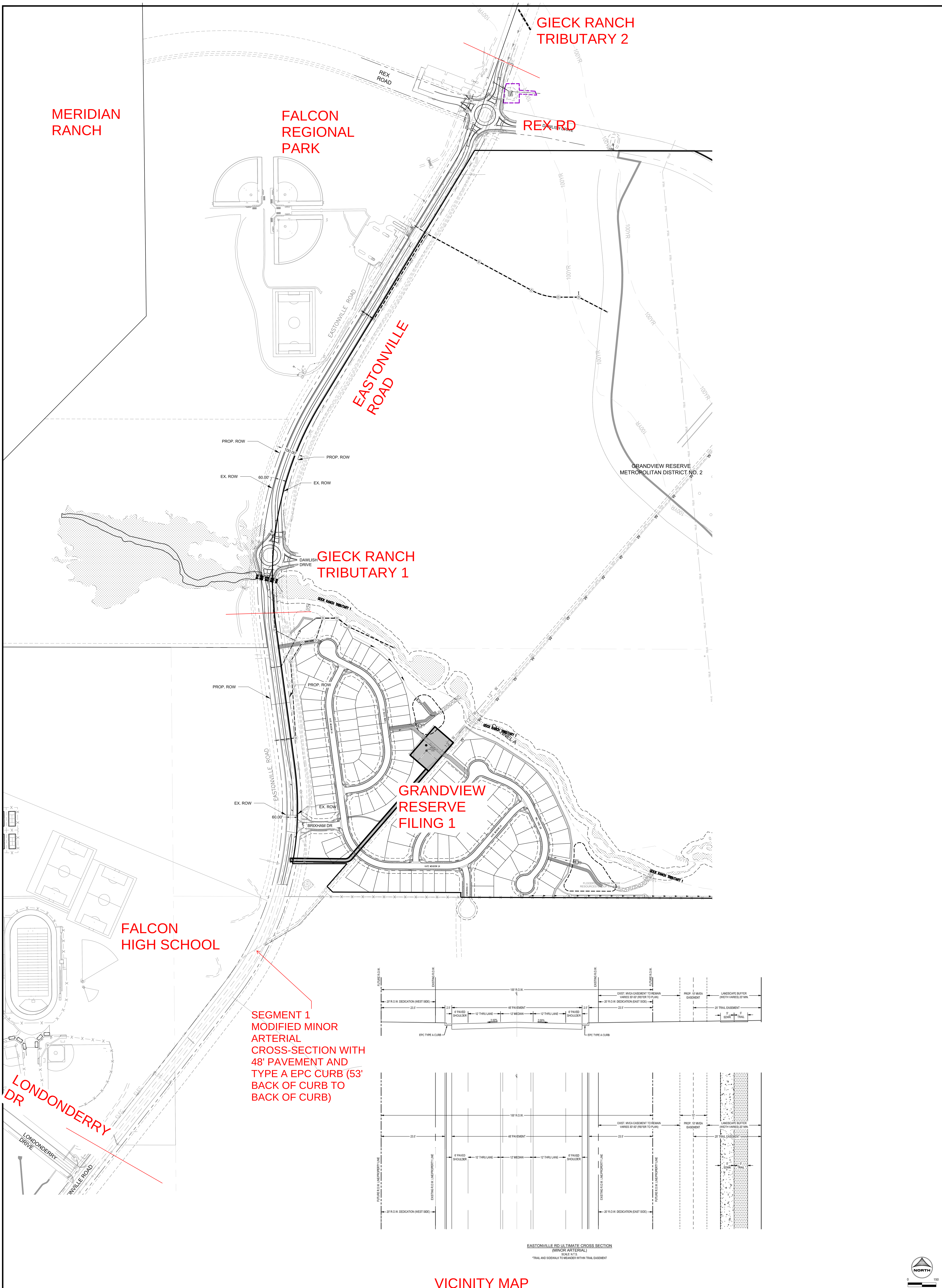
XI. Drawings

Please refer to the appendices for vicinity and drainage basin maps.

XII. References

1. City of Colorado Springs – Drainage Criteria Manual, May 2014, Revised January 2021.
2. Drainage Criteria Manual of El Paso, Colorado, October 2018.
3. Urban Storm Drainage Criteria Manual, Urban Drainage Flood Control District, January 2018.
4. “Gieck Ranch Drainage Basin Planning Study” prepared by Drexel, Barrel & Co, February 2010.
5. “Master Development Drainage Plan Meridian Ranch” prepared by Tech Contractors, July 2021.
6. “The Sanctuary Filing 1 at Meridian Ranch” prepared by Tech Contactors, August 2022.

APPENDIX A – VICINITY MAP, PHOTOS, SOIL MAP, FEMA MAP



VICINITY MAP
N.T.S.

DRAWN BY:	CPM	JOB DATE:	8/29/2023
APPROVED:		JOB NUMBER:	201662.08
CAD DATE:	8/29/2023		
CAD FILE:	J:\2020\201662.08\CAD\Dwgs\Exhibits\-Overall-Exhibit		

BAR IS ONE INCH ON OFFICIAL DRAWINGS.
0 1"
IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

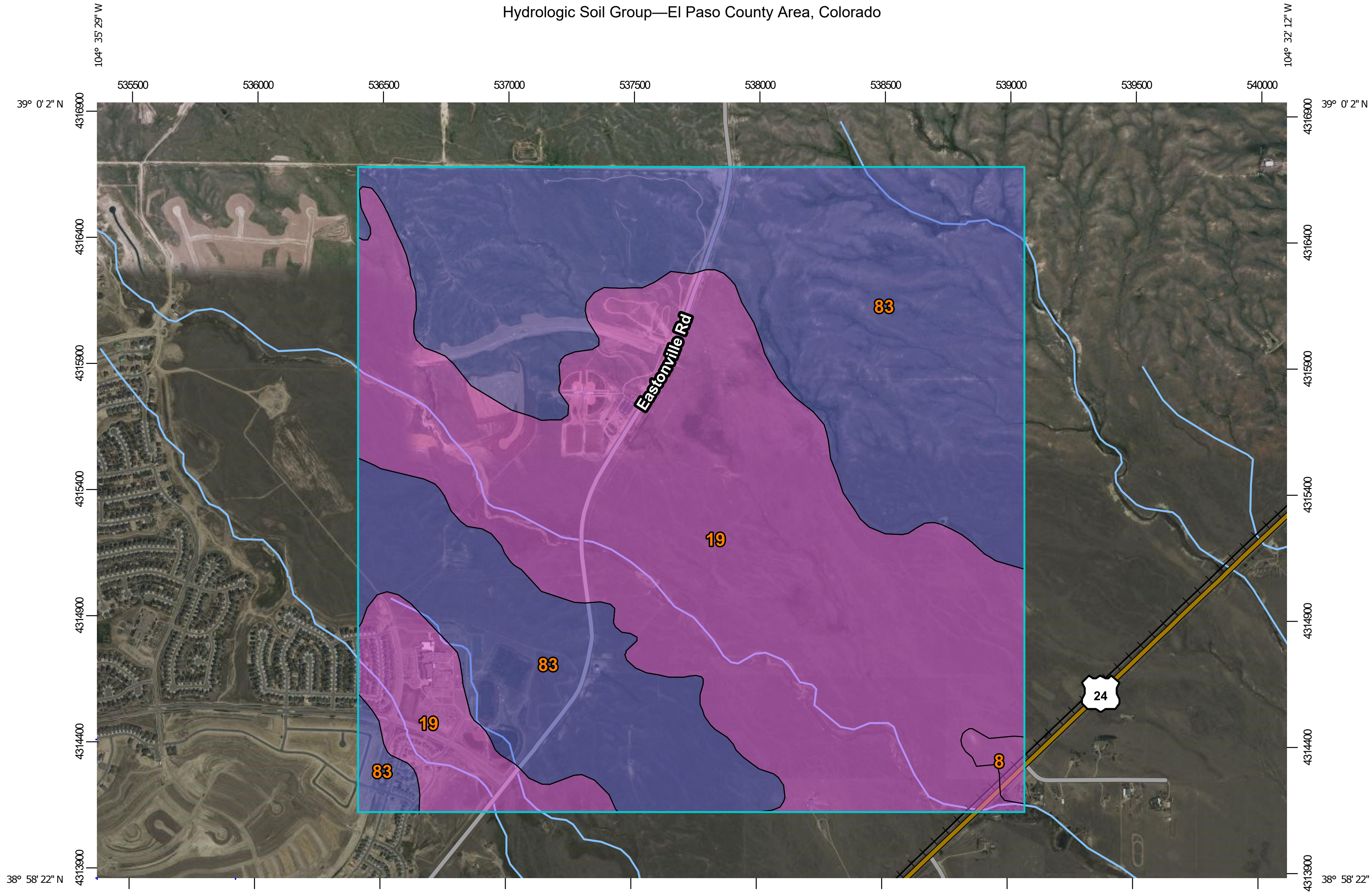
HRGreen
HR GREEN - COLORADO SPRINGS
7222 COMMERCE CENTER DR. SUITE 220
COLORADO SPRINGS CO 80919
PHONE: 719.622.6222
FAX: 844.273.1057

EASTONVILLE ROAD
DR HORTON
EL PASO COUNTY, CO

OVERALL EASTONVILLE PLAN

SHEET
1
1

Photo - at Londonderry and Eastonville looking north



Map Scale: 1:21,700 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 300, 600, 1200, 1800

Feet: 0, 1000, 2000, 4000, 6000

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Date(s) aerial images were photographed: Sep 11, 2018—Jun 12, 2021

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	10.4	0.6%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	839.5	49.8%
83	Stapleton sandy loam, 3 to 8 percent slopes	B	835.7	49.6%
Totals for Area of Interest			**1,685.6**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES TO USERS

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

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

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

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

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

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

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

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

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

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, City of Fountain, Bureau of Land Management, National Oceanic and Atmospheric Administration, United States Geological Survey, and Anderson Consulting Engineers, Inc. These data are current as of 2006.

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

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

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

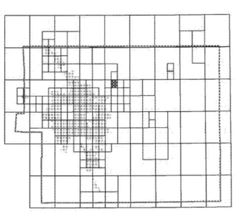
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this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

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

El Paso County Vertical Datum Offset Table

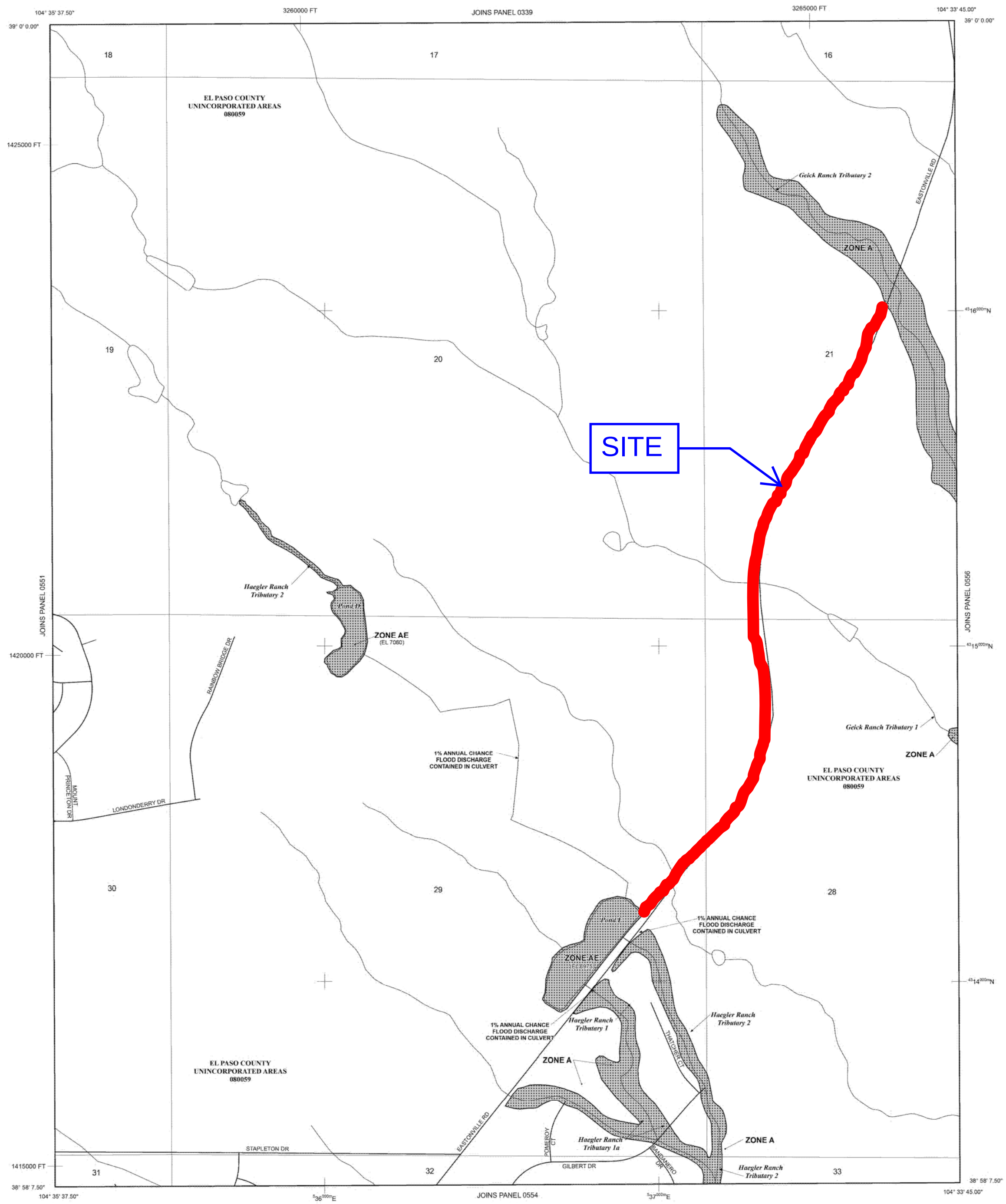
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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

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



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 64 WEST.

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

(A)—(A) Cross section line
(23)- - - -(23) Transect line
97° 07' 30.00" 32° 22' 30.00" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
4275000mN 1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 × Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0552G

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

PANEL 552 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
EL PASO COUNTY	080059	0552	G

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

MAP NUMBER
08041C0552G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

NOAA Atlas 14, Volume 8, Version 2
Location name: Elbert, Colorado, USA*
Latitude: 38.9796°, Longitude: -104.5696°
Elevation: 6996 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.239 (0.189-0.303)	0.291 (0.231-0.370)	0.381 (0.301-0.486)	0.461 (0.361-0.589)	0.576 (0.440-0.768)	0.671 (0.499-0.904)	0.770 (0.554-1.06)	0.875 (0.604-1.24)	1.02 (0.678-1.48)	1.14 (0.733-1.67)
10-min	0.350 (0.277-0.444)	0.426 (0.338-0.542)	0.558 (0.441-0.711)	0.674 (0.529-0.863)	0.844 (0.644-1.12)	0.982 (0.731-1.32)	1.13 (0.811-1.56)	1.28 (0.884-1.81)	1.49 (0.992-2.17)	1.66 (1.07-2.44)
15-min	0.426 (0.338-0.541)	0.520 (0.412-0.660)	0.681 (0.537-0.867)	0.823 (0.645-1.05)	1.03 (0.785-1.37)	1.20 (0.891-1.62)	1.37 (0.988-1.90)	1.56 (1.08-2.21)	1.82 (1.21-2.65)	2.03 (1.31-2.98)
30-min	0.608 (0.482-0.771)	0.740 (0.586-0.940)	0.968 (0.764-1.23)	1.17 (0.916-1.49)	1.46 (1.11-1.94)	1.70 (1.26-2.28)	1.94 (1.40-2.68)	2.20 (1.52-3.12)	2.57 (1.71-3.73)	2.86 (1.84-4.19)
60-min	0.775 (0.615-0.984)	0.933 (0.739-1.18)	1.21 (0.956-1.54)	1.46 (1.15-1.87)	1.84 (1.41-2.47)	2.16 (1.61-2.92)	2.49 (1.80-3.45)	2.85 (1.97-4.05)	3.37 (2.24-4.90)	3.78 (2.44-5.54)
2-hr	0.943 (0.754-1.19)	1.12 (0.898-1.42)	1.46 (1.16-1.84)	1.76 (1.39-2.23)	2.22 (1.72-2.97)	2.62 (1.97-3.52)	3.04 (2.21-4.19)	3.50 (2.45-4.95)	4.16 (2.80-6.03)	4.70 (3.06-6.85)
3-hr	1.03 (0.829-1.29)	1.22 (0.978-1.53)	1.57 (1.25-1.97)	1.90 (1.51-2.40)	2.41 (1.88-3.22)	2.86 (2.17-3.84)	3.34 (2.45-4.60)	3.88 (2.73-5.48)	4.66 (3.15-6.74)	5.29 (3.46-7.69)
6-hr	1.20 (0.968-1.48)	1.40 (1.13-1.74)	1.78 (1.44-2.22)	2.16 (1.73-2.70)	2.76 (2.18-3.66)	3.28 (2.52-4.39)	3.86 (2.86-5.29)	4.51 (3.20-6.34)	5.46 (3.73-7.86)	6.24 (4.12-9.01)
12-hr	1.38 (1.13-1.70)	1.61 (1.31-1.98)	2.05 (1.66-2.53)	2.48 (2.00-3.07)	3.15 (2.51-4.15)	3.74 (2.89-4.96)	4.39 (3.28-5.96)	5.12 (3.66-7.13)	6.17 (4.25-8.82)	7.04 (4.69-10.1)
24-hr	1.60 (1.31-1.95)	1.87 (1.54-2.28)	2.38 (1.94-2.91)	2.85 (2.32-3.51)	3.60 (2.88-4.67)	4.24 (3.29-5.56)	4.94 (3.71-6.63)	5.71 (4.12-7.87)	6.82 (4.73-9.66)	7.73 (5.20-11.0)
2-day	1.85 (1.54-2.24)	2.18 (1.80-2.63)	2.76 (2.28-3.34)	3.29 (2.70-4.01)	4.11 (3.30-5.27)	4.80 (3.76-6.22)	5.54 (4.19-7.36)	6.35 (4.62-8.68)	7.50 (5.25-10.5)	8.44 (5.73-11.9)
3-day	2.03 (1.69-2.44)	2.39 (1.98-2.87)	3.02 (2.50-3.64)	3.60 (2.97-4.36)	4.47 (3.60-5.69)	5.20 (4.08-6.70)	5.98 (4.55-7.90)	6.83 (4.99-9.28)	8.03 (5.65-11.2)	9.00 (6.15-12.7)
4-day	2.18 (1.82-2.61)	2.56 (2.13-3.06)	3.22 (2.68-3.87)	3.82 (3.16-4.62)	4.73 (3.83-6.00)	5.49 (4.33-7.04)	6.30 (4.81-8.30)	7.18 (5.26-9.72)	8.43 (5.94-11.7)	9.43 (6.46-13.3)
7-day	2.58 (2.17-3.07)	2.98 (2.50-3.54)	3.68 (3.08-4.39)	4.32 (3.60-5.18)	5.29 (4.30-6.65)	6.09 (4.84-7.76)	6.96 (5.34-9.09)	7.89 (5.82-10.6)	9.21 (6.55-12.8)	10.3 (7.10-14.4)
10-day	2.93 (2.48-3.47)	3.36 (2.84-3.98)	4.13 (3.47-4.90)	4.81 (4.02-5.74)	5.83 (4.76-7.28)	6.68 (5.32-8.45)	7.58 (5.85-9.86)	8.55 (6.34-11.4)	9.92 (7.08-13.7)	11.0 (7.65-15.4)
20-day	3.91 (3.33-4.58)	4.51 (3.84-5.29)	5.52 (4.68-6.50)	6.39 (5.39-7.55)	7.63 (6.25-9.37)	8.62 (6.90-10.8)	9.64 (7.47-12.4)	10.7 (7.98-14.1)	12.2 (8.74-16.6)	13.3 (9.31-18.4)
30-day	4.70 (4.02-5.47)	5.44 (4.65-6.34)	6.65 (5.66-7.78)	7.66 (6.49-9.00)	9.06 (7.44-11.0)	10.1 (8.15-12.5)	11.2 (8.74-14.3)	12.3 (9.24-16.2)	13.8 (9.98-18.7)	15.0 (10.5-20.6)
45-day	5.67 (4.88-6.57)	6.55 (5.63-7.60)	7.97 (6.82-9.27)	9.12 (7.77-10.7)	10.7 (8.79-12.9)	11.9 (9.56-14.5)	13.0 (10.2-16.4)	14.2 (10.6-18.4)	15.6 (11.3-21.0)	16.7 (11.9-23.0)
60-day	6.48 (5.60-7.48)	7.46 (6.43-8.62)	9.01 (7.74-10.4)	10.3 (8.77-11.9)	11.9 (9.82-14.3)	13.1 (10.6-16.0)	14.3 (11.2-18.0)	15.5 (11.7-20.0)	16.9 (12.3-22.6)	18.0 (12.8-24.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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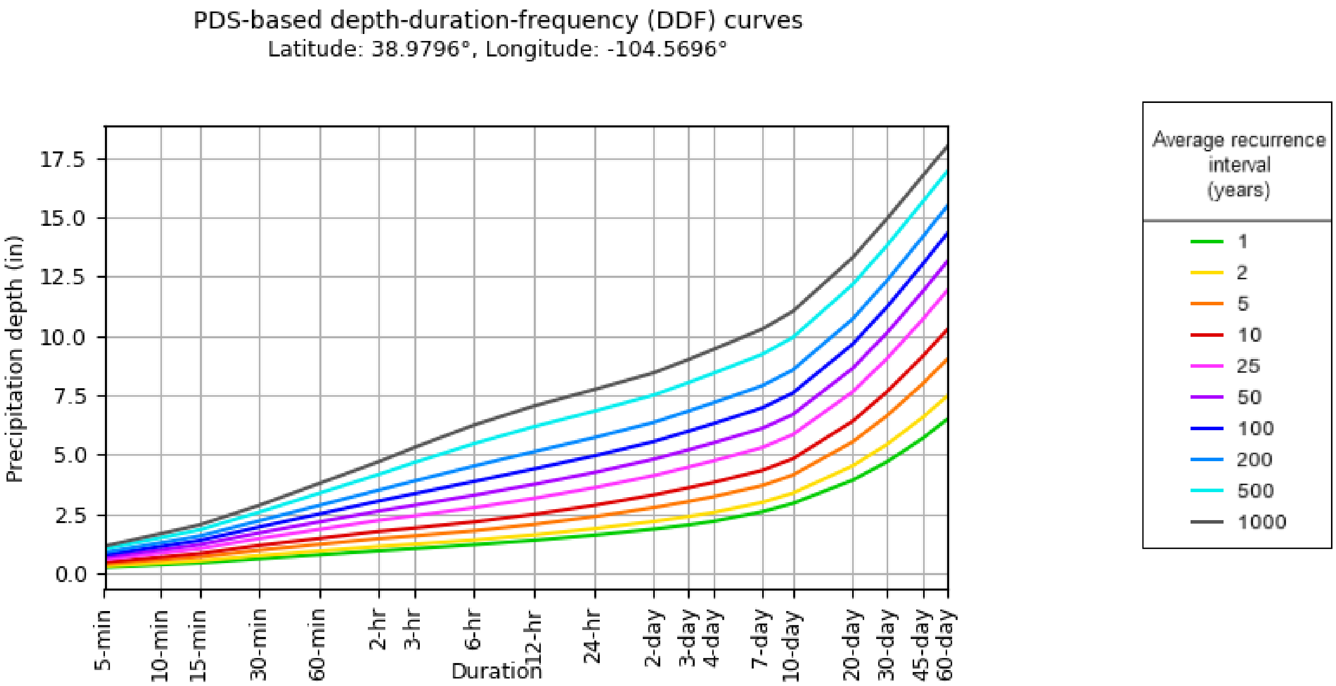
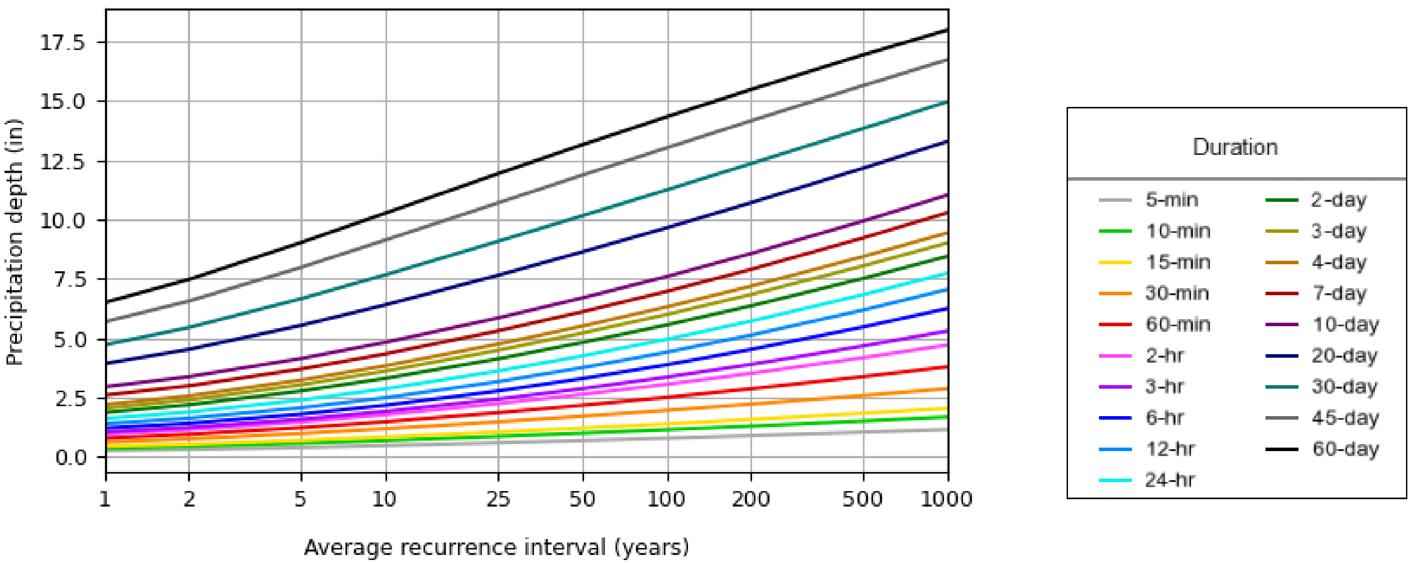
PF graphical





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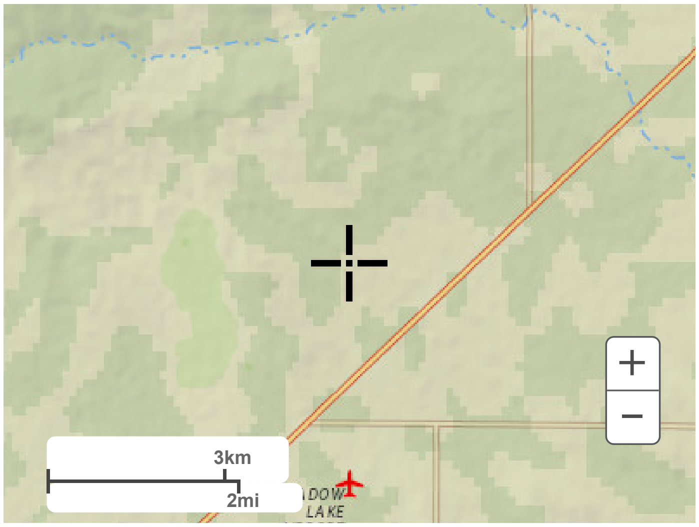
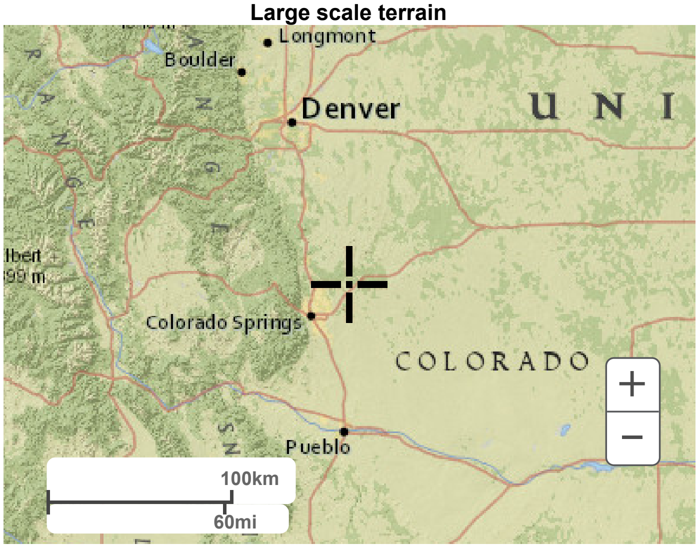
Maps & aerials

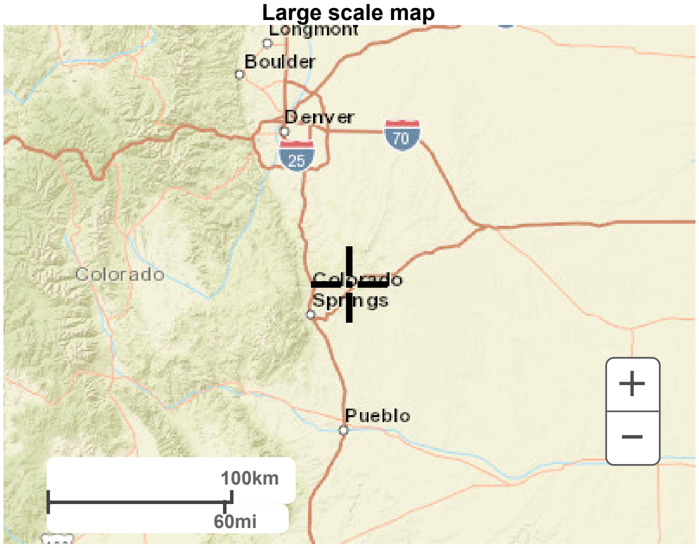
Small scale terrain



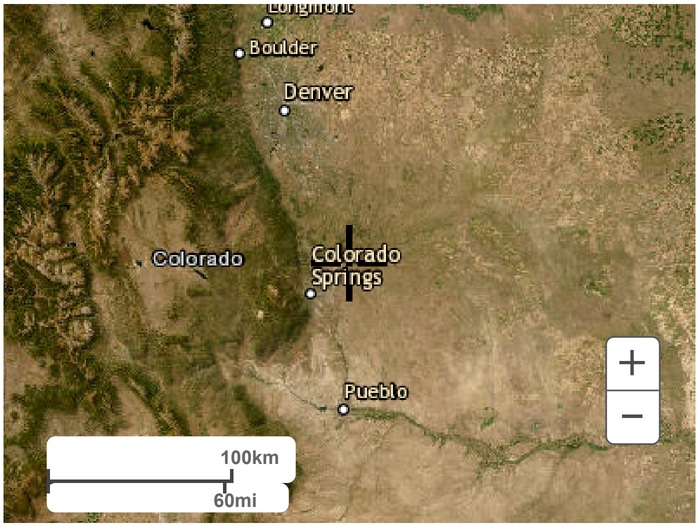
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

APPENDIX B – HYDROLOGIC CALCULATIONS

EASTONVILLE ROAD		**Calc'd by:**	**SPC**
EXISTING CONDITIONS		**Checked by:**	**CM**
EL PASO COUNTY, CO		**Date:**	**8/22/2024**

HRGreen

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
E1	0.47	46	0.7	1.7
E2.1	1.82	13	1.2	4.8
E2.2	0.40	2	0.1	1.0
E3	0.72	39	1.0	2.5
E4	3.17	12	1.9	7.8
E5	0.23	45	0.5	1.1
E6	0.79	14	0.7	2.6
E7	0.23	45	0.5	1.2
E8	0.70	16	0.6	2.1
E9	0.73	45	1.2	2.8
E10.1	2.61	15	1.9	7.0
E10.2	1.89	2	0.7	4.4
OS1	1.58	2	0.5	3.6
OS2	12.21	2	3.6	24.3
OS3.1	1.51	2	0.5	3.6
OS3.2	2.86	2	1.0	6.6
OS3.3	21.12	2	6.4	42.7

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	E1,OS1	1.2	4.9
2	E2,DP1	2.3	9.3
2.2	E2.2	0.1	1.0
3	E3,OS2	4.6	26.6
4	DP3,E4	6.3	33.9
5	E5,OS3.1	0.9	4.5
6	DP5,E6	1.5	6.7
7.1	E7,OS3.2	1.4	7.5
8.1	DP7.1,E8	1.9	9.4
7.2	OS3.3,E9	7.5	45.3
8.2	DP7.2,E10.1	9.2	51.6
8.3	E10.2	0.7	4.4

HRGreen	EASTONVILLE ROAD
	EXISTING CONDITIONS
	EL PASO COUNTY, CO

Calc'd by:	SPC
Checked by:	
Date:	11/27/2023

SOIL TYPE:	HSG A&B

COMPOSITE 'C' FACTORS

BASIN	LAND USE TYPE															TOTAL	COMPOSITE IMPERVIOUSNESS & C FACTOR		
	Paved			Historic Flow Analysis-- Greenbelts, Agriculture			Land Use Undefined			Land Use Undefined			Land Use Undefined						
	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}	%I	C_5	C_{100}				
	100	0.90	0.96	2	0.09	0.36	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00				
	ACRES			ACRES			ACRES			ACRES			ACRES			ACRES	%I	C_5	C_{100}
E1	0.21			0.26												0.47	46	0.45	0.63
E2.1	0.20			1.62												1.82	13	0.18	0.43
E2.2				0.40												0.40	2	0.09	0.36
E3	0.27			0.45												0.72	39	0.39	0.59
E4	0.31			2.86												3.17	12	0.17	0.42
E5	0.10			0.13												0.23	45	0.44	0.62
E6	0.10			0.69												0.79	14	0.19	0.44
E7	0.10			0.13												0.23	45	0.44	0.62
E8	0.10			0.60												0.70	16	0.21	0.45
E9	0.32			0.41												0.73	45	0.45	0.62
E10.1	0.35			2.26												2.61	15	0.20	0.44
E10.2				1.89												1.89	2	0.09	0.36
OS1				1.58												1.58	2	0.09	0.36
OS2				12.21												12.21	2	0.09	0.36
OS3.1				1.51												1.51	2	0.09	0.36
OS3.2				2.86												2.86	2	0.09	0.36
OS3.3				21.12												21.12	2	0.09	0.36

	EASTONVILLE ROAD	Calc'd by:	SPC
HRGreen	EXISTING CONDITIONS	Checked by:	
	EL PASO COUNTY, CO	Date:	8/22/2024

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL
DESIGNATION	C_5	AREA (ac)	LENGTH (ft)	SLOPE %	t_i (min)	C_V	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)
E1	0.45	0.47	117	11.6	5.7	10	1162	3.4	1.8	10.5	16.2
E2.1	0.18	1.82	87	2.4	11.8	10	518	1.7	1.3	6.6	18.4
E2.2	0.09	0.40	92	2.0	14.1	10	89	3.4	1.8	0.8	14.9
E3	0.39	0.72	40	2.0	6.5	10	794	2.5	1.6	8.4	14.9
E4	0.17	3.17	113	5.5	10.3	10	830	2.5	1.6	8.7	19.0
E5	0.44	0.23	30	13.8	2.8	10	310	1.4	1.2	4.4	7.1
E6	0.19	0.79	30	13.8	3.8	10	310	1.4	1.2	4.4	8.2
E7	0.44	0.23	35	25.0	2.4	10	161	0.6	0.8	3.5	5.9
E8	0.21	0.70	25	1.0	8.2	10	161	0.6	0.8	3.5	11.7
E9	0.45	0.73	30	2.0	5.2	10	711	0.5	0.7	16.8	22.0
E10.1	0.20	2.61	30	2.0	7.2	10	711	0.5	0.7	16.8	23.9
E10.2	0.09	1.89	300	2.7	23.2	10	15	4.8	2.2	0.1	23.3
OS1	0.09	1.58	300	2.8	22.8	10	213	4.5	2.1	1.7	24.4
OS2	0.09	12.21	300	4.1	20.0	10	1042	3.4	1.8	9.4	29.5
OS3.1	0.09	1.51	136	3.9	13.7	10	150	8.9	3.0	0.8	14.6
OS3.2	0.09	2.86	174	8.6	11.9	10	267	4.4	2.1	2.1	14.0
OS3.3	0.09	21.12	300	6.0	17.7	10	930	3.4	1.8	8.4	26.1

FORMULAS:

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad V = C_v S_w^{\ 0.5}$$

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

HRGreen

EASTONVILLE ROAD		**Calc'd by:**	**SPC**
EXISTING CONDITIONS		**Checked by:**	
DESIGN STORM: 5-YEAR		**Date:**	**8/22/2024**

			DIRECT RUNOFF						**TOTAL RUNOFF**				**STREET**			**PIPE**				**TRAVEL TIME**			**REMARKS**
STREET	**DESIGN POINT**	**BASIN ID**	**AREA (ac)**	**C_5**	**t_c (min)**	**C_5*A (ac)**	***I* (in./ hr.)**	**Q (cfs)**	**t_c (min)**	**C_5*A (ac)**	***I* (in./ hr.)**	**Q (cfs)**	**Q_{street} (cfs)**	**C_5*A (ac)**	**SLOPE %**	**Q_{PIPE} (cfs)**	**C_5*A (ac)**	**SLOPE %**	**PIPE SIZE (ft)**	**LENGTH (FT)**	**VEL. (FPS)**	**TRAVEL TIME (min**	
		E1	0.47	0.45	16.2	0.21	3.41	0.7															BASIN E1 CAPTURED @ DP1
	1	OS1	1.58	0.09	12.9	0.14	3.75	0.5	16.2	0.35	3.41	**1.2**				1.2	0.35	0.6	3.0	73	7.5	0.16	BASIN E1 AND OS1 COMBINE @ DP1 CAPTURED IN 36" CMP CULVERT, PIPED TO BASIN E2
	2	E2.1	1.82	0.18	13.4	0.33	3.69	1.2	16.3	0.68	3.39	**2.3**											FLOW @ DP2 CONVEYED OFFSITE
	2.2	E2.2	0.40	0.09	11.0	0.04	3.99	0.1	11.0	0.04	3.99	**0.1**											FLOW @ DP2.2 CONVEYED OFFSITE
		E3	0.72	0.39	14.6	0.28	3.56	1.0															BASIN E3 CAPTURED @ DP3
	3	OS2	12.21	0.09	17.5	1.10	3.29	3.6	17.5	1.38	3.29	**4.6**				4.6	1.38	1.1	2.0	47	7.6	0.10	BASIN E3 AND OS2 COMBINE @ DP3 CAPTURED IN 24" CMP CULVERT, PIPED TO BASIN E4
	4	E4	3.17	0.17	15.2	0.54	3.50	1.9	17.6	1.92	3.28	**6.3**											FLOW @ DP4 CONVEYED OFFSITE
		E5	0.23	0.44	7.1	0.10	4.64	0.5															BASIN E5 CAPTURED @ DP5
	5	OS3.1	1.51	0.09	11.6	0.14	3.91	0.5	11.6	0.24	3.91	**0.9**				0.9	0.24	1.3	1.5	56	6.8	0.14	BASIN E5 AND OS3 COMBINE @ DP5 CAPTURED IN 18" CMP CULVERT, PIPED TO BASIN E6
	6	E6	0.79	0.19	8.2	0.15	4.43	0.7	11.7	0.39	3.89	**1.5**											FLOW @ DP6 CONVEYED OFFSITE
		E7	0.23	0.44	5.9	0.10	4.92	0.5															BASIN E7 CAPTURED @ DP7
	7.1	OS3.2	2.86	0.09	12.5	0.26	3.80	1.0	12.5	0.36	3.80	**1.4**				1.4	0.36	0.2	1.5	53	2.3	0.38	BASIN E7 AND OS4.1 COMBINE @ DP7.1 CAPTURED IN 18" CMP CULVERT, PIPED TO BASIN E8
	8.1	E8	0.70	0.21	11.0	0.14	3.98	0.6	12.8	0.50	3.75	**1.9**											FLOW @ DP8.1 CONVEYED OFFSITE
		E9	0.73	0.45	14.1	0.32	3.61	1.2															BASIN E9 CAPTURED @ DP7.2
	7.2	OS3.3	21.12	0.09	16.8	1.90	3.35	6.4	16.8	2.23	3.35	**7.5**				7.5	2.23	0.8	1.5	43	5.3	0.13	BASIN E9 AND OS 4.2 COMBINE @ DP7.2 CAPTURED IN 18" CMP CULVERT, PIPED TO BASIN E10
	8.2	E10.1	2.61	0.20	14.1	0.52	3.61	1.9	17.0	2.74	3.34	**9.2**											FLOW @ DP8.2 CONVEYED OFFSITE
	8.3	E10.2	1.89	0.09	11.8	0.17	3.89	0.7	11.8	0.17	3.89	**0.7**											FLOW @ DP8.3 CONVEYED OFFSITE

HRGreen	EASTONVILLE ROAD																					Calc'd by:	SPC
	EXISTING CONDITIONS																					Checked by:	
	DESIGN STORM: 100-YEAR																					Date:	8/22/2024
			DIRECT RUNOFF						TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_{100}	t_c (min)	C_{100}*A (ac)	*I* (in./ hr.)	Q (cfs)	t_c (min)	C_{100}*A (ac)	*I* (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_{100}*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_{100}*A (ac)	SLOPE %	PIPE SIZE (ft)	LENGTH (ft)	VEL. (ft/s)	TRAVEL TIME (min)	
		E1	0.47	0.63	16.2	0.30	5.72	1.7															BASIN E1 CAPTURED @ DP1
	1	OS1	1.58	0.36	12.9	0.57	6.30	3.6	16.2	0.86	5.72	**4.9**				4.9	0.86	0.6	3.0	73	7.5	0.16	BASIN E1 AND OS1 COMBINE @ DP1 CAPTURED IN 36" CMP CULVERT, PIPED TO BASIN E2
	2	E2.1	1.82	0.43	13.4	0.78	6.20	4.8	16.3	1.64	5.69	**9.3**											FLOW @ DP2 CONVEYED OFFSITE
	2.2	E2.2	0.40	0.36	11.0	0.14	6.69	1.0	11.0	0.14	6.69	**1.0**											FLOW @ DP2.2 CONVEYED OFFSITE
		E3	0.72	0.59	14.6	0.42	5.97	2.5															BASIN E3 CAPTURED @ DP3
	3	OS2	12.21	0.36	17.5	4.40	5.53	24.3	17.5	4.82	5.53	**26.6**				26.6	4.82	1.1	2.0	47	7.6	0.10	BASIN E3 AND OS2 COMBINE @ DP3 CAPTURED IN 24" CMP CULVERT, PIPED TO BASIN E4
	4	E4	3.17	0.42	15.2	1.33	5.87	7.8	17.6	6.14	5.51	**33.9**											FLOW @ DP4 CONVEYED OFFSITE
		E5	0.23	0.62	7.1	0.14	7.79	1.1															BASIN E5 CAPTURED @ DP5
	5	OS3.1	1.51	0.36	11.6	0.54	6.56	3.6	11.6	0.69	6.56	**4.5**				4.5	0.69	1.3	1.5	56	6.8	0.14	BASIN E5 AND OS3 COMBINE @ DP5 CAPTURED IN 18" CMP CULVERT, PIPED TO BASIN E6
	6	E6	0.79	0.44	8.2	0.34	7.44	2.6	11.7	1.03	6.53	**6.7**											FLOW @ DP6 CONVEYED OFFSITE
		E7	0.23	0.62	5.9	0.14	8.26	1.2															BASIN E7 CAPTURED @ DP7
	7.1	OS3.2	2.86	0.36	12.5	1.03	6.38	6.6	12.5	1.17	6.38	**7.5**				7.5	1.17	0.2	1.5	53	2.3	0.38	BASIN E7 AND OS4.1 COMBINE @ DP7.1 CAPTURED IN 18" CMP CULVERT, PIPED TO BASIN E8
	8.1	E8	0.70	0.45	11.0	0.31	6.68	2.1	12.8	1.48	6.30	**9.4**											FLOW @ DP8.1 CONVEYED OFFSITE
		E9	0.73	0.62	14.1	0.45	6.06	2.8															BASIN E9 CAPTURED @ DP7.2
	7.2	OS3.3	21.12	0.36	16.8	7.60	5.62	42.7	16.8	8.06	5.62	**45.3**				45.3	8.06	0.8	1.5	43	5.3	0.13	BASIN E9 AND OS 4.2 COMBINE @ DP7.2 CAPTURED IN 18" CMP CULVERT, PIPED TO BASIN E10
	8.2	E10.1	2.61	0.44	14.1	1.15	6.06	7.0	17.0	9.21	5.60	**51.6**											FLOW @ DP8.2 CONVEYED OFFSITE
	8.3	E10.2	1.89	0.36	11.8	0.68	6.53	4.4	11.8	0.68	6.53	**4.4**											FLOW @ DP8.3 CONVEYED OFFSITE

HRGreen	EASTONVILLE ROAD	Calc'd by:	SPC
	PROPOSED CONDITIONS	Checked by:	CM
	EL PASO COUNTY, CO	Date:	8/26/2024

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q_5 (cfs)	Q_{100} (cfs)
EA1	0.62	97	2.6	4.7
EA2	1.21	50	2.5	5.6
EA3	0.44	91	1.8	3.0
EA4	0.77	52	1.7	2.9
EA5.1	0.37	9	0.3	0.4
EA5.2	0.52	0	0.2	1.6
EA5.3	1.21	0	0.4	2.9
EA5.4	0.41	0	0.1	1.0
EA6	1.09	91	3.1	5.2
EA7	1.92	52	3.2	5.4
EA8	0.94	50	0.5	0.9
EA9	0.88	35	0.4	0.6
EA10.1	0.36	23	0.4	0.6
EA10.2	1.06	23	1.4	4.4
EA11	1.23	0	0.5	0.9
EA12	0.47	25	0.6	1.7
EA13	0.21	26	0.3	0.7
EA8 & EA9 *Per Segment 2 FDR	5.07	78	10.2	17.2
OS1	1.63	2	0.5	3.6
OS2	12.18	2	3.6	24.2
OS3	25.50	2	8.0	53.6

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	ΣQ_5 (cfs)	ΣQ_{100} (cfs)
1	OS1	0.5	3.6
2	DP20, SFB D Release	0.7	5.0
3	OS2	3.6	24.2
4	EA 5.2, OS2, DP4.1, SFB A RELEASE	4.1	28.6
4.1	EA5.3	0.6	3.5
6	EA5.4	0.4	2.0
7	OS3	8.0	53.6
8.3	DP 22, OS3, EDB B RELEASE	9.7	58.1
8.2	EA10.2	1.4	4.0
9	DP1, EA1	3.3	9.3
10	DP9, EA2	5.4	13.9
11	DP10, EA12	5.8	15.2
12	EA13	0.3	0.7
13	EA3	1.8	3.0
14	DP13, EA4	3.3	5.6
15	DP14, EA5	3.5	5.9
16	EA6	3.1	5.2
17	DP16, EA7	6.2	10.3
18	DP17	6.2	10.3
19	DP18,EA8	6.6	11.1
18U	DP17, EA8 & EA9 *PER SEGMENT 2 FDR	15.5	26.0
19U	DP18U, EA8	15.8	26.6
20	EA9	0.4	0.6
8.1	EA10	0.4	0.6
22	EA11	0.5	0.9

NOTE: "U" DENOTES ULTIMATE CONDITION AFTER COMPLETION OF EASTONVILLE ROAD SEGMENT 2 CONSTRUCTION

EASTONVILLE ROAD
PROPOSED CONDITIONS
EL PASO COUNTY, CO

Calc'd by: SPC
Checked by: CM
Date: 11/27/2023

SOIL TYPE: HSG A&B

COMPOSITE 'C' FACTORS									
BASIN	LAND USE TYPE					TOTAL ACRES	COMPOSITE IMPERVIOUSNESS & C FACTOR		
	Paved (%I 100, C_5 0.90, C_{100} 0.96)	Historic Flow Analysis-- Greenbelts, Agriculture (%I 2, C_5 0.09, C_{100} 0.36)	Lawns (%I 0, C_5 0.08, C_{100} 0.35)	Gravel (%I 80, C_5 0.59, C_{100} 0.70)	Drive and Walks (%I 100, C_5 0.90, C_{100} 0.96)				
	ACRES	ACRES	ACRES	ACRES	ACRES	ACRES	%I	C_5	C_{100}
EA1	0.60		0.02			0.62	97	0.87	0.94
EA2	0.60		0.61			1.21	50	0.49	0.65
EA3	0.40		0.04			0.44	91	0.82	0.90
EA4	0.40		0.37			0.77	52	0.50	0.67
EA5.1			0.33	0.04		0.37	9	0.13	0.39
EA5.2			0.52			0.52	0	0.08	0.35
EA5.3			1.21			1.21	0	0.08	0.35
EA5.4			0.41			0.41	0	0.08	0.35
EA6	0.99		0.10			1.09	91	0.83	0.91
EA7	0.99		0.93			1.92	52	0.50	0.67
EA8			0.83	0.09	0.01	0.94	9	0.14	0.39
EA9			0.88			0.88	0	0.08	0.35
EA10.1			0.30	0.01	0.05	0.36	16	0.21	0.44
EA10.2			0.81	0.06	0.20	1.06	23	0.26	0.48
EA11			1.23			1.23	0	0.08	0.35
EA12	0.06		0.34	0.07		0.47	25	0.26	0.48
EA13	0.06		0.15			0.21	26	0.30	0.51
OS1		1.63				1.63	2	0.09	0.36
OS2		12.18				12.18	2	0.09	0.36
OS3		25.50				25.50	2	0.09	0.36
EA8 & EA9 *Per Segment 2 FDR	3.94		1.13			5.07	78	0.72	0.82
SFB A	0.80	0.00	0.74	0.04	0.00	1.58	53		
EDB B	1.98	0.00	1.86	0.09	0.01	3.95	52		
EDB B (ULT)	5.92	0.00	2.99	0.09	0.01	9.02	67		

COMPOSITE 'C' FACTORS																			
BASIN	**LAND USE TYPE**																		
	Paved			**Historic Flow Analysis-- Greenbelts, Agriculture**			**Lawns**			**Gravel**			**Drive and Walks**				**COMPOSITE IMPERVIOUSNESS & C FACTOR**		
	%I	**C_5**	**C_{100}**	**%I**	**C_5**	**C_{100}**	**%I**	**C_5**	**C_{100}**	**%I**	**C_5**	**C_{100}**	**%I**	**C_5**	**C_{100}**				
	100	**0.90**	**0.96**	**2**	**0.09**	**0.36**	**0**	**0.08**	**0.35**	**80**	**0.59**	**0.70**	**100**	**0.90**	**0.96**	**TOTAL**			
	ACRES			**ACRES**			**ACRES**			**ACRES**			**ACRES**			**ACRES**	**%I**	**C_5**	**C_{100}**
SFB D	1.26			1.63			0.97			0.07			0.00			3.93	34		

HRGreen	EASTONVILLE ROAD	Calc'd by:	SPC
	PROPOSED CONDITIONS	Checked by:	CM
	EL PASO COUNTY, CO	Date:	8/26/2024

TIME OF CONCENTRATION

BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL	tc=(L/180)+10	Design tc
DESIGNATION	C_5	AREA (ac)	LENGTH (ft)	SLOPE %	t_i (min)	C_V	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)	tc max	tc design (min)
EA1	0.87	0.62	26	2.0	1.7	20	734	1.6	2.5	4.9	6.6	14.2	6.6
EA2	0.49	1.21	26	2.0	4.6	20	734	1.6	2.5	4.9	9.5	14.2	9.5
EA3	0.82	0.44	26	2.0	2.0	20	326	0.5	1.4	3.8	5.9	12.0	5.9
EA4	0.50	0.77	26	2.0	4.4	20	326	0.5	1.4	3.8	8.3	12.0	8.3
EA5.1	0.13	0.37	25	25.0	3.0	10	100	0.5	0.7	2.4	5.4	10.7	5.4
EA5.2	0.08	0.52	35	33.0	3.4	10	110	5.5	2.3	0.8	5.0	10.8	5.0
EA5.3	0.08	1.21	68	10.0	7.1	10	286	2.3	1.5	3.1	10.3	12.0	10.3
EA5.4	0.08	0.41	78	4.6	9.9	10	145	1.4	1.2	2.0	12.0	11.2	11.2
EA6	0.83	1.09	26	2.0	2.0	20	1304	0.6	1.5	14.0	16.1	17.4	16.1
EA7	0.50	1.92	26	2.0	4.4	20	1304	0.6	1.5	14.0	18.5	17.4	17.4
EA8	0.14	0.94	100	9.0	8.4	10	102	0.5	0.7	2.4	10.8	11.1	10.8
EA9	0.08	0.88	50	24.4	4.6	10	0	0	0.0	0.0	5.0	10.3	5.0
EA10.1	0.21	0.36	35	24.4	3.3	10	0	0	0.0	0.0	5.0	10.2	5.0
EA10.2	0.26	1.06	50	15.0	4.4	10	0	0	0.0	0.0	5.0	10.3	5.0
EA11	0.08	1.23	23	18.0	3.4	10	0	0	0.0	0.0	5.0	10.1	5.0
EA12	0.26	0.47	117	12.0	7.3	10	0	0	0.0	0.0	7.3	10.7	7.3
EA13	0.30	0.21	82	2.0	10.6	10	0	0	0.0	0.0	10.6	10.5	10.5
EA8 & EA9 *Per Segment 2 FDR	0.72	5.07	26	2.0	2.8	20	2500	0.7	1.7	24.9	27.7	24.0	24.0
OS1	0.09	1.63	100	2.7	13.3	10	633	1.5	1.2	8.6	22.0	14.1	14.1
OS2	0.09	12.18	100	4.3	11.4	10	1243	3.2	1.8	11.6	23.0	17.5	17.5
OS3	0.09	25.50	100	6.5	9.9	10	879	3.2	1.8	8.2	18.1	15.4	15.4

FORMULAS:

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L}}{S^{0.33}} \qquad V = C_v S_w^{0.5}$$

Table 6-7. Conveyance Coefficient, C_v

Type of Land Surface	C_v
Heavy meadow	2.5
Tillage/field	5
Riprap (not buried)*	6.5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

* For buried riprap, select C_v value based on type of vegetative cover.

HRGreen

EASTONVILLE ROAD
PROPOSED CONDITIONS
DESIGN STORM: 5-YEAR

Calc'd by: SPC
Checked by: CM
Date: 8/26/2024

	DIRECT RUNOFF									TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
STREET	DESIGN POINT	BASIN ID	AREA (ac)	C_5	t_c (min)	C_5*A (ac)	*I* (in./ hr.)	Q (cfs)	t_c (min)	C_5*A (ac)	*I* (in./ hr.)	Q (cfs)	Q_{street} (cfs)	C_5*A (ac)	SLOPE %	Q_{PIPE} (cfs)	C_5*A (ac)	SLOPE %	PIPE SIZE (ft)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min)	REMARKS
	1	OS1	1.63	0.09	14.1	0.15	3.62	0.5	14.1	0.15	3.62	**0.5**				0.5	0.15	0.5	1.5	10	4.2	0.04	BASIN OS1 @ DP1 CAPTURED IN 18" RCP CULVERT, DRAINS TO BASIN DP9
	2								0.1	0.07	3.62	**0.7**											**SFB D RELEASE @ 0.4 CFS AND DP 20 FLOW @ DP2 CONVEYED OFFSITE**
	3	OS2	12.18	0.09	17.5	1.10	3.29	3.6	17.5	1.10	3.29	**3.6**				3.6	1.10	2.6	2.5	186	13.5	0.23	BASIN OS2 @ DP3 CAPTURED IN 30" RCP CULVERT, DRAINS TO BASIN DP4
	4	EA5.2	0.52	0.08	5.0	0.04	5.17	0.2	17.7	1.23	3.29	**4.1**											**FLOW @ DP4 CONVEYED OFFSITE (INCLUDES DETENTION SFB A 5-YR RELEASE RATE @ 0.03 CFS)**
	4.1	EA5.3	1.21	0.08	10.3	0.10	4.09	0.4	10.3	0.10	3.29	**0.6**											FLOW @ DP4.1 DRAINS SOUTH TO ULTIMATELY COMBINE WITH DP4
	6	EA5.4	0.41	0.08	11.2	0.03	3.95	0.1	11.2	0.03	3.29	**0.4**											**FLOW @ DP6 DRAINS OFFSITE**
	7	OS3	25.50	0.09	15.4	2.30	3.48	8.0	15.4	2.30	3.48	**8.0**				8.0	2.30	0.6	3.0	445	7.3	1.01	BASIN OS3 FLOW @ DP7 CAPTURTED IN CDOT TYPE D INLET, PIPED TO DP8
	8.3								16.5	2.67	3.48	**9.7**											**FLOW @ DP8 CONVEYED OFFSITE (INCLUDES EDB POND B 5-YR RELEASE RATE @ 0.4 CFS, DP7, & DP22)**
	8.2	EA10.2	1.06	0.26	5.0	0.27	5.17	1.4	5.0	0.27	3.48	**1.4**											FLOW @ DP8.2 DRAINS NE TO ULTIMATELY COMBINE WITH DP8
	9	EA1	0.62	0.87	6.6	0.54	4.75	2.6	6.6	0.69	4.75	**3.3**				3.3	0.69	0.5	1.5	52	4.2	0.21	BASIN EA1 CAPTURED @ DP9 BY ON GRADE TYPE R INLET
	10	EA2	1.21	0.49	9.5	0.59	4.21	2.5	9.5	1.28	4.21	**5.4**				5.4	1.28	0.5	1.5	128	4.2	0.51	BASIN EA2 CAPTURED @ DP10 BY ON GRADE TYPE R INLET
	11	EA12	0.47	0.26	7.3	0.12	4.61	0.6	10.0	1.40	4.13	**5.8**				5.8	1.40	1.5	1.5	63	7.2	0.15	BASIN EA12 SHEEET FLOWS DIRECTLY TO SFB D
	12	EA13	0.21	0.30	10.5	0.06	4.06	0.3	10.5	0.06	4.13	**0.3**											**FLOW @ DP12 CONVEYED OFFSITE**
	13	EA3	0.44	0.82	5.9	0.36	4.92	1.8	5.9	0.36	4.92	**1.8**				1.8	0.36	1.3	1.5	56	6.8	0.14	BASIN EA3 CAPTURED @ DP13 BY ON GRADE TYPE R INLET
	14	EA4	0.77	0.50	8.3	0.39	4.42	1.7	8.3	0.75	4.42	**3.3**				3.3	0.75	1.3	1.5	56	6.8	0.14	BASIN EA4 CAPTURED @ DP14 BY ON GRADE TYPE R INLET
	15	EA5.1	0.37	0.13	5.4	0.05	5.06	0.3	8.4	0.80	4.39	**3.5**				3.5	0.80	0.5	1.5	36	4.2	0.14	BASIN EA5 SHEEET FLOWS DIRECTLY TO SFB A
	16	EA6	1.09	0.83	16.1	0.90	3.42	3.1	16.1	0.90	3.42	**3.1**				3.1	0.90	0.5	1.5	52	4.2	0.21	BASIN EA6 CAPTURED @ DP16 BY SUMP TYPE R INLET
	17	EA7	1.92	0.50	17.4	0.97	3.30	3.2	17.4	1.87	3.30	**6.2**				6.2	1.87	0.5	2.0	196	5.1	0.64	BASIN EA7 CAPTURED @ DP17 BY SUMP TYPE R INLET
	18								17.4	1.87	3.30	**6.2**				6.2	1.87	0.5	2.0	42	5.1	0.14	STORM MH @ D18, NO SEGMENT 2 FLOW
	19	EA8	0.94	0.14	10.8	0.13	4.01	0.5	17.5	2.00	3.29	**6.6**				6.6	2.00	0.5	2.0	196	5.1	0.64	BASIN EA8 SHEEET FLOWS DIRECTLY TO EDB B (NO SEGMENT 2 FLOWS)
	18U	EA8 & EA9 *Per Segment 2 FDR	5.07	0.72	24.0	3.64	2.81	10.2	24.0	5.50	2.81	**15.5**				15.5	5.50	0.5	2.0	42	5.1	0.14	SEGMENT 2 FLOW COMBINES @ DP18 WITH SEGMENT 1 FLOWS @ STORM MH
	19U	EA8	0.94	0.14	10.8	0.13	4.01	0.5	24.2	5.64	2.81	**15.8**											BASIN EA8 SHEEET FLOWS DIRECTLY TO EDB B INCLUDING FUTURE TRIBUTARY FLOW FROM SUBBASIN EA8 & EA9 PER THE EASTONVILLE ROAD SEGMENT 2 FDR
	20	EA9	0.88	0.08	5.0	0.07	5.17	0.4	5.0	0.07	5.17	**0.4**											**BASIN EA9 SHEET FLOWS OFFSITE**
	8.1	EA10.1	0.36	0.21	5.0	0.07	5.17	0.4	5.0	0.07	5.17	**0.4**											**BASIN EA10 SHEET FLOWS OFFFSITE**
	22	EA11	1.23	0.08	5.0	0.10	5.17	0.5	5.0	0.10	5.17	**0.5**											**BASIN EA11 SHEET FLOWS OFFSITE**

HRGreen

EASTONVILLE ROAD																					**Calc'd by:**			**SPC**
PROPOSED CONDITIONS																					**Checked by:**			**CM**
DESIGN STORM: 100-YEAR																					**Date:**			**8/26/2024**
			DIRECT RUNOFF						**TOTAL RUNOFF**				**STREET**			**PIPE**				**TRAVEL TIME**			**REMARKS**
STREET	**DESIGN POINT**	**BASIN ID**	**AREA (ac)**	**C_{100}**	**t_c (min)**	**C_{100}*A (ac)**	***I* (in./ hr.)**	**Q (cfs)**	**t_c (min)**	**C_{100}*A (ac)**	***I* (in./ hr.)**	**Q (cfs)**	**Q_{street} (cfs)**	**C_{100}*A (ac)**	**SLOPE %**	**Q_{PIPE} (cfs)**	**C_{100}*A (ac)**	**SLOPE %**	**PIPE SIZE (ft)**	**LENGTH (ft)**	**VEL. (ft/s)**	**TRAVEL TIME (min)**		
	1	OS1	1.63	0.36	14.1	0.59	6.07	3.6	14.1	0.59	6.07	**3.6**				3.6	0.59	0.5	1.5	115	4.2	0.46	BASIN OS1 @ DP1 CAPTURED IN 18" RCP CULVERT, DRAINS TO BASIN DP2	
	2								0.1	0.07	6.07	**5.0**											**SFB D RELEASE @ 4.6 CFS AND DP 20 FLOW @ DP2 CONVEYED OFFSITE**	
	3	OS2	12.18	0.36	17.5	4.38	5.53	24.2	17.5	4.38	5.53	**24.2**				24.2	4.38	2.6	2.5	186	13.5	0.23	BASIN OS2 @ DP3 CAPTURED IN 30" RCP CULVERT, DRAINS TO BASIN DP4	
	4	EA5.2	0.52	0.35	5.0	0.18	8.68	1.6	17.7	4.99	5.53	**28.6**											**FLOW @ DP4 CONVEYED OFFSITE (INCLUDES DETENTION SFB A 100-YR RELEASE RATE @ 1.0 CFS)**	
	4.1	EA5.3	1.21	0.35	10.3	0.42	6.86	2.9	10.3	0.42	5.53	**3.5**											FLOW @ DP4.1 DRAINS SOUTH TO ULTIMATELY COMBINE WITH DP4	
	6	EA5.4	0.41	0.35	11.2	0.14	6.64	1.0	11.2	0.14	5.53	**2.0**											**FLOW @ DP6 DRAINS OFFSITE**	
	7	OS3	25.50	0.36	15.4	9.18	5.84	53.6	15.4	9.18	5.84	**53.6**				53.6	9.18	0.6	3.0	445	7.3	1.01	BASIN OS3 FLOW @ DP7 CAPTURTED IN CDOT TYPE D INLET, PIPED TO DP8	
	8.3								16.5	9.79	5.84	**58.1**											**FLOW @ DP8 CONVEYED OFFSITE (INCLUDES EDB POND B 100-YR RELEASE RATE @ 1.0 CFS, DP7, & DP22)**	
	8.2	EA10.2	1.06	0.48	5.0	0.51	8.68	4.4	5.0	0.51	5.84	**4.0**											FLOW @ DP8.2 DRAINS NE TO ULTIMATELY COMBINE WITH DP8	
	9	EA1	0.62	0.94	6.6	0.58	7.98	4.7	6.6	1.17	7.98	**9.3**				9.3	1.17	0.5	1.5	52	4.2	0.21	BASIN EA1 CAPTURED @ DP9 BY ON GRADE TYPE R INLET	
	10	EA2	1.21	0.65	9.5	0.79	7.07	5.6	9.5	1.96	7.07	**13.9**				13.9	1.96	0.5	1.5	128	4.2	0.51	BASIN EA2 CAPTURED @ DP10 BY ON GRADE TYPE R INLET	
	11	EA12	0.47	0.48	7.3	0.23	7.73	1.7	10.0	2.18	6.94	**15.2**				15.2	2.18	1.5	1.5	63	7.2	0.15	BASIN EA12 SHEEET FLOWS DIRECTLY TO SFB D	
	12	EA13	0.21	0.51	10.5	0.11	6.82	0.7	10.5	0.11	6.94	**0.7**											**FLOW @ DP12 CONVEYED OFFSITE**	
	13	EA3	0.44	0.82	5.9	0.36	8.27	3.0	5.9	0.36	8.27	**3.0**				3.0	0.36	1.3	1.5	56	6.8	0.14	BASIN EA3 CAPTURED @ DP13 BY ON GRADE TYPE R INLET	
	14	EA4	0.77	0.50	8.3	0.39	7.42	2.9	8.3	0.75	7.42	**5.6**				5.6	0.75	1.3	1.5	56	6.8	0.14	BASIN EA4 CAPTURED @ DP14 BY ON GRADE TYPE R INLET	
	15	EA5.1	0.37	0.13	5.4	0.05	8.49	0.4	8.4	0.80	7.37	**5.9**				5.9	0.80	0.5	1.5	36	4.2	0.14	BASIN EA5 SHEEET FLOWS DIRECTLY TO SFB A	
	16	EA6	1.09	0.83	16.1	0.90	5.74	5.2	16.1	0.90	5.74	**5.2**				5.2	0.90	0.5	1.5	52	4.2	0.21	BASIN EA6 CAPTURED @ DP16 BY SUMP TYPE R INLET	
	17	EA7	1.92	0.50	17.4	0.97	5.54	5.4	17.4	1.87	5.54	**10.3**				10.3	1.87	0.5	2.0	196	5.1	0.64	BASIN EA7 CAPTURED @ DP17 BY SUMP TYPE R INLET	
	18								17.4	1.87	5.54	**10.3**				10.3	1.87	0.5	2.0	42	5.1	0.14	STORM MH @ D18, NO SEGMENT 2 FLOW	
	19	EA8	0.94	0.14	10.8	0.13	6.73	0.9	17.5	2.00	5.52	**11.1**				11.1	2.00	0.5	2.0	196	5.1	0.64	BASIN EA8 SHEEET FLOWS DIRECTLY TO EDB B (NO SEGMENT 2 FLOWS)	
	18U	EA8 & EA9 *Per Segment 2 FDR	5.07	0.72	24.0	3.64	4.72	17.2	24.0	5.50	4.72	**26.0**				26.0	5.50	0.5	2.0	42	5.1	0.14	SEGMENT 2 FLOW COMBINES @ DP18 WITH SEGMENT 1 FLOWS @ STORM MH	
	19U	EA8	0.94	0.14	10.8	0.13	6.73	0.9	24.2	5.64	4.71	**26.6**											BASIN EA8 SHEEET FLOWS DIRECTLY TO EDB B INCLUDING FUTURE TRIBUTARY FLOW FROM SUBBASIN EA8 & EA9 PER THE EASTONVILLE ROAD SEGMENT 2 FDR	
	20	EA9	0.88	0.08	5.0	0.07	8.68	0.6	5.0	0.07	8.68	**0.6**											**BASIN EA9 SHEET FLOWS OFFSITE**	
	8.1	EA10.1	0.36	0.21	5.0	0.07	8.68	0.6	5.0	0.07	8.68	**0.6**											**BASIN EA10 SHEET FLOWS OFFFSITE**	
	22	EA11	1.23	0.08	5.0	0.10	8.68	0.9	5.0	0.10	8.68	**0.9**											**BASIN EA11 SHEET FLOWS OFFSITE**	

Provide a map that delineates the SPAs, UIAs, and RPAs.

And a map with just RPAs so we have one to provide our maintenance team in the future so they know what needs to maintained. SPAs do not need to be inspected or maintained post-construction.

These areas do not match the whole basin areas shown on the drainage maps or in the report text on page 9 above. Please clarify in the report text why these areas are less than the total basin area (ex: only the areas of disturbance within the basin area shown as SPAs).

Why not exclude these two basins via the exclusion in ECM App I.7.1.C.1 (20% up to 1ac of development can be excluded)? That way the County does not have to maintain and inspect any RPA areas prior to the Grandview ponds being built.

Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)

Sheet 1 of 1

Designer: SPC
Company: HR GREEN
Date: August 26, 2024
Project: Eastonville Segment 1 - RR
Location: COLORADO SPRINGS, CO

What about OS1?

SITE INFORMATION (User Input in Blue Cells)

WQCV Rainfall Depth: 0.60 inches

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

Area Type	SPA	SPA	SPA	SPA	UIA:RPA	UIA:RPA	SPA	SPA	SPA			
Area ID	EA5.2	EA5.3	EA5.4	EA9	EA10.1	EA10.2	EA11	OS2	OS3			
Downstream Design Point ID	4	4.1	6	20	8.1	8.2	22	3	7			
Downstream BMP Type	None	None	None	None	None	None	None	None	None			
DCIA (ft^2)	--	--	--	--	--	--	--	--	--			
UIA (ft^2)	--	--	--	--	3,606	10,620	--	--	--			
RPA (ft^2)	--	--	--	--	3,309	21,115	--	--	--			
SPA (ft^2)	10,105	20,228	5,422	14,605	--	--	6,572	13,994	37,875			
HSG A (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%			
HSG B (%)	100%	100%	100%	100%	100%	100%	100%	100%	100%			
HSG C/D (%)	0%	0%	0%	0%	0%	0%	0%	0%	0%			
Average Slope of RPA (ft/ft)	--	--	--	--	0.020	0.100	--	--	--			
UIA:RPA Interface Width (ft)	--	--	--	--	285.00	860.00	--	--	--			

CALCULATED RUNOFF RESULTS

Area ID	EA5.2	EA5.3	EA5.4	EA9	EA10.1	EA10.2	EA11	OS2	OS3			
UIA:RPA Area (ft^2)	--	--	--	--	6,915	31,735	--	--	--			
L / W Ratio	--	--	--	--	0.09	0.06	--	--	--			
UIA / Area	--	--	--	--	0.5215	0.3346	--	--	--			
Runoff (in)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00			
Runoff (ft^3)	0	0	0	0	0	0	0	0	0			
Runoff Reduction (ft^3)	505	1011	271	730	150	443	329	700	1894			

CALCULATED WQCV RESULTS

Area ID	EA5.2	EA5.3	EA5.4	EA9	EA10.1	EA10.2	EA11	OS2	OS3			
WQCV (ft^3)	0	0	0	0	150	443	0	0	0			
WQCV Reduction (ft^3)	0	0	0	0	150	443	0	0	0			
WQCV Reduction (%)	0%	0%	0%	0%	100%	100%	0%	0%	0%			
Untreated WQCV (ft^3)	0	0	0	0	0	0	0	0	0			

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

Downstream Design Point ID	4	4.1	6	20	8.1	8.2	22	3	7			
DCIA (ft^2)	0	0	0	0	0	0	0	0	0			
UIA (ft^2)	0	0	0	0	3,606	10,620	0	0	0			
RPA (ft^2)	0	0	0	0	3,309	21,115	0	0	0			
SPA (ft^2)	10,105	20,228	5,422	14,605	0	0	6,572	13,994	37,875			
Total Area (ft^2)	10,105	20,228	5,422	14,605	6,915	31,735	6,572	13,994	37,875			
Total Impervious Area (ft^2)	0	0	0	0	3,606	10,620	0	0	0			
WQCV (ft^3)	0	0	0	0	150	443	0	0	0			
WQCV Reduction (ft^3)	0	0	0	0	150	443	0	0	0			
WQCV Reduction (%)	0%	0%	0%	0%	100%	100%	0%	0%	0%			
Untreated WQCV (ft^3)	0	0	0	0	0	0	0	0	0			

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

Total Area (ft^2)	147,451
Total Impervious Area (ft^2)	14,226
WQCV (ft^3)	593
WQCV Reduction (ft^3)	593
WQCV Reduction (%)	100%
Untreated WQCV (ft^3)	0

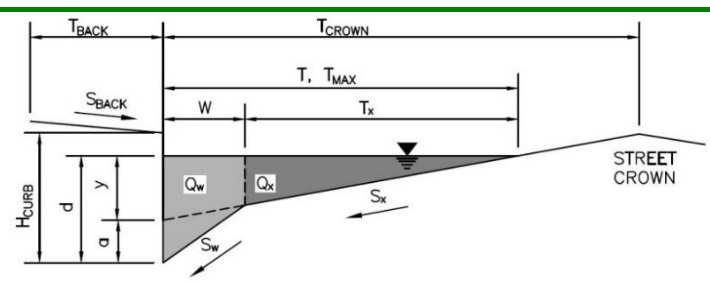
APPENDIX C – HYDRAULIC CALCULATIONS

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

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

Project: Eastonville Road - Segment 1 Improvements

Inlet ID: Inlet DP9



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	2.5	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} =	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 =	0.005	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

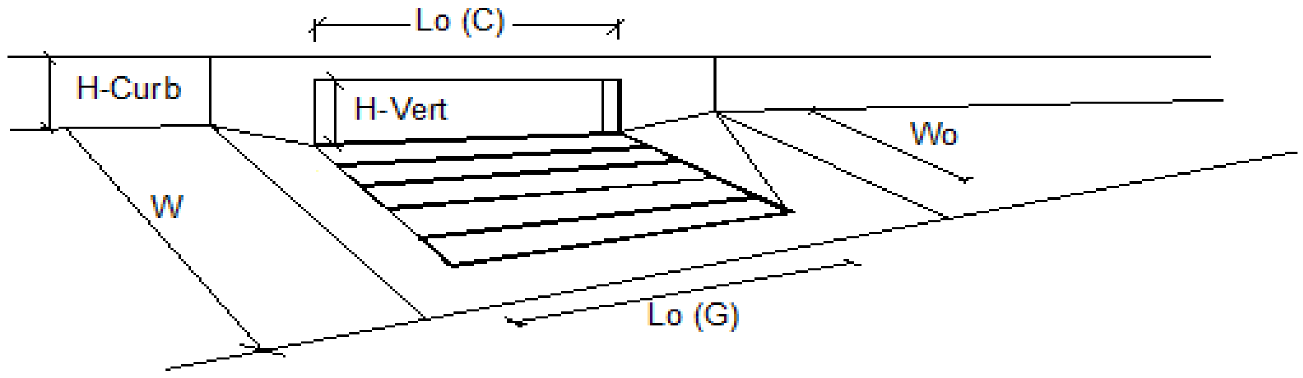
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**13.0**	**17.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.60 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 4.70 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet — CDOT Type R Curb Opening	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.6**	**4.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

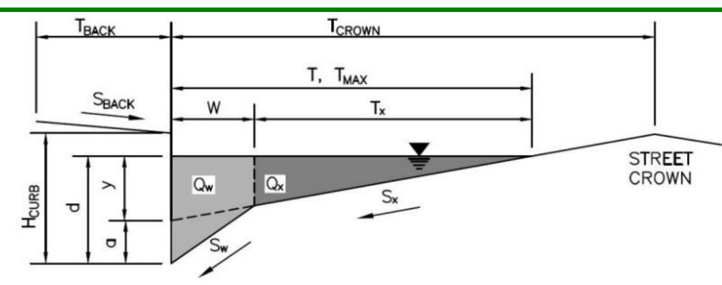
Per DP summary table, flows at DP 9 are 3.3 and 9.3 cfs

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

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

Project: Eastonville Road - Segment 1 Improvements

Inlet ID: Inlet DP10



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.5	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} =	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 =	0.005	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

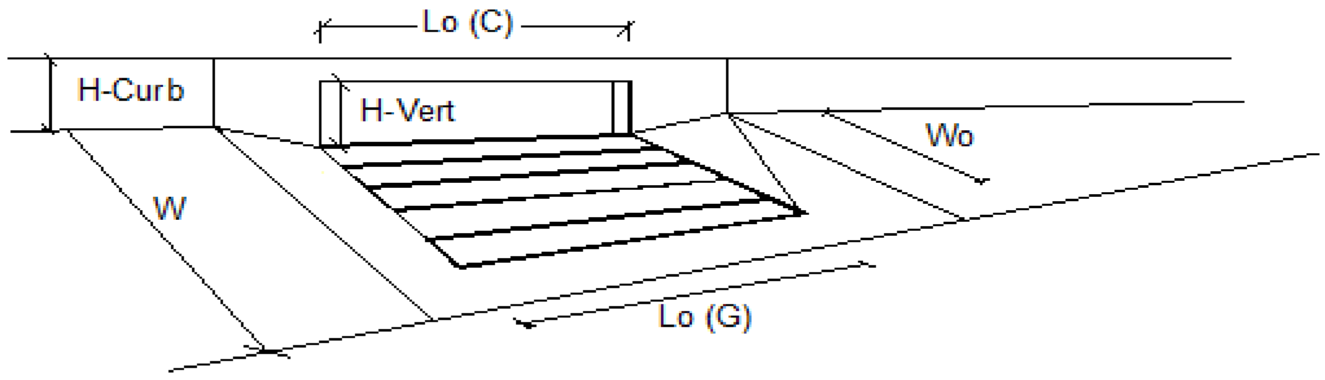
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**13.0**	**17.0**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.50 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 5.60 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	3	3	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.10	0.10	

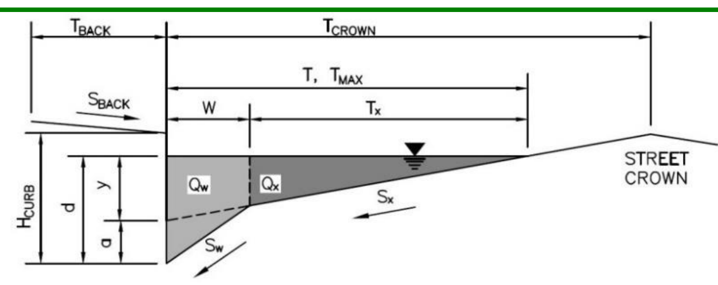
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**2.5**	**5.6**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

Per DP summary table, flows at DP 10 are 5.4 and 13.9 cfs

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

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

Project: Eastonville Road - Segment 1 Improvements
Inlet ID: Inlet DP13



Gutter Geometry:

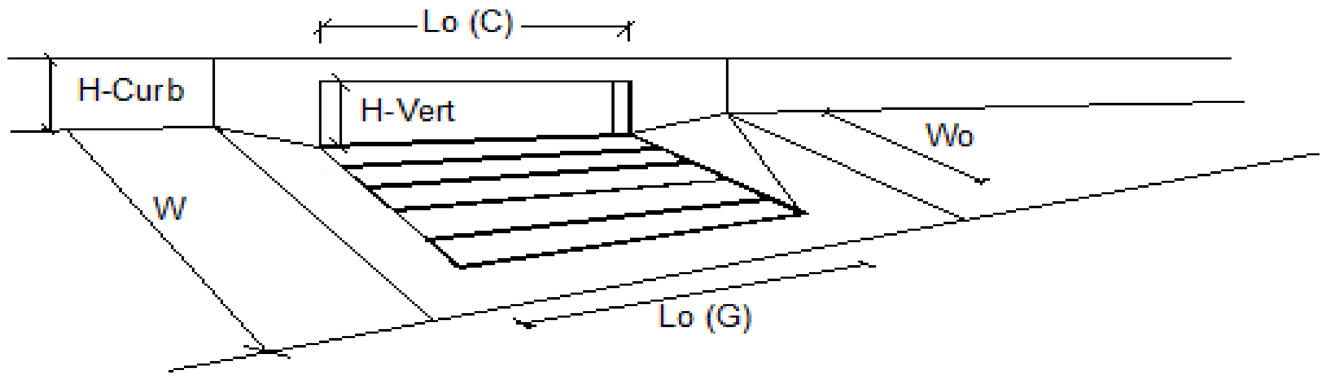
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	2.5		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	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 =	0.018		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**24.6**	**29.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.80 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.00 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



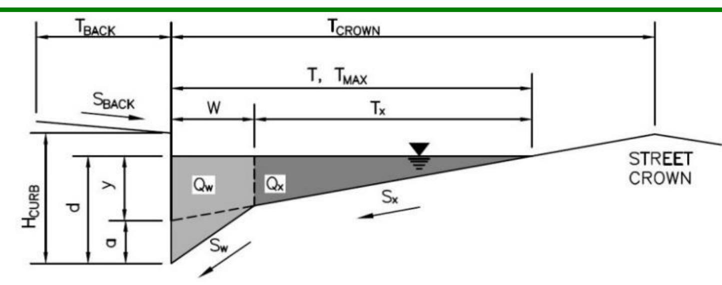
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.8**	**3.0**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

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

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

Project: Eastonville Road - Segment 1 Improvements
Inlet ID: Inlet DP14



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.5	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} =	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 =	0.018	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

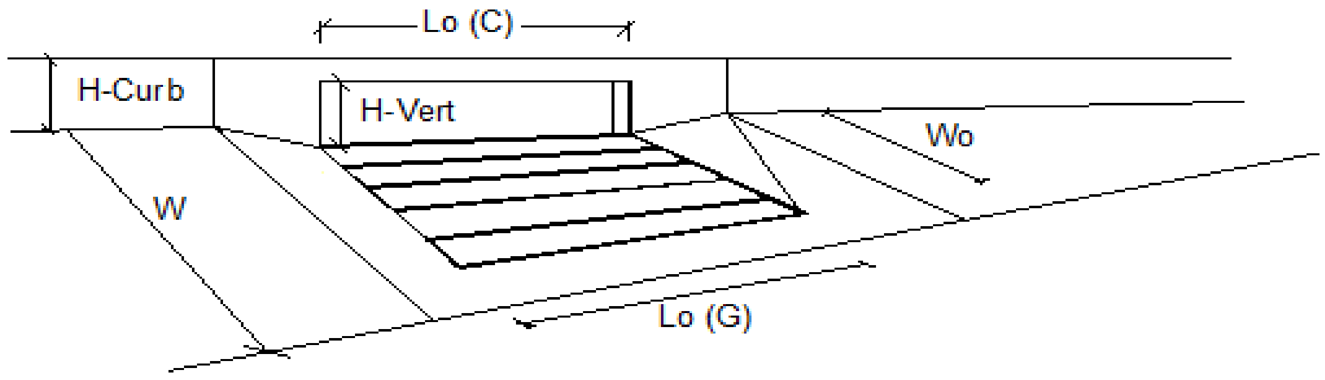
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**24.6**	**29.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 1.70 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 2.90 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.10	0.10	

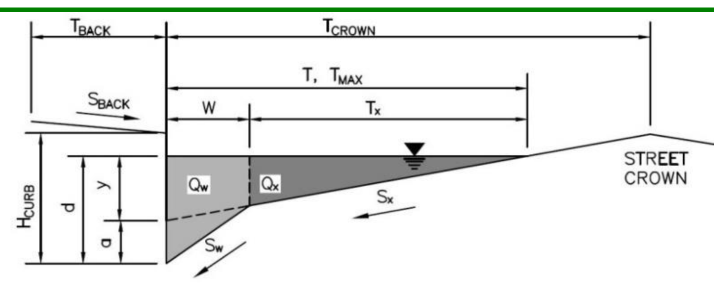
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.7**	**2.9**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

Per DP summary table, flows at DP 14 are 3.3 and 5.6 cfs

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

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

Project: Eastonville Road - Segment 1 Improvements
Inlet ID: Inlet DP16



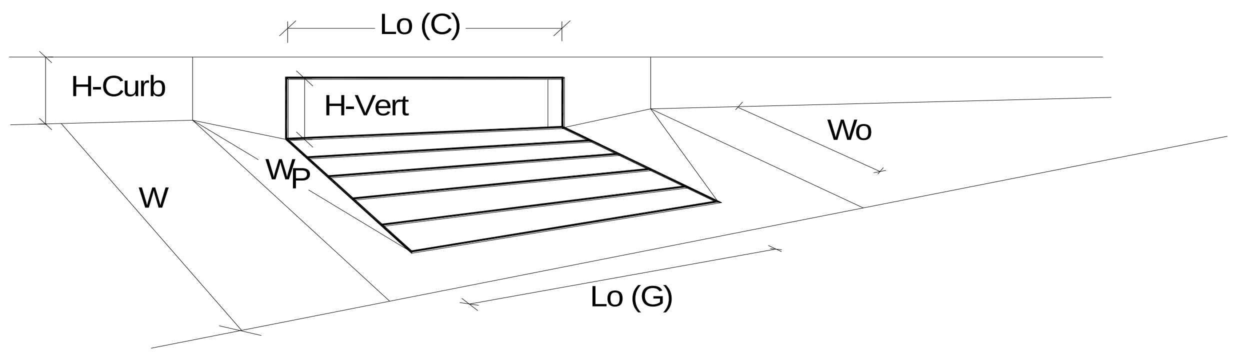
Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	2.5		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} =	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 =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



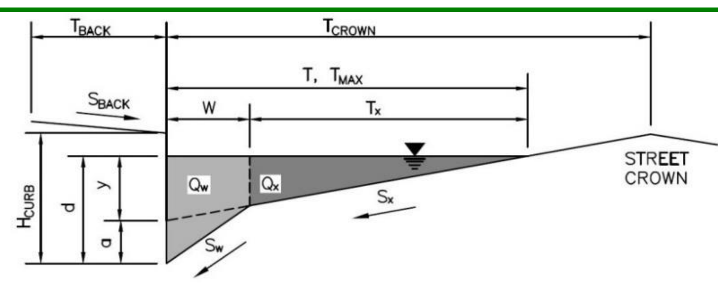
		MINOR	MAJOR	
Design Information (Input) — CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.5	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.38	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.93	0.96	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**8.3**	**10.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	3.1	5.2	cfs

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

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

Project: Eastonville Road - Segment 1 Improvements

Inlet ID: Inlet DP17



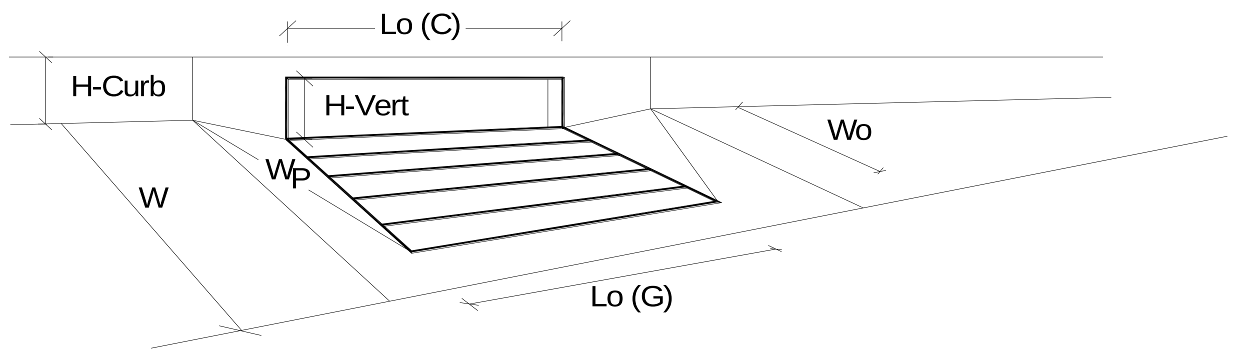
Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	23.5		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} =	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 =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	20.0	26.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.5	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.03 (August 2023)



Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)		a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)		No =	2	2	
Water Depth at Flowline (outside of local depression)		Ponding Depth =	6.0	6.5	inches
Grate Information			MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate		L_o (G) =	N/A	N/A	feet
Width of a Unit Grate		W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)		A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)		C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)		C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)		C_o (G) =	N/A	N/A	
Curb Opening Information			MINOR	MAJOR	
Length of a Unit Curb Opening		L_o (C) =	5.00	5.00	feet
Height of Vertical Curb Opening in Inches		H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches		H_{throat} =	6.00	6.00	inches
Angle of Throat		Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)		W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)		C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)		C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)		C_o (C) =	0.67	0.67	
Low Head Performance Reduction (Calculated)			MINOR	MAJOR	
Depth for Grate Midwidth		d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation		d_{Curb} =	0.33	0.38	ft
Grated Inlet Performance Reduction Factor for Long Inlets		RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets		RF_{Curb} =	0.93	0.96	
Combination Inlet Performance Reduction Factor for Long Inlets		$RF_{Combination}$ =	N/A	N/A	
			MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)		**Q_a =**	**8.3**	**10.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)		$Q_{PEAK\ REQUIRED}$ =	3.2	5.4	cfs

Per DP summary table, flows at DP 17 are 6.2 and 10.3 cfs

Eastonville Rd Segment 1
Sump Inlet Capacity
El Paso County

Suggest using MHFD Inlet spreadsheet to determine inlet capacities

Where did these lengths come from? Length of Type D inlet is only 80" and Type C inlet is 48".

Calc'd by: SPC
Checked by: CM
Date: 8/23/2024

Structure Type	Design Point	Required Inlet Capacity [cfs]	Flow Depth / Depth of Water Over Grate (d) [ft]	Inlet Operating as Weir / Orifice	Weir or Orifice Discharge Coefficient (C_w/C_o)	Clear Opening Area (A_0) [ft^2]	Weir Length (L_W) [ft]	Clogging Factor (%)	Clogged Effective Weir Length (L_W) [ft]	Clogged Opening Area (A_0) [ft^2]	Provided Inlet Capacity (CFS)
CDOT Type D - Standard Grate	7	53.6	2.75	ORIFICE	0.67	10.38	11.51	20	9.21	8.30	**74.04**
CDOT Type C - Standard Grate	1	3.6	0.50	WEIR	3	6.3	9	10	8.10	5.67	**8.59**
				ORIFICE	0	0	0	0	0.00	0.00	**0.00**
				ORIFICE	0	0	0	0	0.00	0.00	**0.00**
				ORIFICE	0	0	0	0	0.00	0.00	**0.00**

Factors seem low

Urban Storm Drainage Criteria Manual (USDCM) Volume 1 Chapter 7 Section 3.2.7

The hydraulic capacity of grate, curb-opening, and slotted inlets operating as weirs is expressed as:

$Q_i = C_w L_w d^{1.5}$ (Equation 7-37)

Where: Q_i = inlet capacity (cfs)
C_w = weir discharge coefficient
L_w = weir length (ft)
d = flow depth (ft).

The hydraulic capacity of grate, curb-opening, and slotted inlets operating as orifices is expressed as:

$Q_i = C_o A_o (2gd)^{0.5}$ (Equation 7-38)

Where: Q_i = inlet capacity (cfs)
C_o = orifice discharge coefficient
A_o = orifice area (ft2)
d = characteristic depth (ft) as defined in Table 7-8
g = 32.2 ft/sec2

Table 7-8. Sump inlet discharge variables and coefficients
(Modified From Akan and Houghtalen 2002)

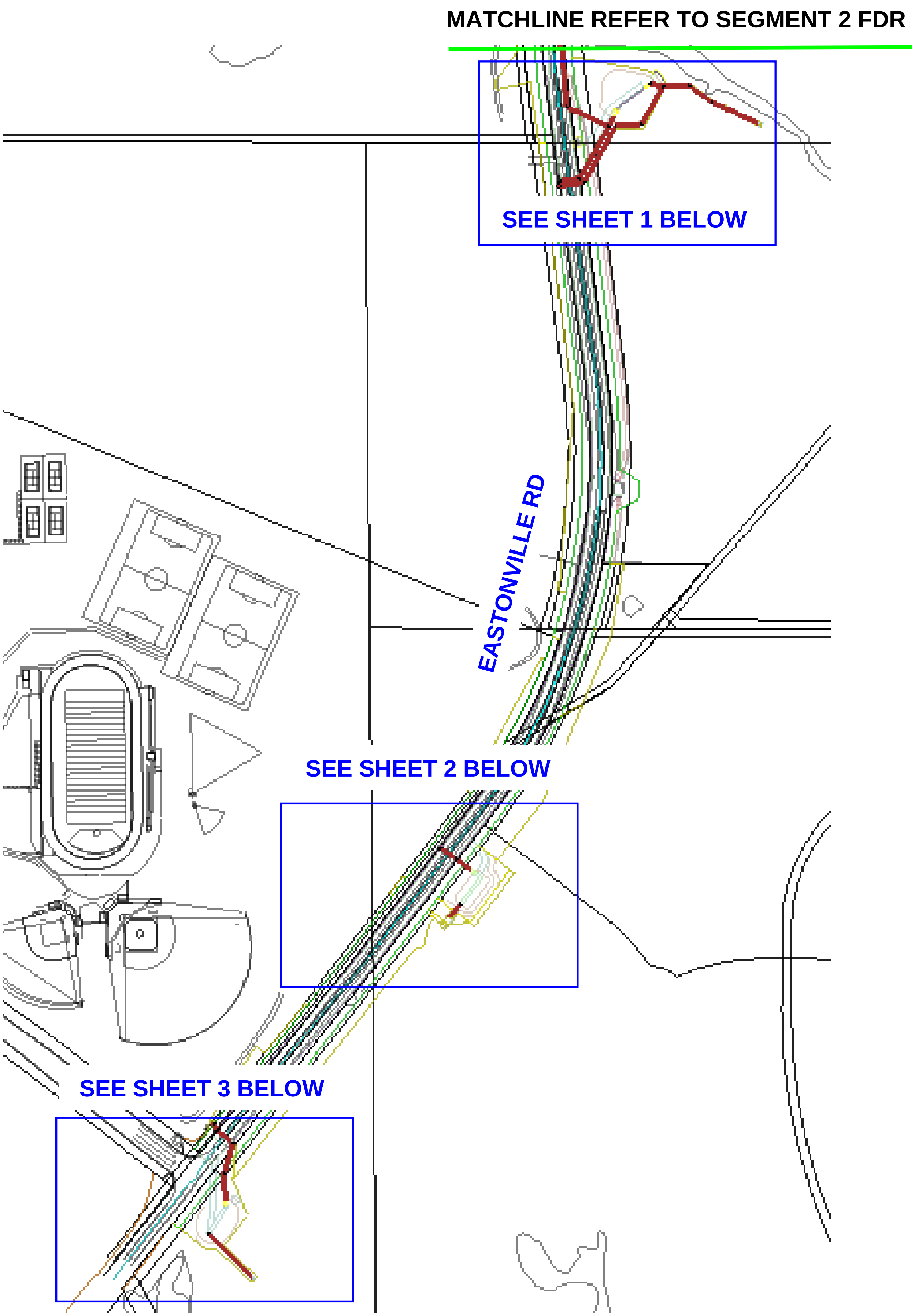
Inlet Type	C_w	L_w[1]	Weir Equation Valid For	Definitions of Terms
Grate Inlet	3.00	$L + 2W$	$d < 1.79(A_o/L_w)$	L = Length of grate (ft) W = Width of grate (ft) d = Depth of water over grate (ft) A_0 = Clear opening area[2] (ft^2)
Curb-opening Inlet	3.00	L	$d < h$	L = Length of curb opening (ft) h = Height of curb opening (ft) $d = d_i - (h/2)$ (ft) d_i = Depth of water at curb opening (ft)
Depressed Curb Opening Inlet[3]	2.30	$L + 1.8W$	$d < (h + a)$	W = Lateral width of depression (ft) a = Depth of curb depression (ft)
Slotted Inlets	2.48	L	$d < 0.2$ ft	L = Length of slot (ft) d = Depth at curb (ft)

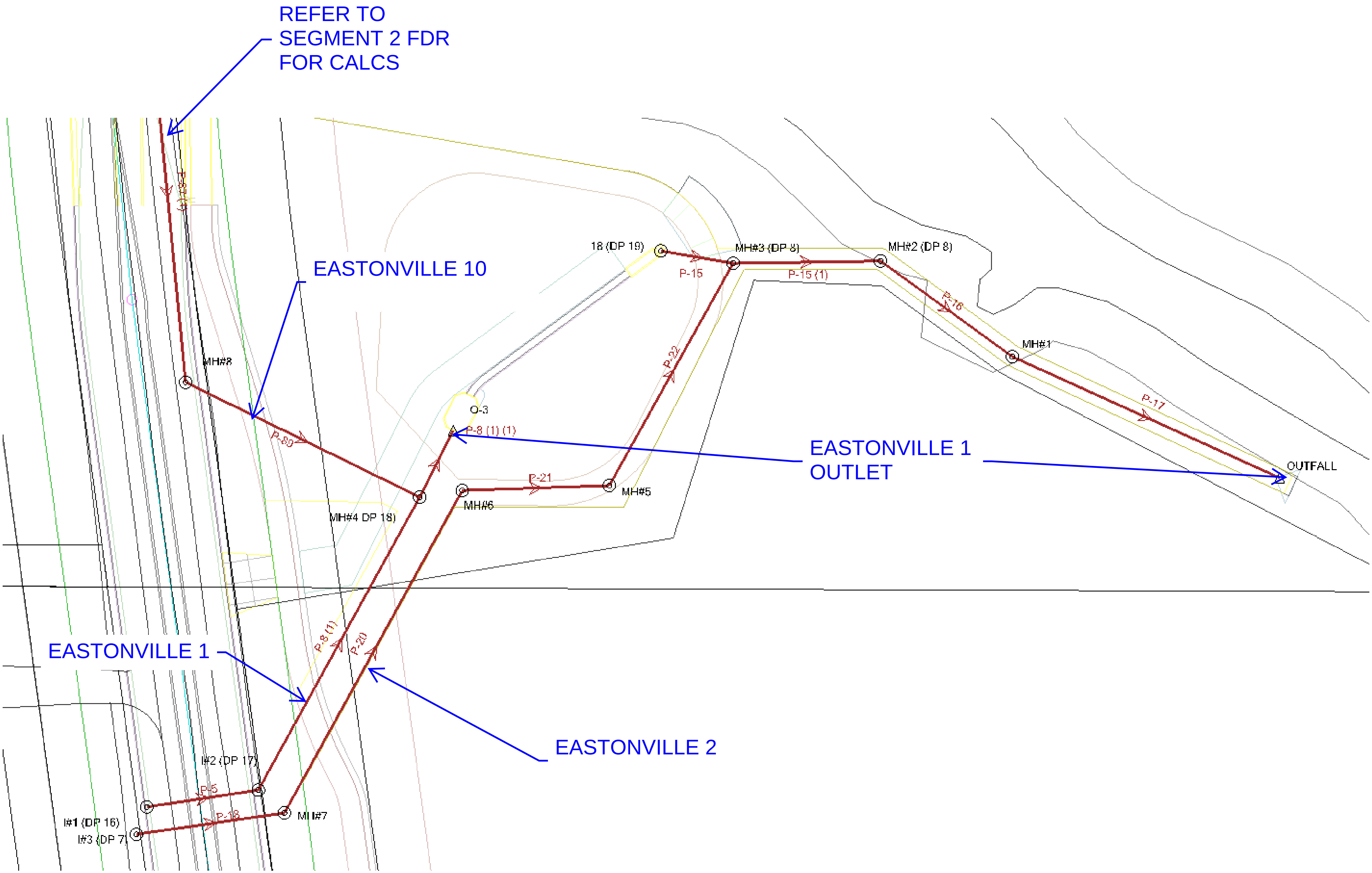
[1] The weir length should be reduced where clogging is expected.
[2] Ratio of clear opening area to total area is 0.8 for P-1-7/8-4 and reticuline grates, 0.9 for P-1-7/8 and 0.6 for P-1-1/8 grates. Curved vane and tilt bar grates are not recommended at sump locations unless in combination with curb openings.
[3] If $L > 12$ ft, use the expressions for curb-opening inlets without depression.

	C_o	A_0[4]	Orifice Equation Valid for	Definition of Terms
Grate Inlet	0.67	Clear opening area[5]	$d > 1.79(A_o/L_w)$	d = Depth of water over grate (ft)
Curb-opening Inlet (depressed or undepressed, horizontal orifice throat[6])	0.67	$(h)(L)$	$d_i > 1.4h$	$d = d_i - (h/2)$ (ft) d_i = Depth of water at curb opening (ft) h = Height of curb opening (ft)
Slotted Inlet	0.80	$(L)(W)$	$d > 0.40$ ft	L = Length of slot (ft) W = Width of slot (ft) d = Depth of water over slot (ft)

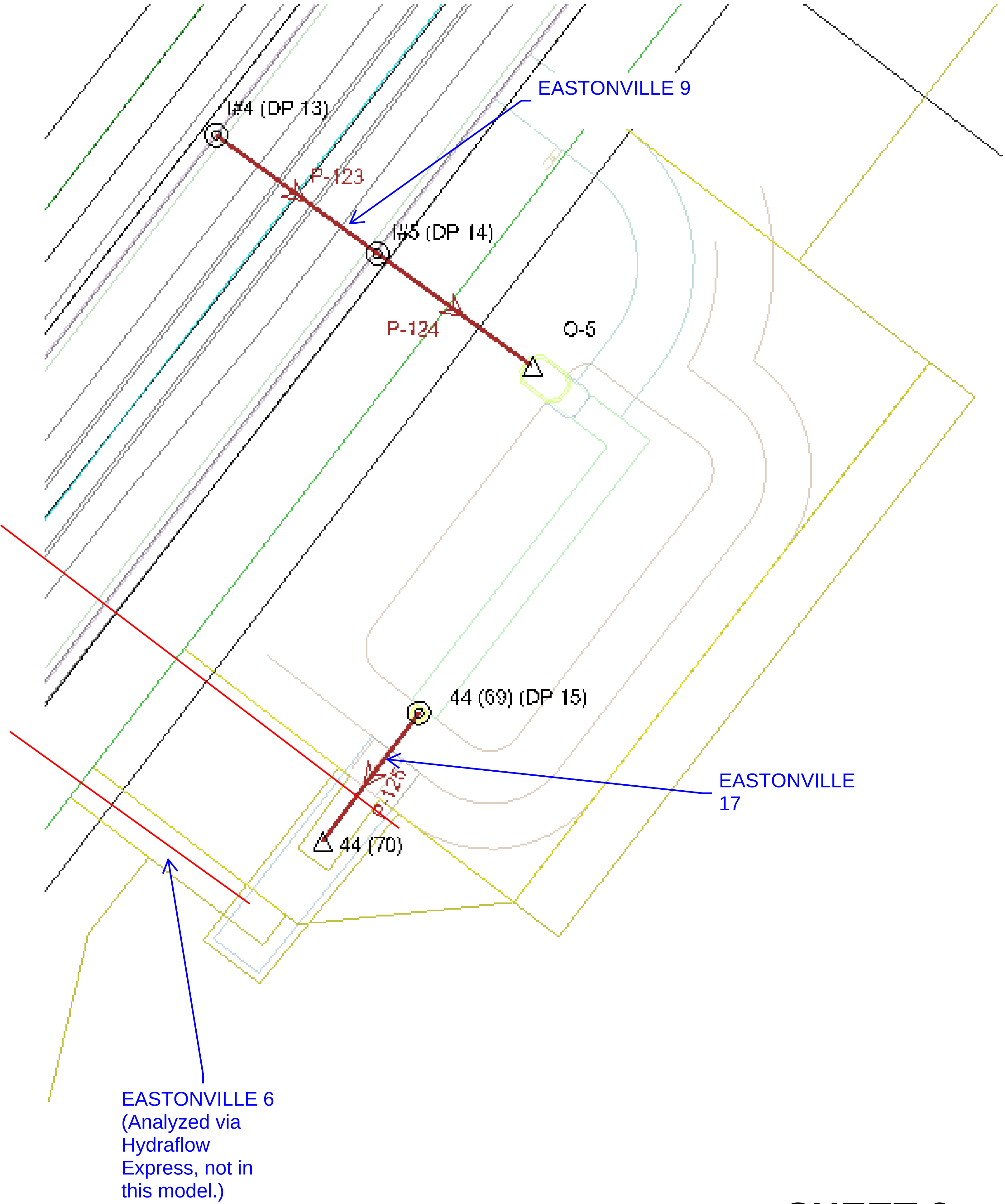
[4] The orifice area should be reduced where clogging is expected.
[5] The ratio of clear opening area to total area is 0.8 for P-1-7/8-4 and reticuline grates, 0.9 for P-1-7/8 and 0.6 for P-1-1/8 grates. Curved vane and tilt bar grates are not recommended at sump locations unless in combination with curb openings.
[6] See Figure 7-12 for other types of throats.

STORMCAD NETWORK LAYOUT: SEGMENT 1

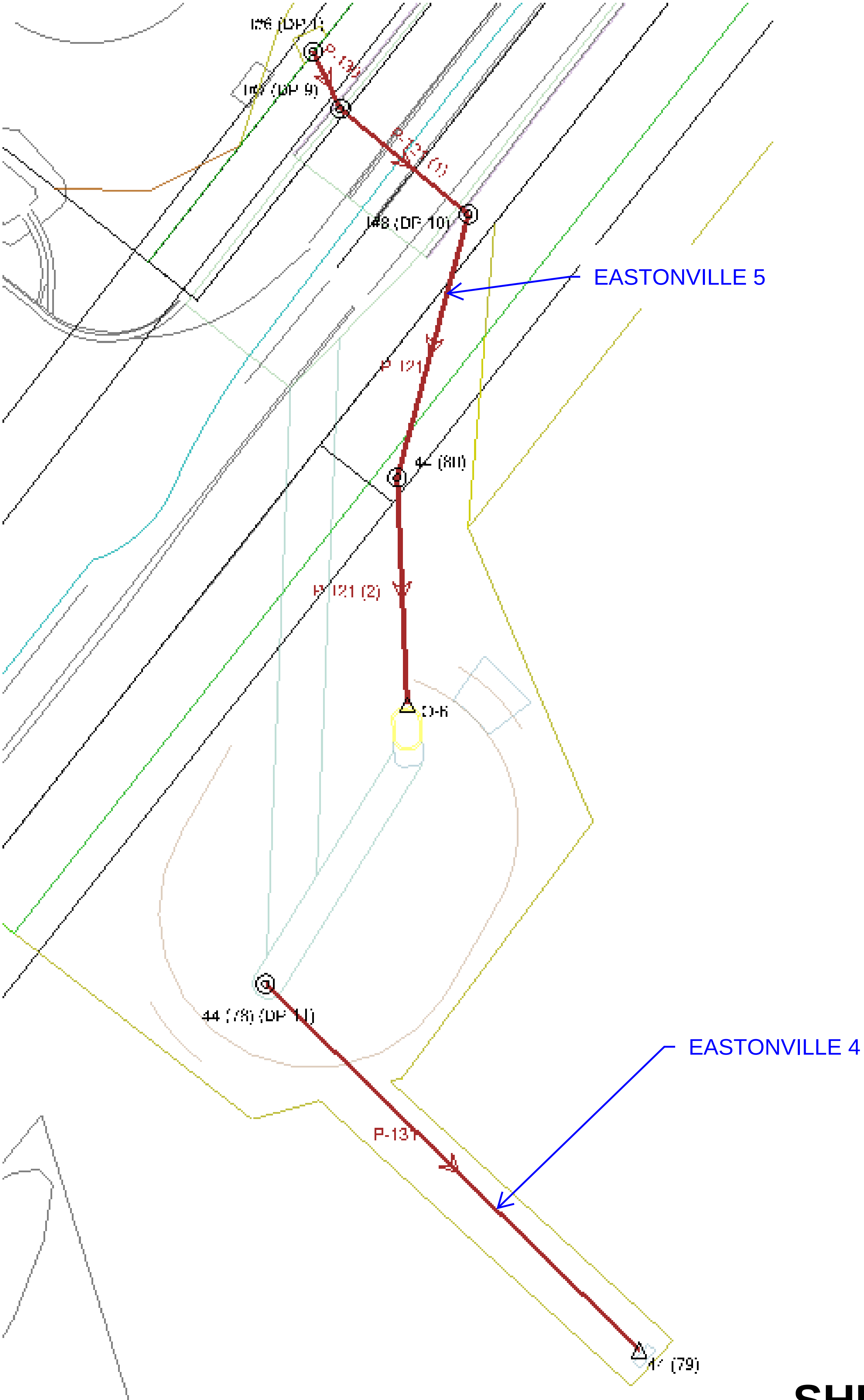



REFER TO
SEGMENT 2 FDR
FOR CALCS
EASTONVILLE 10
18 (DP 19)
MH#3 (DP 8)
MH#2 (DP 8)
P-15
P-15 (1)
P-16
MH#1
P-17
MH#8
P-22
O-3
P-8 (1) (1)
P-80
EASTONVILLE 1
OUTLET
OUTFALL
P-21
MH#5
MH#6
MH#4 DP 18)
EASTONVILLE 1
P-8 (1)
P-20
EASTONVILLE 2
I#2 (DP 17)
P-5
P-18
MH#7
I#1 (DP 16)
I#3 (DP 7)

SHEET 1


I#4 (DP 13)
P-123
EASTONVILLE 9
I#5 (DP 14)
P-124
O-5
44 (69) (DP 15)
EASTONVILLE 17
P-125
44 (70)
EASTONVILLE 6 (Analyzed via Hydraflow Express, not in this model.)

SHEET 2



SHEET 3

100 YEAR TAILWATER CONDITION: PIPE SUMMARY TABLE

	Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n
66: P-8 (1) (1)	P-8 (1) (1)	MH#4 DP 18)	6,985.02	O-3	6,984.82	41.6	0.005	36.0	0.013
67: P-124	P-124	I#5 (DP 14)	6,983.07	O-5	6,981.82	50.1	0.025	18.0	0.013
68: P-121 (2)	P-121 (2)	44 (80)	6,966.45	O-6	6,966.08	74.1	0.005	24.0	0.013
69: P-18	P-18	I#3 (DP 7)	6,986.04	MH#7	6,985.68	71.3	0.005	42.0	0.013
70: P-20	P-20	MH#7	6,985.37	MH#6	6,983.61	175.6	0.010	42.0	0.013
71: P-5	P-5	I#1 (DP 16)	6,989.53	I#2 (DP 17)	6,989.27	52.7	0.005	18.0	0.013
72: P-8 (1)	P-8 (1)	I#2 (DP 17)	6,988.77	MH#4 DP 18)	6,986.02	147.0	0.019	24.0	0.013
73: P-21	P-21	MH#6	6,983.41	MH#5	6,982.59	82.2	0.010	42.0	0.013
74: P-22	P-22	MH#5	6,982.39	MH#3 (DP 8)	6,981.23	115.7	0.010	42.0	0.013
75: P-15	P-15	18 (DP 19)	6,983.25	MH#3 (DP 8)	6,983.03	30.8	0.007	18.0	0.013
76: P-15 (1)	P-15 (1)	MH#3 (DP 8)	6,981.03	MH#2 (DP 8)	6,980.65	75.1	0.005	42.0	0.013
77: P-16	P-16	MH#2 (DP 8)	6,980.55	MH#1	6,980.16	78.1	0.005	42.0	0.013
78: P-123	P-123	I#4 (DP 13)	6,983.43	I#5 (DP 14)	6,983.17	52.0	0.005	18.0	0.013
79: P-17	P-17	MH#1	6,980.06	OUTFALL	6,979.36	139.8	0.005	42.0	0.013
80: P-125	P-125	44 (69) (DP 15)	6,978.42	44 (70)	6,978.21	42.5	0.005	18.0	0.013
84: P-121	P-121	I#8 (DP 10)	6,966.90	44 (80)	6,966.45	89.0	0.005	24.0	0.013
85: P-130	P-130	I#6 (DP 1)	6,967.50	I#7 (DP 9)	6,967.37	19.6	0.007	18.0	0.013
87: P-121 (1)	P-121 (1)	I#7 (DP 9)	6,967.27	I#8 (DP 10)	6,967.00	53.0	0.005	18.0	0.013
88: P-131	P-131	44 (78) (DP 11)	6,963.40	44 (79)	6,962.52	167.9	0.005	18.0	0.013
127: P-89	P-89	MH#8	6,986.76	MH#4 DP 18)	6,986.02	116.1	0.006	24.0	0.013
146: P-87 (1)	P-87 (1)	MH#9	6,989.76	MH#8	6,986.86	193.5	0.015	24.0	0.013

	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
66: P-8 (1) (1)	26.00	3.68	46.25	56.2	6,988.25	6,988.19
67: P-124	5.60	8.48	16.60	33.7	6,983.98	6,982.43
68: P-121 (2)	13.90	5.73	15.98	87.0	6,967.89	6,967.42
69: P-18	53.60	8.15	71.48	75.0	6,988.34	6,988.30
70: P-20	53.60	10.63	100.73	53.2	6,987.66	6,986.34
71: P-5	5.20	4.52	7.38	70.5	6,990.51	6,990.40
72: P-8 (1)	10.30	8.86	30.94	33.3	6,989.92	6,988.63
73: P-21	53.60	10.61	100.49	53.3	6,985.70	6,985.32
74: P-22	53.60	10.63	100.72	53.2	6,984.68	6,984.42
75: P-15	3.00	4.54	8.88	33.8	6,984.43	6,984.42
76: P-15 (1)	56.50	8.24	71.57	78.9	6,983.69	6,983.58
77: P-16	56.50	8.20	71.10	79.5	6,982.91	6,982.52
78: P-123	3.00	3.98	7.43	40.4	6,984.40	6,984.38
79: P-17	56.50	8.21	71.18	79.4	6,982.41	6,981.71
80: P-125	1.20	3.10	7.45	16.1	6,978.83	6,978.62
84: P-121	13.90	5.76	16.08	86.4	6,968.34	6,967.92
85: P-130	3.60	2.04	8.55	42.1	6,969.95	6,969.92
87: P-121 (1)	9.30	5.26	7.50	124.0	6,969.28	6,968.86
88: P-131	1.40	3.28	7.61	18.4	6,963.84	6,962.96
127: P-89	17.20	5.47	18.06	95.3	6,989.30	6,988.63
146: P-87 (1)	17.20	9.29	27.70	62.1	6,991.26	6,989.59

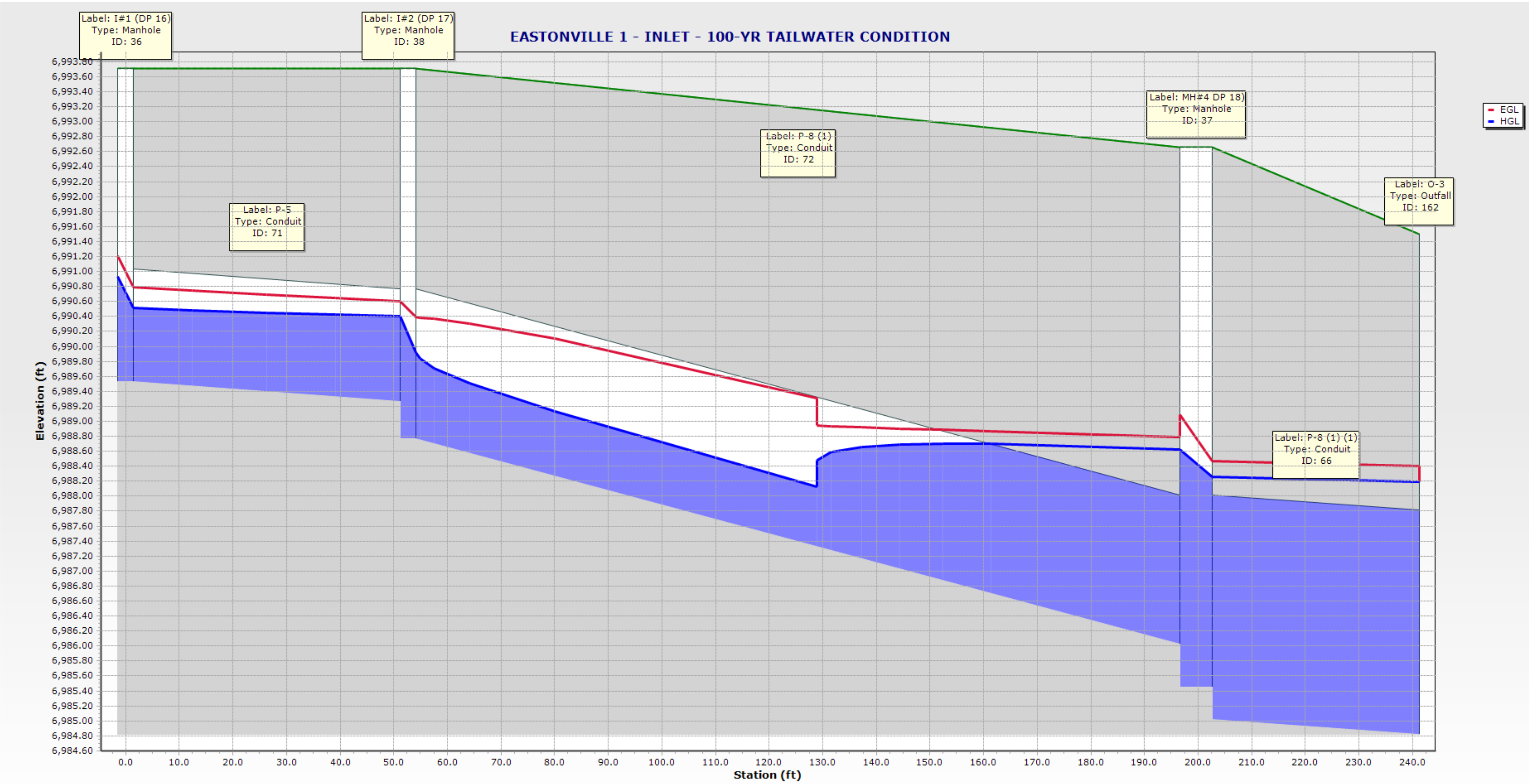
NOTE: EASTONVILLE 1, 5, & 9 SEGMENTS HAVE BEEN ANALYZED IN THE FREE OUTFALL CONDITION BELOW TO MEET CAPACITY & VELOCITY REQUIREMENTS. SEGMENT 2 PIPES & STRUCTURES INCLUDED IN TABLE, REFER TO FDR FOR COMPLETE ANALYSIS.

100 YEAR TAILWATER CONDITION: STRUCTURE SUMMARY TABLE

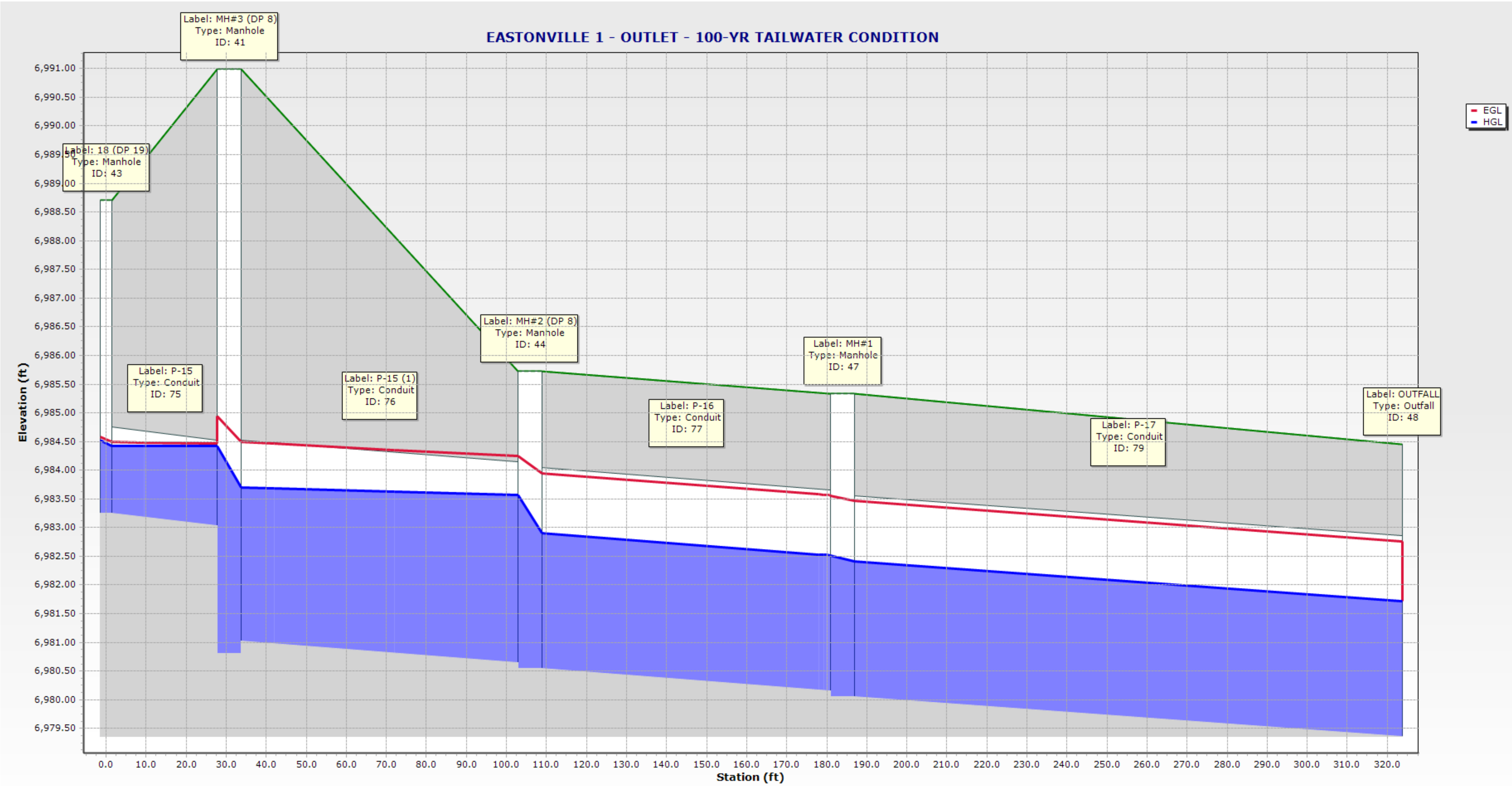
	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Hydraulic Grade Line (In) (ft)	Notes
35: MH#7	6,993.84	6,993.84	6,985.68	53.60	6,987.66	Standard	6,988.30	STORM MH
36: I#1 (DP 16	6,993.71	6,993.71	(N/A)	5.20	6,990.51	Standard	6,990.93	CDOT Type-R
37: MH#4 DP	6,992.66	6,992.66	6,986.02	26.00	6,988.25	Standard	6,988.63	STORM MH
38: I#2 (DP 17	6,993.71	6,993.71	6,989.27	10.30	6,989.92	Standard	6,990.40	CDOT Type-R
39: MH#6	6,992.82	6,992.82	6,983.61	53.60	6,985.70	Standard	6,986.34	STORM MH
40: MH#5	6,991.57	6,991.57	6,982.59	53.60	6,984.68	Standard	6,985.32	STORM MH
41: MH#3 (DP	6,990.99	6,990.99	6,981.23	56.50	6,983.69	Standard	6,984.42	STORM MH
42: I#3 (DP 7)	6,991.04	6,991.04	(N/A)	53.60	6,988.34	Standard	6,989.83	CDOT Type-D
43: 18 (DP 19)	6,988.70	6,988.70	(N/A)	3.00	6,984.43	Standard	6,984.52	CDOT Type-C
44: MH#2 (DP	6,985.73	6,985.73	6,980.65	56.50	6,982.91	Standard	6,983.58	STORM MH
45: I#4 (DP 13	6,987.25	6,987.25	(N/A)	3.00	6,984.40	Standard	6,984.54	CDOT Type-R
46: I#5 (DP 14	6,987.25	6,987.25	6,983.17	5.60	6,983.98	Standard	6,984.38	CDOT Type-R
47: MH#1	6,985.33	6,985.33	6,980.16	56.50	6,982.41	Standard	6,982.52	STORM MH
49: 44 (69) (D	6,982.25	6,982.25	(N/A)	1.20	6,978.83	Standard	6,978.85	CDOT Type-C
55: 44 (80)	6,976.21	6,976.21	6,966.45	13.90	6,967.89	Standard	6,967.92	STORM MH
57: I#7 (DP 9)	6,976.23	6,976.23	6,967.37	9.30	6,969.28	Standard	6,969.92	CDOT Type-R
58: I#8 (DP 10	6,976.19	6,976.19	6,967.00	13.90	6,968.34	Standard	6,968.86	CDOT Type-R
59: I#6 (DP 1)	6,975.55	6,975.55	(N/A)	3.60	6,969.95	Standard	6,970.04	CDOT Type-c
60: 44 (78) (D	6,967.25	6,967.25	(N/A)	1.40	6,963.84	Standard	6,964.01	CDOT Type-C
120: MH#8	6,995.46	6,995.46	6,986.86	17.20	6,989.30	Standard	6,989.59	STORM MH

	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
48: OUTFALL	6,984.45	6,979.36	Free Outfall		6,981.71	56.50	CDOT FES
53: 44 (70)	6,979.71	6,978.21	Free Outfall		6,978.62	1.20	CDOT FES
64: 44 (79)	6,964.02	6,962.52	Free Outfall		6,962.96	1.40	CDOT FES
162: O-3	6,991.50	6,984.82	User Defined Tailwater	6,988.19	6,988.19	26.00	Dummy Null
164: O-5	6,984.50	6,981.82	User Defined Tailwater	6,982.14	6,982.43	5.60	Dummy Null
165: O-6	6,970.50	6,966.08	User Defined Tailwater	6,967.26	6,967.42	13.90	Dummy Null

NOTE: EASTONVILLE 1, 5 & 9 SEGMENTS HAVE BEEN ANALYZED IN THE FREE OUTFALL CONDITION BELOW TO MEET CAPACITY & VELOCITY REQUIREMENTS. SEGMENT 2 PIPES & STRUCTURES INCLUDED IN TABLE, REFER TO FDR FOR COMPLETE ANALYSIS.



NOTE: THIS SEGMENT HAS BEEN ANALYZED IN THE FREE OUTFALL CONDITION BLEOW TO MEET CAPACITY & VELOCITY REQUIREMENTS



EASTONVILLE 1 - OUTLET - 100-YR TAILWATER CONDITION
Label: MH#3 (DP 8)
Type: Manhole
ID: 41
Label: 18 (DP 19)
Type: Manhole
ID: 43
Label: P-15
Type: Conduit
ID: 75
Label: P-15 (1)
Type: Conduit
ID: 76
Label: MH#2 (DP 8)
Type: Manhole
ID: 44
Label: MH#1
Type: Manhole
ID: 47
Label: P-16
Type: Conduit
ID: 77
Label: P-17
Type: Conduit
ID: 79
Label: OUTFALL
Type: Outfall
ID: 48
EGL
HGL
Elevation (ft)
6,991.00
6,990.50
6,990.00
6,989.50
6,989.00
6,988.50
6,988.00
6,987.50
6,987.00
6,986.50
6,986.00
6,985.50
6,985.00
6,984.50
6,984.00
6,983.50
6,983.00
6,982.50
6,982.00
6,981.50
6,981.00
6,980.50
6,980.00
6,979.50
Station (ft)
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
120.0
130.0
140.0
150.0
160.0
170.0
180.0
190.0
200.0
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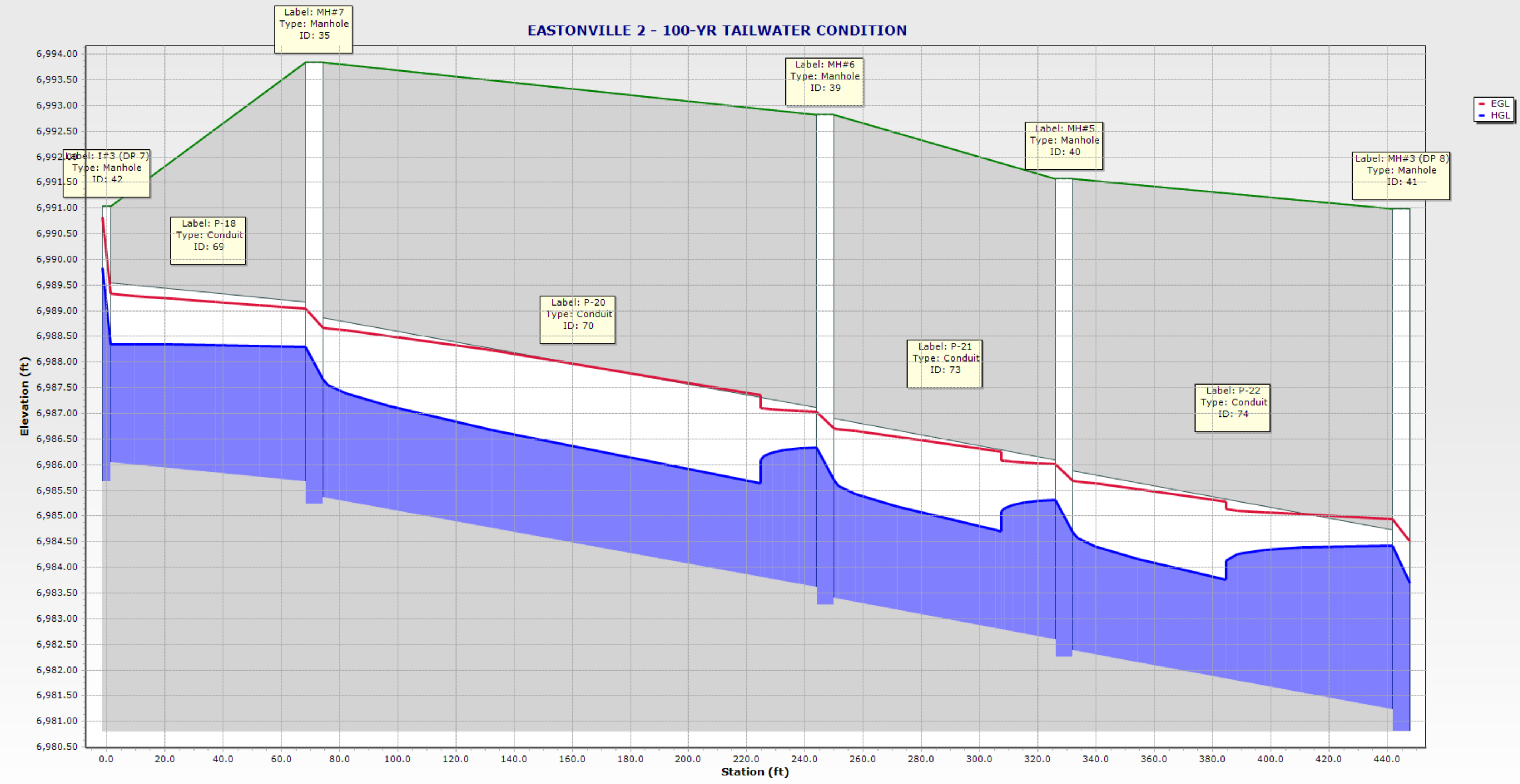
300.0
310.0
320.0



EASTONVILLE 2 - 100-YR TAILWATER CONDITION
Label: MH#7
Type: Manhole
ID: 35
Label: MH#6
Type: Manhole
ID: 39
Label: MH#5
Type: Manhole
ID: 40
Label: MH#3 (DP 8)
Type: Manhole
ID: 41
Label: I#3 (DP 7)
Type: Manhole
ID: 42
Label: P-18
Type: Conduit
ID: 69
Label: P-20
Type: Conduit
ID: 70
Label: P-21
Type: Conduit
ID: 73
Label: P-22
Type: Conduit
ID: 74
EGL
HGL
Elevation (ft)
Station (ft)
6,994.00
6,993.50
6,993.00
6,992.50
6,991.50
6,991.00
6,990.50
6,990.00
6,989.50
6,989.00
6,988.50
6,988.00
6,987.50
6,987.00
6,986.50
6,986.00
6,985.50
6,985.00
6,984.50
6,984.00
6,983.50
6,983.00
6,982.50
6,982.00
6,981.50
6,981.00
6,980.50
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
220.0
240.0
260.0
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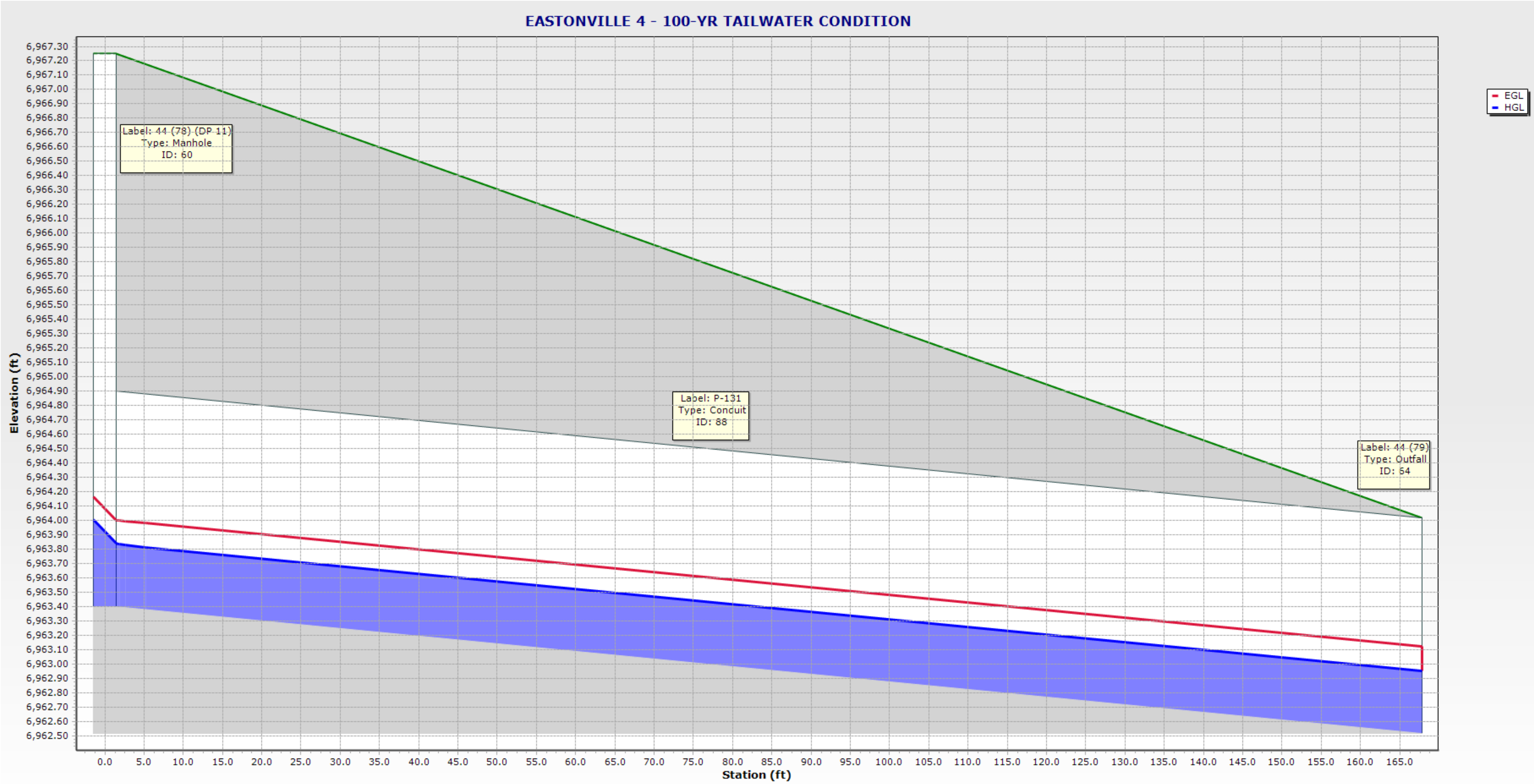
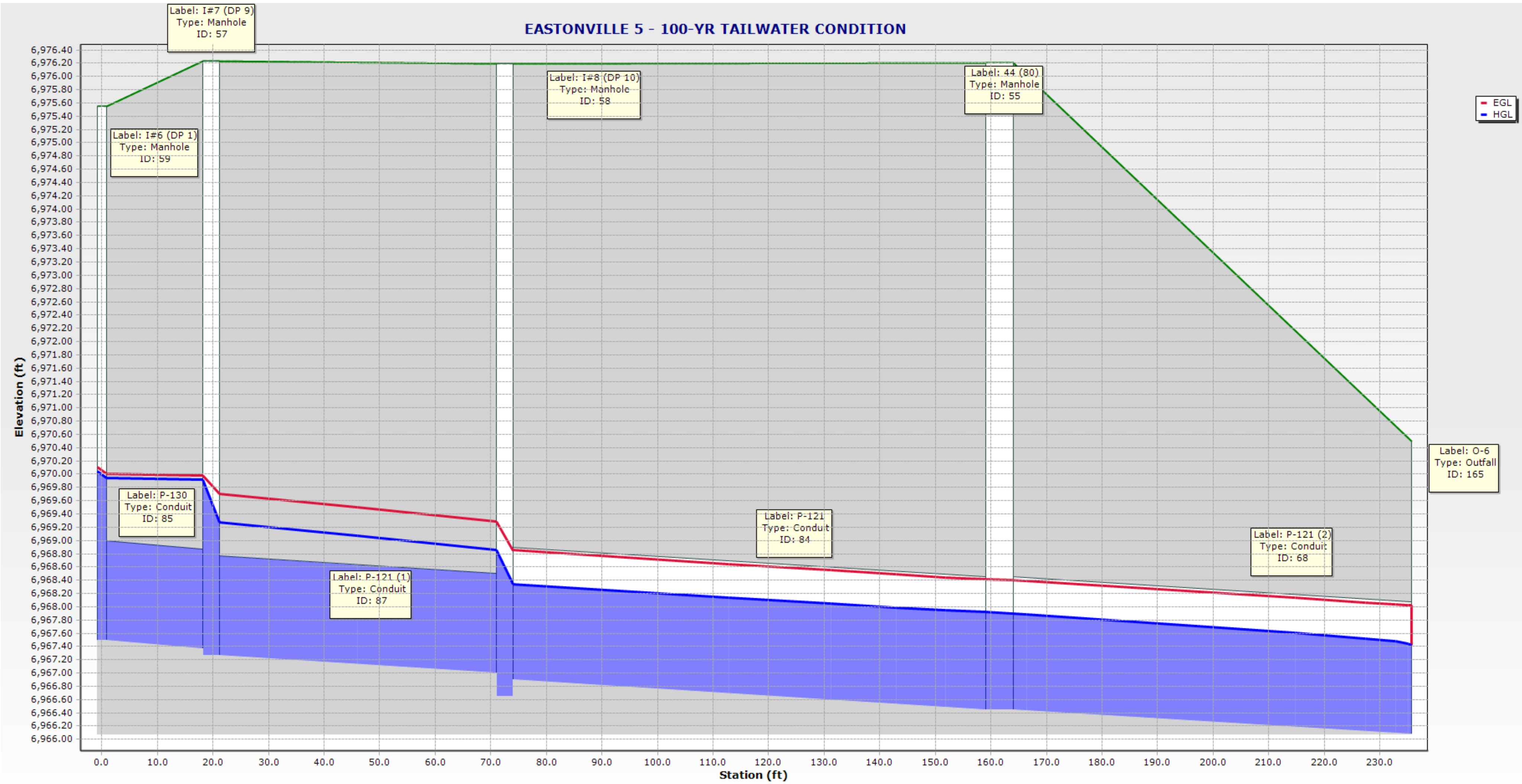
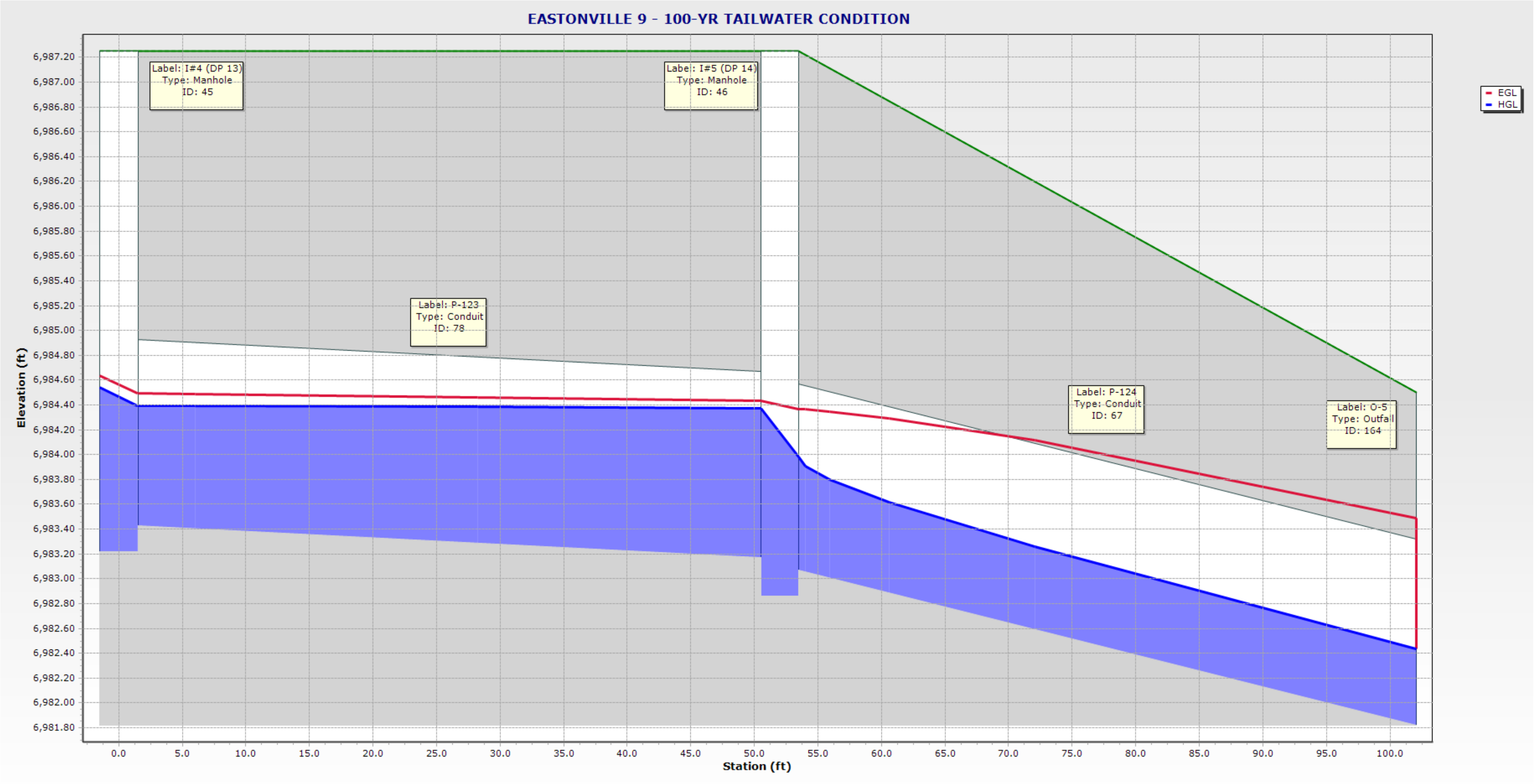
440.0



EASTONVILLE 4 - 100-YR TAILWATER CONDITION
Elevation (ft)
Station (ft)
EGL
HGL
Label: 44 (78) (DP 11)
Type: Manhole
ID: 60
Label: P-131
Type: Conduit
ID: 88
Label: 44 (79)
Type: Outfall
ID: 64

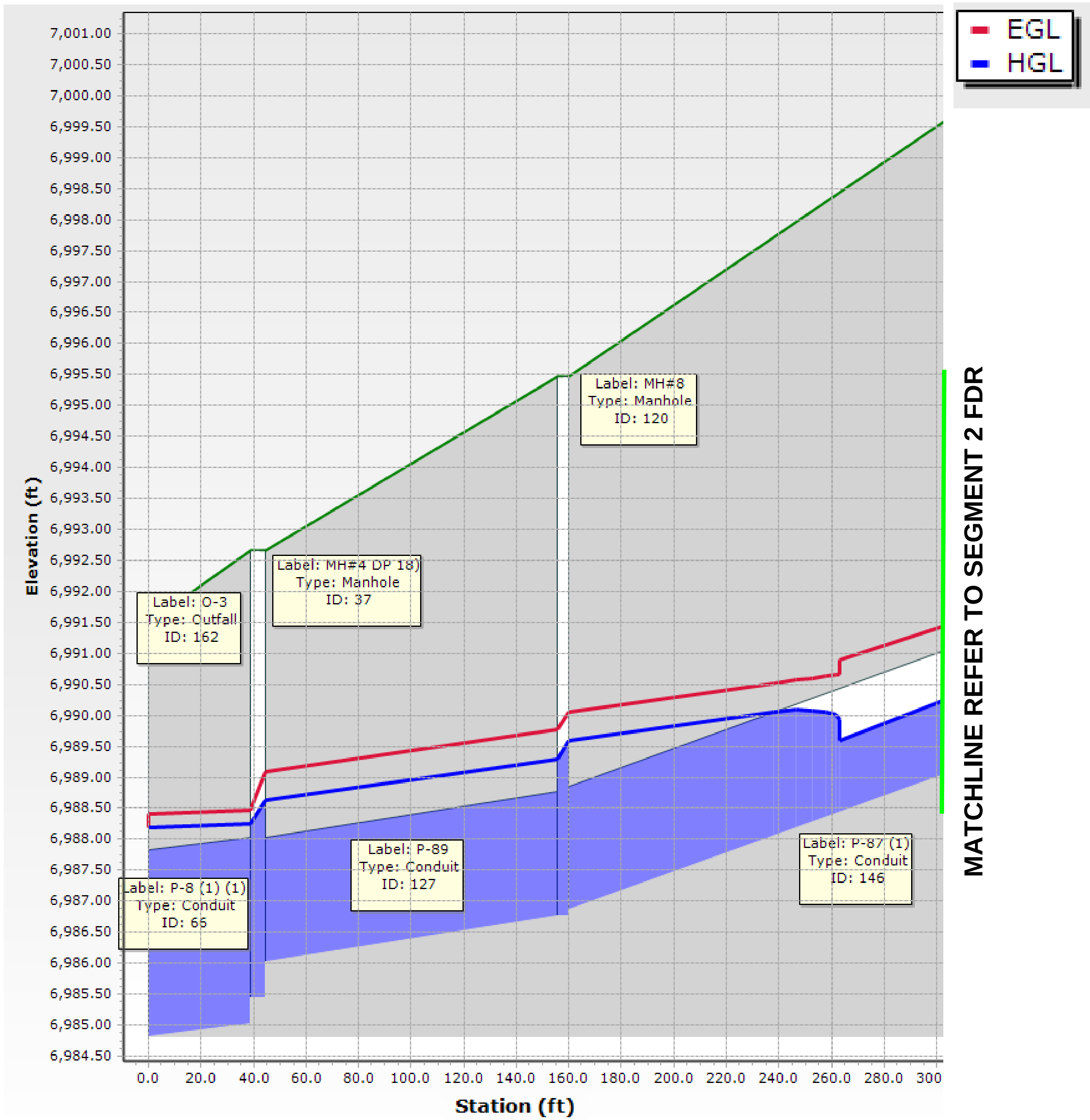


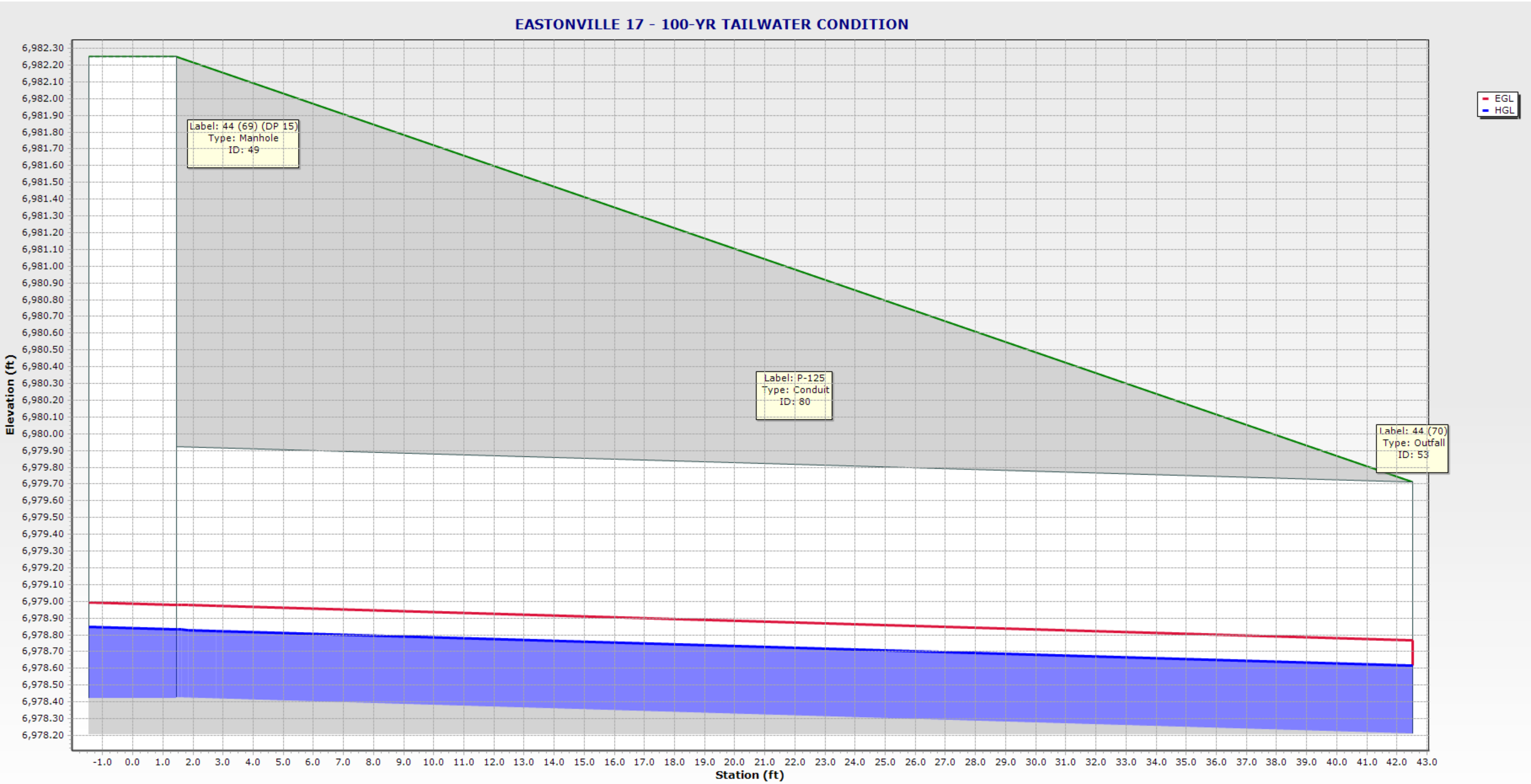
NOTE: THIS SEGMENT HAS BEEN ANALYZED IN THE FREE OUTFALL CONDITION BLEOW TO MEET CAPACITY & VELOCITY REQUIREMENTS



NOTE: THIS SEGMENT HAS BEEN ANALYZED IN THE FREE OUTFALL CONDITION BLEOW TO MEET CAPACITY & VELOCITY REQUIREMENTS

EASTONVILLE 10 - 100-YR TAILWATER CONDITION




EASTONVILLE 17 - 100-YR TAILWATER CONDITION
Label: 44 (69) (DP 15)
Type: Manhole
ID: 49
Label: P-125
Type: Conduit
ID: 80
Label: 44 (70)
Type: Outfall
ID: 53
EGL
HGL
Elevation (ft)
Station (ft)

5 YEAR TAILWATER CONDITION: PIPE SUMMARY TABLE

	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n
66: P-8 (1) (1)	MH#4 DP 18)	6,985.02	O-3	6,984.82	41.6	0.005	36.0	0.013
67: P-124	I#5 (DP 14)	6,983.07	O-5	6,981.82	50.1	0.025	18.0	0.013
68: P-121 (2)	44 (80)	6,966.45	O-6	6,966.08	74.1	0.005	24.0	0.013
69: P-18	I#3 (DP 7)	6,986.04	MH#7	6,985.68	71.3	0.005	42.0	0.013
70: P-20	MH#7	6,985.37	MH#6	6,983.61	175.6	0.010	42.0	0.013
71: P-5	I#1 (DP 16)	6,989.53	I#2 (DP 17)	6,989.27	52.7	0.005	18.0	0.013
72: P-8 (1)	I#2 (DP 17)	6,988.77	MH#4 DP 18)	6,986.02	147.0	0.019	24.0	0.013
73: P-21	MH#6	6,983.41	MH#5	6,982.59	82.2	0.010	42.0	0.013
74: P-22	MH#5	6,982.39	MH#3 (DP 8)	6,981.23	115.7	0.010	42.0	0.013
75: P-15	18 (DP 19)	6,983.25	MH#3 (DP 8)	6,983.03	30.8	0.007	18.0	0.013
76: P-15 (1)	MH#3 (DP 8)	6,981.03	MH#2 (DP 8)	6,980.65	75.1	0.005	42.0	0.013
77: P-16	MH#2 (DP 8)	6,980.55	MH#1	6,980.16	78.1	0.005	42.0	0.013
78: P-123	I#4 (DP 13)	6,983.43	I#5 (DP 14)	6,983.17	52.0	0.005	18.0	0.013
79: P-17	MH#1	6,980.06	OUTFALL	6,979.36	139.8	0.005	42.0	0.013
80: P-125	44 (69) (DP 15)	6,978.42	44 (70)	6,978.21	42.5	0.005	18.0	0.013
84: P-121	I#8 (DP 10)	6,966.90	44 (80)	6,966.45	89.0	0.005	24.0	0.013
85: P-130	I#6 (DP 1)	6,967.50	I#7 (DP 9)	6,967.37	19.6	0.007	18.0	0.013
87: P-121 (1)	I#7 (DP 9)	6,967.27	I#8 (DP 10)	6,967.00	53.0	0.005	18.0	0.013
88: P-131	44 (78) (DP 11)	6,963.40	44 (79)	6,962.52	167.9	0.005	18.0	0.013
127: P-89	MH#8	6,986.76	MH#4 DP 18)	6,986.02	116.1	0.006	24.0	0.013
146: P-87 (1)	MH#9	6,989.76	MH#8	6,986.86	193.5	0.015	24.0	0.013

	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
66: P-8 (1) (1)	15.50	5.89	46.25	33.5	6,987.08	6,987.07
67: P-124	3.30	7.32	16.60	19.9	6,983.76	6,982.27
68: P-121 (2)	5.40	4.59	15.98	33.8	6,967.27	6,966.99
69: P-18	8.00	4.91	71.48	11.2	6,986.89	6,986.47
70: P-20	8.00	6.26	100.73	7.9	6,986.22	6,984.28
71: P-5	3.10	3.99	7.38	42.0	6,990.21	6,989.99
72: P-8 (1)	6.20	7.69	30.94	20.0	6,989.65	6,987.32
73: P-21	8.00	6.25	100.49	8.0	6,984.26	6,983.26
74: P-22	8.00	6.26	100.72	7.9	6,983.24	6,982.18
75: P-15	0.40	2.54	8.88	4.5	6,983.48	6,983.25
76: P-15 (1)	8.40	4.98	71.57	11.7	6,981.90	6,981.62
77: P-16	8.40	4.96	71.10	11.8	6,981.42	6,980.97
78: P-123	1.80	3.46	7.43	24.2	6,984.04	6,984.03
79: P-17	8.40	4.96	71.18	11.8	6,980.94	6,980.17
80: P-125	0.03	1.03	7.45	0.4	6,978.49	6,978.27
84: P-121	5.40	4.61	16.08	33.6	6,967.72	6,967.29
85: P-130	0.50	2.64	8.55	5.8	6,968.35	6,968.35
87: P-121 (1)	3.30	4.11	7.50	44.0	6,968.06	6,968.03
88: P-131	0.40	2.28	7.61	5.3	6,963.63	6,962.75
127: P-89	10.20	5.92	18.06	56.5	6,987.90	6,987.32
146: P-87 (1)	10.20	8.15	27.70	36.8	6,990.90	6,988.20

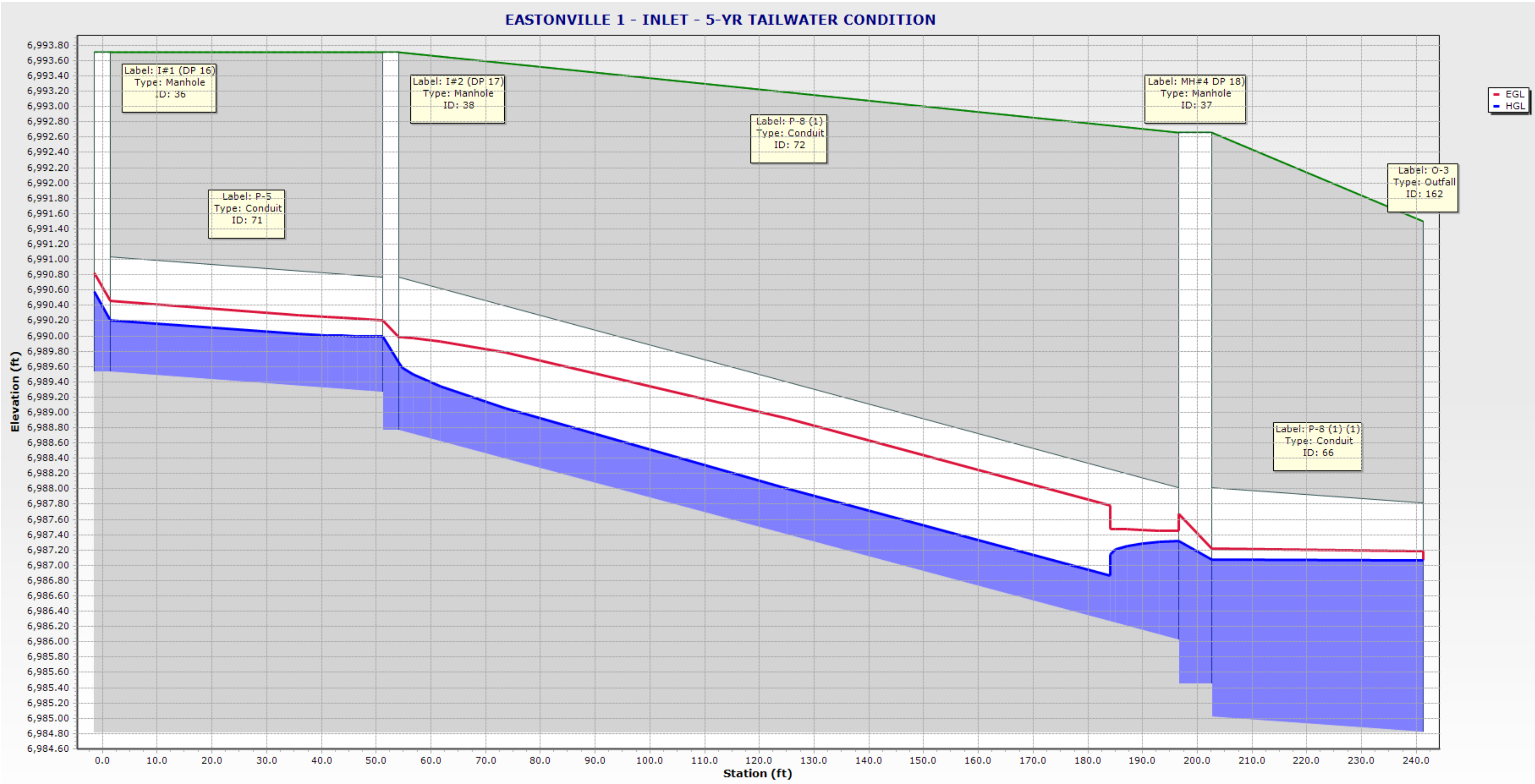
NOTE: EASTONVILLE 1, 5 & 9 SEGMENTS HAVE BEEN ANALYZED IN THE FREE OUTFALL CONDITION BELOW TO MEET CAPACITY & VELOCITY REQUIREMENTS. SEGMENT 2 PIPES & STRUCTURES INCLUDED IN TABLE, REFER TO FDR FOR COMPLETE ANALYSIS.

5 YEAR TAILWATER CONDITION: STRUCTURE SUMMARY TABLE

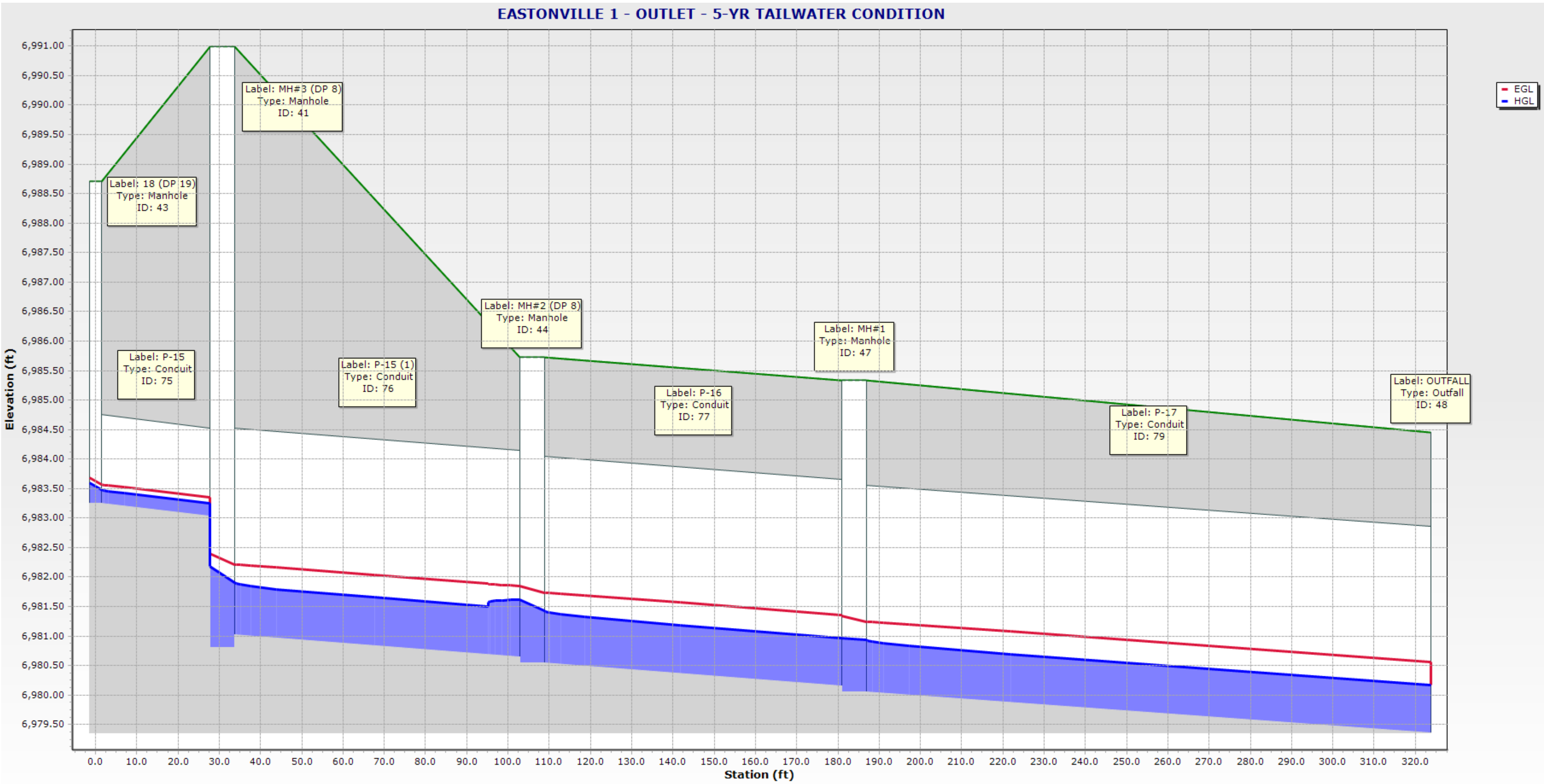
	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Hydraulic Grade Line (In) (ft)	Notes
35: MH#7	6,993.84	6,993.84	6,985.68	8.00	6,986.22	Standard	6,986.42	STORM MH
36: I#1 (DP 16	6,993.71	6,993.71	(N/A)	3.10	6,990.21	Standard	6,990.58	CDOT Type-R
37: MH#4 DP	6,992.66	6,992.66	6,986.02	15.50	6,987.08	Standard	6,987.32	STORM MH
38: I#2 (DP 17	6,993.71	6,993.71	6,989.27	6.20	6,989.65	Standard	6,989.99	CDOT Type-R
39: MH#6	6,992.82	6,992.82	6,983.61	8.00	6,984.26	Standard	6,984.46	STORM MH
40: MH#5	6,991.57	6,991.57	6,982.59	8.00	6,983.24	Standard	6,983.44	STORM MH
41: MH#3 (DP	6,990.99	6,990.99	6,981.23	8.40	6,981.90	Standard	6,982.18	STORM MH
42: I#3 (DP 7)	6,991.04	6,991.04	(N/A)	8.00	6,986.89	Standard	6,987.35	CDOT Type-D
43: 18 (DP 19)	6,988.70	6,988.70	(N/A)	0.40	6,983.48	Standard	6,983.60	CDOT Type-C
44: MH#2 (DP	6,985.73	6,985.73	6,980.65	8.40	6,981.42	Standard	6,981.62	STORM MH
45: I#4 (DP 13	6,987.25	6,987.25	(N/A)	1.80	6,984.04	Standard	6,984.21	CDOT Type-R
46: I#5 (DP 14	6,987.25	6,987.25	6,983.17	3.30	6,983.76	Standard	6,984.03	CDOT Type-R
47: MH#1	6,985.33	6,985.33	6,980.16	8.40	6,980.94	Standard	6,980.97	STORM MH
49: 44 (69) (D	6,982.25	6,982.25	(N/A)	0.03	6,978.49	Standard	6,978.49	CDOT Type-C
55: 44 (80)	6,976.21	6,976.21	6,966.45	5.40	6,967.27	Standard	6,967.29	STORM MH
57: I#7 (DP 9)	6,976.23	6,976.23	6,967.37	3.30	6,968.06	Standard	6,968.35	CDOT Type-R
58: I#8 (DP 10	6,976.19	6,976.19	6,967.00	5.40	6,967.72	Standard	6,968.03	CDOT Type-R
59: I#6 (DP 1)	6,975.55	6,975.55	(N/A)	0.50	6,968.35	Standard	6,968.35	CDOT Type-c
60: 44 (78) (D	6,967.25	6,967.25	(N/A)	0.40	6,963.63	Standard	6,963.72	CDOT Type-C
120: MH#8	6,995.46	6,995.46	6,986.86	10.20	6,987.90	Standard	6,988.20	STORM MH

	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
48: OUTFALL	6,984.45	6,979.36	Free Outfall		6,980.17	8.40	CDOT FES
53: 44 (70)	6,979.71	6,978.21	Free Outfall		6,978.27	0.03	CDOT FES
64: 44 (79)	6,964.02	6,962.52	Free Outfall		6,962.75	0.40	CDOT FES
162: O-3	6,991.50	6,984.82	User Defined Tailwater	6,987.07	6,987.07	15.50	Dummy Null
164: O-5	6,984.50	6,981.82	User Defined Tailwater	6,981.93	6,982.27	3.30	Dummy Null
165: O-6	6,970.50	6,966.08	User Defined Tailwater	6,966.99	6,966.99	5.40	Dummy Null

NOTE: EASTONVILLE 1, 5 & 9 SEGMENTS HAVE BEEN ANALYZED IN THE FREE OUTFALL CONDITION BELOW TO MEET CAPACITY & VELOCITY REQUIREMENTS. SEGMENT 2 PIPES & STRUCTURES INCLUDED IN TABLE, REFER TO FDR FOR COMPLETE ANALYSIS.



NOTE: THIS SEGMENT HAS BEEN ANALYZED IN THE FREE OUTFALL CONDITION BLEOW TO MEET CAPACITY & VELOCITY REQUIREMENTS



EASTONVILLE 1 - OUTLET - 5-YR TAILWATER CONDITION
Label: MH#3 (DP 8)
Type: Manhole
ID: 41
Label: 18 (DP 19)
Type: Manhole
ID: 43
Label: MH#2 (DP 8)
Type: Manhole
ID: 44
Label: MH#1
Type: Manhole
ID: 47
Label: P-15
Type: Conduit
ID: 75
Label: P-15 (1)
Type: Conduit
ID: 76
Label: P-16
Type: Conduit
ID: 77
Label: OUTFALL
Type: Outfall
ID: 48
Label: P-17
Type: Conduit
ID: 79
EGL
HGL
Elevation (ft)
Station (ft)
6,991.00
6,990.50
6,990.00
6,989.50
6,989.00
6,988.50
6,988.00
6,987.50
6,987.00
6,986.50
6,986.00
6,985.50
6,985.00
6,984.50
6,984.00
6,983.50
6,983.00
6,982.50
6,982.00
6,981.50
6,981.00
6,980.50
6,980.00
6,979.50
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
120.0
130.0
140.0
150.0
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180.0
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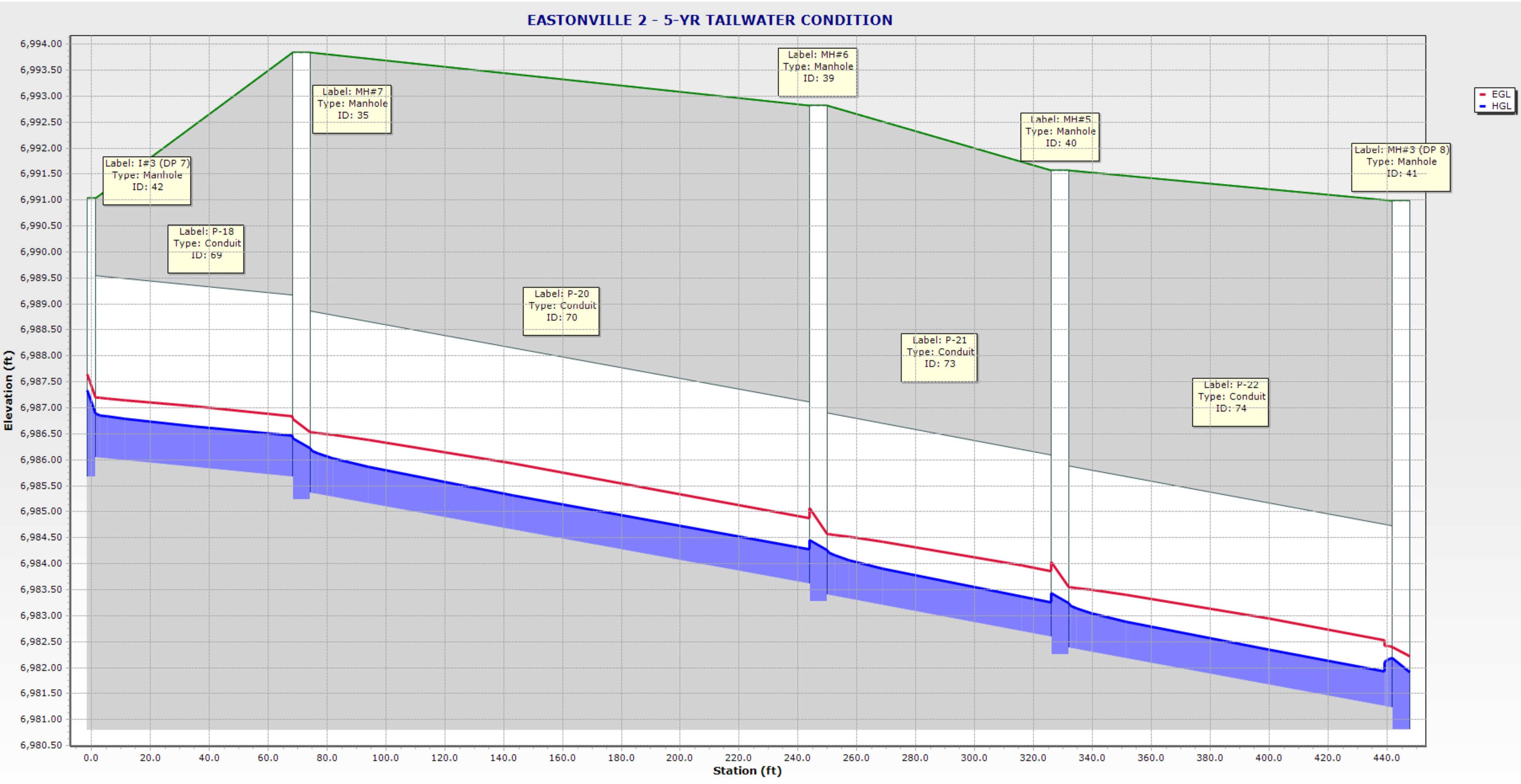
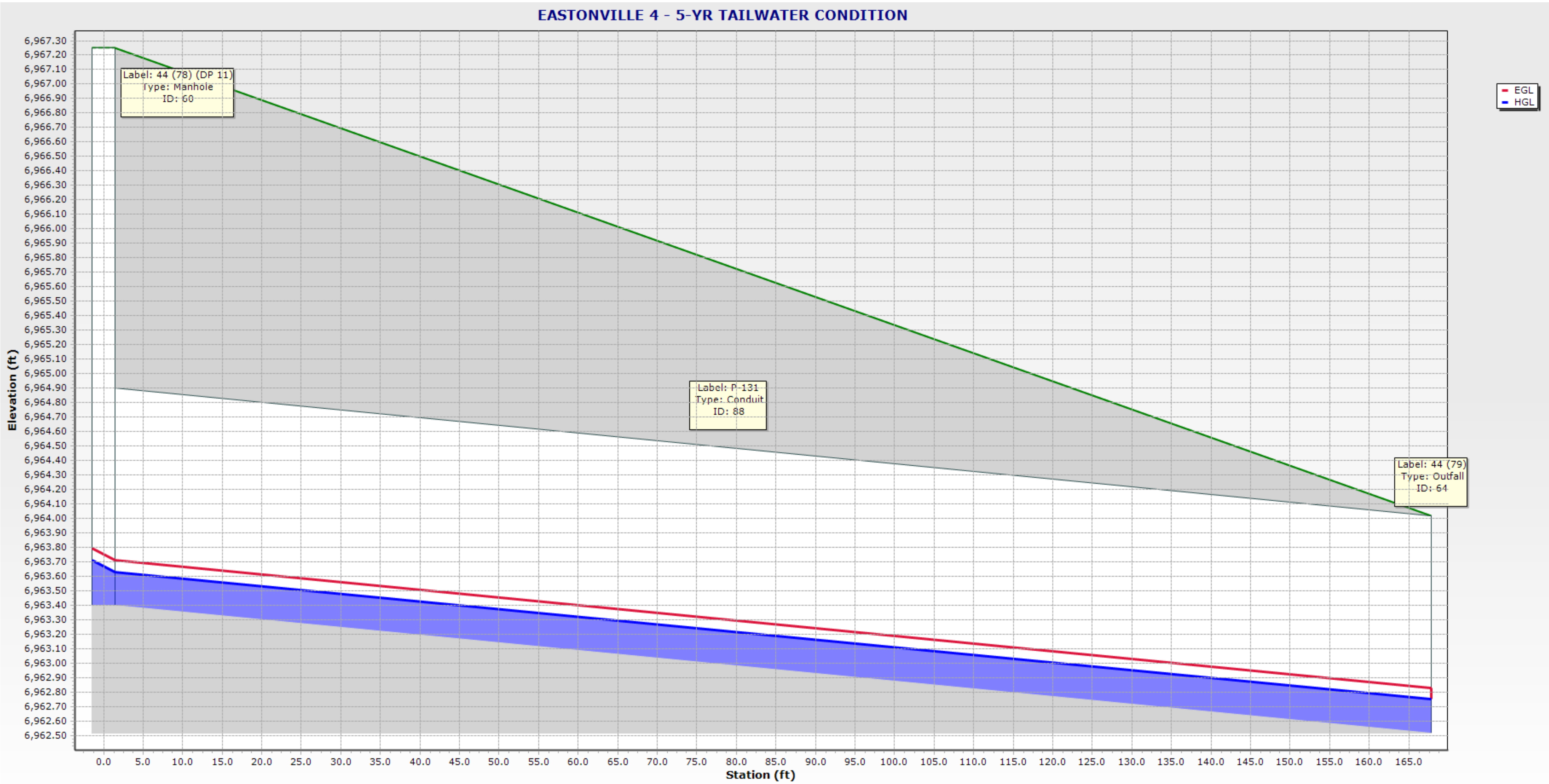
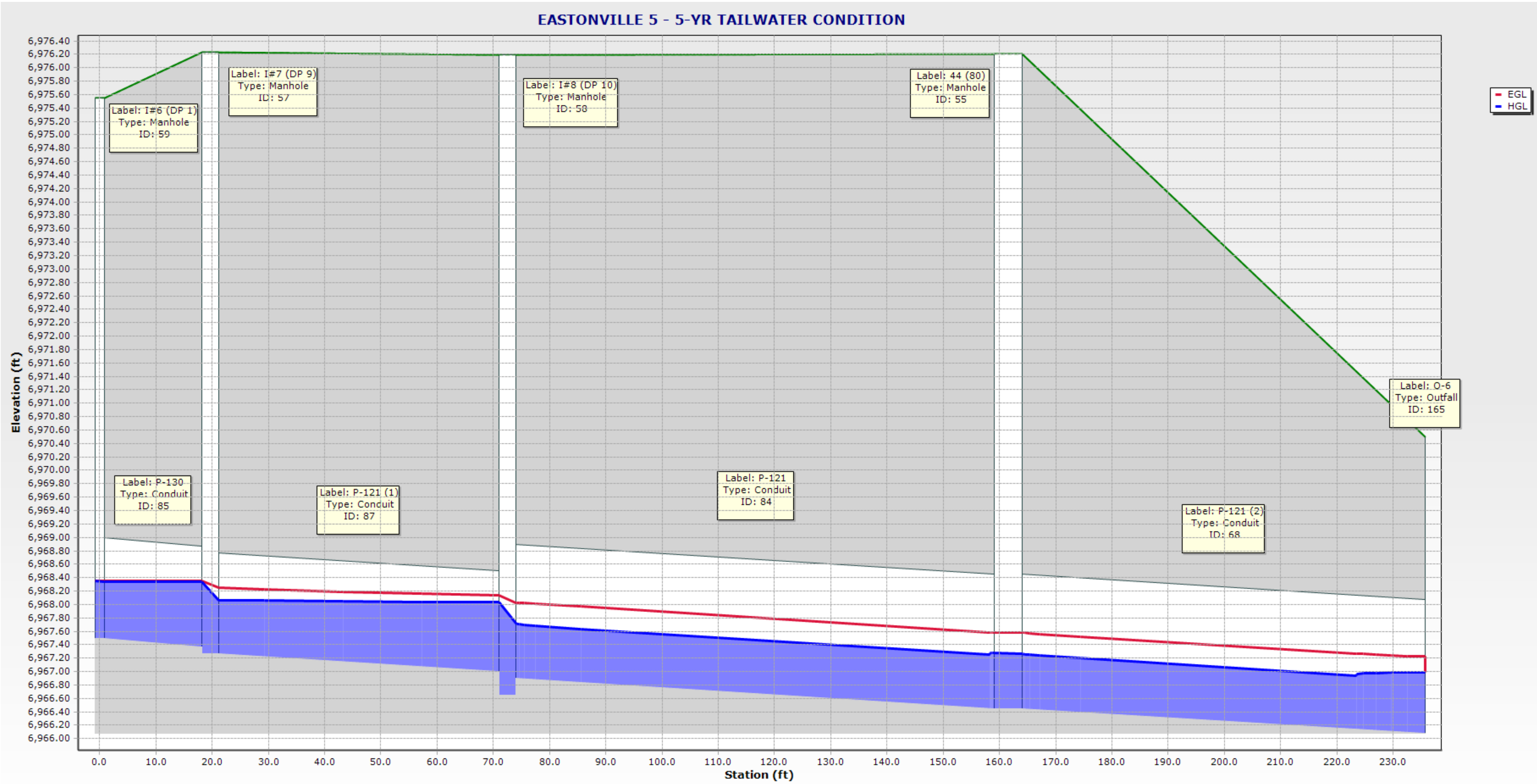


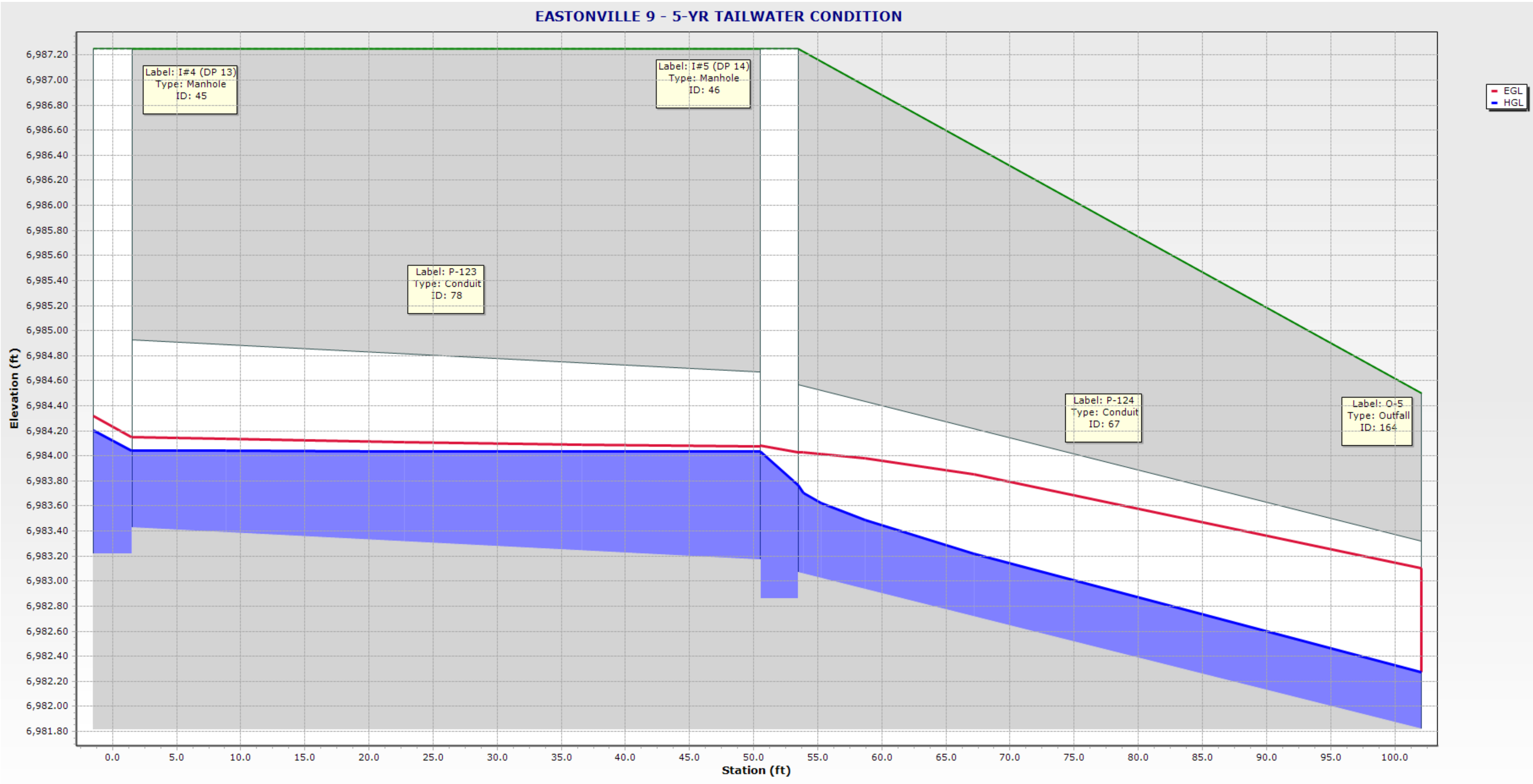
EASTONVILLE 2 - 5-YR TAILWATER CONDITION
Label: I#3 (DP 7)
Type: Manhole
ID: 42
Label: P-18
Type: Conduit
ID: 69
Label: MH#7
Type: Manhole
ID: 35
Label: P-20
Type: Conduit
ID: 70
Label: MH#6
Type: Manhole
ID: 39
Label: P-21
Type: Conduit
ID: 73
Label: MH#5
Type: Manhole
ID: 40
Label: P-22
Type: Conduit
ID: 74
Label: MH#3 (DP 8)
Type: Manhole
ID: 41
EGL
HGL
Elevation (ft)
Station (ft)
6,994.00
6,993.50
6,993.00
6,992.50
6,992.00
6,991.50
6,991.00
6,990.50
6,990.00
6,989.50
6,989.00
6,988.50
6,988.00
6,987.50
6,987.00
6,986.50
6,986.00
6,985.50
6,985.00
6,984.50
6,984.00
6,983.50
6,983.00
6,982.50
6,982.00
6,981.50
6,981.00
6,980.50
0.0
20.0
40.0
60.0
80.0
100.0
120.0
140.0
160.0
180.0
200.0
220.0
240.0
260.0
280.0
300.0
320.0
340.0
360.0
380.0
400.0
420.0
440.0



EASTONVILLE 4 - 5-YR TAILWATER CONDITION
Label: 44 (78) (DP 11)
Type: Manhole
ID: 60
Label: P-131
Type: Conduit
ID: 88
Label: 44 (79)
Type: Outfall
ID: 64
EGL
HGL
Elevation (ft)
Station (ft)

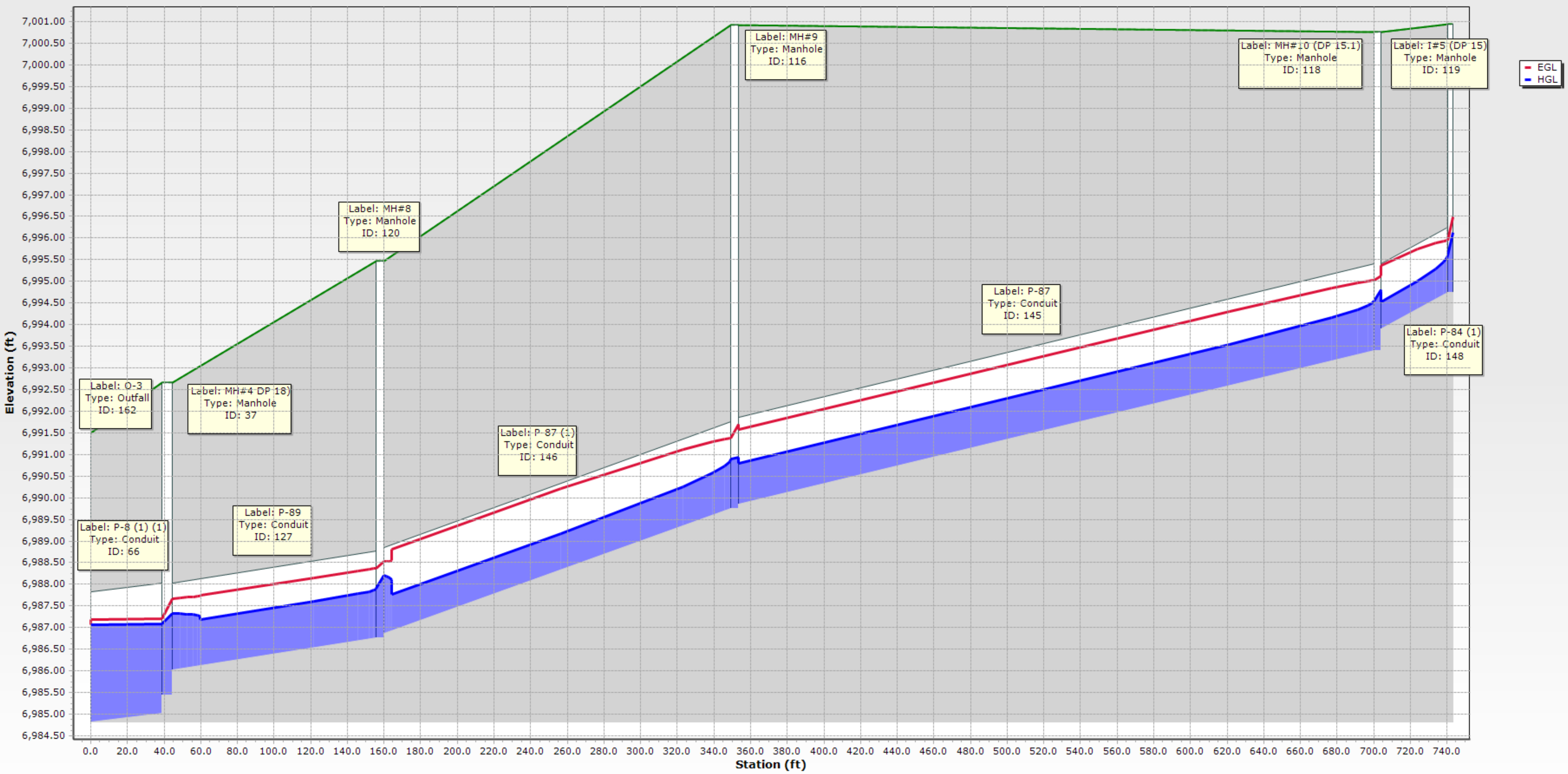


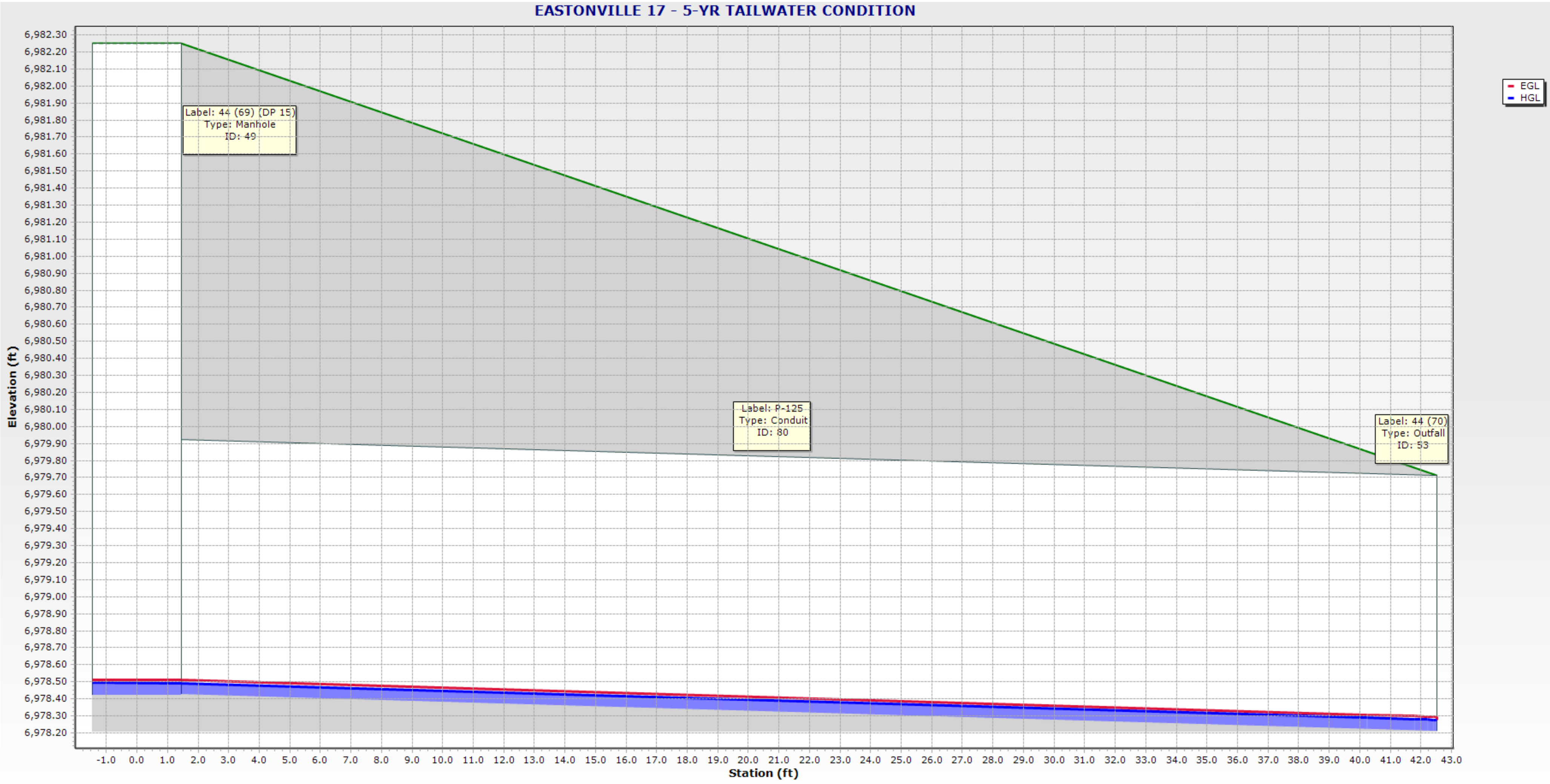
NOTE: THIS SEGMENT HAS BEEN ANALYZED IN THE FREE OUTFALL CONDITION BLEOW TO MEET CAPACITY & VELOCITY REQUIREMENTS



NOTE: THIS SEGMENT HAS BEEN ANALYZED IN THE FREE OUTFALL CONDITION BLEOW TO MEET CAPACITY & VELOCITY REQUIREMENTS

EASTONVILLE 10 - 5-YR TAILWATER CONDITION





EASTONVILLE 17 - 5-YR TAILWATER CONDITION
Elevation (ft)
Station (ft)
Label: 44 (69) (DP 15)
Type: Manhole
ID: 49
Label: P-125
Type: Conduit
ID: 80
Label: 44 (70)
Type: Outfall
ID: 53
EGL
HGL

100 YEAR FREE OUTFALL CONDITION: PIPE SUMMARY TABLE

	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n
66: P-8 (1) (1)	MH#4 DP 18)	6,985.02	O-3	6,984.82	41.6	0.005	36.0	0.013
67: P-124	I#5 (DP 14)	6,983.07	O-5	6,981.82	50.1	0.025	18.0	0.013
68: P-121 (2)	44 (80)	6,966.45	O-6	6,966.08	74.1	0.005	24.0	0.013
69: P-18	I#3 (DP 7)	6,986.04	MH#7	6,985.68	71.3	0.005	42.0	0.013
70: P-20	MH#7	6,985.37	MH#6	6,983.61	175.6	0.010	42.0	0.013
71: P-5	I#1 (DP 16)	6,989.53	I#2 (DP 17)	6,989.27	52.7	0.005	18.0	0.013
72: P-8 (1)	I#2 (DP 17)	6,988.77	MH#4 DP 18)	6,986.02	147.0	0.019	24.0	0.013
73: P-21	MH#6	6,983.41	MH#5	6,982.59	82.2	0.010	42.0	0.013
74: P-22	MH#5	6,982.39	MH#3 (DP 8)	6,981.23	115.7	0.010	42.0	0.013
75: P-15	18 (DP 19)	6,983.25	MH#3 (DP 8)	6,983.03	30.8	0.007	18.0	0.013
76: P-15 (1)	MH#3 (DP 8)	6,981.03	MH#2 (DP 8)	6,980.65	75.1	0.005	42.0	0.013
77: P-16	MH#2 (DP 8)	6,980.55	MH#1	6,980.16	78.1	0.005	42.0	0.013
78: P-123	I#4 (DP 13)	6,983.43	I#5 (DP 14)	6,983.17	52.0	0.005	18.0	0.013
79: P-17	MH#1	6,980.06	OUTFALL	6,979.36	139.8	0.005	42.0	0.013
80: P-125	44 (69) (DP 15)	6,978.42	44 (70)	6,978.21	42.5	0.005	18.0	0.013
84: P-121	I#8 (DP 10)	6,966.90	44 (80)	6,966.45	89.0	0.005	24.0	0.013
85: P-130	I#6 (DP 1)	6,967.50	I#7 (DP 9)	6,967.37	19.6	0.007	18.0	0.013
87: P-121 (1)	I#7 (DP 9)	6,967.27	I#8 (DP 10)	6,967.00	53.0	0.005	18.0	0.013
88: P-131	44 (78) (DP 11)	6,963.40	44 (79)	6,962.52	167.9	0.005	18.0	0.013
127: P-89	MH#8	6,986.76	MH#4 DP 18)	6,986.02	116.1	0.006	24.0	0.013
146: P-87 (1)	MH#9	6,989.76	MH#8	6,986.86	193.5	0.015	24.0	0.013

	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
66: P-8 (1) (1)	26.00	6.73	46.25	56.2	6,986.67	6,986.43
67: P-124	5.60	8.48	16.60	33.7	6,983.98	6,982.43
68: P-121 (2)	13.90	5.73	15.98	87.0	6,967.89	6,967.42
69: P-18	53.60	8.15	71.48	75.0	6,988.34	6,988.30
70: P-20	53.60	10.63	100.73	53.2	6,987.66	6,986.34
71: P-5	5.20	4.52	7.38	70.5	6,990.51	6,990.40
72: P-8 (1)	10.30	8.86	30.94	33.3	6,989.92	6,987.84
73: P-21	53.60	10.61	100.49	53.3	6,985.70	6,985.32
74: P-22	53.60	10.63	100.72	53.2	6,984.68	6,984.42
75: P-15	2.90	4.50	8.88	32.7	6,984.43	6,984.42
76: P-15 (1)	56.50	8.24	71.57	78.9	6,983.69	6,983.58
77: P-16	56.50	8.20	71.10	79.5	6,982.91	6,982.52
78: P-123	3.00	3.98	7.43	40.4	6,984.40	6,984.38
79: P-17	56.50	8.21	71.18	79.4	6,982.41	6,981.71
80: P-125	1.00	2.94	7.45	13.4	6,978.80	6,978.58
84: P-121	13.90	5.76	16.08	86.4	6,968.34	6,967.92
85: P-130	3.60	2.04	8.55	42.1	6,969.95	6,969.92
87: P-121 (1)	9.30	5.26	7.50	124.0	6,969.28	6,968.86
88: P-131	4.60	4.51	7.61	60.5	6,964.24	6,963.34
127: P-89	17.20	6.54	18.06	95.3	6,988.35	6,987.84
146: P-87 (1)	17.20	9.29	27.70	62.1	6,991.26	6,988.76

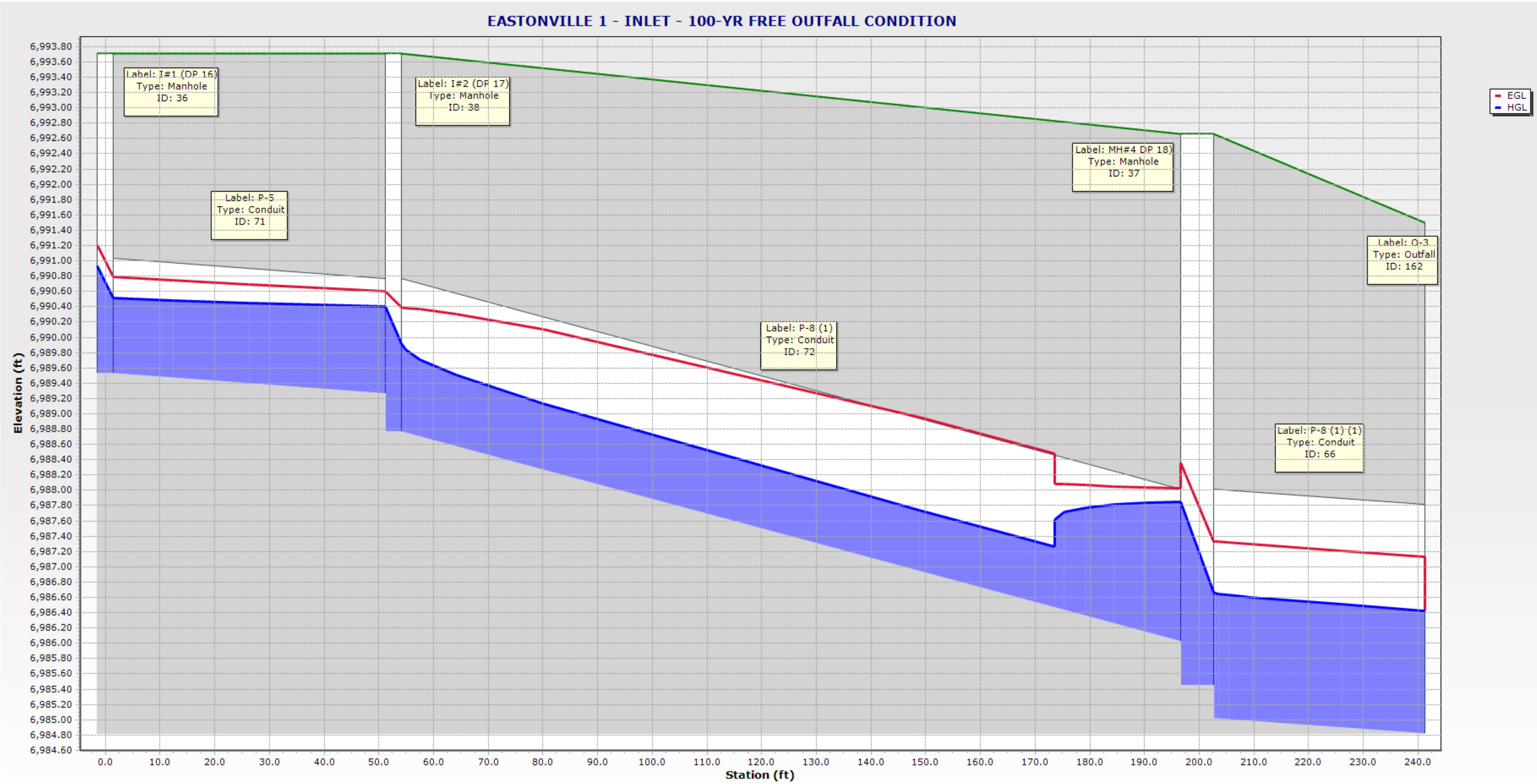
NOTE: SEE PROFILES FOR PIPES STUDIED WITH THIS ANALYSIS

100 YEAR FREE OUTFALL CONDITION: STRUCTURE SUMMARY TABLE

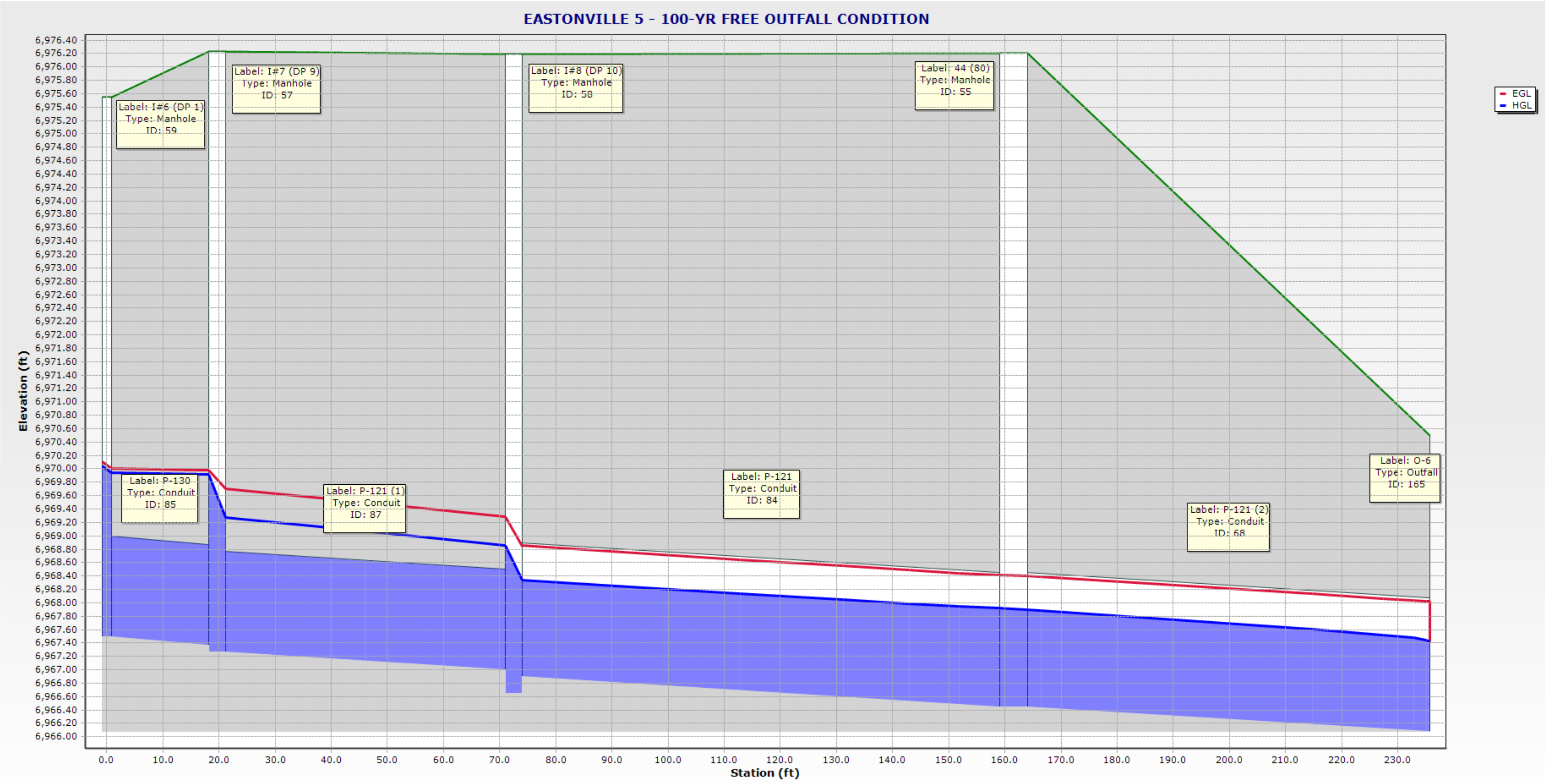
	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Hydraulic Grade Line (In) (ft)	Notes
35: MH#7	6,993.84	6,993.84	6,985.68	53.60	6,987.66	Standard	6,988.30	STORM MH
36: I#1 (DP 16	6,993.71	6,993.71	(N/A)	5.20	6,990.51	Standard	6,990.93	CDOT Type-R
37: MH#4 DP	6,992.66	6,992.66	6,986.02	26.00	6,986.67	Standard	6,987.84	STORM MH
38: I#2 (DP 17	6,993.71	6,993.71	6,989.27	10.30	6,989.92	Standard	6,990.40	CDOT Type-R
39: MH#6	6,992.82	6,992.82	6,983.61	53.60	6,985.70	Standard	6,986.34	STORM MH
40: MH#5	6,991.57	6,991.57	6,982.59	53.60	6,984.68	Standard	6,985.32	STORM MH
41: MH#3 (DP	6,990.99	6,990.99	6,981.23	56.50	6,983.69	Standard	6,984.42	STORM MH
42: I#3 (DP 7)	6,991.04	6,991.04	(N/A)	53.60	6,988.34	Standard	6,989.83	CDOT Type-D
43: 18 (DP 19)	6,988.70	6,988.70	(N/A)	2.90	6,984.43	Standard	6,984.51	CDOT Type-C
44: MH#2 (DP	6,985.73	6,985.73	6,980.65	56.50	6,982.91	Standard	6,983.58	STORM MH
45: I#4 (DP 13	6,987.25	6,987.25	(N/A)	3.00	6,984.40	Standard	6,984.54	CDOT Type-R
46: I#5 (DP 14	6,987.25	6,987.25	6,983.17	5.60	6,983.98	Standard	6,984.38	CDOT Type-R
47: MH#1	6,985.33	6,985.33	6,980.16	56.50	6,982.41	Standard	6,982.52	STORM MH
49: 44 (69) (D	6,982.25	6,982.25	(N/A)	1.00	6,978.80	Standard	6,978.81	CDOT Type-C
55: 44 (80)	6,976.21	6,976.21	6,966.45	13.90	6,967.89	Standard	6,967.92	STORM MH
57: I#7 (DP 9)	6,976.23	6,976.23	6,967.37	9.30	6,969.28	Standard	6,969.92	CDOT Type-R
58: I#8 (DP 10	6,976.19	6,976.19	6,967.00	13.90	6,968.34	Standard	6,968.86	CDOT Type-R
59: I#6 (DP 1)	6,975.55	6,975.55	(N/A)	3.60	6,969.95	Standard	6,970.04	CDOT Type-c
60: 44 (78) (D	6,967.25	6,967.25	(N/A)	4.60	6,964.24	Standard	6,964.56	CDOT Type-C
120: MH#8	6,995.46	6,995.46	6,986.86	17.20	6,988.35	Standard	6,988.76	STORM MH

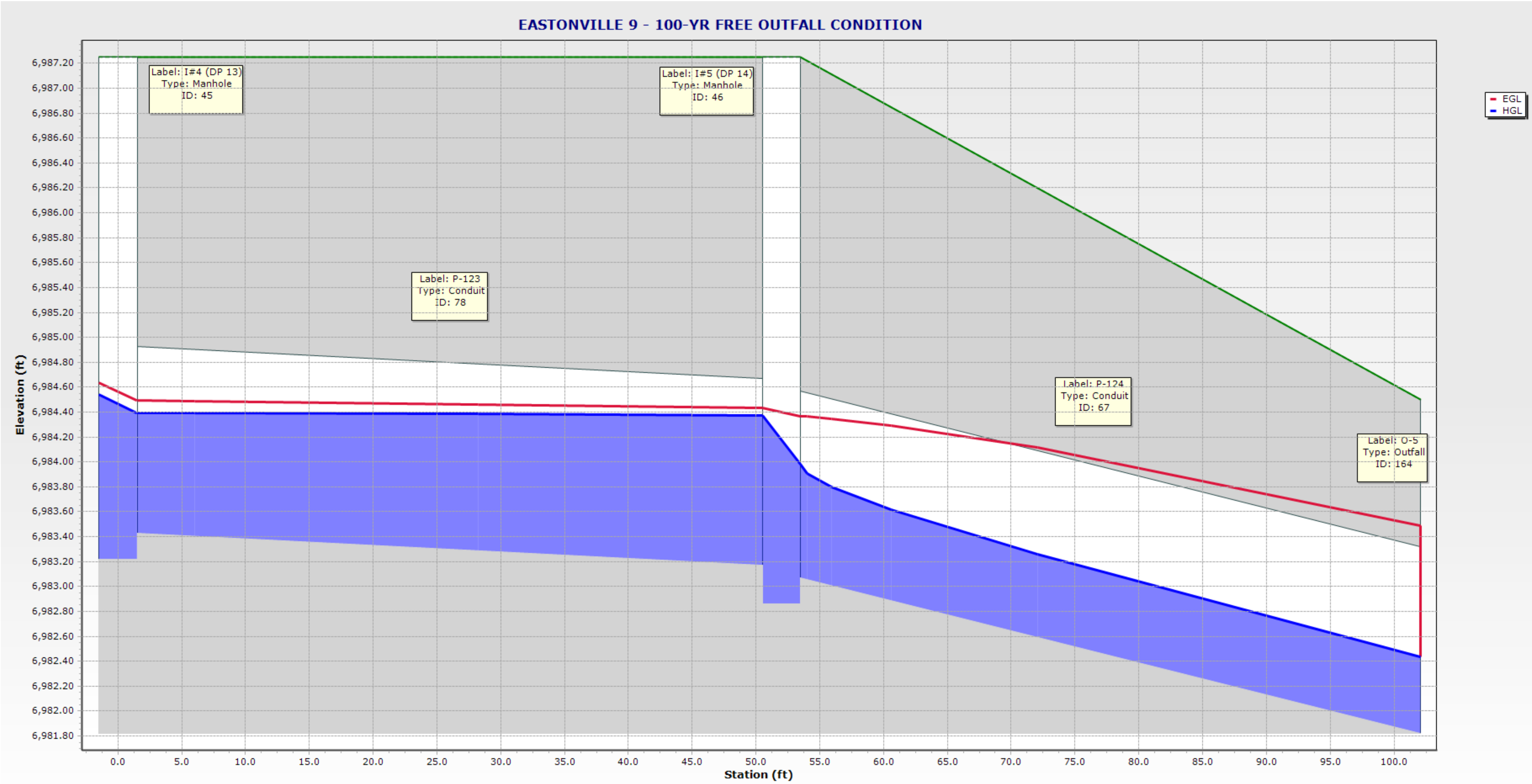
	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
48: OUTFALL	6,984.45	6,979.36	Free Outfall		6,981.71	56.50	CDOT FES
53: 44 (70)	6,979.71	6,978.21	Free Outfall		6,978.58	1.00	CDOT FES
64: 44 (79)	6,964.02	6,962.52	Free Outfall		6,963.34	4.60	CDOT FES
162: O-3	6,991.50	6,984.82	Free Outfall		6,986.43	26.00	Dummy Null
164: O-5	6,984.50	6,981.82	Free Outfall		6,982.43	5.60	Dummy Null
165: O-6	6,970.50	6,966.08	Free Outfall		6,967.42	13.90	Dummy Null

NOTE: SEE PROFILES FOR PIPES STUDIED WITH THIS ANALYSIS



EASTONVILLE 1 - INLET - 100-YR FREE OUTFALL CONDITION
Label: I#1 (DP 16)
Type: Manhole
ID: 36
Label: I#2 (DP 17)
Type: Manhole
ID: 38
Label: MH#4 DP 18)
Type: Manhole
ID: 37
Label: P-5
Type: Conduit
ID: 71
Label: O-3
Type: Outfall
ID: 162
Label: P-8 (1)
Type: Conduit
ID: 72
Label: P-8 (1) (1)
Type: Conduit
ID: 66
EGL
HGL
Elevation (ft)
Station (ft)


EASTONVILLE 5 - 100-YR FREE OUTFALL CONDITION
Label: I#6 (DP 1)
Type: Manhole
ID: 59
Label: I#7 (DP 9)
Type: Manhole
ID: 57
Label: I#8 (DP 10)
Type: Manhole
ID: 58
Label: 44 (80)
Type: Manhole
ID: 55
Label: P-130
Type: Conduit
ID: 85
Label: P-121 (1)
Type: Conduit
ID: 87
Label: P-121
Type: Conduit
ID: 84
Label: P-121 (2)
Type: Conduit
ID: 68
Label: O-6
Type: Outfall
ID: 165
EGL
HGL
Elevation (ft)
Station (ft)


EASTONVILLE 9 - 100-YR FREE OUTFALL CONDITION
Label: I#4 (DP 13)
Type: Manhole
ID: 45
Label: I#5 (DP 14)
Type: Manhole
ID: 46
Label: P-123
Type: Conduit
ID: 78
Label: P-124
Type: Conduit
ID: 67
Label: O-5
Type: Outfall
ID: 164
EGL
HGL
Elevation (ft)
Station (ft)
6,987.20
6,987.00
6,986.80
6,986.60
6,986.40
6,986.20
6,986.00
6,985.80
6,985.60
6,985.40
6,985.20
6,985.00
6,984.80
6,984.60
6,984.40
6,984.20
6,984.00
6,983.80
6,983.60
6,983.40
6,983.20
6,983.00
6,982.80
6,982.60
6,982.40
6,982.20
6,982.00
6,981.80
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0
100.0

5 YEAR FREE OUTFALL CONDITION: PIPE SUMMARY TABLE

	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n
66: P-8 (1) (1)	MH#4 DP 18)	6,985.02	O-3	6,984.82	41.6	0.005	36.0	0.013
67: P-124	I#5 (DP 14)	6,983.07	O-5	6,981.82	50.1	0.025	18.0	0.013
68: P-121 (2)	44 (80)	6,966.45	O-6	6,966.08	74.1	0.005	24.0	0.013
69: P-18	I#3 (DP 7)	6,986.04	MH#7	6,985.68	71.3	0.005	42.0	0.013
70: P-20	MH#7	6,985.37	MH#6	6,983.61	175.6	0.010	42.0	0.013
71: P-5	I#1 (DP 16)	6,989.53	I#2 (DP 17)	6,989.27	52.7	0.005	18.0	0.013
72: P-8 (1)	I#2 (DP 17)	6,988.77	MH#4 DP 18)	6,986.02	147.0	0.019	24.0	0.013
73: P-21	MH#6	6,983.41	MH#5	6,982.59	82.2	0.010	42.0	0.013
74: P-22	MH#5	6,982.39	MH#3 (DP 8)	6,981.23	115.7	0.010	42.0	0.013
75: P-15	18 (DP 19)	6,983.25	MH#3 (DP 8)	6,983.03	30.8	0.007	18.0	0.013
76: P-15 (1)	MH#3 (DP 8)	6,981.03	MH#2 (DP 8)	6,980.65	75.1	0.005	42.0	0.013
77: P-16	MH#2 (DP 8)	6,980.55	MH#1	6,980.16	78.1	0.005	42.0	0.013
78: P-123	I#4 (DP 13)	6,983.43	I#5 (DP 14)	6,983.17	52.0	0.005	18.0	0.013
79: P-17	MH#1	6,980.06	OUTFALL	6,979.36	139.8	0.005	42.0	0.013
80: P-125	44 (69) (DP 15)	6,978.42	44 (70)	6,978.21	42.5	0.005	18.0	0.013
84: P-121	I#8 (DP 10)	6,966.90	44 (80)	6,966.45	89.0	0.005	24.0	0.013
85: P-130	I#6 (DP 1)	6,967.50	I#7 (DP 9)	6,967.37	19.6	0.007	18.0	0.013
87: P-121 (1)	I#7 (DP 9)	6,967.27	I#8 (DP 10)	6,967.00	53.0	0.005	18.0	0.013
88: P-131	44 (78) (DP 11)	6,963.40	44 (79)	6,962.52	167.9	0.005	18.0	0.013
127: P-89	MH#8	6,986.76	MH#4 DP 18)	6,986.02	116.1	0.006	24.0	0.013
146: P-87 (1)	MH#9	6,989.76	MH#8	6,986.86	193.5	0.015	24.0	0.013

	Flow (cfs)	Velocity (ft/s)	Capacity (Full Flow) (cfs)	Flow / Capacity (Design) (%)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
66: P-8 (1) (1)	15.50	5.89	46.25	33.5	6,986.28	6,986.02
67: P-124	3.30	7.32	16.60	19.9	6,983.76	6,982.27
68: P-121 (2)	5.40	4.59	15.98	33.8	6,967.27	6,966.88
69: P-18	8.00	4.91	71.48	11.2	6,986.89	6,986.47
70: P-20	8.00	6.26	100.73	7.9	6,986.22	6,984.28
71: P-5	3.10	3.99	7.38	42.0	6,990.21	6,989.99
72: P-8 (1)	6.20	7.69	30.94	20.0	6,989.65	6,986.63
73: P-21	8.00	6.25	100.49	8.0	6,984.26	6,983.26
74: P-22	8.00	6.26	100.72	7.9	6,983.24	6,982.18
75: P-15	0.40	2.54	8.88	4.5	6,983.48	6,983.25
76: P-15 (1)	8.40	4.98	71.57	11.7	6,981.90	6,981.62
77: P-16	8.40	4.96	71.10	11.8	6,981.42	6,980.97
78: P-123	1.80	3.46	7.43	24.2	6,984.04	6,984.03
79: P-17	8.40	4.96	71.18	11.8	6,980.94	6,980.17
80: P-125	0.03	1.03	7.45	0.4	6,978.49	6,978.27
84: P-121	5.40	4.61	16.08	33.6	6,967.72	6,967.29
85: P-130	0.50	2.64	8.55	5.8	6,968.35	6,968.35
87: P-121 (1)	3.30	4.11	7.50	44.0	6,968.06	6,968.03
88: P-131	0.40	2.28	7.61	5.3	6,963.63	6,962.75
127: P-89	10.20	5.92	18.06	56.5	6,987.90	6,987.10
146: P-87 (1)	10.20	8.15	27.70	36.8	6,990.90	6,988.20

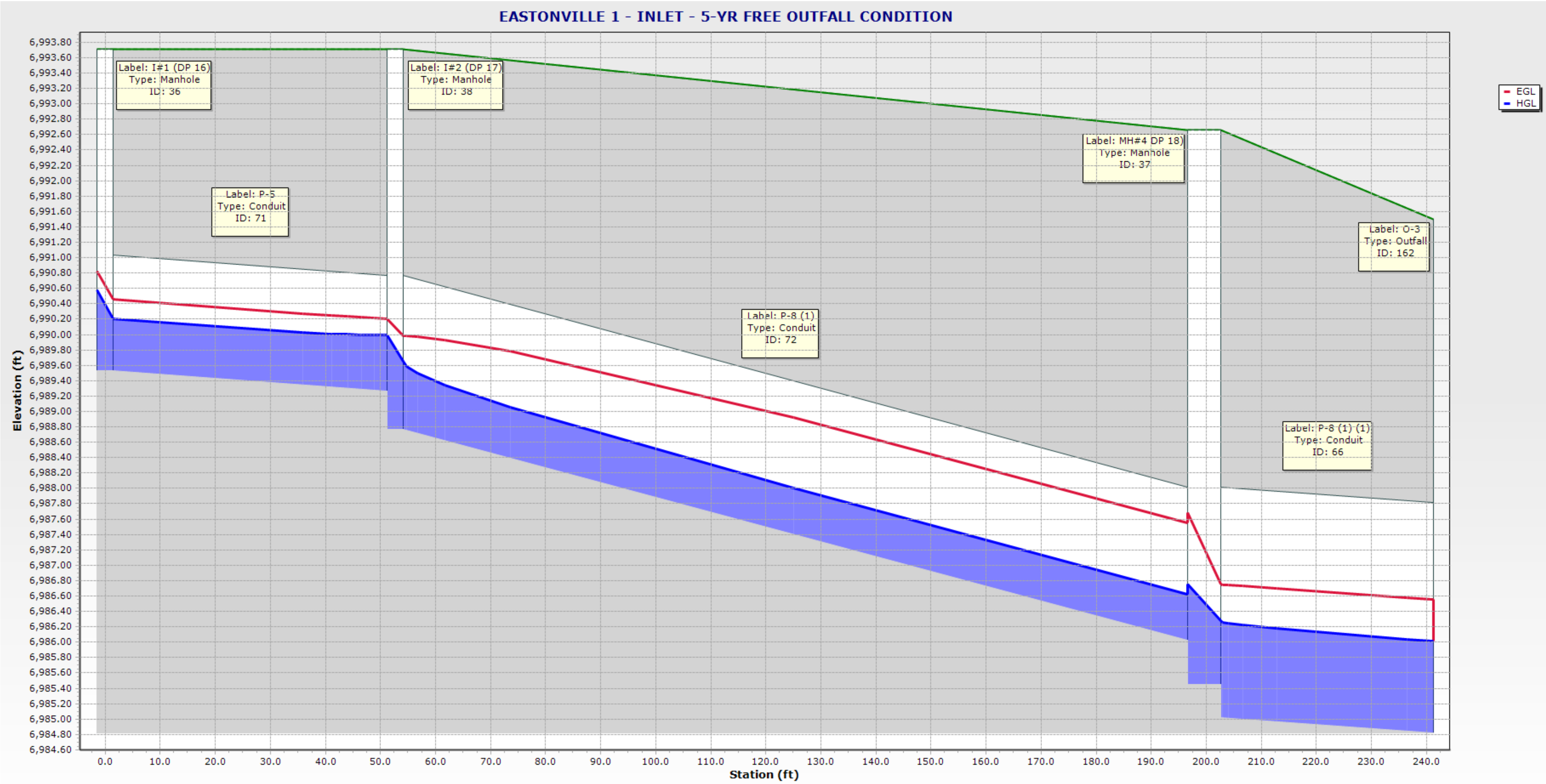
NOTE: SEE PROFILES FOR PIPES STUDIED WITH THIS ANALYSIS

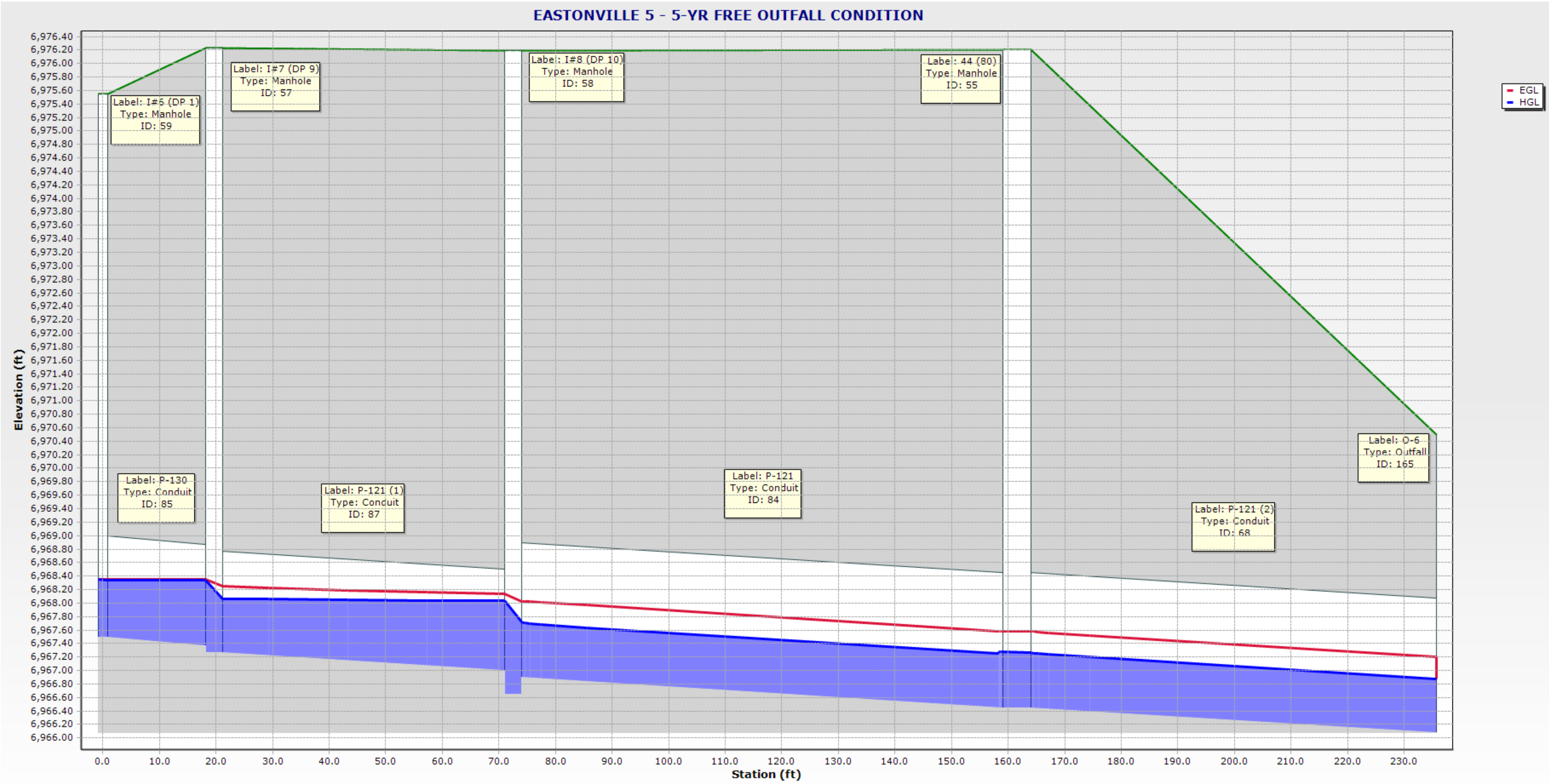
5 YEAR FREE OUTFALL CONDITION: STRUCTURE SUMMARY TABLE

	Elevation (Ground) (ft)	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Hydraulic Grade Line (In) (ft)	Notes
35: MH#7	6,993.84	6,993.84	6,985.68	8.00	6,986.22	Standard	6,986.42	STORM MH
36: I#1 (DP 16	6,993.71	6,993.71	(N/A)	3.10	6,990.21	Standard	6,990.58	CDOT Type-R
37: MH#4 DP	6,992.66	6,992.66	6,986.02	15.50	6,986.28	Standard	6,986.76	STORM MH
38: I#2 (DP 17	6,993.71	6,993.71	6,989.27	6.20	6,989.65	Standard	6,989.99	CDOT Type-R
39: MH#6	6,992.82	6,992.82	6,983.61	8.00	6,984.26	Standard	6,984.46	STORM MH
40: MH#5	6,991.57	6,991.57	6,982.59	8.00	6,983.24	Standard	6,983.44	STORM MH
41: MH#3 (DP	6,990.99	6,990.99	6,981.23	8.40	6,981.90	Standard	6,982.18	STORM MH
42: I#3 (DP 7)	6,991.04	6,991.04	(N/A)	8.00	6,986.89	Standard	6,987.35	CDOT Type-D
43: 18 (DP 19)	6,988.70	6,988.70	(N/A)	0.40	6,983.48	Standard	6,983.60	CDOT Type-C
44: MH#2 (DP	6,985.73	6,985.73	6,980.65	8.40	6,981.42	Standard	6,981.62	STORM MH
45: I#4 (DP 13	6,987.25	6,987.25	(N/A)	1.80	6,984.04	Standard	6,984.21	CDOT Type-R
46: I#5 (DP 14	6,987.25	6,987.25	6,983.17	3.30	6,983.76	Standard	6,984.03	CDOT Type-R
47: MH#1	6,985.33	6,985.33	6,980.16	8.40	6,980.94	Standard	6,980.97	STORM MH
49: 44 (69) (D	6,982.25	6,982.25	(N/A)	0.03	6,978.49	Standard	6,978.49	CDOT Type-C
55: 44 (80)	6,976.21	6,976.21	6,966.45	5.40	6,967.27	Standard	6,967.29	STORM MH
57: I#7 (DP 9)	6,976.23	6,976.23	6,967.37	3.30	6,968.06	Standard	6,968.35	CDOT Type-R
58: I#8 (DP 10	6,976.19	6,976.19	6,967.00	5.40	6,967.72	Standard	6,968.03	CDOT Type-R
59: I#6 (DP 1)	6,975.55	6,975.55	(N/A)	0.50	6,968.35	Standard	6,968.35	CDOT Type-c
60: 44 (78) (D	6,967.25	6,967.25	(N/A)	0.40	6,963.63	Standard	6,963.72	CDOT Type-C
120: MH#8	6,995.46	6,995.46	6,986.86	10.20	6,987.90	Standard	6,988.20	STORM MH

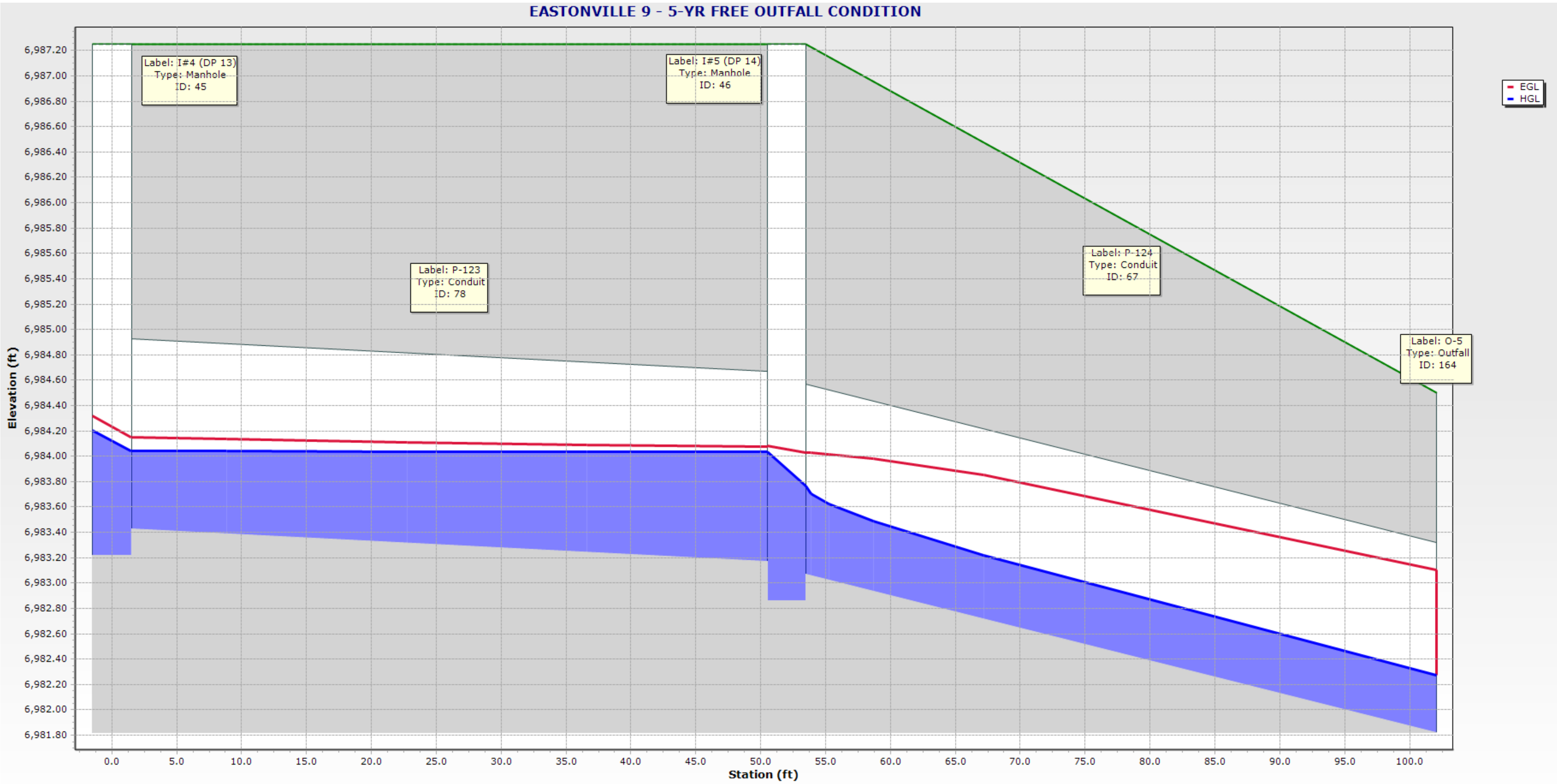
	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Boundary Condition Type	Elevation (User Defined Tailwater) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (cfs)	Notes
48: OUTFALL	6,984.45	6,979.36	Free Outfall		6,980.17	8.40	CDOT FES
53: 44 (70)	6,979.71	6,978.21	Free Outfall		6,978.27	0.03	CDOT FES
64: 44 (79)	6,964.02	6,962.52	Free Outfall		6,962.75	0.40	CDOT FES
162: O-3	6,991.50	6,984.82	Free Outfall		6,986.02	15.50	Dummy Null
164: O-5	6,984.50	6,981.82	Free Outfall		6,982.27	3.30	Dummy Null
165: O-6	6,970.50	6,966.08	Free Outfall		6,966.88	5.40	Dummy Null

NOTE: SEE PROFILES FOR PIPES STUDIED WITH THIS ANALYSIS


EASTONVILLE 1 - INLET - 5-YR FREE OUTFALL CONDITION
Label: I#1 (DP 16)
Type: Manhole
ID: 36
Label: I#2 (DP 17)
Type: Manhole
ID: 38
Label: MH#4 DP 18)
Type: Manhole
ID: 37
Label: P-5
Type: Conduit
ID: 71
Label: P-8 (1)
Type: Conduit
ID: 72
Label: O-3
Type: Outfall
ID: 162
Label: P-8 (1) (1)
Type: Conduit
ID: 66
EGL
HGL
Elevation (ft)
Station (ft)



EASTONVILLE 5 - 5-YR FREE OUTFALL CONDITION
Elevation (ft)
Station (ft)
EGL
HGL
Label: I#6 (DP 1)
Type: Manhole
ID: 59
Label: I#7 (DP 9)
Type: Manhole
ID: 57
Label: I#8 (DP 10)
Type: Manhole
ID: 58
Label: 44 (80)
Type: Manhole
ID: 55
Label: O-6
Type: Outfall
ID: 165
Label: P-130
Type: Conduit
ID: 85
Label: P-121 (1)
Type: Conduit
ID: 87
Label: P-121
Type: Conduit
ID: 84
Label: P-121 (2)
Type: Conduit
ID: 68



EASTONVILLE 9 - 5-YR FREE OUTFALL CONDITION
Label: I#4 (DP 13)
Type: Manhole
ID: 45
Label: I#5 (DP 14)
Type: Manhole
ID: 46
Label: P-123
Type: Conduit
ID: 78
Label: P-124
Type: Conduit
ID: 67
Label: O-5
Type: Outfall
ID: 164
EGL
HGL
Elevation (ft)
Station (ft)
6,987.20
6,987.00
6,986.80
6,986.60
6,986.40
6,986.20
6,986.00
6,985.80
6,985.60
6,985.40
6,985.20
6,985.00
6,984.80
6,984.60
6,984.40
6,984.20
6,984.00
6,983.80
6,983.60
6,983.40
6,983.20
6,983.00
6,982.80
6,982.60
6,982.40
6,982.20
6,982.00
6,981.80
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0
100.0

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Aug 23 2024

DP3

Invert Elev Dn (ft)	=	6976.11
Pipe Length (ft)	=	160.34
Slope (%)	=	1.27
Invert Elev Up (ft)	=	6978.15
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

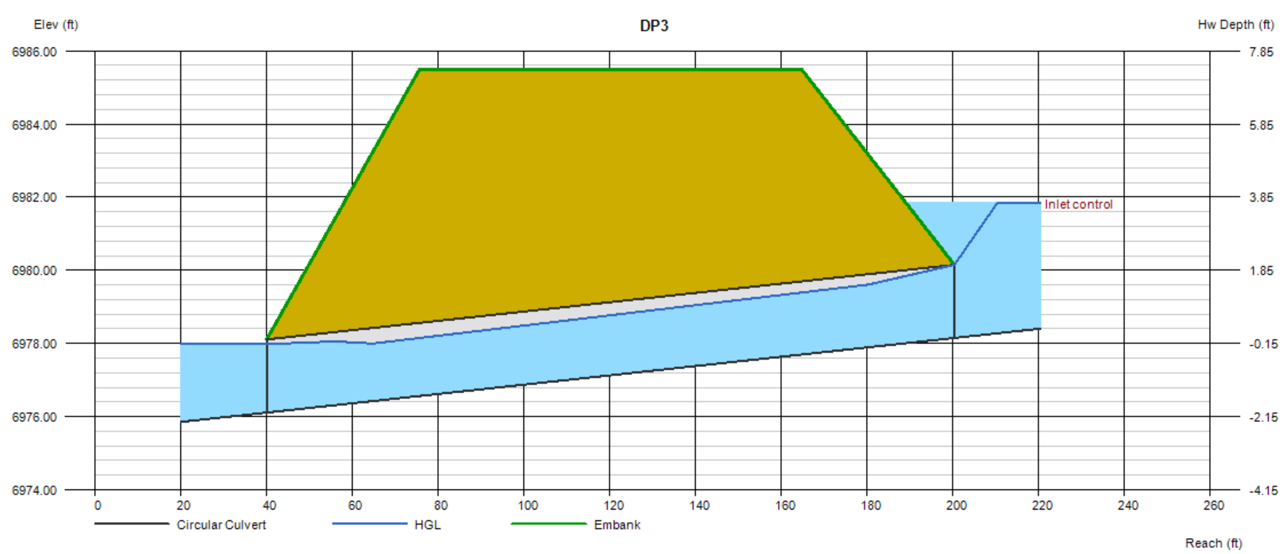
Top Elevation (ft)	=	6985.50
Top Width (ft)	=	89.00
Crest Width (ft)	=	15.00

Calculations

Qmin (cfs)	=	24.20
Qmax (cfs)	=	24.20
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	24.20
Qpipe (cfs)	=	24.20
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.92
Veloc Up (ft/s)	=	8.34
HGL Dn (ft)	=	6977.98
HGL Up (ft)	=	6979.89
Hw Elev (ft)	=	6981.84
Hw/D (ft)	=	1.84
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. — Friday, Aug 23 2024

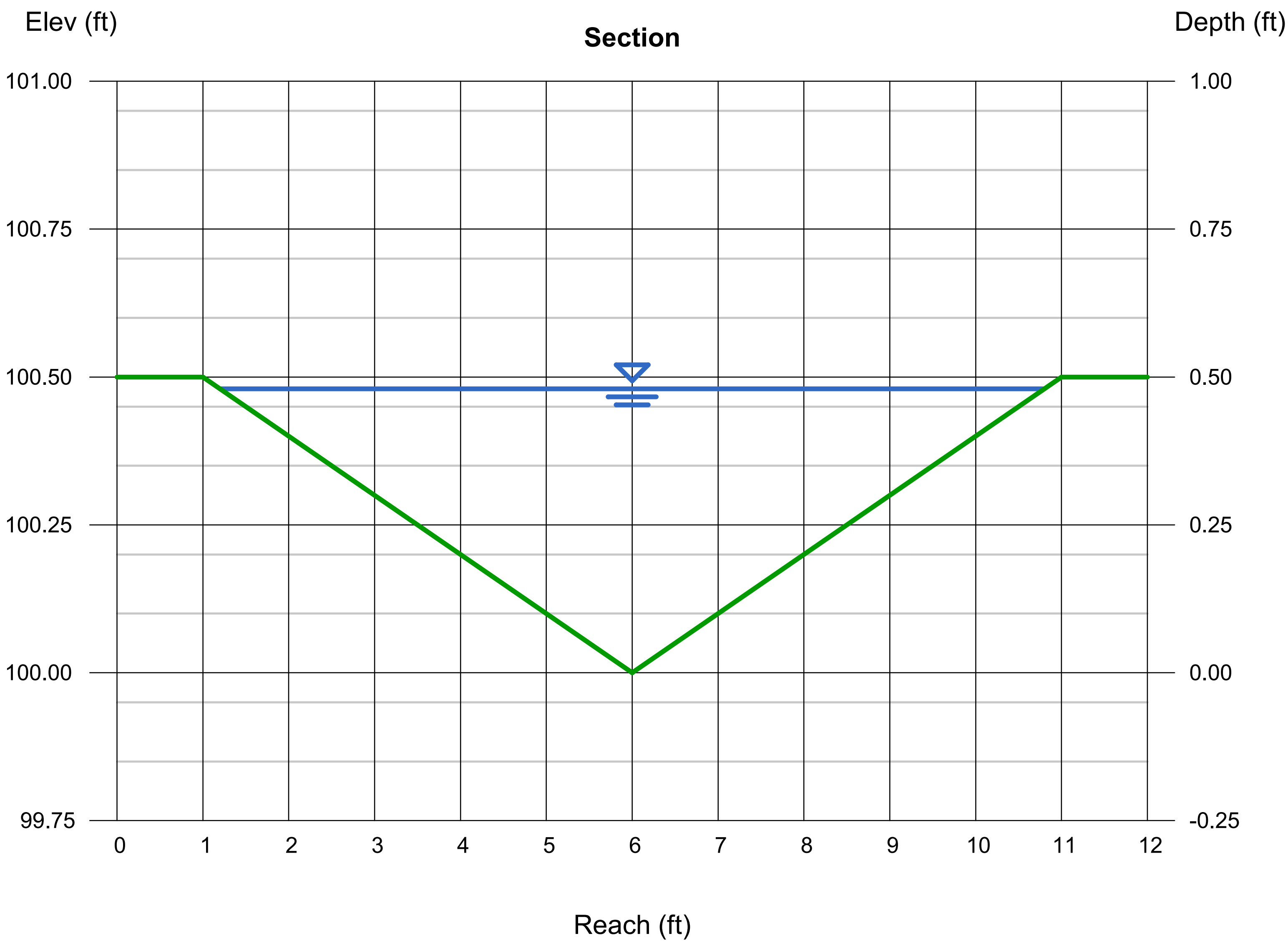
Roadside Swale Capacity DP1

Triangular
Side Slopes (z:1) = 10.00, 10.00
Total Depth (ft) = 0.50

Invert Elev (ft) = 100.00
Slope (%) = 0.50
N-Value = 0.025

Calculations
Compute by: Known Q
Known Q (cfs) = 3.60

Highlighted
Depth (ft) = 0.48
Q (cfs) = 3.600
Area (sqft) = 2.30
Velocity (ft/s) = 1.56
Wetted Perim (ft) = 9.65
Crit Depth, Yc (ft) = 0.39
Top Width (ft) = 9.60
EGL (ft) = 0.52



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Aug 23 2024

Roadside Swale Capacity DP3

Trapezoidal

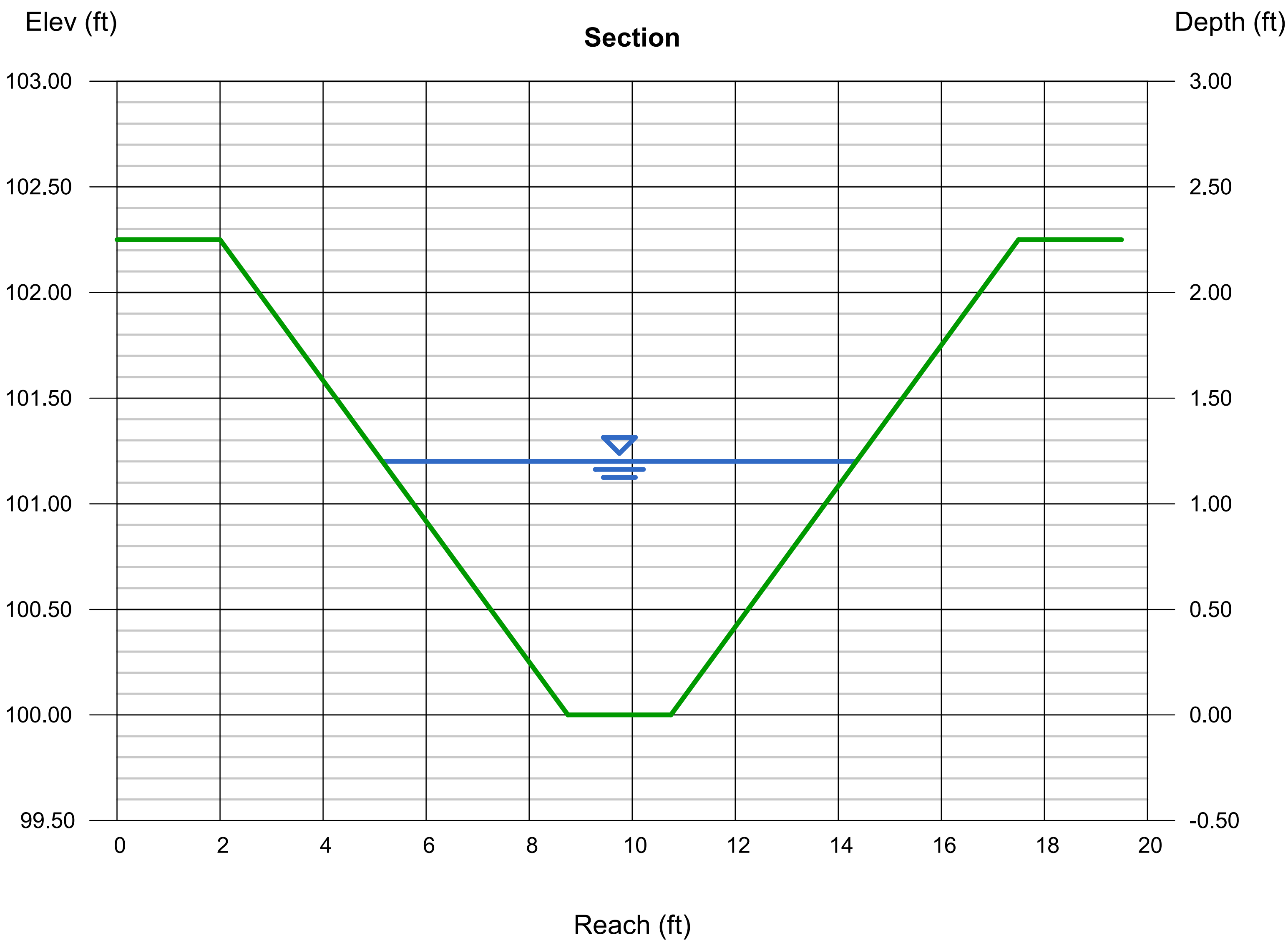
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.25
Invert Elev (ft)	= 100.00
Slope (%)	= 0.60
N-Value	= 0.025

Calculations

Compute by:	Known Q
Known Q (cfs)	= 24.20

Highlighted

Depth (ft)	= 1.20
Q (cfs)	= 24.20
Area (sqft)	= 6.72
Velocity (ft/s)	= 3.60
Wetted Perim (ft)	= 9.59
Crit Depth, Yc (ft)	= 1.04
Top Width (ft)	= 9.20
EGL (ft)	= 1.40

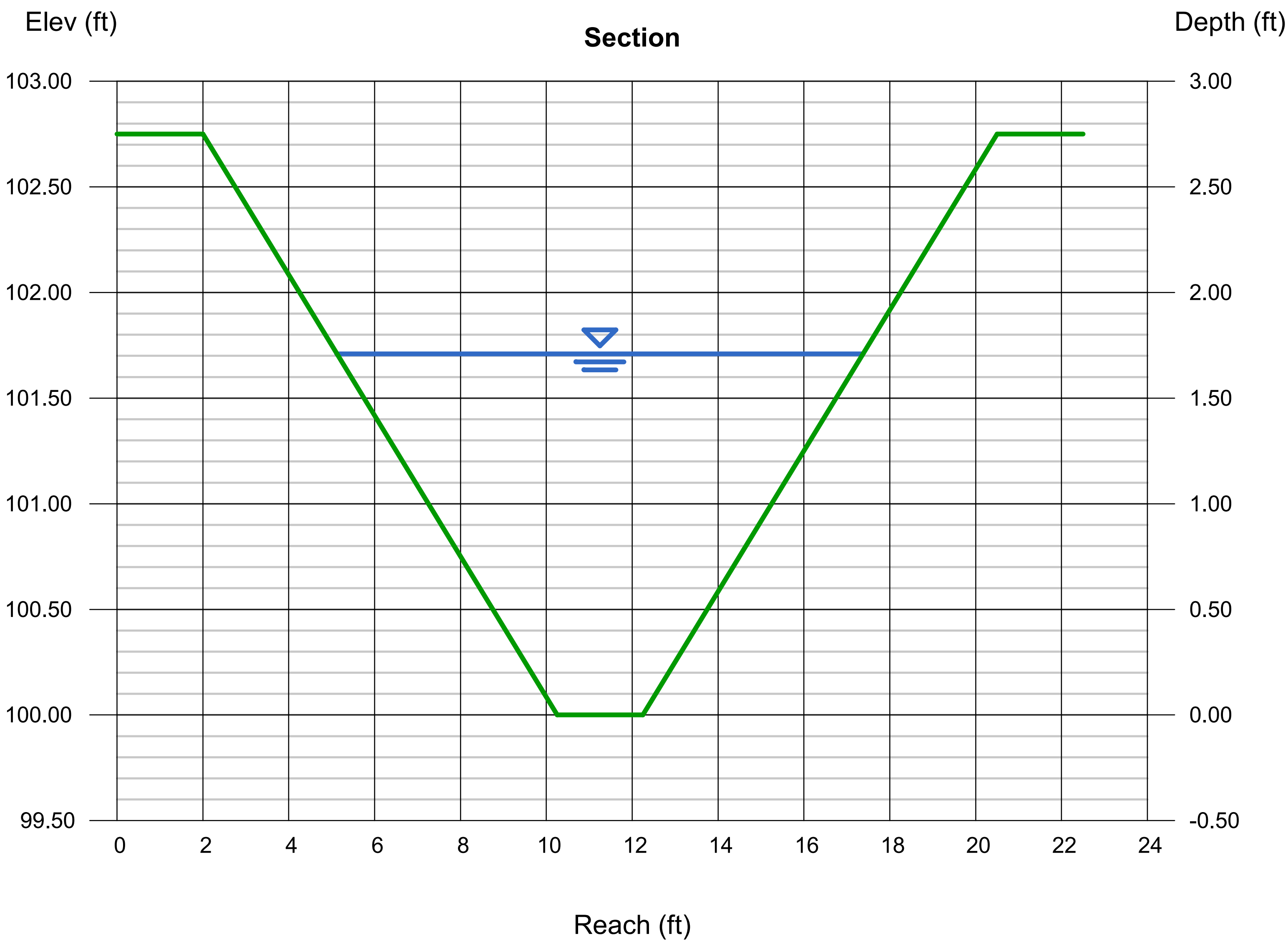


Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Aug 23 2024

Roadside Swale Capacity DP7

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 2.00	Depth (ft)	= 1.71
Side Slopes (z:1)	= 3.00, 3.00	Q (cfs)	= 53.60
Total Depth (ft)	= 2.75	Area (sqft)	= 12.19
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 4.40
Slope (%)	= 0.60	Wetted Perim (ft)	= 12.81
N-Value	= 0.025	Crit Depth, Yc (ft)	= 1.53
		Top Width (ft)	= 12.26
Calculations		EGL (ft)	= 2.01
Compute by:	Known Q		
Known Q (cfs)	= 53.60		

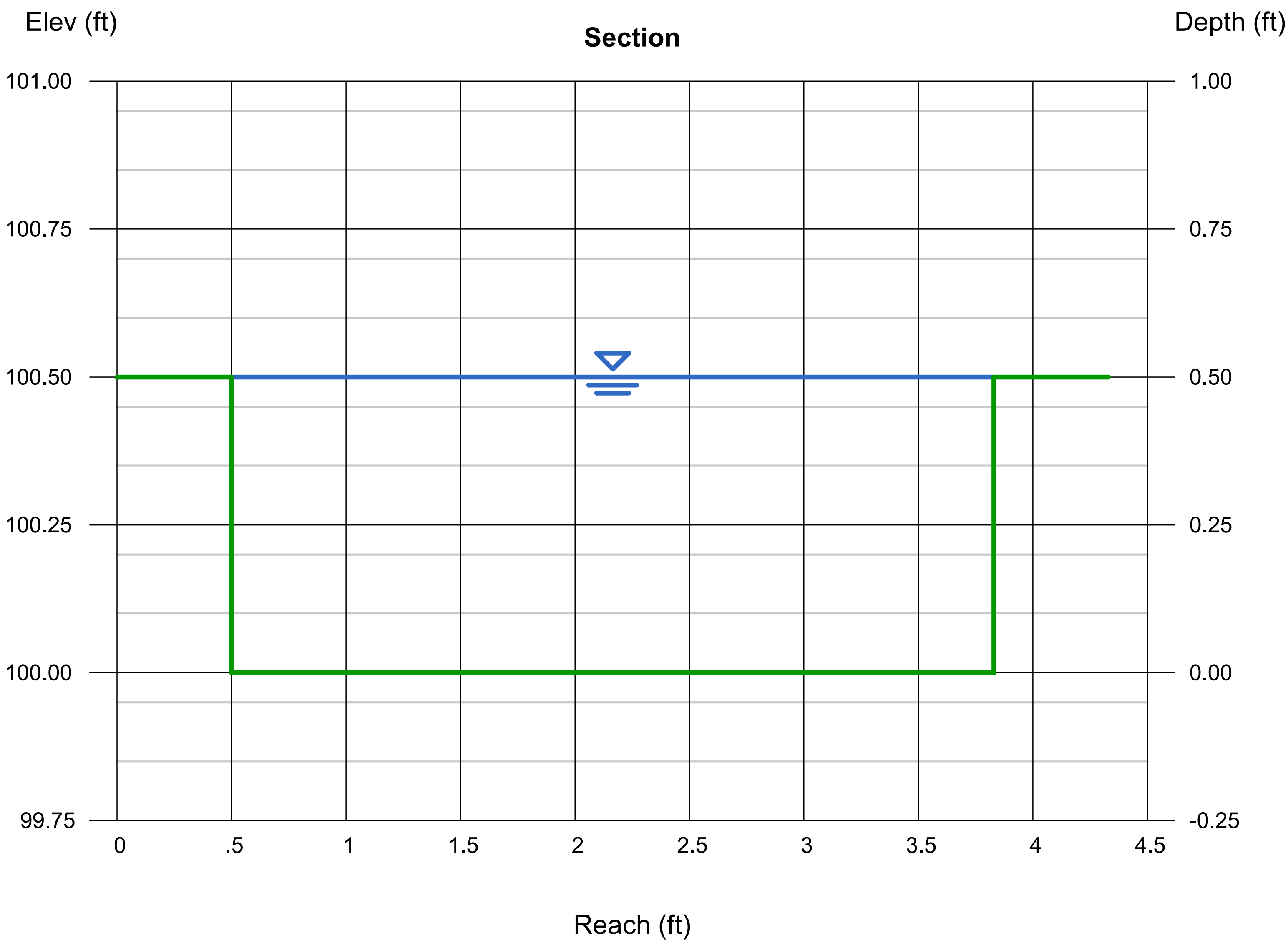


Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Mar 15 2024

EDB B Trickle Channel Capacity

Rectangular		**Highlighted**	
Bottom Width (ft)	= 3.33	Depth (ft)	= 0.50
Total Depth (ft)	= 0.50	Q (cfs)	= 7.707
		Area (sqft)	= 1.67
Invert Elev (ft)	= 100.00	Velocity (ft/s)	= 4.63
Slope (%)	= 0.50	Wetted Perim (ft)	= 4.33
N-Value	= 0.012	Crit Depth, Yc (ft)	= 0.50
		Top Width (ft)	= 3.33
Calculations		EGL (ft)	= 0.83
Compute by:	Known Depth		
Known Depth (ft)	= 0.50		



HRGreen	EASTONVILLE RD SEG 1	**Calc'd by:**	SPC
	201662.08	**Checked by:**	CM
	DP2 (SFB D OUTLET)	**Date:**	8/23/2024

Input Parameters		
Flow (Q)	4.6	cfs
Tailwater depth (Y_t)	0.60	ft
Conduit Diameter (D_c)	18	in
Expansion Factor (per Fig. 9-35)	6	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	1.67	
D_{50} =	2.08	in
UDFCD Riprap Type =	Type VL	
Design D_{50} =	6	in
Minimum Mantle Thickness =	12	in
Minimum Length of Apron =	4.50	ft

Calculations also need to provide min width of apron

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \quad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \quad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	EASTONVILLE RD SEG 1	**Calc'd by:**	SPC
	201662.08	**Checked by:**	CM
	DP4 (24" RCP CULVERT OUTLET)	**Date:**	8/23/2024

Input Parameters		
Flow (Q)	24.2	cfs
Tailwater depth (Y_t)	0.80	ft
Conduit Diameter (D_c)	24	in
Expansion Factor (per Fig. 9-35)	3.25	
Soil Type	Non-Cohesive Soils	

Summary table shows 28.6 cfs

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	4.28	
D_{50} =	7.09	in
UDFCD Riprap Type =	Type L	
Design D_{50} =	9	in
Minimum Mantle Thickness =	18	in
Minimum Length of Apron =	13.16	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \qquad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \qquad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	EASTONVILLE RD SEG 1	Calc'd by:	SPC
	201662.08	Checked by:	CM
	DP4 (SFB A OUTLET)	Date:	8/23/2024

Input Parameters		
Flow (Q)	1	cfs
Tailwater depth (Y_t)	0.60	ft
Conduit Diameter (D_c)	18	in
Expansion Factor (per Fig. 9-35)	6.5	
Soil Type	Non-Cohesive Soils	

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	0.36	
D_{50} =	0.45	in
UDFCD Riprap Type =	Type VL	
Design D_{50} =	6	in
Minimum Mantle Thickness =	12	in
Minimum Length of Apron =	4.50	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right) \qquad \text{Equation 9-11}$$

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

$$A_t = \frac{Q}{V} \qquad \text{Equation 9-12}$$

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

HRGreen	**EASTONVILLE RD SEG 1**	**Calc'd by:**	**SPC**
	201662.08	**Checked by:**	**CM**
	DP8.3 (EDB B Outlet)	**Date:**	**8/23/2024**

Input Parameters		
Flow (Q)	60	cfs
Tailwater depth (Y_t)	1.40	ft
Conduit Diameter (D_c)	42	in
Expansion Factor (per Fig. 9-35)	5	
Soil Type	Non-Cohesive Soils	

*ULTIMATE FLOW TO DP8

Calculated Parameters		
Froude Parameter ($Q/D^{2.5}$)	2.62	
D_{50} =	7.59	in
UDFCD Riprap Type =	Type L	
Design D_{50} =	9	in
Minimum Mantle Thickness =	18	in
Minimum Length of Apron =	25.36	ft

Calculated D_{50} for riprap was calculated using Equation 9-16 in the USDCM Vol 2.

$$d_{50} = \frac{0.023Q}{Y_t^{1.2} D_c^{0.3}}$$

Calculated minimum length of apron was calculated using Equations 9-11 and 9-12 in the USDCM Vol. 2

$$L_p = \left(\frac{1}{2\tan\theta}\right)\left(\frac{A_t}{Y_t} - W\right)$$ Equation 9-11

$$A_t = \frac{Q}{V}$$ Equation 9-12

Where:

L_p = length of protection (ft)

W = width of the conduit (ft, use diameter for circular conduits)

Y_t = tailwater depth (ft)

θ = the expansion angle of the culvert flow

Where:

Q = design discharge (cfs)

V = the allowable non-eroding velocity in the downstream channel (ft/sec)

A_t = required area of flow at allowable velocity (ft²)

Note:

[1] Calculations follow criteria in the USDCM Vol.2 Chapter 9

[2] Calculations assume a circular culvert

[3] This spreadsheet assumes y_t/D_t=0.4 in cases where y_t is unknown or a hydraulic jump is suspected downstream of the outlet.

[4] Per the USDCM Vol.2 in no case should L_p be less than 3D, nor does L_p need to be greater than 10D whenever the Froude parameter is less than 6.0. whenever the Froude parameter is greater than 6, increase the maximum L_p required by 1/4 D_c for each whole number by which the Froude parameter is greater than 6

Slope should be what's on the back side of pond, usually 3:1 or 4:1

	Riprap Sizing - Spillway				
	q (cfs/ft)	S (ft/ft)	C_f	n	D_{50} min. (in)
SFB-A	0.50	0.02	3	0.025	1.44
EDB-B	1.14	0.02	3	0.025	2.29
SFB-D	1.78	0.02	3	0.025	2.94

Type VL Riprap (D_{50} = 6") will be utilized for the spillway protection

$$D_{50} = 5.23\, S^{0.43}\, (1.35\, C_f\, q)^{0.56}$$ Equation 13-9

Where:

D_{50} = median rock size (in)
S = longitudinal slope (ft/ft)
C_f = concentration factor (1.0 to 3.0)
q = unit discharge (cfs/ft)

When:

η (porosity) = 0.0 (i.e., for buried soil riprap)

APPENDIX D – WATER QUALITY & DETENTION

Unresolved previous comment:

Please provide forebay sizing calcs for SFB A and D.

Design Procedure Form: Sand Filter (SF)

UD-BMP (Version 3.07, March 2018)

Designer: SPC
Company: HR Green
Date: August 23, 2024
Project: Eastonville Road - Segment 1 Improvements SFB A
Location: El Paso County, CO

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a (100% if all paved and roofed areas upstream of sand filter)	I_a = 53.0 % ✓
B) Tributary Area's Imperviousness Ratio ($i = I_a/100$)	i = 0.530
C) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time $WQCV = 0.8 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i)$	WQCV = 0.17 watershed inches
D) Contributing Watershed Area (including sand filter area)	Area = 68,825 sq ft ✓
E) Water Quality Capture Volume (WQCV) Design Volume $V_{WQCV} = WQCV / 12 * Area$	V_{WQCV} = cu ft
F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 0.42 in
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume	$V_{WQCV\ OTHER}$ = 962 cu ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{WQCV\ USER}$ = cu ft
2. Basin Geometry	
A) WQCV Depth	D_{WQCV} = 0.5 ft
B) Sand Filter Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred). Use "0" if sand filter has vertical walls.	Z = 4.00 ft / ft ✓
C) Minimum Filter Area (Flat Surface Area)	A_{Min} = 456 sq ft
D) Actual Filter Area	A_{Actual} = 902 sq ft ✓
E) Volume Provided	V_T = 22300 cu ft ✓
3. Filter Material	Choose One: (●) 18" CDOT Class B or C Filter Material; ( ) Other (Explain):
4. Underdrain System	
A) Are underdrains provided?	Choose One: (●) YES ( ) NO
B) Underdrain system orifice diameter for 12 hour drain time	
i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice	y = 2.3 ft ✓
ii) Volume to Drain in 12 Hours	*REFER TO MHFD DETENTION CALCS*
iii) Orifice Diameter, 3/8" Minimum	

Design Procedure Form: Sand Filter (SF)

Designer: SPC
Company: HR Green
Date: August 23, 2024
Project: Eastonville Road - Segment 1 Improvements SFB A
Location: El Paso County, CO

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric

A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?

Choose One
- ○ YES
- ◉ NO

6. Inlet / Outlet Works

A) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet

Engery dissapation at inlet points provided via riprap/forebay, and means of conveying flows in excess of the WQCV through the outlet is via the modified type 'C' inlet outlet structure grate, and a restricted outlet pipe.

Notes:

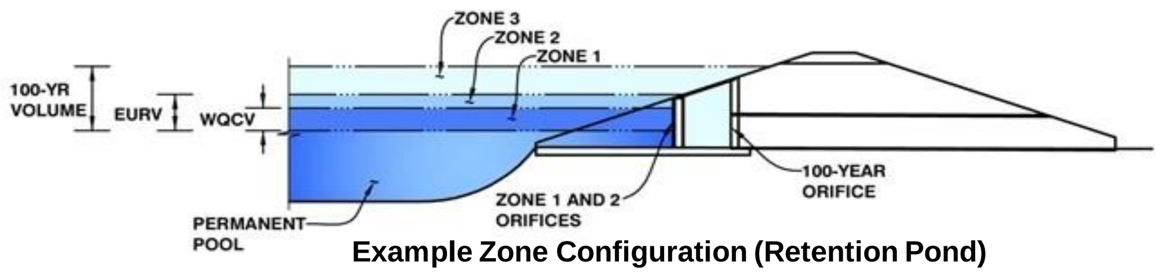
Provide forebay sizing calcs.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: **Eastonville Road SEGMENT 1**

Basin ID: **SFB A**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**SF**		**Note: L / W Ratio > 8**
Watershed Area =	1.58	acres	**L / W Ratio = 17.58**
Watershed Length =	1,100	ft	
Watershed Length to Centroid =	500	ft	
Watershed Slope =	0.030	ft/ft	
Watershed Imperviousness =	53.00%	percent	
Percentage Hydrologic Soil Group A =	0.0%	percent	
Percentage Hydrologic Soil Group B =	100.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Target WQCV Drain Time =	12.0	hours	
Location for 1-hr Rainfall Depths =	User Input		

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.023	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.090	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.084	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.119	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.150	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.190	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.223	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.264	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.68 in.) =	0.423	acre-feet	3.68	inches
Approximate 2-yr Detention Volume =	0.068	acre-feet		
Approximate 5-yr Detention Volume =	0.093	acre-feet		
Approximate 10-yr Detention Volume =	0.122	acre-feet		
Approximate 25-yr Detention Volume =	0.133	acre-feet		
Approximate 50-yr Detention Volume =	0.139	acre-feet		
Approximate 100-yr Detention Volume =	0.154	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.023	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.067	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.064	acre-feet
Total Detention Basin Volume =	0.154	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	N/A	ft
Slope of Trickle Channel (S_{TC}) =	N/A	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

6981

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Media Surface	--	0.00	--	--	--	902	0.021		
6982	--	1.00	--	--	--	5,914	0.136	3,408	0.078
6983	--	2.00	--	--	--	7,188	0.165	9,959	0.229
6984	--	3.00	--	--	--	8,563	0.197	17,834	0.409
6984.5	--	3.50	--	--	--	9,301	0.214	22,300	0.512
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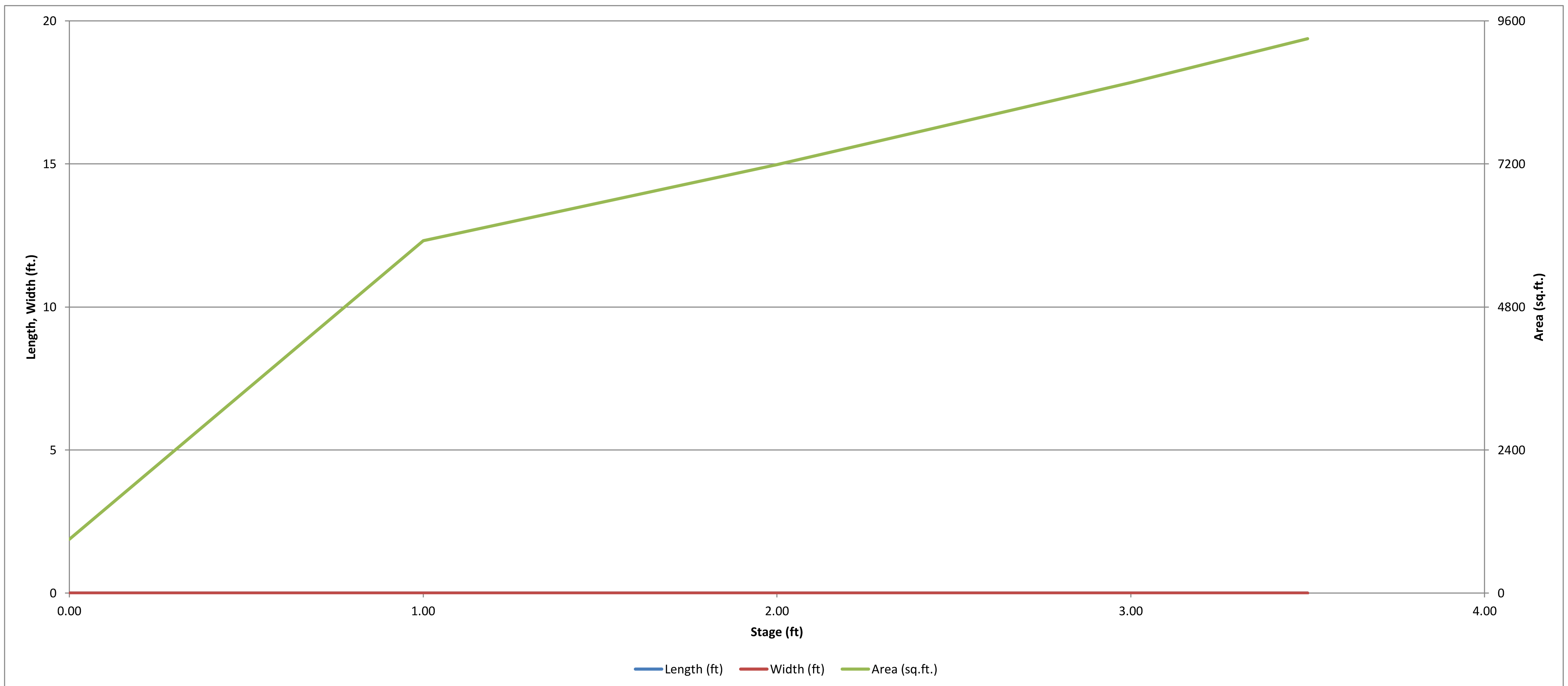
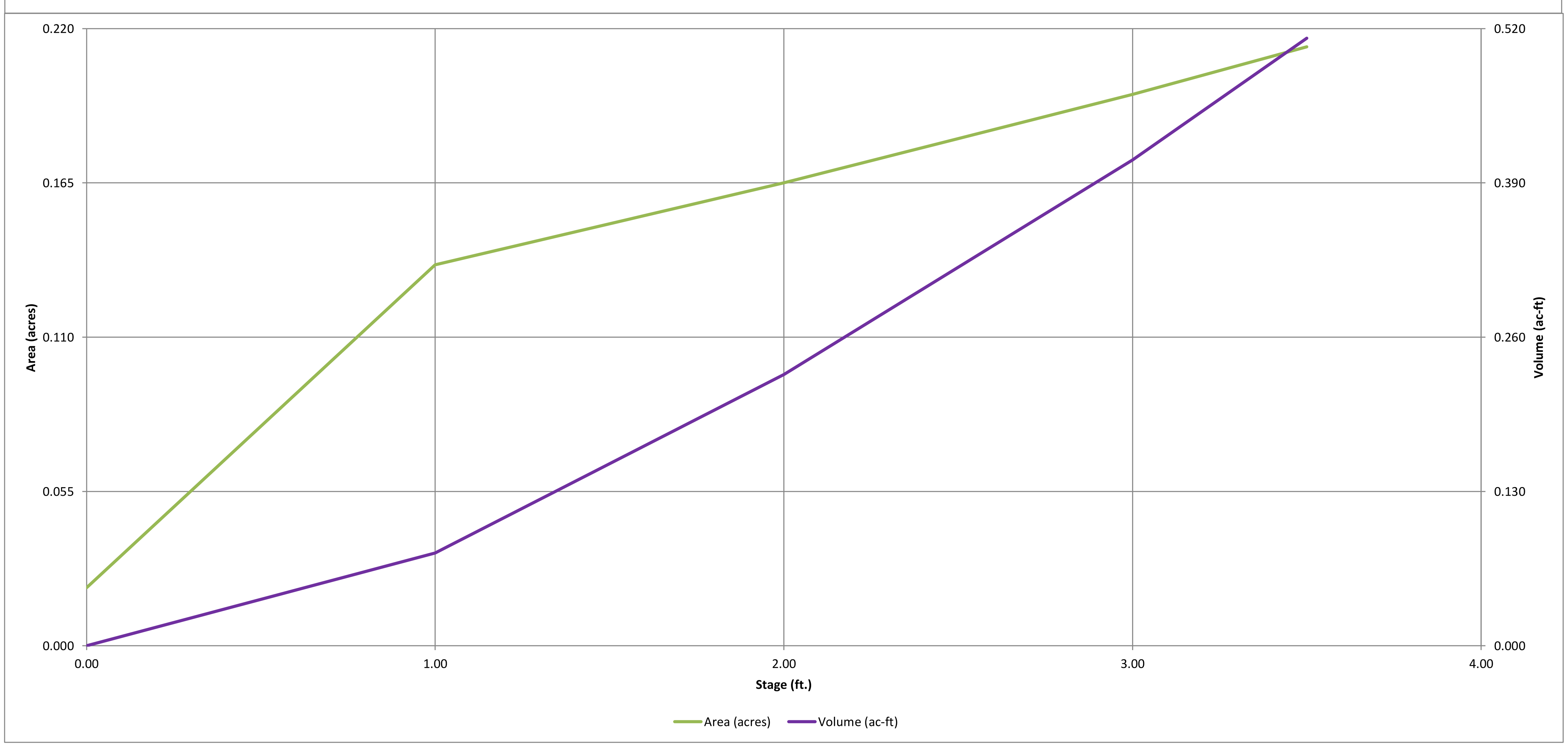
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



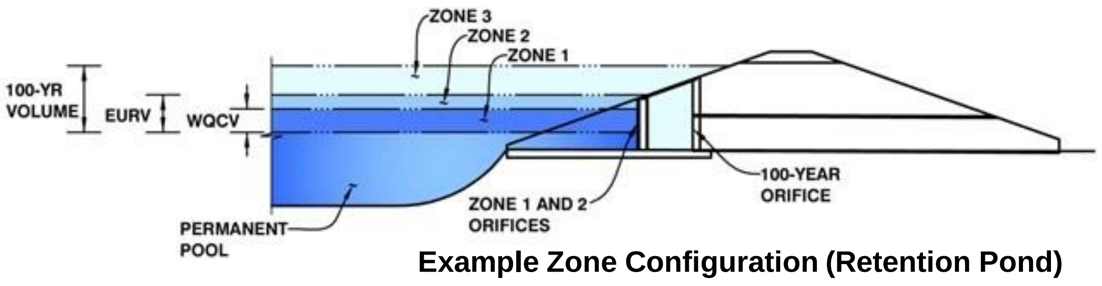


✓ = calcs match details in plans
X = calcs do not match details in plans

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: **Eastonville Road SEGMENT 1**
Basin ID: **SFB A**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.48	0.023	Filtration Media
Zone 2 (EURV)	1.09	0.067	Circular Orifice
Zone 3 (100-year)	1.53	0.064	Weir&Pipe (Restrict)
Total (all zones)		0.154	

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

X Underdrain Orifice Invert Depth =	2.33	ft (distance below the filtration media surface)	Underdrain Orifice Area =	0.0	ft^2
X Underdrain Orifice Diameter =	0.75	inches	Underdrain Orifice Centroid =	0.03	feet

Calculated Parameters for Underdrain

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

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

Calculated Parameters for Plate

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

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
✓ Invert of Vertical Orifice =	0.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	1.09	N/A	ft (relative to basin bottom at Stage = 0 ft)
✓ Vertical Orifice Diameter =	0.44	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.00	N/A	ft^2
Vertical Orifice Centroid =	0.02	N/A	feet

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

	Zone 3 Weir	Not Selected	
✓ Overflow Weir Front Edge Height, Ho =	1.25	N/A	ft (relative to basin bottom at Stage = 0 ft)
✓ Overflow Weir Front Edge Length =	3.00	N/A	feet
✓ Overflow Weir Grate Slope =	0.00	N/A	H:V
✓ Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	1.25	N/A	feet
Overflow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	58.36	N/A	
Overflow Grate Open Area w/o Debris =	6.26	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.13	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
X Depth to Invert of Outlet Pipe =	2.58	N/A	ft (distance below basin bottom at Stage = 0 ft)
✓ Outlet Pipe Diameter =	18.00	N/A	inches
X Restrictor Plate Height Above Pipe Invert =	2.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.11	N/A	ft^2
Outlet Orifice Centroid =	0.10	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	0.68	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

X Spillway Invert Stage=	2.24	ft (relative to basin bottom at Stage = 0 ft)	X Spillway Design Flow Depth=	0.26	feet
X Spillway Crest Length =	5.00	feet	Stage at Top of Freeboard =	3.50	feet
✓ Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.21	acres
✓ Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.51	acre-ft

Calculated Parameters for Spillway

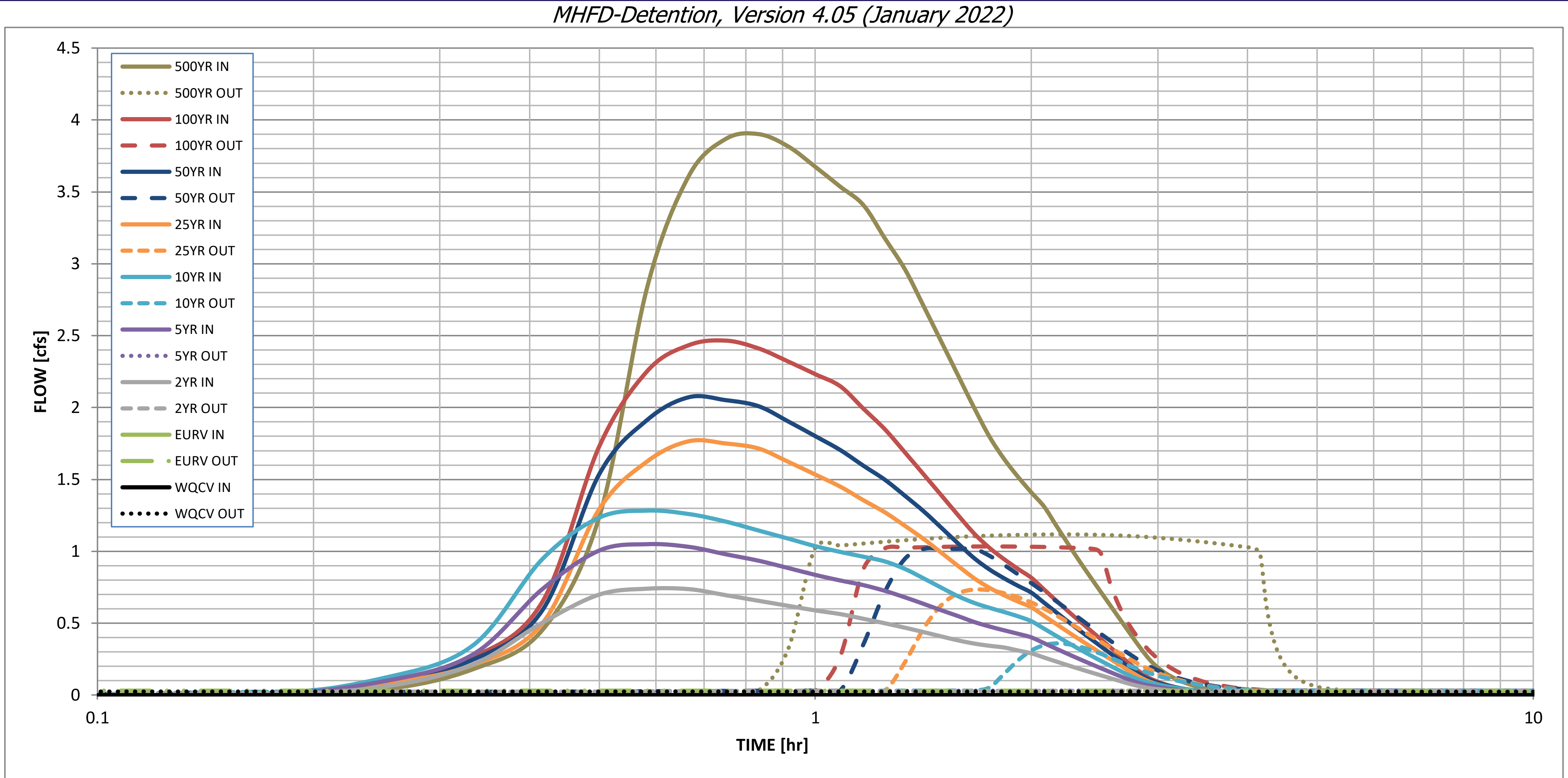
Routed Hydrograph Results

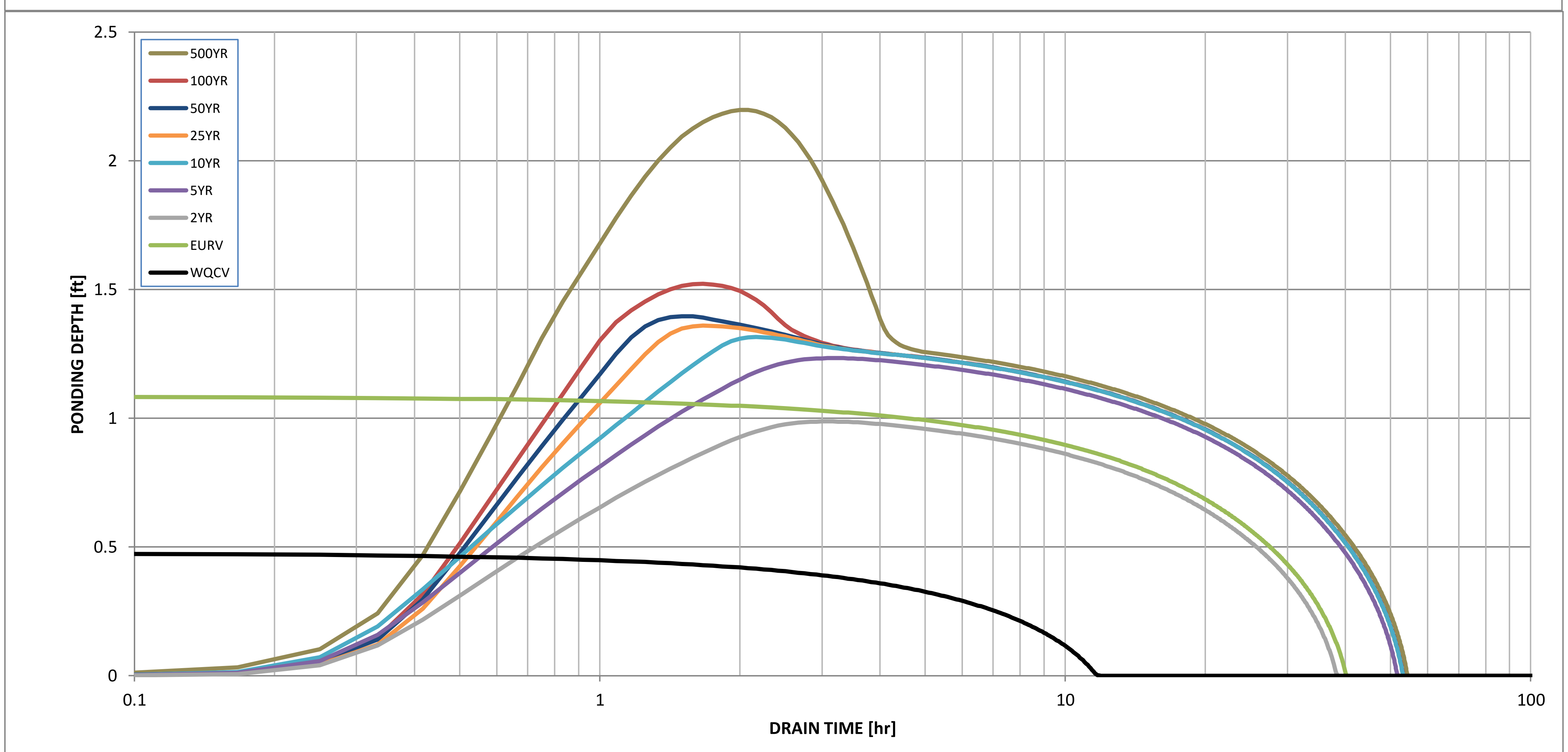
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

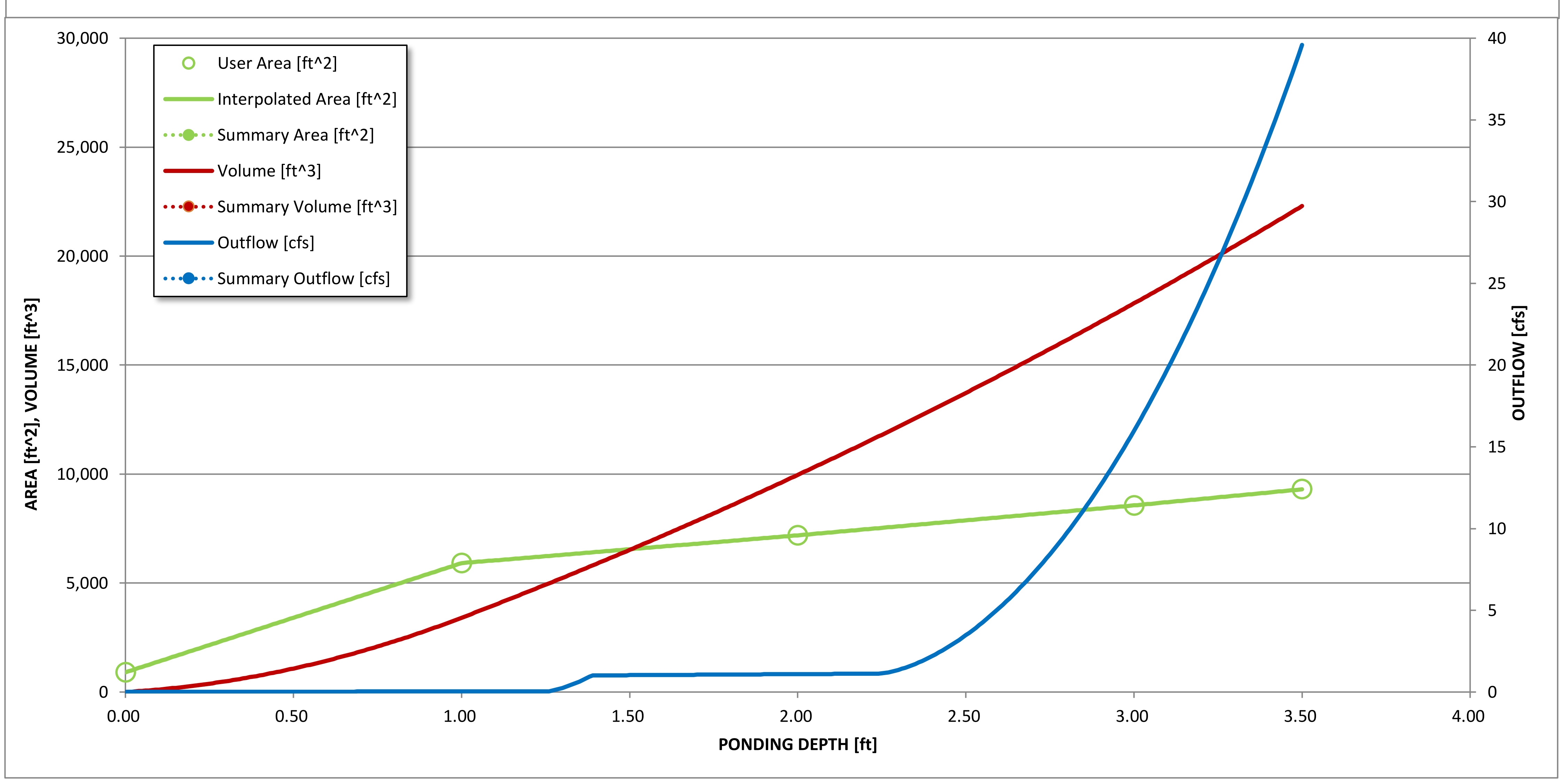
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.68
CUHP Runoff Volume (acre-ft) =	0.023	0.090	0.084	0.119	0.150	0.190	0.223	0.264	0.423
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.084	0.119	0.150	0.190	0.223	0.264	0.423
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.2	0.4	0.7	0.8	1.1	1.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.05	0.14	0.22	0.41	0.52	0.68	1.22
Peak Inflow Q (cfs) =	N/A	N/A	0.7	1.0	1.3	1.8	2.1	2.5	3.9
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.03	0.4	0.7	1.0	1.0	1.1
✓ Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.1	1.0	1.1	1.2	1.0	0.6
Structure Controlling Flow =	Filtration Media	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.1	0.1	0.2	0.2	0.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
✓ Time to Drain 97% of Inflow Volume (hours) =	11	39	37	50	51	50	50	49	48
✓ Time to Drain 99% of Inflow Volume (hours) =	**12**	40	38	51	52	52	52	52	52
Maximum Ponding Depth (ft) =	0.48	1.09	0.99	1.23	1.32	1.36	1.40	1.52	2.20
Area at Maximum Ponding Depth (acres) =	0.08	0.14	0.13	0.14	0.14	0.15	0.15	0.15	0.17
Maximum Volume Stored (acre-ft) =	0.023	0.091	0.076	0.110	0.122	0.128	0.133	0.153	0.261

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

Time Interval: 5.00 min

SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.04
0:15:00	0.00	0.00	0.06	0.10	0.12	0.08	0.10	0.10	0.18
0:20:00	0.00	0.00	0.21	0.28	0.35	0.21	0.25	0.26	0.45
0:25:00	0.00	0.00	0.50	0.74	0.95	0.50	0.59	0.65	1.24
0:30:00	0.00	0.00	0.70	1.01	1.23	1.29	1.54	1.73	2.84
0:35:00	0.00	0.00	0.74	1.05	1.28	1.63	1.91	2.25	3.61
0:40:00	0.00	0.00	0.74	1.03	1.26	1.77	2.07	2.43	3.87
0:45:00	0.00	0.00	0.70	0.98	1.21	1.75	2.05	2.47	3.90
0:50:00	0.00	0.00	0.66	0.94	1.15	1.72	2.01	2.41	3.82
0:55:00	0.00	0.00	0.62	0.88	1.09	1.62	1.90	2.32	3.67
1:00:00	0.00	0.00	0.59	0.84	1.04	1.53	1.80	2.23	3.54
1:05:00	0.00	0.00	0.56	0.80	1.00	1.45	1.70	2.15	3.41
1:10:00	0.00	0.00	0.53	0.77	0.96	1.36	1.60	1.99	3.18
1:15:00	0.00	0.00	0.50	0.73	0.93	1.27	1.50	1.85	2.96
1:20:00	0.00	0.00	0.47	0.68	0.88	1.18	1.39	1.69	2.70
1:25:00	0.00	0.00	0.44	0.63	0.81	1.09	1.28	1.53	2.45
1:30:00	0.00	0.00	0.41	0.59	0.75	0.99	1.16	1.39	2.22
1:35:00	0.00	0.00	0.38	0.55	0.69	0.90	1.05	1.25	1.99
1:40:00	0.00	0.00	0.36	0.51	0.64	0.81	0.95	1.12	1.79
1:45:00	0.00	0.00	0.34	0.48	0.61	0.75	0.87	1.02	1.64
1:50:00	0.00	0.00	0.33	0.45	0.58	0.69	0.81	0.94	1.52
1:55:00	0.00	0.00	0.31	0.43	0.55	0.65	0.76	0.88	1.41
2:00:00	0.00	0.00	0.29	0.40	0.51	0.61	0.71	0.82	1.31
2:05:00	0.00	0.00	0.26	0.36	0.46	0.55	0.64	0.73	1.18
2:10:00	0.00	0.00	0.23	0.32	0.41	0.49	0.58	0.66	1.05
2:15:00	0.00	0.00	0.21	0.29	0.36	0.44	0.51	0.58	0.93
2:20:00	0.00	0.00	0.18	0.25	0.32	0.39	0.45	0.52	0.82
2:25:00	0.00	0.00	0.16	0.22	0.28	0.34	0.39	0.45	0.72
2:30:00	0.00	0.00	0.14	0.19	0.24	0.29	0.34	0.39	0.62
2:35:00	0.00	0.00	0.12	0.16	0.20	0.25	0.29	0.33	0.52
2:40:00	0.00	0.00	0.10	0.13	0.17	0.20	0.24	0.27	0.42
2:45:00	0.00	0.00	0.08	0.10	0.13	0.16	0.19	0.21	0.33
2:50:00	0.00	0.00	0.06	0.08	0.11	0.13	0.14	0.16	0.25
2:55:00	0.00	0.00	0.05	0.07	0.09	0.10	0.11	0.12	0.19
3:00:00	0.00	0.00	0.04	0.06	0.07	0.07	0.09	0.09	0.15
3:05:00	0.00	0.00	0.03	0.05	0.06	0.06	0.07	0.07	0.12
3:10:00	0.00	0.00	0.03	0.04	0.05	0.05	0.06	0.06	0.09
3:15:00	0.00	0.00	0.03	0.03	0.04	0.04	0.05	0.04	0.07
3:20:00	0.00	0.00	0.02	0.03	0.04	0.03	0.04	0.04	0.06
3:25:00	0.00	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.04
3:30:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.04
3:35:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
3:40:00	0.00	0.00	0.01	0.01	0.02	0.01	0.02	0.01	0.02
3:45:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
3:50:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
3:55:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: SPC
Company: HR Green
Date: August 23, 2024
Project: Eastonville Road - Segment 1 Improvements EDB B ULTIMATE CONDITIONS
Location: EL PASO COUNTY, CO

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a ✓	I_a = 67.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.670
C) Contributing Watershed Area ✓	Area = 9.020 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = 0.42 in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ○ Water Quality Capture Volume (WQCV) ◉ Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$)	V_{DESIGN}= ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$)	$V_{DESIGN\ OTHER}$= 0.192 ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ac-ft
I) NRCS Hydrologic Soil Groups of Tributary Watershed ✓	
i) Percentage of Watershed consisting of Type A Soils	HSG_A = 100 %
ii) Percentage of Watershed consisting of Type B Soils	HSG_B = 0 %
iii) Percentage of Watershed consisting of Type C/D Soils	$HSG_{C/D}$ = 0 %
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = 0.756 ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$= ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	
5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.006 ac-ft
B) Actual Forebay Volume	V_F = 0.006 ac-ft
C) Forebay Depth (D_F = 18 inch maximum) ✓	D_F = 15.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge ✓	Q_{100} = 26.00 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 0.52 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe ◉ Wall with Rect. Notch ○ Wall with V-Notch Weir — Flow too small for berm w/ pipe
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width X	Calculated W_N = 4.3 in

Per CDs, the forebay has approx dimensions (conservative values) of 12'x8'x1.25'. From that I get a volume of 120 CF which is 0.003 ac-ft. Please dbl check my math and up-size the forebay as needed.

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**SPC**
Company:	**HR Green**
Date:	**August 23, 2024**
Project:	**Eastonville Road - Segment 1 Improvements EDB B ULTIMATE CONDITIONS**
Location:	**EL PASO COUNTY, CO**

6. Trickle Channel	
A) Type of Trickle Channel	Choose One: (●) Concrete ( ) Soft Bottom
F) Slope of Trickle Channel	S = 0.0050 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	✓ D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	✓ A_M = 10 sq ft
C) Outlet Type	Choose One: (●) Orifice Plate ( ) Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	✓ $D_{orifice}$ = 1.00 inches
E) Total Outlet Area	A_{ot} = 5.50 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	✓ D_{IS} = 4 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = 25 cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 3.3 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 193 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) Other (Y/N): N	*S.S. Well Screen with 60% Open Area*
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 321 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 5.05 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 88.6 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

Designer: SPC
Company: HR Green
Date: August 23, 2024
Project: Eastonville Road - Segment 1 Improvements EDB B ULTIMATE CONDITIONS
Location: EL PASO COUNTY, CO

10. Overflow Embankment

A) Describe embankment protection for 100-year and greater overtopping:

B) Slope of Overflow Embankment
(Horizontal distance per unit vertical, 4:1 or flatter preferred)

Ze = 4.00 ft / ft

11. Vegetation

Choose One
- ○ Irrigated
- ● Not Irrigated

12. Access

A) Describe Sediment Removal Procedures

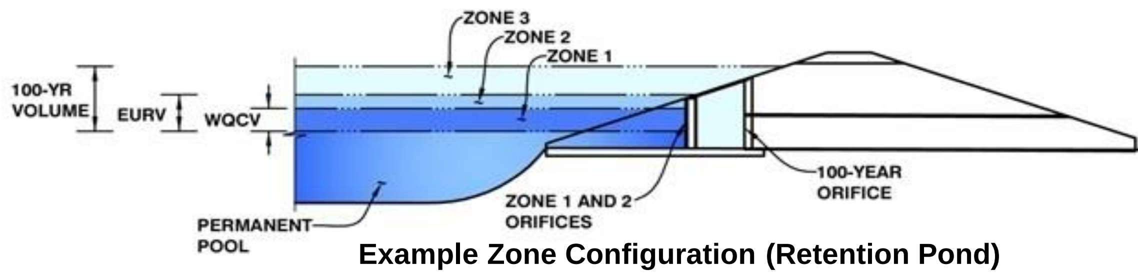
Notes:

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: Eastonville Road - Segment 1 Improvements

Basin ID: EDB B: INTERIM CONDITION, BASINS [EA6 - EA8]



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**		**Note: L / W Ratio > 8**	
Watershed Area =	3.95	acres	**L / W Ratio = 17.8**	
Watershed Length =	1,750	ft		
Watershed Length to Centroid =	500	ft		
Watershed Slope =	0.009	ft/ft		
Watershed Imperviousness =	53.00%	percent		
Percentage Hydrologic Soil Group A =	100.0%	percent		
Percentage Hydrologic Soil Group B =	0.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.071	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.245	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.184	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.244	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.292	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.364	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.435	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.524	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.68 in.) =	0.895	acre-feet	3.68	inches
Approximate 2-yr Detention Volume =	0.158	acre-feet		
Approximate 5-yr Detention Volume =	0.208	acre-feet		
Approximate 10-yr Detention Volume =	0.253	acre-feet		
Approximate 25-yr Detention Volume =	0.308	acre-feet		
Approximate 50-yr Detention Volume =	0.343	acre-feet		
Approximate 100-yr Detention Volume =	0.384	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.071	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.175	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.139	acre-feet
Total Detention Basin Volume =	0.384	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

	Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
6983.5	**Top of Micropool**	--	0.00	--	--	--	10	0.000		
	6984	--	0.50	--	--	--	211	0.005	55	0.001
	6985	--	1.50	--	--	--	4,539	0.104	2,430	0.056
	6986	--	2.50	--	--	--	7,443	0.171	8,421	0.193
	6987	--	3.50	--	--	--	9,104	0.209	16,695	0.383
	6988	--	4.50	--	--	--	10,914	0.251	26,704	0.613
	6989	--	5.50	--	--	--	12,910	0.296	38,616	0.886
	6990	--	6.50	--	--	--	15,069	0.346	52,605	1.208
	6991	--	7.50	--	--	--	17,408	0.400	68,844	1.580
	6991.5	--	8.00	--	--	--	18,407	0.423	77,797	1.786
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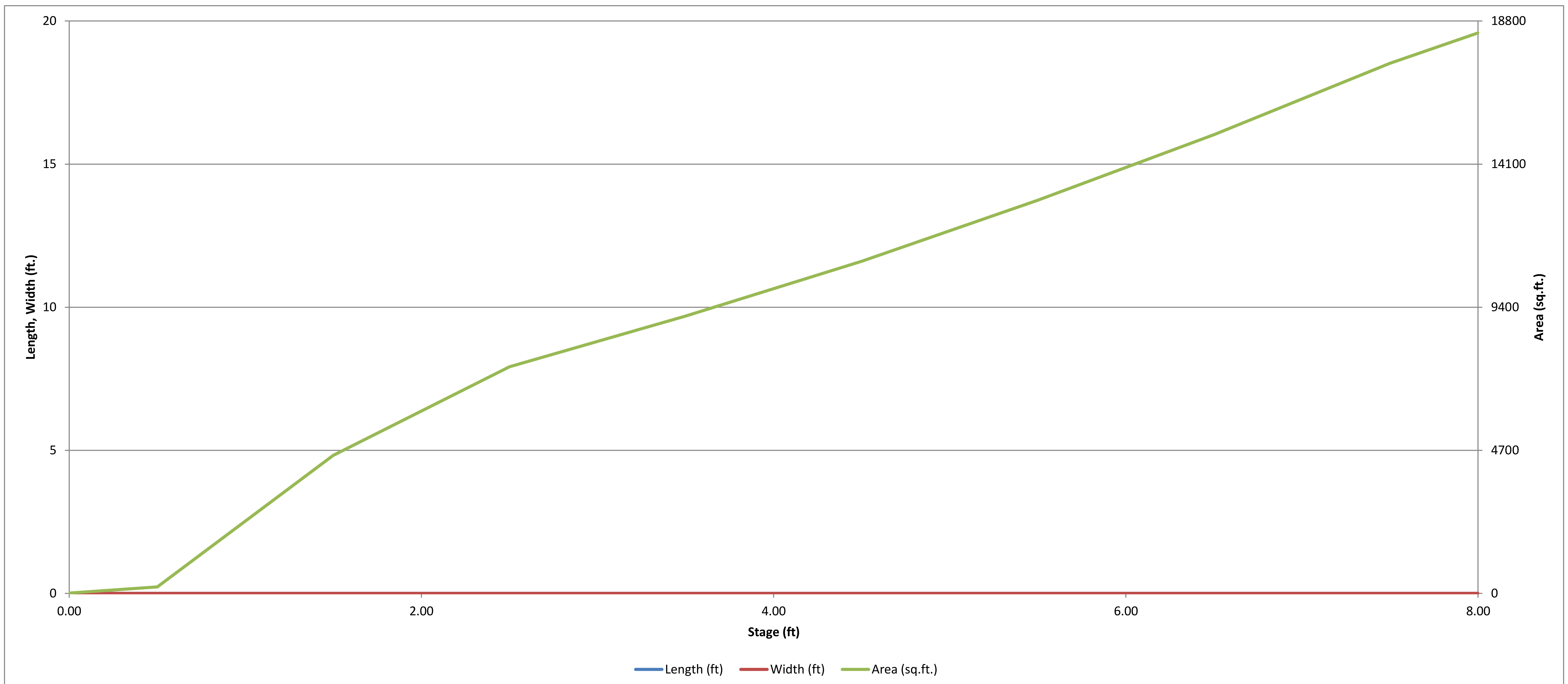
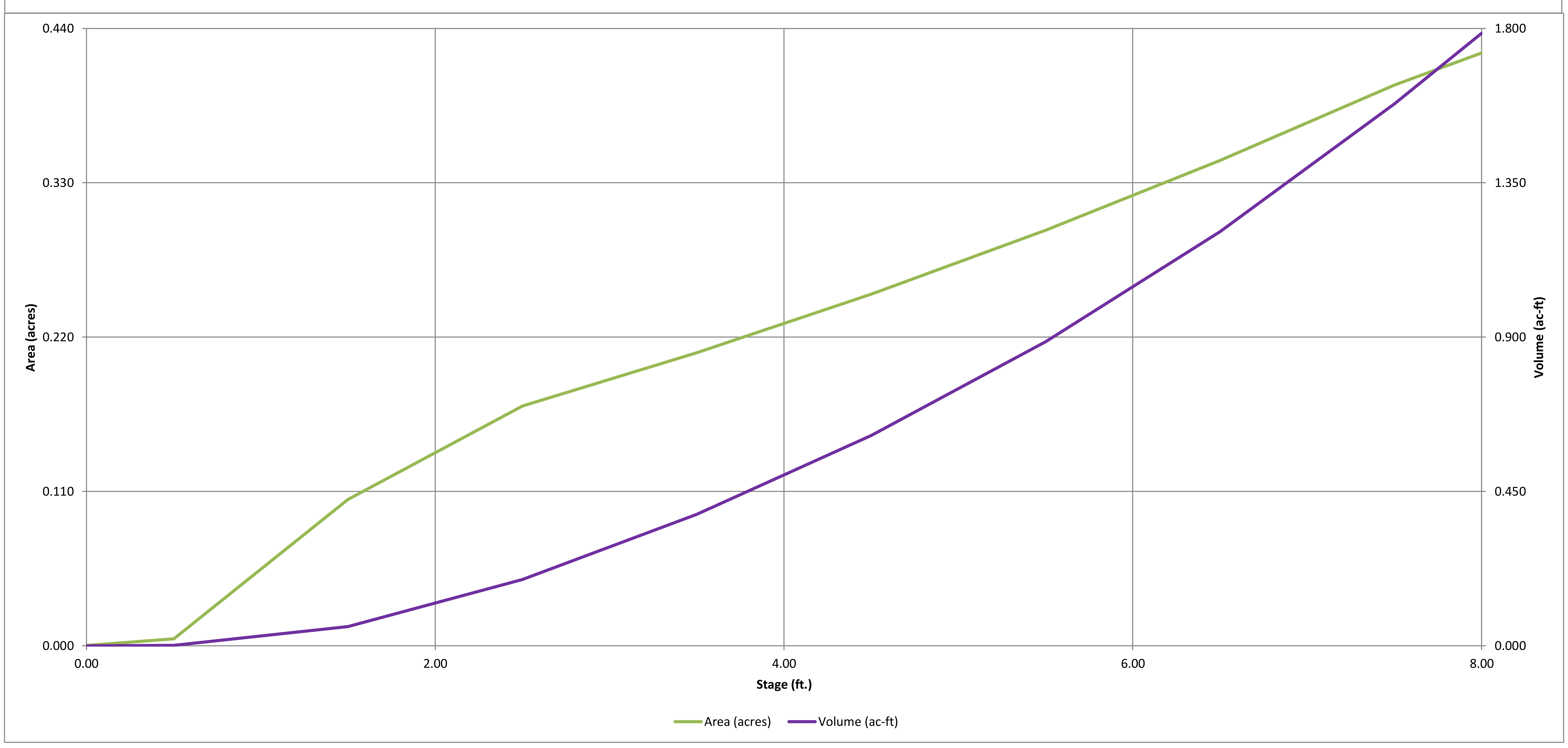
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



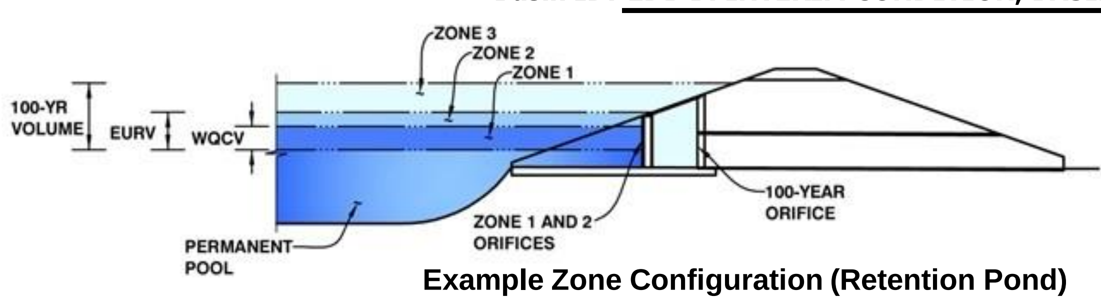


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: Eastonville Road - Segment 1 Improvements

Basin ID: EDB B: INTERIM CONDITION, BASINS [EA6 - EA8]



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.64	0.071	Orifice Plate
Zone 2 (EURV)	2.80	0.175	Rectangular Orifice
Zone 3 (100-year)	3.51	0.139	Weir&Pipe (Restrict)
Total (all zones)		0.384	

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

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

Calculated Parameters for Underdrain

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

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

✔ Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	1.64	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
✔ Orifice Plate: Orifice Area per Row =	0.31	sq. inches (diameter = 5/8 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	2.132E-03	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
✔ Stage of Orifice Centroid (ft)	0.00	0.60	1.20					
✔ Orifice Area (sq. inches)	0.31	0.31	0.31					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Rectangular	Not Selected	
✔ Invert of Vertical Orifice =	2.00	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	2.76	N/A	ft (relative to basin bottom at Stage = 0 ft)
✔ Vertical Orifice Height =	8.00	N/A	inches
✔ Vertical Orifice Width =	3.25		inches

Calculated Parameters for Vertical Orifice

	Zone 2 Rectangular	Not Selected	
Vertical Orifice Area =	0.18	N/A	ft^2
Vertical Orifice Centroid =	0.33	N/A	feet

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

	Zone 3 Weir	Not Selected	
✔ Overflow Weir Front Edge Height, Ho =	5.20	N/A	ft (relative to basin bottom at Stage = 0 ft)
✔ Overflow Weir Front Edge Length =	3.00	N/A	feet
✔ Overflow Weir Grate Slope =	0.00	N/A	H:V
✔ Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.20	N/A	feet
Overflow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	3.54	N/A	
Overflow Grate Open Area w/o Debris =	6.26	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.13	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
✔ Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)
✔ Outlet Pipe Diameter =	18.00	N/A	inches
✔ Restrictor Plate Height Above Pipe Invert =	18.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	1.77	N/A	ft^2
Outlet Orifice Centroid =	0.75	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	3.14	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

✔ Spillway Invert Stage=	6.50	ft (relative to basin bottom at Stage = 0 ft)
✔ Spillway Crest Length =	15.50	feet
✔ Spillway End Slopes =	4.00	H:V
✔ Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

✔ Spillway Design Flow Depth=	0.50	feet
Stage at Top of Freeboard =	8.00	feet
Basin Area at Top of Freeboard =	0.42	acres
Basin Volume at Top of Freeboard =	1.79	acre-ft

Routed Hydrograph Results

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

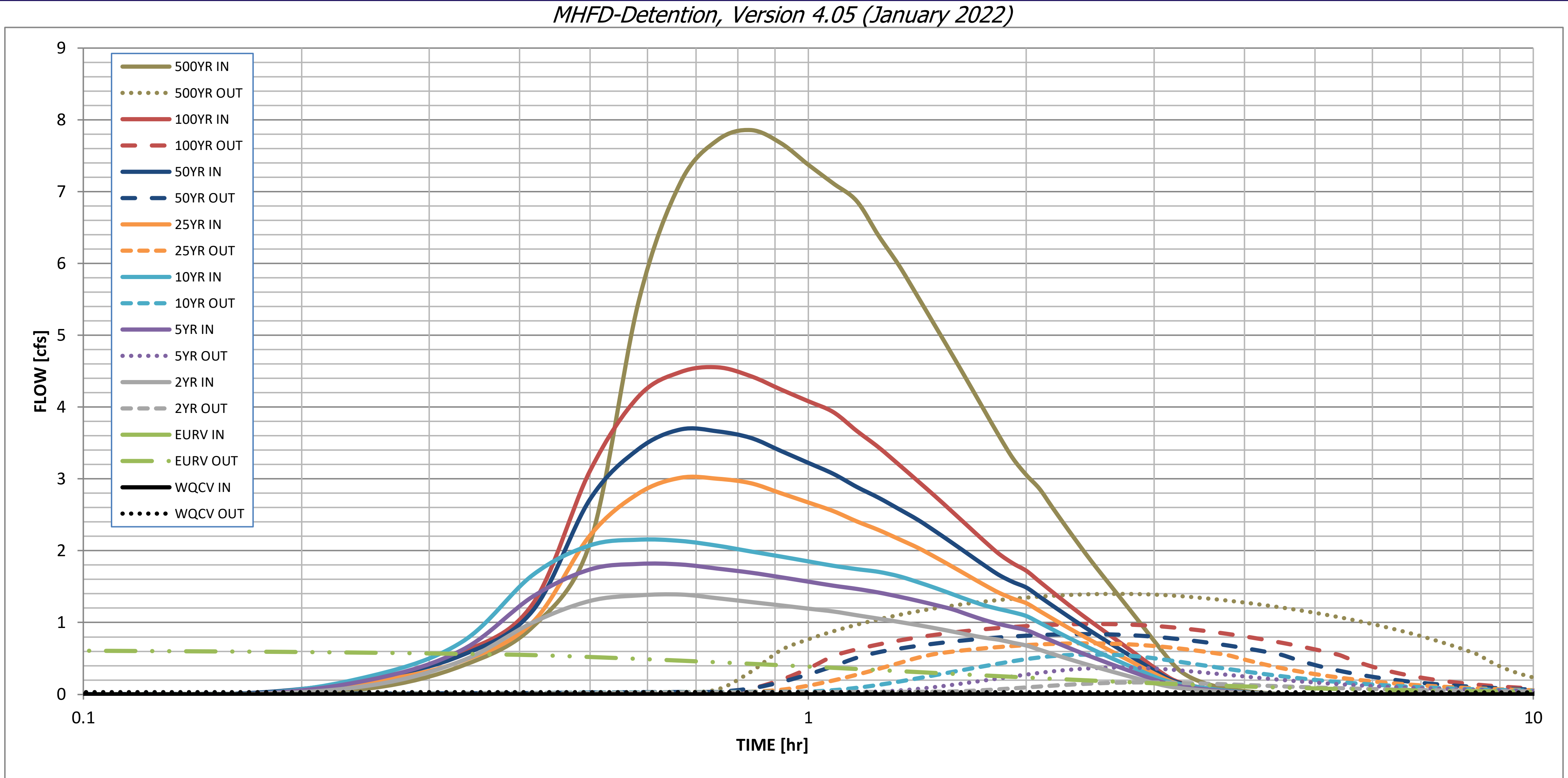
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.68
CUHP Runoff Volume (acre-ft) =	0.071	0.245	0.184	0.244	0.292	0.364	0.435	0.524	0.895
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.184	0.244	0.292	0.364	0.435	0.524	0.895
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.0	0.0	0.3	0.6	1.0	2.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.01	0.08	0.15	0.26	0.70
Peak Inflow Q (cfs) =	N/A	N/A	1.4	1.8	2.2	3.0	3.7	4.6	7.9
Peak Outflow Q (cfs) =	0.0	0.6	0.2	0.4	0.6	0.7	0.8	1.0	1.4
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	16.2	17.1	2.4	1.4	1.0	0.5
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	ertical Orifice
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	40	63	65	65	64	63	62	61	56
Time to Drain 99% of Inflow Volume (hours) =	**43**	68	69	70	70	70	70	69	69
Maximum Ponding Depth (ft) =	1.64	2.80	2.31	2.53	2.68	2.92	3.16	3.47	4.70
Area at Maximum Ponding Depth (acres) =	0.11	0.18	0.16	0.17	0.18	0.19	0.20	0.21	0.26
Maximum Volume Stored (acre-ft) =	0.071	0.246	0.162	0.197	0.223	0.267	0.312	0.377	0.661

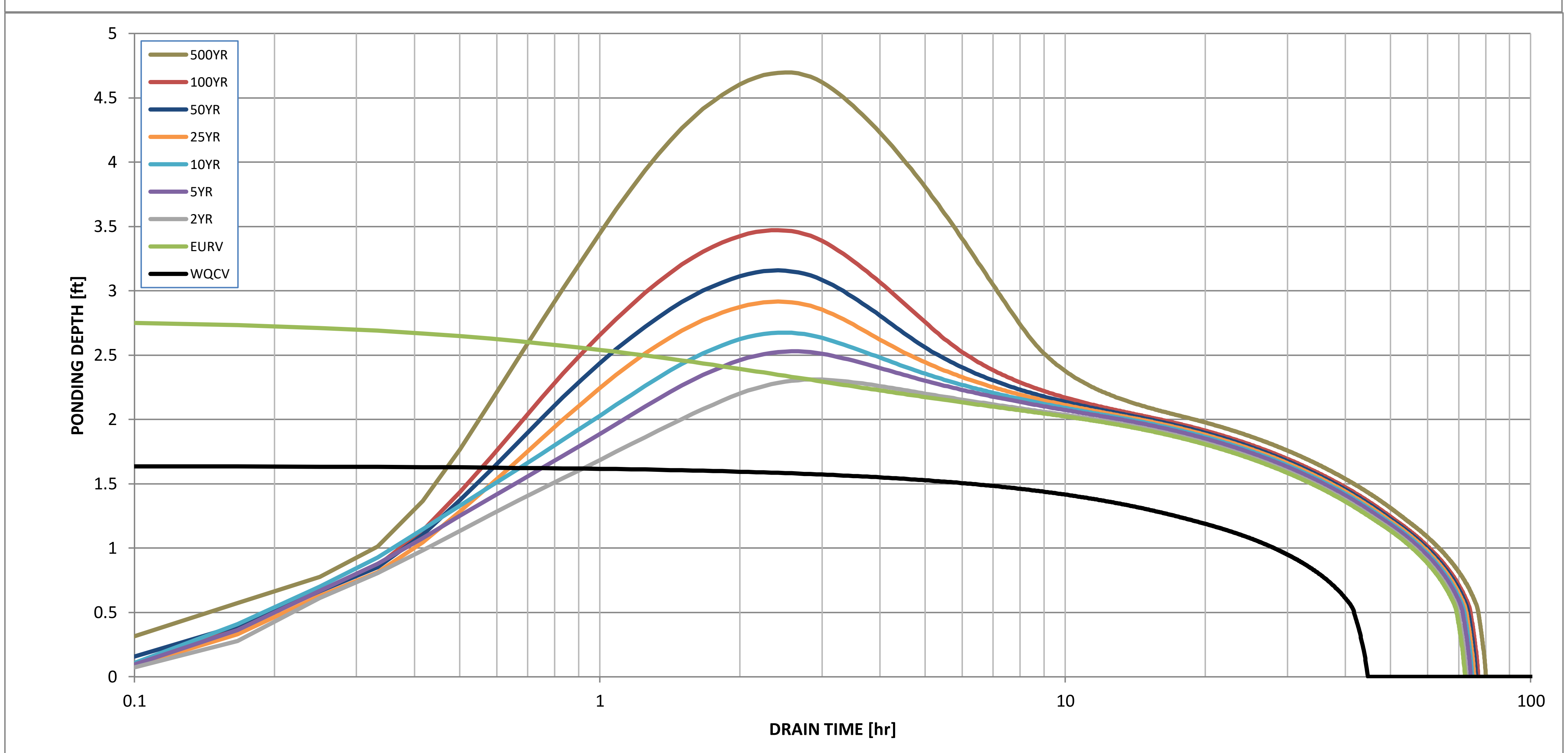
Unresolved:
Why aren't these values that are >1 highlighted in red like they were with the last submittal?

Rregardless, the ratio should be less than or equal to 1 for minor (5-yr) and major (100-yr) design storms. See Chapter 4.1 of DCM volume 2 (and also Chap 2 of MHFD DCM vol. 3).

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)





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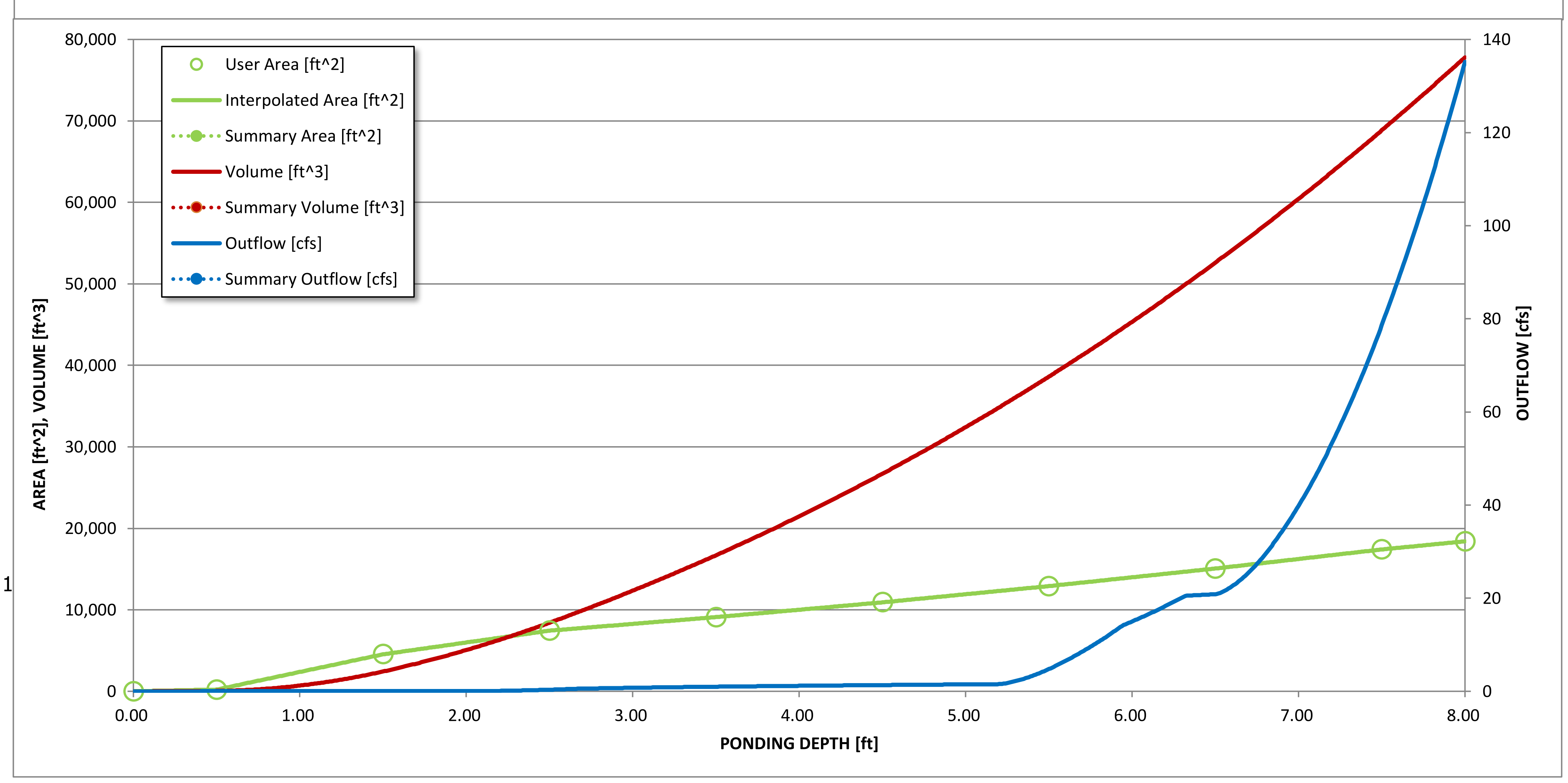


S-A-V-D Chart Axis Override	X-axis	Left Y-Axis	Right Y-Axis
minimum bound			
maximum bound			

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

Time Interval: 5.00 min

SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.09
0:15:00	0.00	0.00	0.13	0.21	0.26	0.17	0.22	0.21	0.40
0:20:00	0.00	0.00	0.47	0.62	0.73	0.47	0.55	0.58	0.94
0:25:00	0.00	0.00	1.00	1.36	1.66	1.00	1.16	1.26	2.11
0:30:00	0.00	0.00	1.30	1.74	2.07	2.21	2.72	3.11	5.47
0:35:00	0.00	0.00	1.38	1.82	2.15	2.80	3.42	4.15	7.13
0:40:00	0.00	0.00	1.39	1.81	2.14	3.02	3.69	4.49	7.72
0:45:00	0.00	0.00	1.34	1.75	2.07	3.00	3.66	4.55	7.86
0:50:00	0.00	0.00	1.29	1.69	1.99	2.94	3.57	4.43	7.68
0:55:00	0.00	0.00	1.24	1.63	1.92	2.80	3.39	4.25	7.38
1:00:00	0.00	0.00	1.19	1.57	1.85	2.67	3.22	4.08	7.11
1:05:00	0.00	0.00	1.15	1.51	1.79	2.55	3.07	3.93	6.87
1:10:00	0.00	0.00	1.10	1.47	1.74	2.41	2.89	3.67	6.39
1:15:00	0.00	0.00	1.05	1.42	1.71	2.29	2.74	3.44	5.98
1:20:00	0.00	0.00	1.01	1.36	1.65	2.16	2.58	3.20	5.54
1:25:00	0.00	0.00	0.96	1.30	1.56	2.04	2.43	2.97	5.12
1:30:00	0.00	0.00	0.92	1.24	1.48	1.91	2.27	2.75	4.71
1:35:00	0.00	0.00	0.87	1.18	1.39	1.77	2.10	2.54	4.33
1:40:00	0.00	0.00	0.83	1.11	1.31	1.65	1.95	2.33	3.95
1:45:00	0.00	0.00	0.79	1.03	1.24	1.52	1.80	2.13	3.60
1:50:00	0.00	0.00	0.76	0.98	1.19	1.41	1.66	1.96	3.28
1:55:00	0.00	0.00	0.72	0.94	1.14	1.33	1.56	1.82	3.05
2:00:00	0.00	0.00	0.68	0.89	1.09	1.27	1.49	1.72	2.87
2:05:00	0.00	0.00	0.62	0.82	1.00	1.16	1.36	1.57	2.62
2:10:00	0.00	0.00	0.57	0.75	0.91	1.06	1.24	1.44	2.38
2:15:00	0.00	0.00	0.51	0.68	0.82	0.97	1.13	1.30	2.16
2:20:00	0.00	0.00	0.47	0.61	0.74	0.87	1.02	1.18	1.95
2:25:00	0.00	0.00	0.42	0.55	0.67	0.79	0.92	1.06	1.76
2:30:00	0.00	0.00	0.38	0.50	0.60	0.71	0.83	0.96	1.58
2:35:00	0.00	0.00	0.34	0.44	0.53	0.63	0.74	0.85	1.40
2:40:00	0.00	0.00	0.30	0.39	0.47	0.56	0.65	0.75	1.23
2:45:00	0.00	0.00	0.26	0.34	0.41	0.49	0.57	0.65	1.07
2:50:00	0.00	0.00	0.22	0.29	0.35	0.42	0.49	0.56	0.90
2:55:00	0.00	0.00	0.19	0.25	0.30	0.35	0.41	0.47	0.75
3:00:00	0.00	0.00	0.16	0.21	0.25	0.29	0.33	0.37	0.59
3:05:00	0.00	0.00	0.13	0.17	0.20	0.23	0.26	0.29	0.45
3:10:00	0.00	0.00	0.10	0.14	0.17	0.18	0.20	0.22	0.34
3:15:00	0.00	0.00	0.09	0.12	0.14	0.14	0.16	0.17	0.26
3:20:00	0.00	0.00	0.08	0.10	0.12	0.12	0.13	0.14	0.21
3:25:00	0.00	0.00	0.06	0.09	0.11	0.10	0.11	0.11	0.17
3:30:00	0.00	0.00	0.06	0.07	0.09	0.08	0.09	0.09	0.13
3:35:00	0.00	0.00	0.05	0.06	0.08	0.07	0.08	0.07	0.11
3:40:00	0.00	0.00	0.04	0.05	0.06	0.06	0.06	0.06	0.09
3:45:00	0.00	0.00	0.03	0.04	0.05	0.05	0.05	0.05	0.07
3:50:00	0.00	0.00	0.03	0.04	0.04	0.04	0.04	0.04	0.06
3:55:00	0.00	0.00	0.02	0.03	0.03	0.03	0.03	0.03	0.04
4:00:00	0.00	0.00	0.02	0.02	0.03	0.02	0.03	0.03	0.04
4:05:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
4:10:00	0.00	0.00	0.01	0.01	0.02	0.01	0.02	0.01	0.02
4:15:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
4:20:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

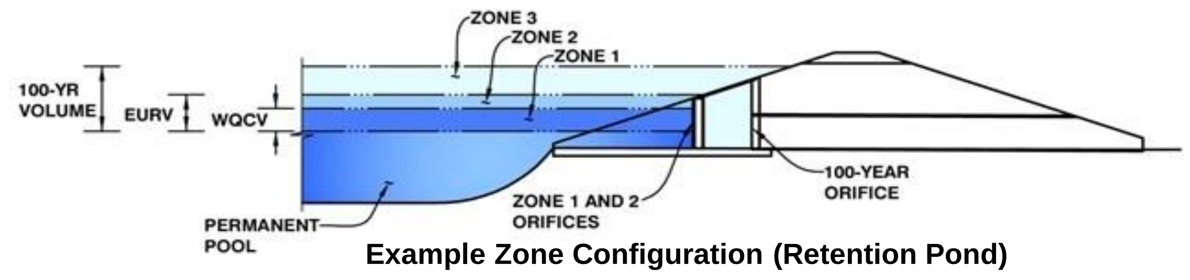
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: **Eastonville Road**

Basin ID: **POND B: Ultimate Conditions (INCLUDES SEGMENT 2 FLOW) [BASINS EA6 - EA10]**

See my comments on this page on the Segment 2 FDR.



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB			
Watershed Area =	9.02	acres		
Watershed Length =	1,750	ft		
Watershed Length to Centroid =	500	ft		
Watershed Slope =	0.009	ft/ft		
Watershed Imperviousness =	67.00%	percent		
Percentage Hydrologic Soil Group A =	100.0%	percent		
Percentage Hydrologic Soil Group B =	0.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Target WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths = User Input				

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.197	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.756	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.556	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.728	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.866	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	1.043	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.217	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	1.427	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.68 in.) =	2.302	acre-feet	3.68	inches
Approximate 2-yr Detention Volume =	0.493	acre-feet		
Approximate 5-yr Detention Volume =	0.644	acre-feet		
Approximate 10-yr Detention Volume =	0.775	acre-feet		
Approximate 25-yr Detention Volume =	0.930	acre-feet		
Approximate 50-yr Detention Volume =	1.024	acre-feet		
Approximate 100-yr Detention Volume =	1.119	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.197	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.559	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.363	acre-feet
Total Detention Basin Volume =	1.119	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

	Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
6983.5	**Top of Micropool**	--	0.00	--	--	--	10	0.000		
	6984	--	0.50	--	--	--	211	0.005	55	0.001
	6985	--	1.50	--	--	--	4,539	0.104	2,430	0.056
	6986	--	2.50	--	--	--	7,443	0.171	8,421	0.193
	6987	--	3.50	--	--	--	9,104	0.209	16,695	0.383
	6988	--	4.50	--	--	--	10,914	0.251	26,704	0.613
	6989	--	5.50	--	--	--	12,910	0.296	38,616	0.886
	6990	--	6.50	--	--	--	15,069	0.346	52,605	1.208
	6991	--	7.50	--	--	--	17,408	0.400	68,844	1.580
	6991.5	--	8.00	--	--	--	18,407	0.423	77,797	1.786
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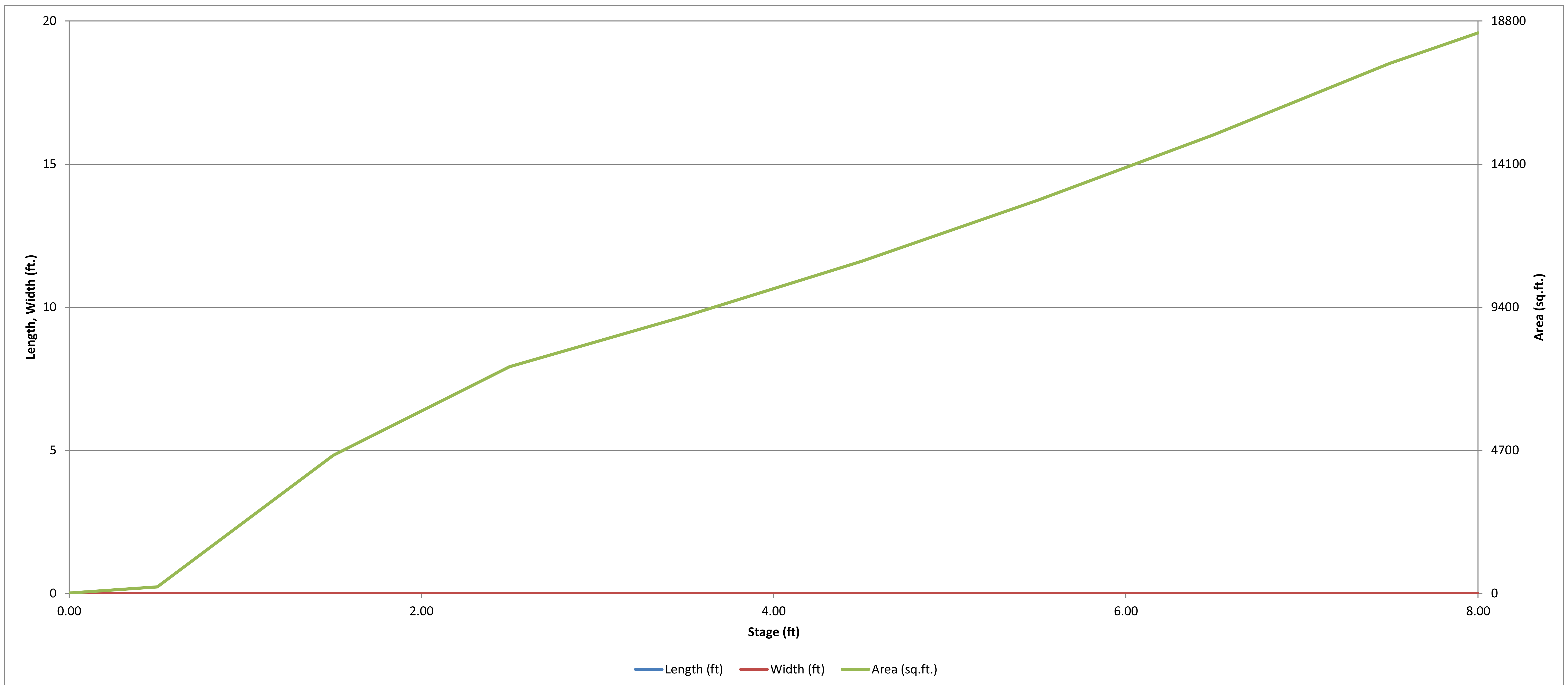
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15
10
5
0
18800
14100
9400
4700
0
Length, Width (ft.)
Area (sq.ft.)
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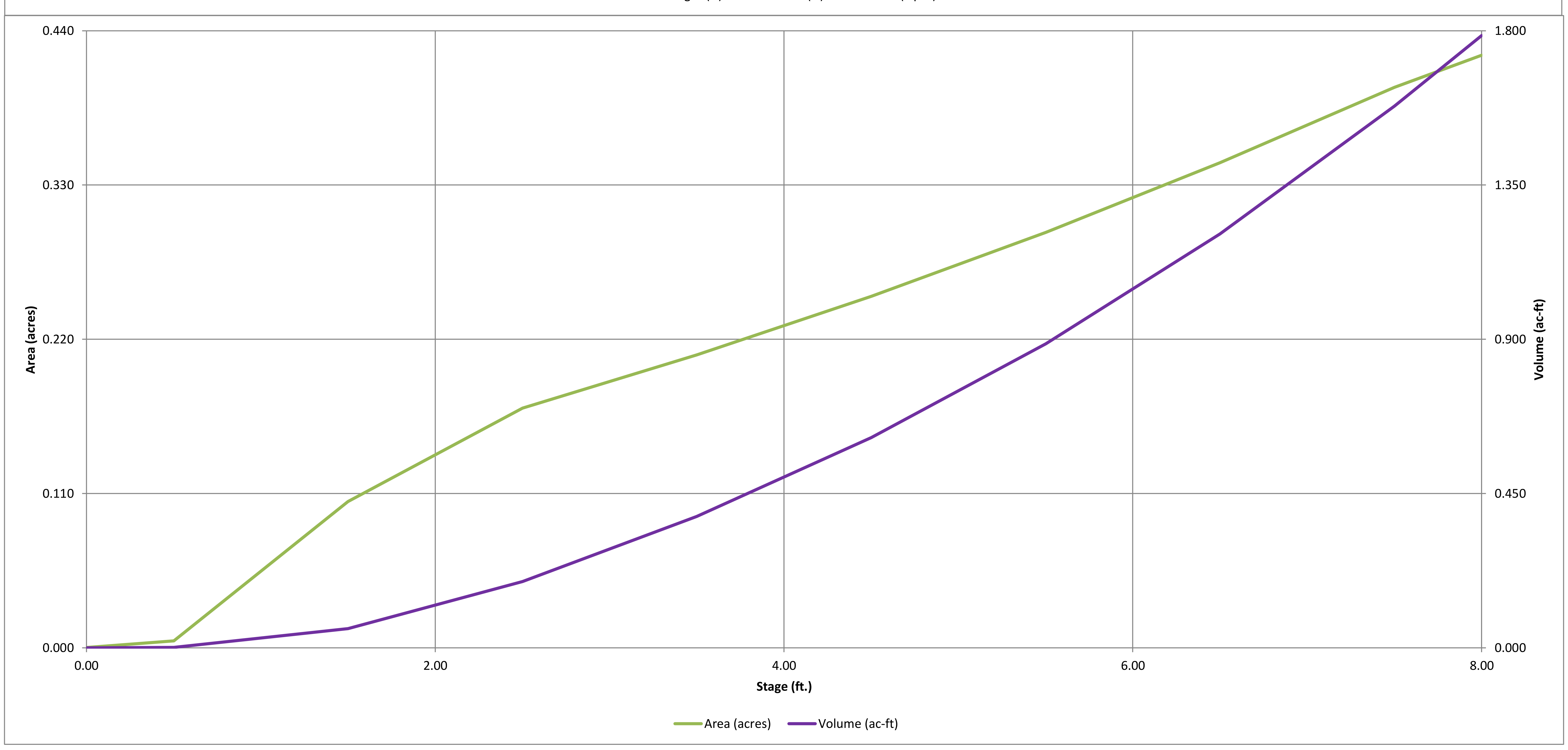
2.00
4.00
6.00
8.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)


0.440
0.330
0.220
0.110
0.000
1.800
1.350
0.900
0.450
0.000
Area (acres)
Volume (ac-ft)
0.00
2.00
4.00
6.00
8.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

When are the details for this Ultimate Condition going to be designed/submitted? Because I do not see them with the Segment 2 CDs.

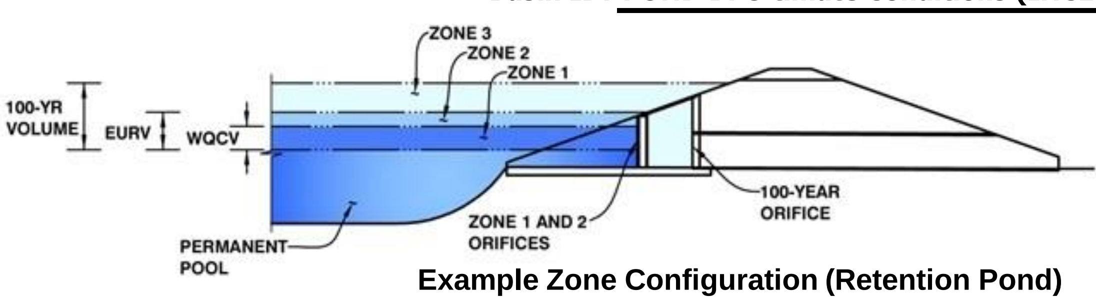
Please provide them so that I can review these calcs.

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: **Eastonville Road**

Basin ID: **POND B: Ultimate Conditions (INCLUDES SEGMENT 2 FLOW) [BASINS EA6 - EA10]**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.53	0.197	Orifice Plate
Zone 2 (EURV)	5.05	0.559	Circular Orifice
Zone 3 (100-year)	6.25	0.363	Weir&Pipe (Restrict)
	Total (all zones)	1.119	

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

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

Calculated Parameters for Underdrain

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

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	2.53	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	0.79	sq. inches (diameter = 1 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	5.451E-03	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	0.87	1.73					
Orifice Area (sq. inches)	0.79	0.79	0.79					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	2.55	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	5.18	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	1.75	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.02	N/A	ft^2
Vertical Orifice Centroid =	0.07	N/A	feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.20	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	5.20	N/A	feet
Overflow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	25.92	N/A	
Overflow Grate Open Area w/o Debris =	6.26	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.13	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.25	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	18.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	3.50		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.24	N/A	ft^2
Outlet Orifice Centroid =	0.17	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	0.91	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.50	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	15.50	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.50	feet
Stage at Top of Freeboard =	8.00	feet
Basin Area at Top of Freeboard =	0.42	acres
Basin Volume at Top of Freeboard =	1.79	acre-ft

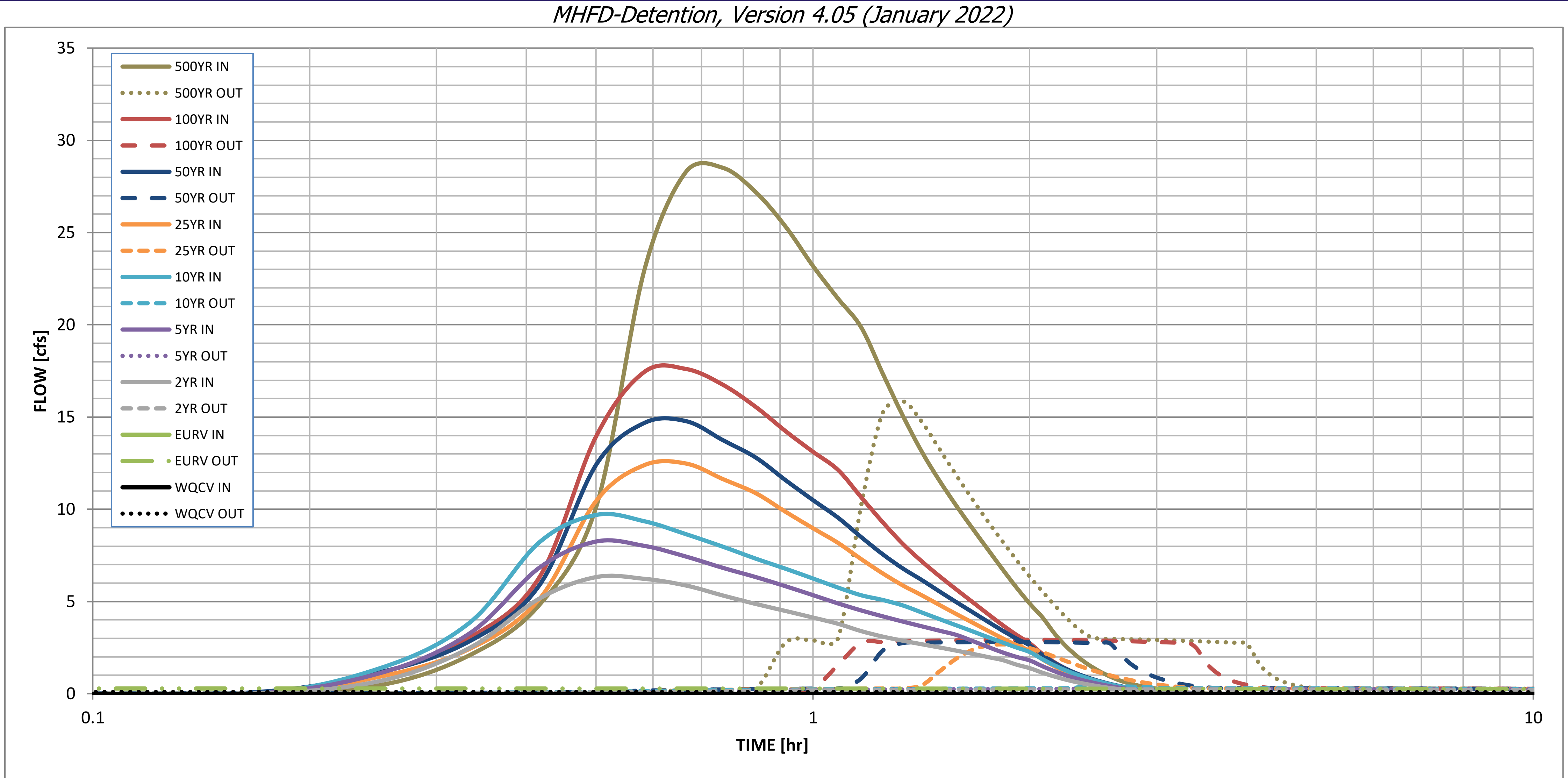
Routed Hydrograph Results

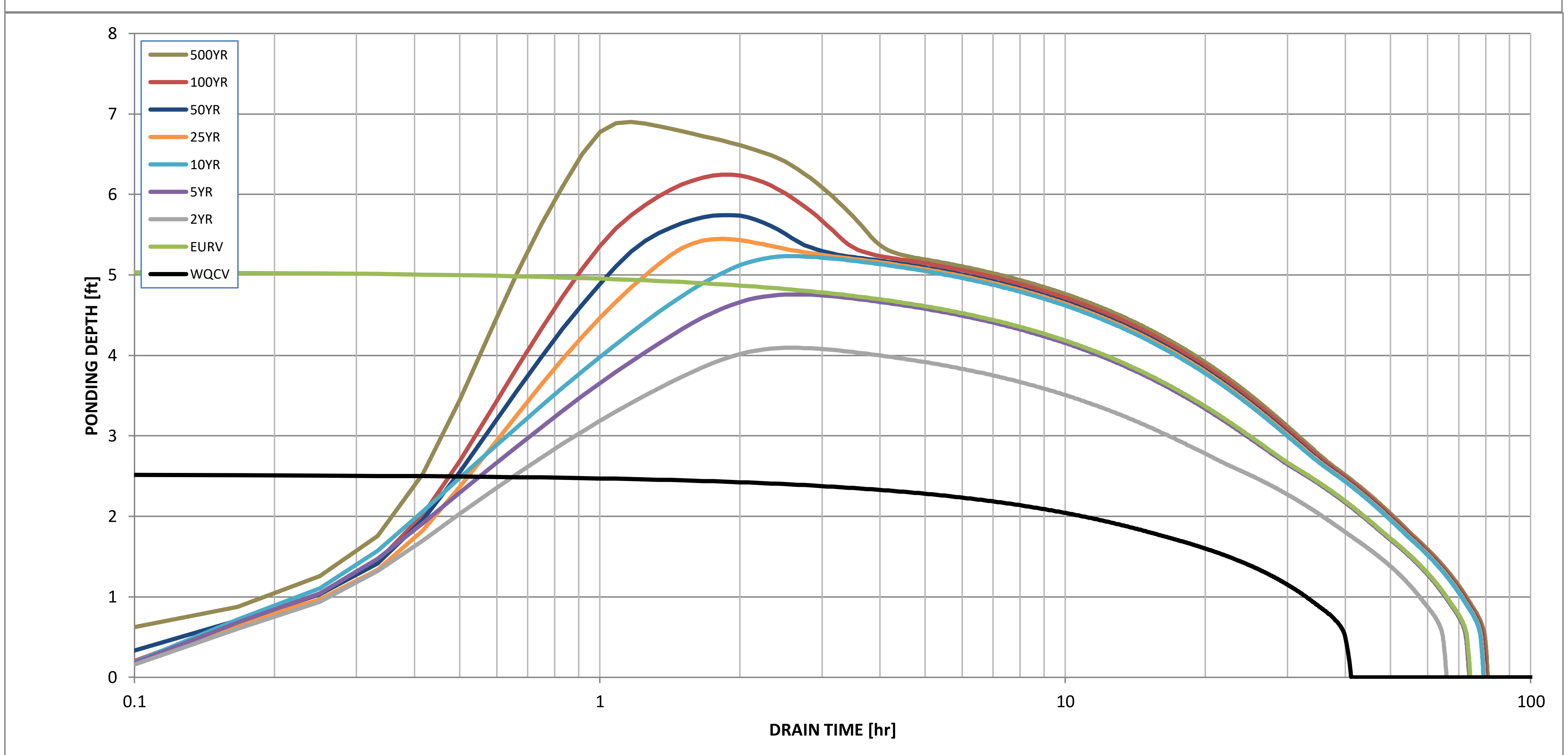
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

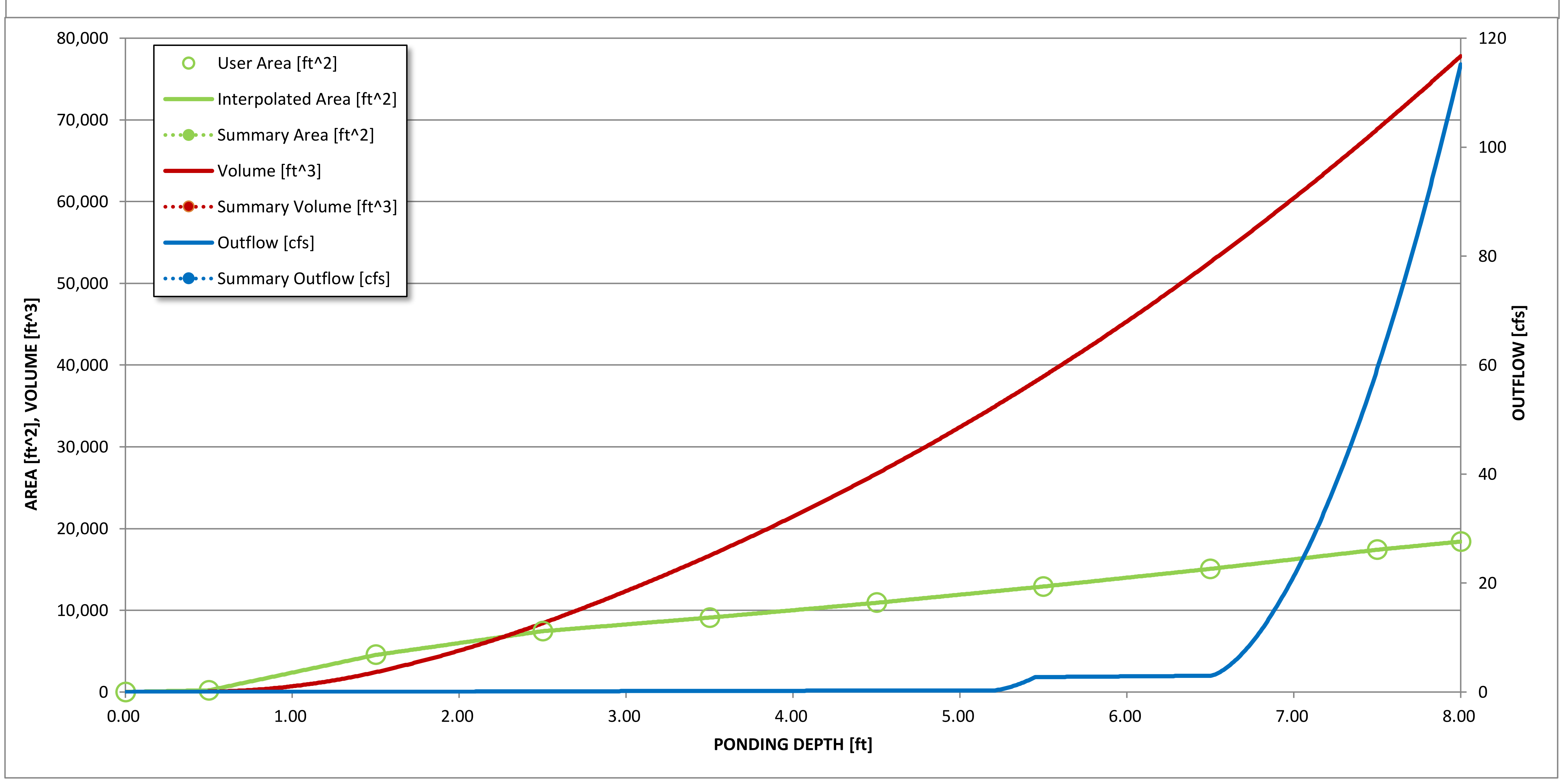
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.68
CUHP Runoff Volume (acre-ft) =	0.197	0.756	0.556	0.728	0.866	1.043	1.217	1.427	2.302
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.556	0.728	0.866	1.043	1.217	1.427	2.302
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.1	0.1	1.0	2.0	3.3	8.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.00	0.01	0.01	0.11	0.22	0.36	0.97
Peak Inflow Q (cfs) =	N/A	N/A	6.3	8.3	9.7	12.5	14.8	17.6	28.5
Peak Outflow Q (cfs) =	0.1	0.3	0.2	0.3	0.4	2.7	2.8	2.9	15.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	3.6	3.9	2.7	1.4	0.9	1.8
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	0.0	0.4	0.4	0.4	0.4
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	37	64	58	64	68	67	66	65	59
Time to Drain 99% of Inflow Volume (hours) =	**40**	70	62	69	74	74	73	73	71
Maximum Ponding Depth (ft) =	2.53	5.05	4.09	4.76	5.23	5.45	5.74	6.25	6.90
Area at Maximum Ponding Depth (acres) =	0.17	0.28	0.23	0.26	0.28	0.29	0.31	0.33	0.37
Maximum Volume Stored (acre-ft) =	0.198	0.758	0.514	0.677	0.808	0.869	0.959	1.119	1.350

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.01	0.46
	0:15:00	0.00	0.00	0.68	1.11	1.37	0.92	1.16	1.13	2.08
	0:20:00	0.00	0.00	2.48	3.26	3.84	2.43	2.84	3.03	4.80
	0:25:00	0.00	0.00	5.15	6.82	8.20	5.12	5.86	6.29	10.12
	0:30:00	0.00	0.00	6.32	8.25	9.69	10.45	12.41	13.96	22.97
	0:35:00	0.00	0.00	6.23	8.02	9.35	12.39	14.68	17.45	28.30
	0:40:00	0.00	0.00	5.87	7.44	8.65	12.48	14.78	17.61	28.51
	0:45:00	0.00	0.00	5.33	6.82	7.97	11.64	13.74	16.75	27.19
	0:50:00	0.00	0.00	4.87	6.32	7.32	10.87	12.80	15.54	25.32
	0:55:00	0.00	0.00	4.49	5.83	6.77	9.86	11.57	14.23	23.19
	1:00:00	0.00	0.00	4.13	5.35	6.25	8.98	10.50	13.12	21.43
	1:05:00	0.00	0.00	3.79	4.90	5.76	8.18	9.55	12.14	19.87
	1:10:00	0.00	0.00	3.40	4.52	5.34	7.30	8.50	10.66	17.36
	1:15:00	0.00	0.00	3.10	4.20	5.08	6.53	7.56	9.30	15.07
	1:20:00	0.00	0.00	2.88	3.91	4.79	5.87	6.79	8.12	13.12
	1:25:00	0.00	0.00	2.68	3.65	4.40	5.34	6.16	7.17	11.53
	1:30:00	0.00	0.00	2.51	3.42	4.04	4.80	5.54	6.36	10.17
	1:35:00	0.00	0.00	2.33	3.18	3.70	4.31	4.96	5.64	8.95
	1:40:00	0.00	0.00	2.16	2.86	3.38	3.85	4.42	4.97	7.82
	1:45:00	0.00	0.00	1.99	2.54	3.07	3.42	3.91	4.32	6.75
	1:50:00	0.00	0.00	1.83	2.24	2.78	3.01	3.43	3.73	5.77
	1:55:00	0.00	0.00	1.58	2.00	2.51	2.64	2.99	3.20	4.89
	2:00:00	0.00	0.00	1.39	1.81	2.26	2.33	2.63	2.74	4.14
	2:05:00	0.00	0.00	1.14	1.49	1.87	1.86	2.10	2.16	3.25
	2:10:00	0.00	0.00	0.93	1.22	1.53	1.49	1.67	1.70	2.55
	2:15:00	0.00	0.00	0.76	0.99	1.25	1.19	1.34	1.34	2.00
	2:20:00	0.00	0.00	0.61	0.80	1.02	0.95	1.07	1.05	1.56
	2:25:00	0.00	0.00	0.50	0.65	0.82	0.76	0.86	0.83	1.22
	2:30:00	0.00	0.00	0.40	0.52	0.66	0.61	0.68	0.65	0.94
	2:35:00	0.00	0.00	0.32	0.41	0.52	0.48	0.54	0.50	0.72
	2:40:00	0.00	0.00	0.25	0.32	0.40	0.37	0.42	0.39	0.56
	2:45:00	0.00	0.00	0.20	0.25	0.32	0.29	0.32	0.30	0.44
	2:50:00	0.00	0.00	0.16	0.20	0.25	0.23	0.26	0.24	0.35
	2:55:00	0.00	0.00	0.12	0.15	0.19	0.18	0.20	0.19	0.27
	3:00:00	0.00	0.00	0.09	0.11	0.14	0.14	0.15	0.14	0.21
	3:05:00	0.00	0.00	0.06	0.08	0.10	0.10	0.11	0.10	0.15
	3:10:00	0.00	0.00	0.04	0.05	0.07	0.07	0.07	0.07	0.10
	3:15:00	0.00	0.00	0.02	0.03	0.04	0.04	0.05	0.04	0.06
	3:20:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.03
	3:25:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Design Procedure Form: Sand Filter (SF)

UD-BMP (Version 3.07, March 2018)

Designer: SPC
Company: HR Green
Date: August 23, 2024
Project: Eastonville Road - Segment 1 Improvements SFBD
Location: El Paso County, CO

add space between SFB and D

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a (100% if all paved and roofed areas upstream of sand filter)	I_a = 34.0 %
B) Tributary Area's Imperviousness Ratio (i = I_a/100)	i = 0.340
C) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time $WQCV= 0.8 * (0.91* i^3 - 1.19 * i^2 + 0.78 * i)$	WQCV = 0.13 watershed inches
D) Contributing Watershed Area (including sand filter area)	Area = 171,191 sq ft
E) Water Quality Capture Volume (WQCV) Design Volume V_{WQCV} = WQCV / 12 * Area	V_{WQCV} = 1,865 cu ft
F) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = in
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume	$V_{WQCV\ OTHER}$ = cu ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{WQCV\ USER}$ = cu ft
2. Basin Geometry	
A) WQCV Depth	D_{WQCV} = 1.0 ft
B) Sand Filter Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred). Use "0" if sand filter has vertical walls.	Z = 4.00 ft / ft ✓
C) Minimum Filter Area (Flat Surface Area)	A_{Min} = 728 sq ft
D) Actual Filter Area	A_{Actual} = 938 sq ft ✓
E) Volume Provided	V_T = 39003 cu ft
3. Filter Material	Choose One: (●) 18" CDOT Class B or C Filter Material ( ) Other (Explain):
4. Underdrain System	
A) Are underdrains provided?	Choose One: (●) YES ( ) NO
B) Underdrain system orifice diameter for 12 hour drain time	
i) Distance From Lowest Elevation of the Storage Volume to the Center of the Orifice	y = 2.3 ft ✓
ii) Volume to Drain in 12 Hours	Vol_{12} = 1,865 cu ft
iii) Orifice Diameter, 3/8" Minimum	D_O = 1 in

0.94in per MHFD-Detention calcs below.

Design Procedure Form: Sand Filter (SF)

Designer:	**SPC**
Company:	**HR Green**
Date:	**August 23, 2024**
Project:	**Eastonville Road - Segment 1 Improvements SFBD**
Location:	**El Paso County, CO**

5. Impermeable Geomembrane Liner and Geotextile Separator Fabric

A) Is an impermeable liner provided due to proximity of structures or groundwater contamination?

Choose One
- ○ YES
- ◉ NO

6. Inlet / Outlet Works

A) Describe the type of energy dissipation at inlet points and means of conveying flows in excess of the WQCV through the outlet

Engery dissapation at inlet points provided via riprap/forebay, and means of conveying flows in excess of the WQCV through the outlet is via the modified type 'C' inlet outlet structure grate, and a restricted outlet pipe.

Notes:

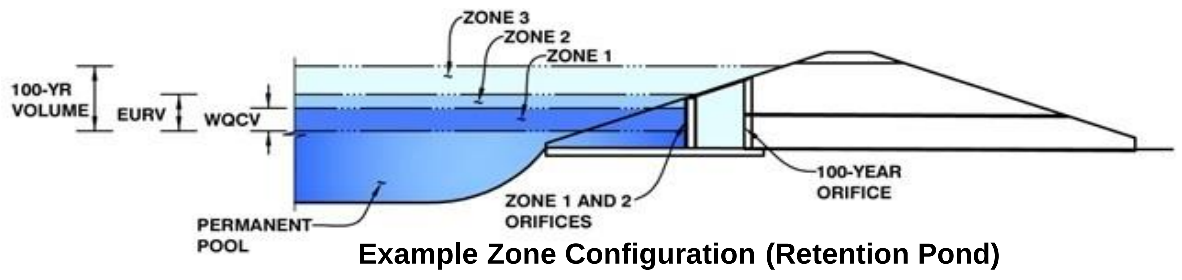
Provide forebay sizing calcs.

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: Eastonville Road

Basin ID: SFB D



Example Zone Configuration (Retention Pond)

Watershed Information

			Optional User Overrides	
Selected BMP Type =	**SF**			
Watershed Area =	3.93	acres		
Watershed Length =	895	ft		
Watershed Length to Centroid =	243	ft		
Watershed Slope =	0.016	ft/ft		
Watershed Imperviousness =	34.00%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	100.0%	percent		
Percentage Hydrologic Soil Groups C/D =	0.0%	percent		
Target WQCV Drain Time =	12.0	hours		
Location for 1-hr Rainfall Depths = User Input				

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.043	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.139	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.136	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.212	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.282	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.385	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.465	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.569	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3.68 in.) =	0.954	acre-feet	3.68	inches
Approximate 2-yr Detention Volume =	0.100	acre-feet		
Approximate 5-yr Detention Volume =	0.142	acre-feet		
Approximate 10-yr Detention Volume =	0.202	acre-feet		
Approximate 25-yr Detention Volume =	0.230	acre-feet		
Approximate 50-yr Detention Volume =	0.242	acre-feet		
Approximate 100-yr Detention Volume =	0.282	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.043	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.096	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.144	acre-feet
Total Detention Basin Volume =	0.282	acre-feet
Initial Surcharge Volume (ISV) =	N/A	ft^3
Initial Surcharge Depth (ISD) =	N/A	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	N/A	ft
Slope of Trickle Channel (S_{TC}) =	N/A	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

	Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
6966	**Media Surface**	--	0.00	--	--	--	938	0.022		
	6966.5	--	0.50	--	--	--	6,972	0.160	1,977	0.045
		--	1.50	--	--	--	8,300	0.191	9,613	0.221
		--	2.50	--	--	--	9,923	0.228	18,725	0.430
		--	3.50	--	--	--	9,589	0.220	28,481	0.654
	6,970.50	--	4.50	--	--	--	11,455	0.263	39,003	0.895
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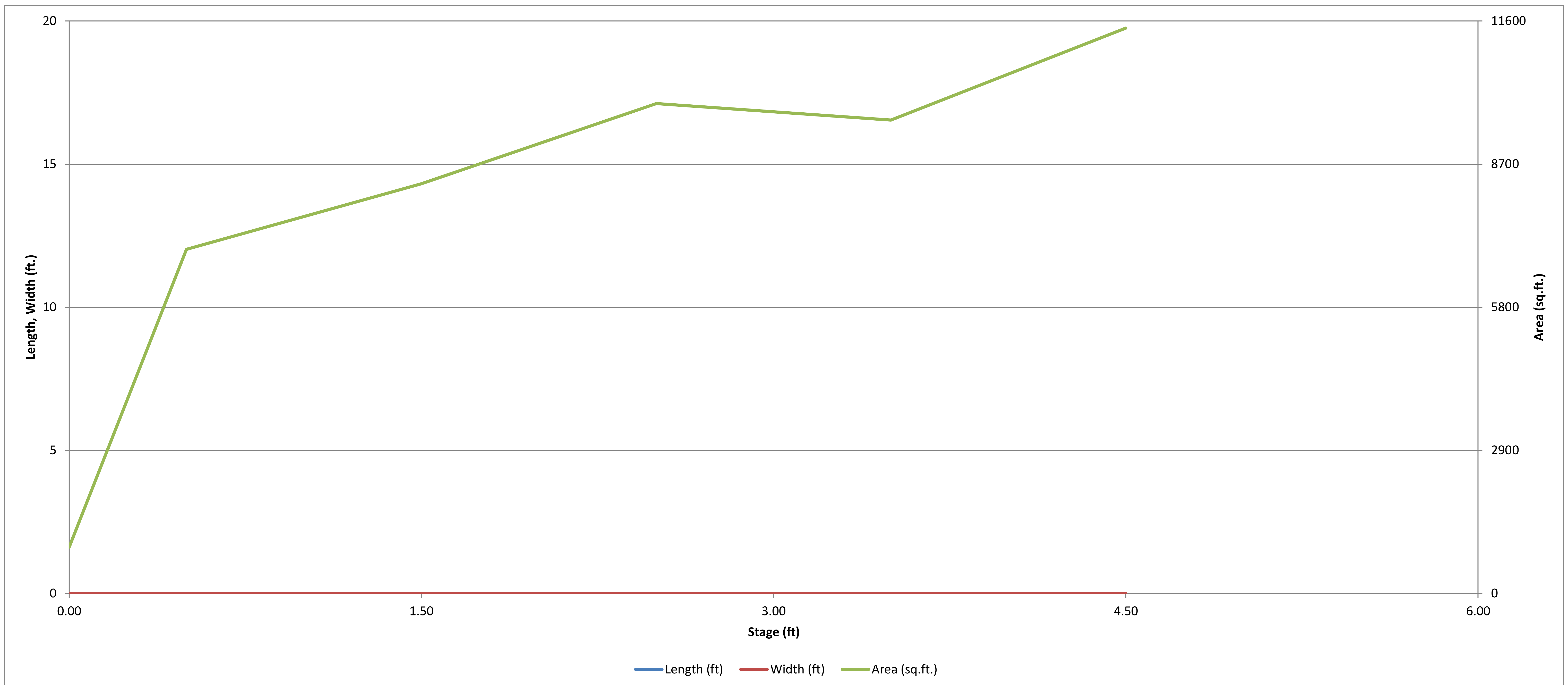
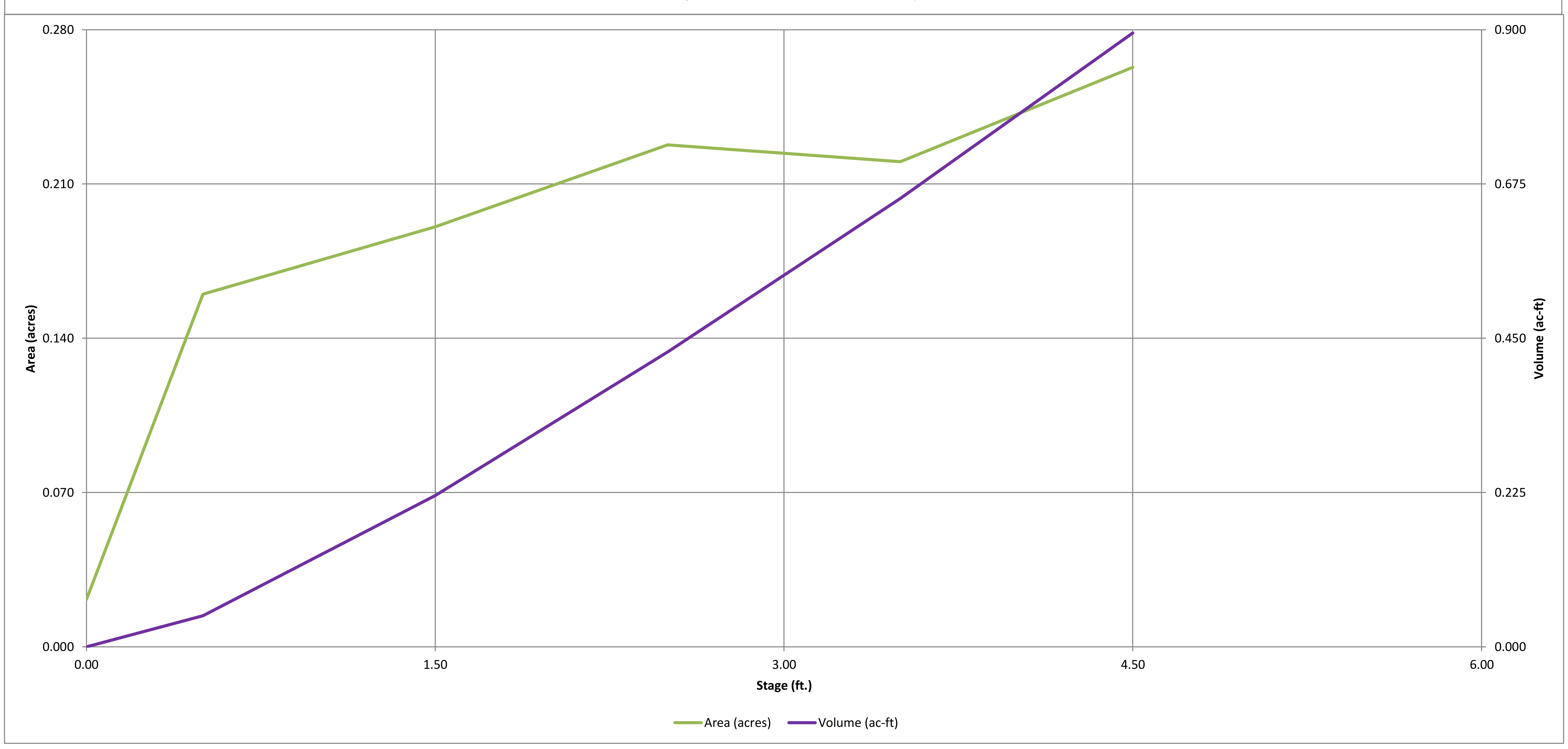

20
15
10
5
0
Length, Width (ft.)
11600
8700
5800
2900
0
Area (sq.ft.)
0.00
1.50
3.00
4.50
6.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

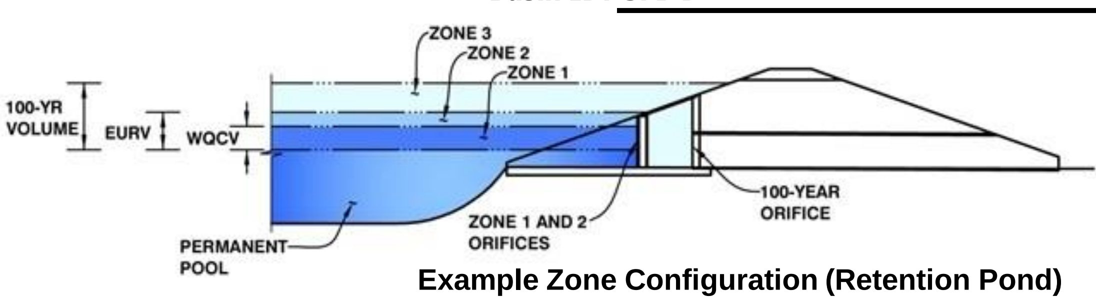

0.280
0.210
0.140
0.070
0.000
Area (acres)
0.900
0.675
0.450
0.225
0.000
Volume (ac-ft)
0.00
1.50
3.00
4.50
6.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

✓ = calcs match details in plans
X = calcs do not match details in plans

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: **Eastonville Road**
Basin ID: **SFB D**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	0.49	0.043	Filtration Media
Zone 2 (EURV)	1.06	0.096	Circular Orifice
Zone 3 (100-year)	1.82	0.144	Weir&Pipe (Restrict)
Total (all zones)		0.282	

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

✓ Underdrain Orifice Invert Depth =	2.25	ft (distance below the filtration media surface)
✓ Underdrain Orifice Diameter =	0.94	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	0.0	ft^2
Underdrain Orifice Centroid =	0.04	feet

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

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

Calculated Parameters for Plate

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

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

	Row 1 (optional)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Orifice Area (sq. inches)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
X Invert of Vertical Orifice =	0.50	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	0.92	N/A	ft (relative to basin bottom at Stage = 0 ft)
X Vertical Orifice Diameter =	0.38	N/A	inches

no detail for orifice plate provided on plans, could not confirm these values on CDs

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.00	N/A	ft^2
Vertical Orifice Centroid =	0.02	N/A	feet

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

	Zone 3 Weir	Not Selected	
✓ Overflow Weir Front Edge Height, Ho =	1.25	N/A	ft (relative to basin bottom at Stage = 0 ft)
✓ Overflow Weir Front Edge Length =	3.00	N/A	feet
✓ Overflow Weir Grate Slope =	0.00	N/A	H:V
✓ Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	1.25	N/A	feet
Overflow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	12.88	N/A	
Overflow Grate Open Area w/o Debris =	6.26	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.13	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
✓ Depth to Invert of Outlet Pipe =	2.50	N/A	ft (distance below basin bottom at Stage = 0 ft)
✓ Outlet Pipe Diameter =	18.00	N/A	inches
✓ Restrictor Plate Height Above Pipe Invert =	5.75		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.49	N/A	ft^2
Outlet Orifice Centroid =	0.28	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	1.20	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

X Spillway Invert Stage=	3.00	ft (relative to basin bottom at Stage = 0 ft)
✓ Spillway Crest Length =	4.00	feet
✓ Spillway End Slopes =	4.00	H:V
✓ Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

X Spillway Design Flow Depth=	0.50	feet
Stage at Top of Freeboard =	4.50	feet
Basin Area at Top of Freeboard =	0.26	acres
Basin Volume at Top of Freeboard =	0.90	acre-ft

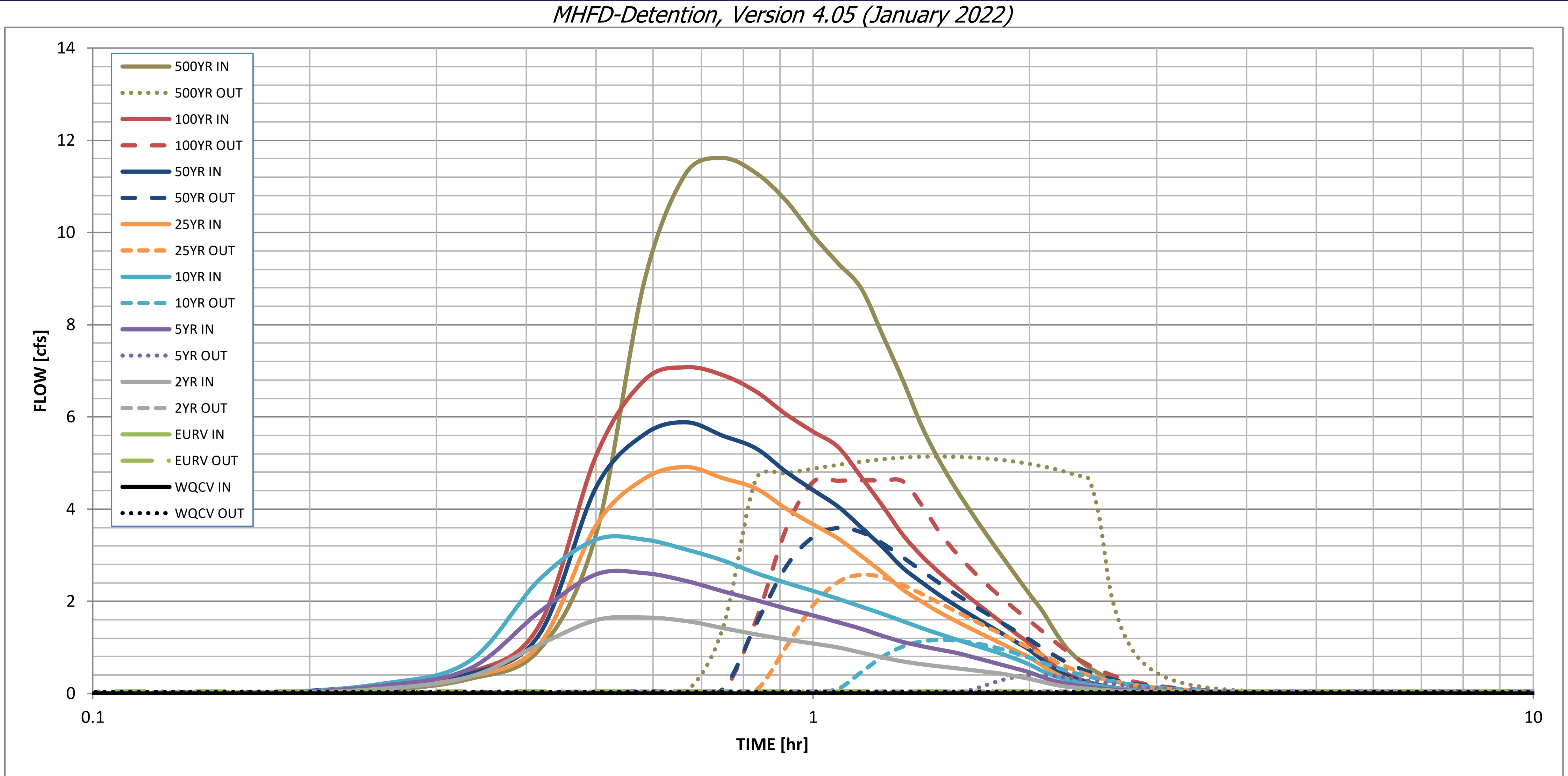
Routed Hydrograph Results

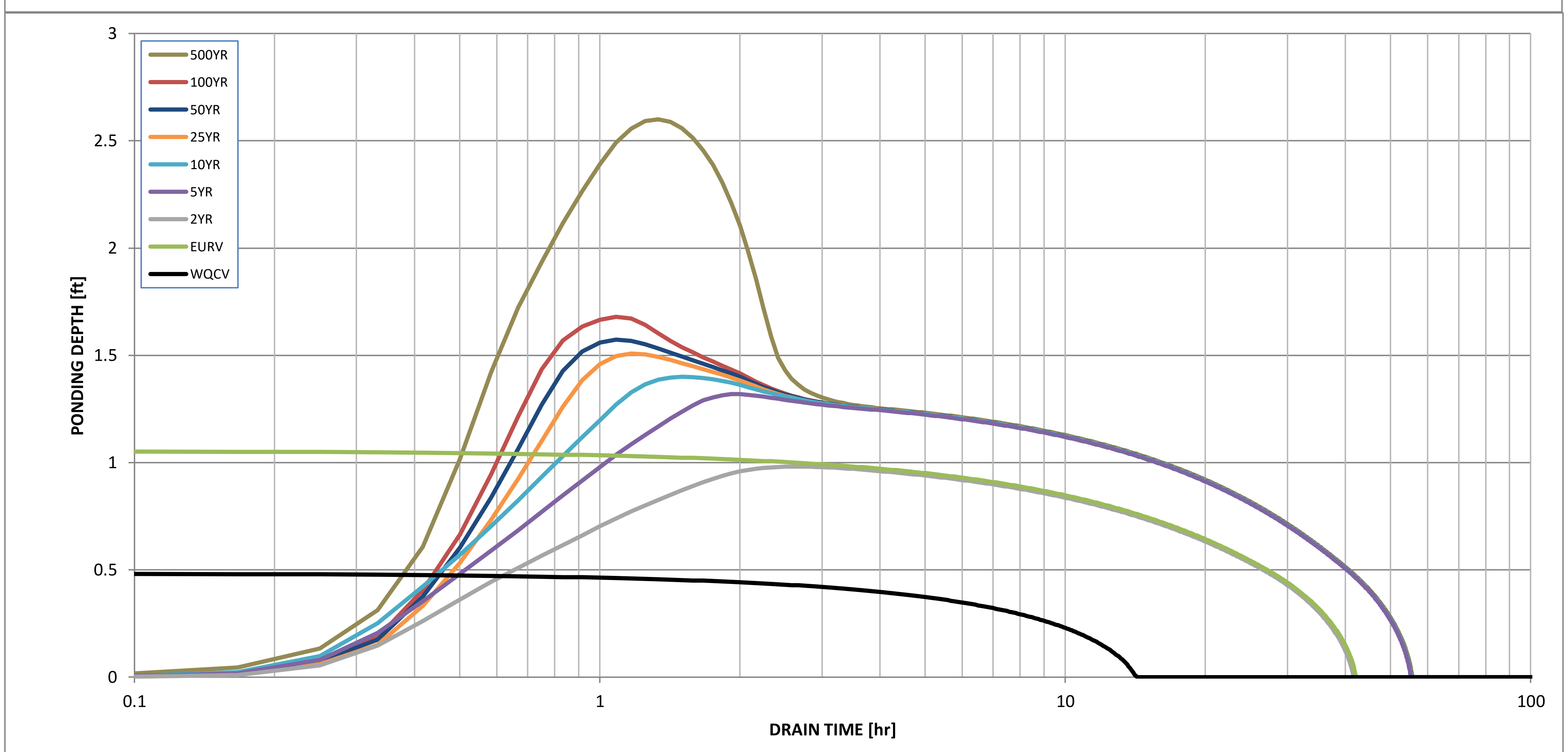
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

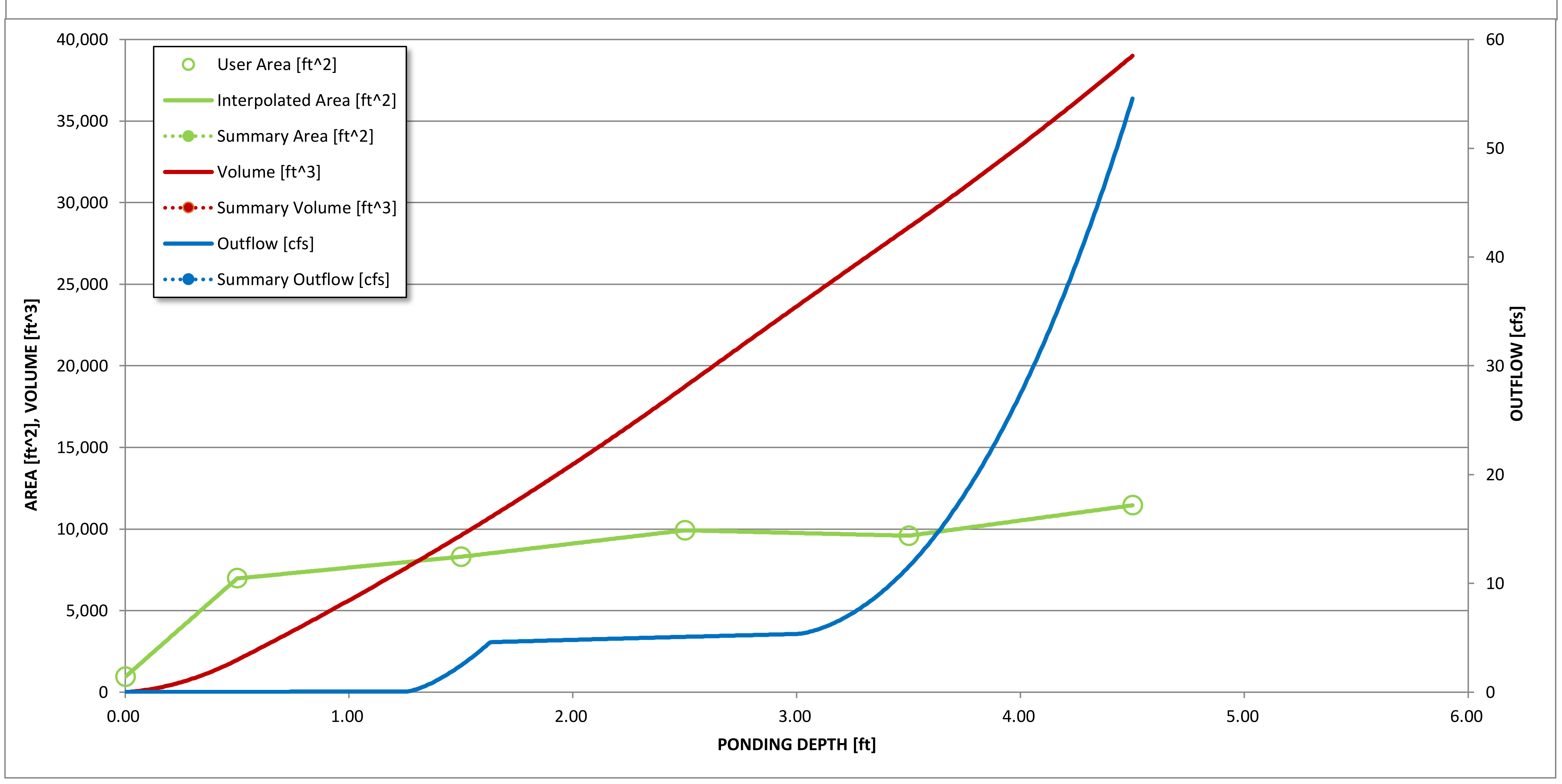
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.68
CUHP Runoff Volume (acre-ft) =	0.043	0.139	0.136	0.212	0.282	0.385	0.465	0.569	0.954
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.136	0.212	0.282	0.385	0.465	0.569	0.954
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.4	1.1	1.6	2.9	3.6	4.6	8.1
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.10	0.27	0.41	0.73	0.92	1.18	2.07
Peak Inflow Q (cfs) =	N/A	N/A	1.6	2.6	3.3	4.9	5.9	7.1	11.6
Peak Outflow Q (cfs) =	0.0	0.0	0.0	0.4	1.2	2.6	3.6	4.6	5.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.4	0.7	0.9	1.0	1.0	0.6
Structure Controlling Flow =	Filtration Media	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.1	0.2	0.4	0.6	0.7	0.8
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	14	41	40	53	53	51	51	50	46
Time to Drain 99% of Inflow Volume (hours) =	**14**	42	41	55	54	54	54	54	52
Maximum Ponding Depth (ft) =	0.49	1.06	0.98	1.32	1.40	1.51	1.57	1.68	2.60
Area at Maximum Ponding Depth (acres) =	0.16	0.18	0.17	0.18	0.19	0.19	0.19	0.20	0.23
Maximum Volume Stored (acre-ft) =	0.044	0.140	0.126	0.185	0.200	0.221	0.234	0.256	0.453

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.07
	0:15:00	0.00	0.00	0.10	0.16	0.20	0.14	0.17	0.17	0.31
	0:20:00	0.00	0.00	0.36	0.54	0.70	0.36	0.42	0.46	0.95
	0:25:00	0.00	0.00	1.06	1.77	2.47	1.06	1.27	1.47	3.46
	0:30:00	0.00	0.00	1.59	2.58	3.34	3.65	4.47	5.16	8.94
	0:35:00	0.00	0.00	1.65	2.61	3.34	4.66	5.62	6.80	11.29
	0:40:00	0.00	0.00	1.57	2.44	3.12	4.91	5.88	7.08	11.61
	0:45:00	0.00	0.00	1.42	2.22	2.89	4.67	5.59	6.91	11.29
	0:50:00	0.00	0.00	1.28	2.03	2.61	4.45	5.32	6.55	10.70
	0:55:00	0.00	0.00	1.17	1.85	2.40	4.02	4.82	6.06	9.94
	1:00:00	0.00	0.00	1.08	1.69	2.23	3.67	4.41	5.68	9.33
	1:05:00	0.00	0.00	1.00	1.55	2.05	3.36	4.06	5.35	8.79
	1:10:00	0.00	0.00	0.89	1.40	1.88	2.99	3.61	4.70	7.77
	1:15:00	0.00	0.00	0.78	1.25	1.73	2.62	3.17	4.07	6.79
	1:20:00	0.00	0.00	0.70	1.12	1.57	2.25	2.72	3.44	5.79
	1:25:00	0.00	0.00	0.64	1.03	1.42	1.99	2.41	2.98	5.03
	1:30:00	0.00	0.00	0.59	0.95	1.29	1.76	2.13	2.62	4.42
	1:35:00	0.00	0.00	0.55	0.88	1.17	1.56	1.90	2.31	3.89
	1:40:00	0.00	0.00	0.51	0.79	1.06	1.39	1.68	2.03	3.40
	1:45:00	0.00	0.00	0.47	0.70	0.95	1.23	1.48	1.77	2.96
	1:50:00	0.00	0.00	0.43	0.62	0.85	1.07	1.30	1.52	2.54
	1:55:00	0.00	0.00	0.37	0.54	0.75	0.92	1.11	1.29	2.15
	2:00:00	0.00	0.00	0.32	0.46	0.63	0.78	0.94	1.08	1.79
	2:05:00	0.00	0.00	0.25	0.36	0.49	0.60	0.73	0.83	1.35
	2:10:00	0.00	0.00	0.19	0.27	0.38	0.44	0.53	0.59	0.99
	2:15:00	0.00	0.00	0.15	0.21	0.30	0.32	0.39	0.44	0.74
	2:20:00	0.00	0.00	0.12	0.17	0.25	0.25	0.30	0.33	0.57
	2:25:00	0.00	0.00	0.10	0.14	0.20	0.19	0.23	0.24	0.43
	2:30:00	0.00	0.00	0.08	0.12	0.17	0.15	0.18	0.18	0.32
	2:35:00	0.00	0.00	0.07	0.09	0.13	0.11	0.14	0.14	0.24
	2:40:00	0.00	0.00	0.05	0.08	0.11	0.09	0.11	0.10	0.18
	2:45:00	0.00	0.00	0.04	0.06	0.08	0.07	0.08	0.07	0.13
	2:50:00	0.00	0.00	0.03	0.05	0.06	0.05	0.06	0.06	0.10
	2:55:00	0.00	0.00	0.03	0.04	0.05	0.04	0.05	0.04	0.08
	3:00:00	0.00	0.00	0.02	0.03	0.04	0.03	0.04	0.04	0.06
	3:05:00	0.00	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.05
	3:10:00	0.00	0.00	0.01	0.02	0.02	0.02	0.02	0.02	0.04
	3:15:00	0.00	0.00	0.01	0.01	0.02	0.01	0.02	0.02	0.03
	3:20:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02
	3:25:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX E – REFERENCE MATERIAL

NEW DOC

For previous reports, only provide cover sheet and relevant sheets from report, highlighting information referenced. Do not include entire report.

Final Drainage Report

for

Meridian Ranch Filing 11A

MERIDIAN RANCH

A GOLF & RECREATIONAL COMMUNITY

EL PASO COUNTY, COLORADO

Prepared For:

GTL DEVELOPMENT, INC.
3575 Kenyon Street
San Diego, CA 92110

March 2014

Prepared By:
Tech Contractors
12311 Rex Road
Falcon, CO 80831
719.495.7444

CERTIFICATIONS

Design Engineer's Statement:

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

COLORADO REGISTERED THOMAS A. KERBY 31429 PROFESSIONAL ENGINEER

2-18-14

Thomas A. Kerby, P.E. #31429 Date

Owner/Developer's Statement:

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

February 18, 2014

Genevieve Tchang Frost, Vice President Date
GTL Development, Inc.
P.O. Box 80036
San Diego, CA 92138

El Paso County:

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

3-20-2014

Andre P. Brackin, P.E., Date
County Engineer / ECM Administrator

Meridian Ranch Filing 11A
Final Drainage Report

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EXECUTIVE SUMMARY

The purpose of the following Final Drainage Report (FDR) is to present proposed drainage patterns for the Meridian Ranch Filing 11A area after construction activities.

Runoff quantities and proposed facilities have been calculated using the current City of Colorado Springs/El Paso County Drainage Criteria Manual (DCM).

The Meridian Ranch Filing 11A Final Plat encompasses 106± acres of proposed residential development and is located in Sections 20 and 29, Township 12 South, Range 64 West of the 6th Principal Meridian. It is approximately 12 miles northeast of the city of Colorado Springs, 2.5 miles north of the unincorporated town of Falcon, and immediately north of the Woodmen Hills development.

The Meridian Ranch Filing 11A Final Drainage Report is being submitted to the county as part of the final plat submittal. The Board of County Commissioners placed a condition of approval for the overall Meridian Ranch Sketch Plan to not release greater than 80 percent of the historic flow rate across Eastonville Road along the easterly boundary of the overall project site. This report shows that the development of the project meets the requirements set forth by the Board of Commissioners.

Meridian Ranch Filing 11A is currently within the Gieck Ranch Drainage Basin which has been studied as part of the respective Drainage Basin Studies and is currently waiting for some minor revisions prior to final approval from the El Paso County. The condition set by the Board of Commissioners is more stringent than those anticipated in the DBPS. However, the project developer has agreed to be in substantial conformance with the appropriate "to-be approved" DBPS.

Based on the aforementioned design parameters the proposed grading will not adversely affect downstream properties.

INTRODUCTION

Purpose

The purpose of the following Final Drainage Report (FDR) is to present final drainage patterns after the construction Meridian Ranch Filing 11A based on calculated final build-out design flows.

Scope

The scope of this report includes:

- Location and description of the proposed drainage facilities.
- Calculations for design peak flows within the proposed project area.
- Discussion and analysis of existing and proposed drainage characteristics.

Runoff quantities and proposed facilities have been calculated using the current City of Colorado Springs/El Paso County Drainage Criteria Manual (DCM).

EXISTING CONDITIONS

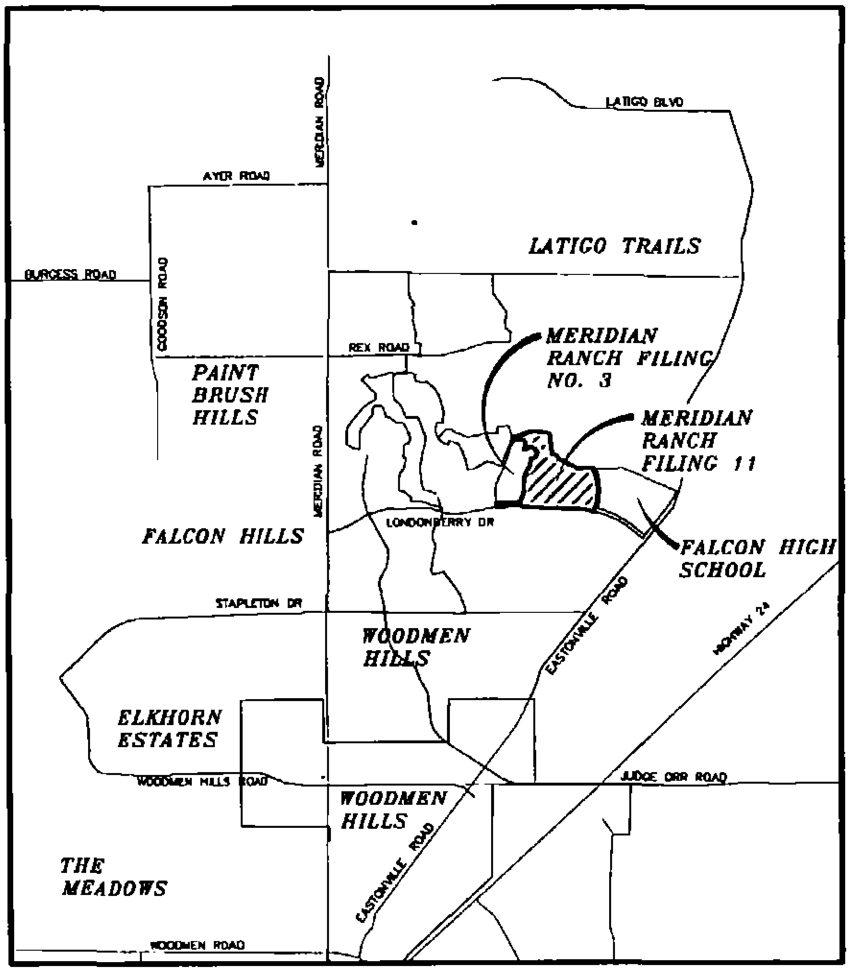
General Location

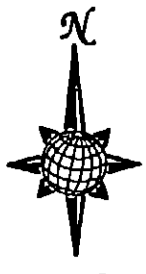
The Meridian Ranch Filing 11A encompasses 106± acres of proposed residential development and is located in Sections 20 and 29, Township 12 South, Range 64 West of the 6th Principal Meridian. It is approximately 12 miles northeast of the city of Colorado Springs, 2.5 miles north of the unincorporated town of Falcon, and immediately north of the Woodmen Hills development. Please see Figure 1: Meridian Ranch Filing 11A Vicinity Map.

Land Use

Historically, ranching dominated the area surrounding Meridian Ranch; however, currently urbanization has occurred in the general vicinity. Most notably, urbanization is occurring to the north with Latigo Trails, to the south in the Woodmen Hills Subdivision, to the east in Four Way Ranch, to the west in the Falcon Hills subdivision, and to the northwest in the Paint Brush Hills subdivision.

Figure 1: Vicinity Map





VICINITY MAP
N.T.S.

N.T.S.

MERIDIAN RANCH FILING 11 VICINITY MAP	TECH CONTRACTORS 12311 REX ROAD FALCON, CO 80831
FIGURE 1	TELEPHONE: 719.495.7444 FAX: 719.495.2457

Topography and Floodplains

The topography of the site is typical of a high desert, short prairie grass with relatively flat slopes generally ranging from 2% to 4%. The Gieck and Haegler Basins drain generally from the northwest to southeast. The basin is tributary to the Black Squirrel Creek.

The Flood Insurance Rate Maps (FIRM No. 08041C0575-F dated 3/17/99) indicates that there are portions of the Meridian Ranch Filing 11A within or near a designated flood plain. The floodplain will be removed as a result of the construction of the improvements associated with this project. A Conditional Letter of Map Revision (CLoMR) was approved in October 2006 and will be finalized upon completion of the improvements through a final Letter of Map Revision (LoMR). CLoMR file number 05-08-0050R. Upon completion of the improvements there will be no portions of this project site is near a designated flood plain. Please see Figure 2: Meridian Ranch Filing 11A Federal Emergency Management Agency (FEMA) Floodplain Map.

Geology

The National Resources Conservation Service (NRCS) soil survey records indicate that the service area is predominately covered by soils classified in the Stapleton series which is categorized in the Hydrological Group B. There is also an area of Pring soils found, which is also categorized in the Hydrological Group B.

The Stapleton (83) sandy loam is a deep, non-calcareous, well-drained soil formed in alluvium derived from arkosic bedrock on uplands. Permeability of this soil is rapid. Available water capacity is moderate, surface runoff is slow, and the hazard of erosion and soil blowing is moderate.

This soil is suited to habitat for open land and rangeland wildlife. The main limitation of this soil for urban development is frost-action potential.

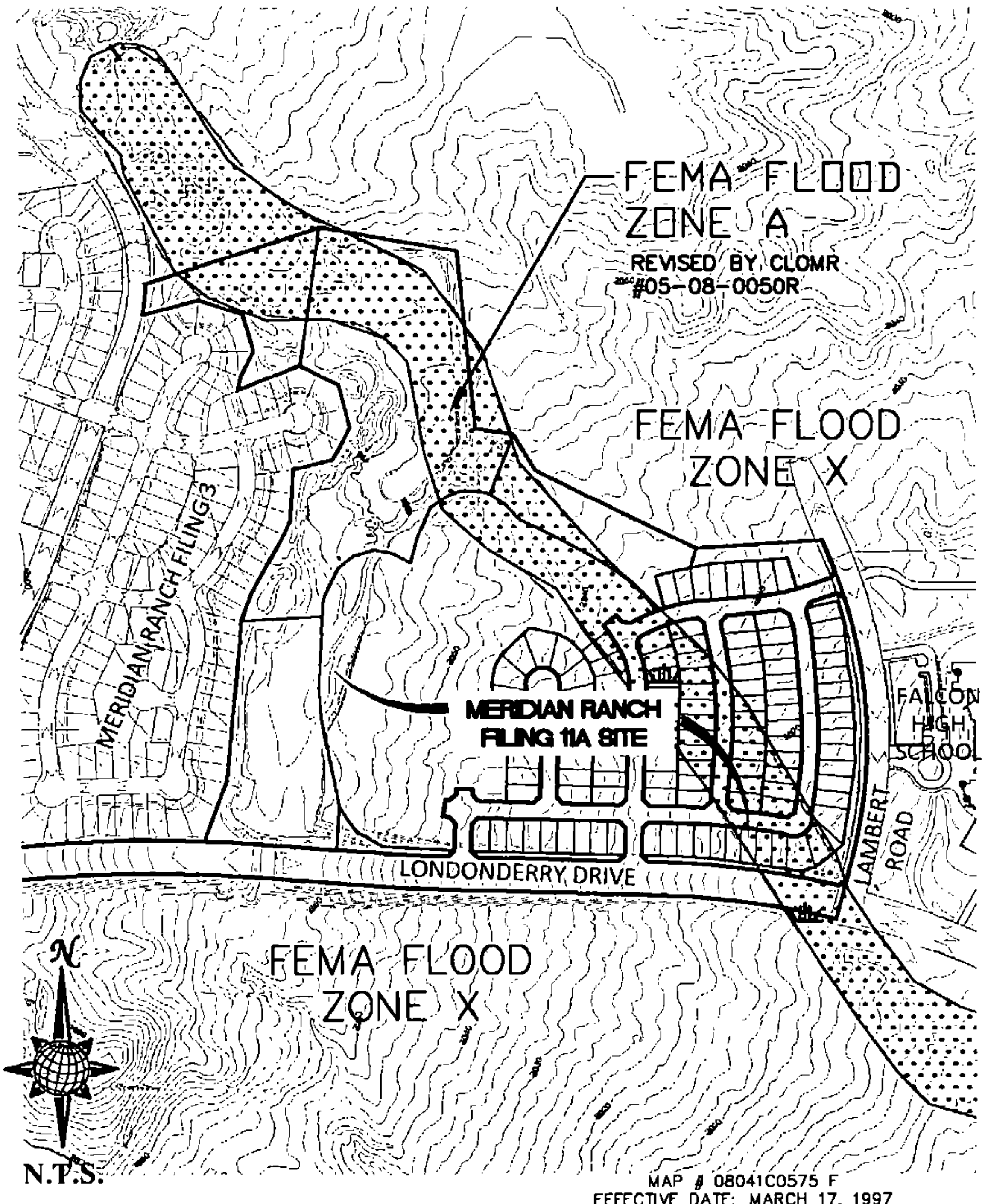
Typically, these soils are well-drained, gravelly sandy loams that form on alluvial terraces and fans and exhibit high permeability and low available water capacity with depth to bedrock greater than 6 feet.

The Columbine (19) gravelly sandy loam is a deep, well-drained to excessively drained soil formed in coarse textured material on alluvial terraces, fans and flood plains. Permeability of this soil is very rapid. Available water capacity is low to moderate, surface runoff is slow, and the hazard of erosion is slight to moderate.

This soil is used mainly for grazing livestock, for wildlife habitat and for home sites. The main limitation of this soil for urban development is a hazard of flooding in some areas.

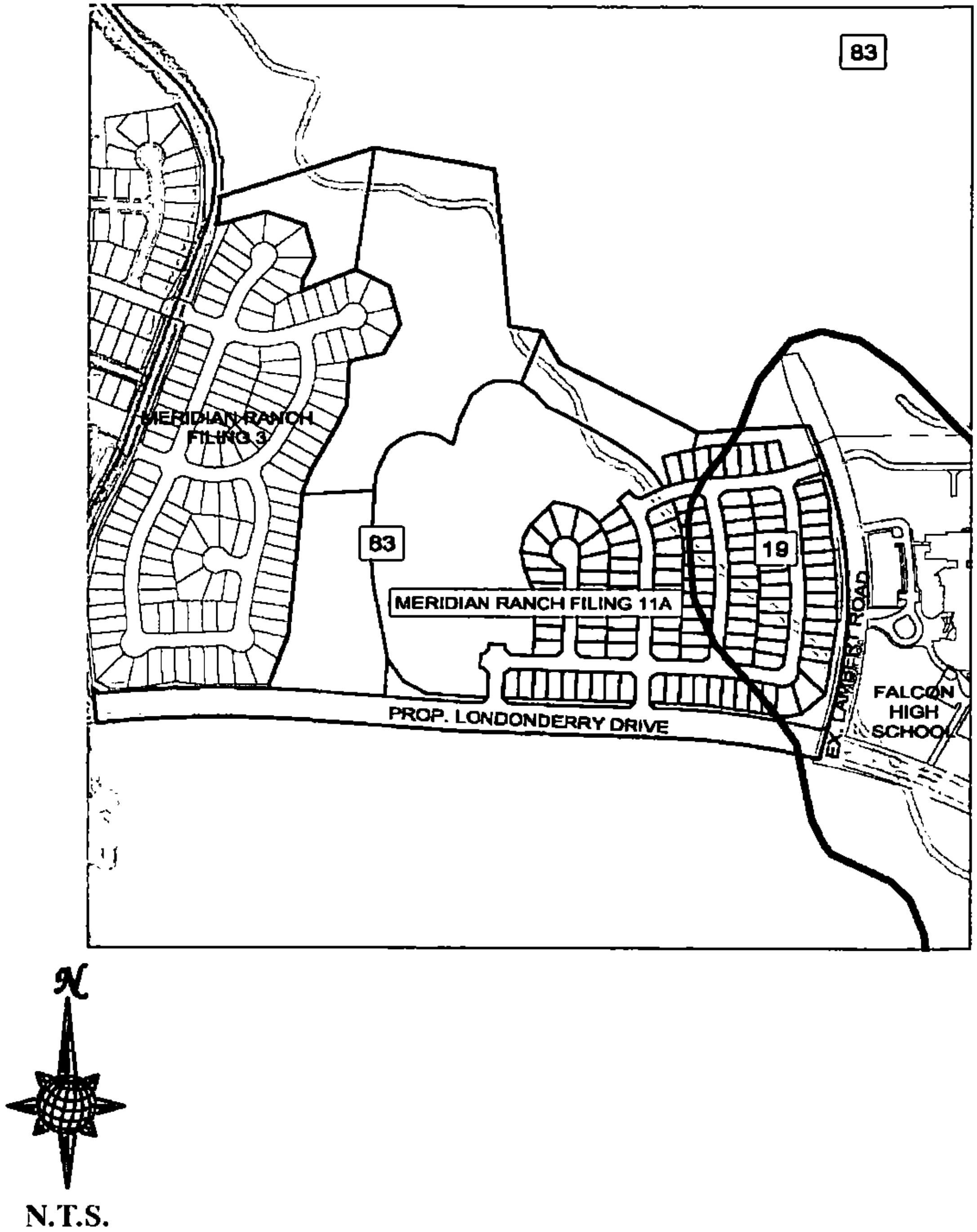
Note: (#) indicates Soil Conservation Survey soil classification number. See Figure 3. Meridian Ranch – Soils Map.

Figure 2: FEMA Floodplain Map



MERIDIAN RANCH FILING 11A FEMA FLOODPLAIN MAP	TECH CONTRACTORS 12311 REX ROAD FALCON, CO 80831 TELEPHONE: 719.495.7444 FAX: 719.495.2457
FIGURE 2	

Figure 3: Soils Map



MERIDIAN RANCH FILING 11A SOILS MAP	TECH CONTRACTORS 12311 REX ROAD FALCON, CO 80831
FIGURE 3	TELEPHONE: 719.495.7444 FAX: 719.495.2457

Climate

Mild summers and winter, light precipitation; high evaporation and moderately high wind velocities characterize the climate of the study area. The average annual monthly temperature is 48.4 F with an average monthly low of 30.3 F in the winter and an average monthly high of 68.1 F in the summer. Two years in ten will have maximum temperature higher than 98 F and a minimum temperature lower than –16 F. Precipitation averages 15.73"es annually, with 80% of this occurring during the months of April through September. The average annual Class A pan evaporation is 45"es. (Soil Survey of El Paso County Area, Colorado).

Natural Hazards Analysis

Natural hazards analysis indicates that no unusual surface or subsurface hazards are located near the vicinity. However, because the soils are cohesionless, sloughing of steep banks during drilling and/or excavation could occur. By citing improvements in a manner that provides and opportunity to lay the banks of excavations back at a 1:1 slope during construction, the problems associated with sloughing soils can be minimized.

DRAINAGE BASINS AND SUB-BASINS

Gieck Basin

The project site is located within the Gieck Ranch Drainage Basin and accepts flow from off-site areas to the north within Meridian Ranch.

Three different scenarios were analyzed for the drainage condition for the Meridian Ranch Filing 11A development. The first scenario analyzes the historic conditions, this condition has all of the area tributary to the project site in the pre-development state.

The second scenario, the developed conditions scenario, has existing conditions surrounding the site with the addition of project site in its developed condition. This condition was analyzed to ensure that developed drainage condition at Eastonville Road is similar to the historic condition after completion of the project.

The final scenario, the future conditions scenario, has the entire Meridian Ranch developed. This condition was analyzed to ensure that proposed detention pond is properly designed for the future developed drainage conditions within Meridian Ranch as dictated by the Board of County Commissioners.

DRAINAGE DESIGN CRITERIA

SCS Hydrograph Procedure

The Soil Conservation Service (SCS) Hydrograph (HEC-HMS) procedure was used to determine design parameters for the major drainage facilities within the project. Onsite basin areas were calculated using aerial topography of the site and approved final design data. Times of concentration were estimated using the SCS procedures described in the DCM. Based upon the hydrologic soil type, the natural conditions found in the basins and the runoff curve numbers (CN) chart from Table 5-4 and Table 5-5 of the DCM for Antecedent Moisture Condition II (AMC II), the following CN values were used for the given conditions.

Table 1: SCS Runoff Curve Numbers

Condition	CN
Residential Lots (2.5 acre)	66
Residential Lots (1 acre)	68
Residential Lots (1/2 acre)	70
Residential Lots (1/3 acre)	72
Residential Lots (1/4 acre)	75
Residential Lots (1/5 acre)	78
Residential Lots (1/6 acre)	80
School	80
Parks/Open Space	62
Light Industrial	92
Commercial	90
Roadways	98
Golf Course	62
Undeveloped	61
Graded	67

*Curve Numbers were interpolated and based on amount of impervious area per lot.
The 100-year, 24 hour storm precipitation selected from the NOAA is isopluvial map in Figure 5-4e from the DCM was 4.4". The 5-year, 24 hour storm precipitation selected from the rainfall depth-duration relationship chart in Figure 5-6 from the DCM was 2.6". These numbers along with SCS information were used as input to the U.S. Army Corp of Engineers HEC-HMS computer model to determine design runoffs.

Rational Method Hydrologic Criteria

The Rational Method was used to estimate stormwater runoff at Design Points with total tributary areas of less than 100 total acres, specifically those located within the developed area of Meridian Ranch Filing 11A. The Rational method is used to analyze the storm drainage system design within the project. The Rational Method Coefficients, "C-values", were selected from the rainfall depth-duration relationship chart in Figure 5-6 from the DCM requirements and the intensities for each basin are calculated from Figure 5-1 of the DCM based upon the basin time of concentration.

Pond D Detention Storage Criteria

Detention Pond D, constructed with Meridian Ranch Filing 3 is impacted by the improvements associated with Meridian Ranch Filing 11A. The permanent outfall control structure and drain pipe will be constructed with this most recent filing in Meridian Ranch.

As a part of the analysis, the pond was modeled using the as-built contours and recalculation of the WQCV stand pipe. The Pond D Stage Storage Table and WQCV calculation can be found in Appendix E - Detention Pond Information.

Two models were calculated for Pond D, the interim and future final, to determine the storage volume and maximum storage elevation with the pond for the 5-year storm event and the 100-year event. The current future maximum storage volume is determined to be 21.1 ac-ft at an elevation of 7056.4 ft. This elevation leaves sufficient freeboard below the emergency overflow spillway; the maximum volume of Pond D to the spillway is 32.0 ac-ft providing 50 percent additional capacity at final build out. Another model was created using current condition plus the Filing 11A downstream of Pond D. This model was used to help design the second pond constructed with this filing. This interim model used the as-build topographic survey information for Pond D and the upstream area tributary to the pond was modeled under its current existing state. This model yielded a maximum storage volume of 16.3 ac-ft with a maximum surface elevation of 7055.7 feet, leaving ample space for future upstream development.

A WQCV analysis was also performed on account of the changed conditions shown by the as-built survey of the pond after its construction. The analysis showed that a different water quality stand pipe could be installed with the construction of the permanent concrete outfall structure. These calculations can be found in the appendix and have been incorporated into the construction plans.

The storm drain outfall system including the permanent concrete outfall structure and the storm drain pipe from Pond D to Lambert Drive will be constructed ahead of the improvements for Meridian Ranch Filing 11A. This construction is necessary to complete the system associated with a CLOMR on file with FEMA so that the process can move forward to complete LOMR and remove the floodplain from the maps in this area. The design and construction of the Pond D outfall system is based on the calculations and analysis found in this report.

Table 2: Pond D Summary Data

POND D						
	PEAK INFLOW	PEAK OUTFLOW	TOTAL INFLOW	TOTAL OUTFLOW	PEAK STORAGE	PEAK ELEVATION
	CFS	CFS	AC-FT	AC-FT	AC-FT	FT
INTERIM CONDITIONS - FILING 11A						
100-YEAR STORM	361	64	34.5	29.6	16.3	7055.7
5-YEAR STORM	95	8	11.2	8.0	6.0	7053.5
FUTURE CONDITIONS						
100-YEAR STORM	495	105	45.7	40.3	21.1	7056.4
5-YEAR STORM	153	15.0	16.3	12.8	8.4	7054.1

Pond E Detention Storage Criteria

Detention Pond E is located south of Londonderry and west of Eastonville, southeast of the project site and will be owned and maintained by the Meridian Service Metropolitan District

(MSMD). A maintenance agreement between the Meridian Service Metropolitan District and El Paso County will be executed and recorded as a part of the Meridian Ranch Filing 11A Final Plat process.

The SCS calculation method was used to determine inflow and outflow from the detention pond to ensure that the additional runoff does not overcharge the pond and the discharges do not adversely impact drainage patterns downstream of Eastonville Road. Storm drainage runoff will enter the pond from the project site via an existing pipe network and overland through existing drainage swales. The ultimate future build-out design of the pond was analyzed to insure that additional grading and sizing of the pond would be unnecessary after development of Meridian Ranch Filing 11A other areas tributary to the detention pond. This SCS calculation can be found in the appendix.

The pond is designed to accommodate the final inflow from Meridian Ranch Filing 11A as well as the ultimate build out of all the tributary areas. Concrete control structures have been preliminarily designed to reduce the developed flows to at or below the historic peak flow rates and will be installed at a later date. Temporary CMP control structures that were installed with the grading operation will continue to be used in the interim to reduce the flow rates that will cross Eastonville Road at Design Points H08 and H09. The control structures will be analyzed with each development that is tributary to the pond.

The temporary control structure at DP H08 consists of a 12" CMP water quality control riser with a trash grate having a top elevation of 6968.00. The water quality control riser will be connected to a 54" CMP control riser with a 12" CMP pipe at 1%. The temporary control structure will consist of a 54" CMP with a top elevation of 6970.95 in order to accept storm flows from larger events. The pipe is to be equipped with a welded trash rack. The riser also has a 1.5'x 8' slot opening (elev. = 6969.45) is proposed along the front of the control structure to pass lower flows.

Table 3: Pond E Summary Data

POND E						
	PEAK INFLOW	PEAK OUTFLOW	TOTAL INFLOW	TOTAL OUTFLOW	PEAK STORAGE	PEAK ELEVATION
	CFS	CFS	AC-FT	AC-FT	AC-FT	FT
INTERIM CONDITIONS - FILING 11A						
Design Point H08						
100-YEAR STORM	333	74	70.9	65.2	17.6	6971.2
5-YEAR STORM	66	12	20.6	18.4	6.2	6969.7
Design Point H09						
100-YEAR STORM	333	67	70.9	65.2	17.6	6971.2
5-YEAR STORM	66	6.3	20.6	18.4	6.2	6969.7
FUTURE CONDITIONS						
Design Point H08						
100-YEAR STORM	707	155	107.3	91.9	33.5	6972.6
5-YEAR STORM	233	15.8	38.2	27.4	17.5	6971.2
Design Point H09						
100-YEAR STORM	707	62	107.3	91.9	33.5	6972.6
5-YEAR STORM	233	8.7	38.2	27.4	17.5	6971.2

The temporary control structure at DP H09 consists of a 12" CMP water quality control riser with a trash grate having a top elevation of 6968.00. The water quality control riser will be connected to a 54" CMP control riser with a 12" CMP pipe at 1%. The temporary control structure will consist of a 54" CMP with a top elevation of 6970.95 in order to accept storm flows from larger events. The pipe is to be equipped with a welded trash rack. The riser also has a 1.2'x 5' slot opening (elev. = 6969.75) is proposed along the front of the control structure to pass lower flows.

An analysis of the SCS calculations show that with the control structures in place for the developed flows, the flow rates are reduced sufficiently to reduce the peak rates below the target of 80-percent of historic at Eastonville Road during the post grading condition.

Table 4: Eastonville Road at DP H08 and H09

EASTONVILLE FLOW RATES					
EVENT	HISTORIC PEAK FLOW (CFS)	FILING 11A PEAK FLOW (CFS)	PERCENT OF HISTORIC	FUTURE PEAK FLOW (CFS)	PERCENT OF HISTORIC
H08					
100-YEAR	232	74	32%	155	67%
5-YEAR	22	12	55%	15.8	72%
H09					
100-YEAR	87	67	77%	62	71%
5-YEAR	11	6.3	57%	8.7	79%

A water quality capture volume (WQCV) was added to the required storage volume for the final build out condition. The purpose of the WQCV is to allow particulates to settle out and accumulate over time to improve water quality and to maintain full volume for detention during the life of the facility for a major storm event. 332 acres are tributary to the detention pond during the developed condition resulting in a required WQCV of 1.6 ac-ft.

The WQCV of 1.6 ac-ft. was added to the detention of the minor storm and half (0.8 ac-ft.) was added to the detention volume of the major storm. This was accomplished with respect to the HEC-HMS computer run by providing a starting detention volume of 1.6 ft. for the 5-year storm and 0.8 ft. for the 100-year storm. The resulting storage elevations remain well below the emergency spillway elevation. See Appendix B for more information.

The WQCV was calculated by using the equations found in Volume 2, of the Drainage Criteria Manual (DCM). The release rate from the WQCV is generally very small, which helps minimize downstream impacts. Detaining the WQCV also serves to cleanse the "first flush" of runoff from the higher initial concentration of sediment and pollutants by allowing for settlement to occur. This greatly improves the quality of runoff, leaving the facility and reduces the potential for erosion. The positive impact on water quality is expected to be significant, particularly during the construction phase of the development.

DRAINAGE FACILITY DESIGN

General Concept

The developed portions of the project site are located within the Gieck Drainage Basin. Storm water runoff will be conveyed across the site existing and proposed swales. The proposed project is within the Gieck Basin which has been studied as part of the Gieck Ranch Drainage Basin Study and is currently waiting for final approval from the El Paso County. The condition set by the Board of County Commissioners is more stringent than those anticipated in the DBPS. However, the project developer has agreed to be in substantial conformance with the appropriate "to-be approved" DBPS or the Board of County Commissioners condition, whichever is more stringent.

The facilities have been adequately sized such that the interim developed flows and final flows for the 100-year storm event from Filing 11A will be detained and released at or below the historic flow rate for the 100-year storm event. The Meridian Ranch MDDP has established that the discharge rates across Eastonville Road will be at or below 80% of the historic flow for the 100-year storm event upon full development of entire project.

Figure 4: Meridian Ranch SCS Calculations – Historic Conditions Map shows the drainage patterns of the site prior to development. Figure 5: Meridian Ranch Filing 11A SCS Calculations – Developed Conditions outlines the existing and build-out general drainage patterns for Filing No. 11. Figure 6: Meridian Ranch Filing 11A SCS Calculations – Future Conditions shows Meridian Ranch at full build-out and indicates the anticipated general drainage patterns for the areas tributary to Pond E.

The purpose of this report is to show that the development of Meridian Ranch Filing 11A will not adversely impact the existing drainage facilities adjacent and downstream of the development. Further evaluation will be necessary at each stage of future development within the Meridian Ranch and the anticipated build-out is reached.

SCS Calculation Method

Gieck Ranch Drainage Basin

The Meridian Ranch Filing 11A site is within the Gieck Drainage Basin. The project will affect the existing drainage characteristics of the basin and is be mitigated by a detention facility that is located southeasterly of the intersection of Eastonville.

Of the key design points identified along Eastonville Road, as described in the Meridian Ranch MDDP, H08 and H09 are affected by Meridian Ranch Filing 11A. Historically, the 100-yr storm flow at H08 is 232 cfs and at H09 is 87 cfs; the interim flow at H08 after being detained at Pond E for the 100-yr storm flow is 74 cfs at H08 and 69 cfs at H09.

The construction of Pond E will result in a net decrease of peak flow rates at Eastonville Road (DP-H08) from 232 cfs to 74 cfs, a 68 percent decrease for the 100-yr storm for the interim conditions. The peak flow rate at DP-09 at Eastonville Road after the construction of Pond E will decrease from 87 cfs to 67 cfs a 23 percent decrease. Based on these net decreases in flow rates it is concluded that the grading of Meridian Ranch Filing 11A will have no adverse impact to the downstream facilities of the Gieck Ranch Drainage Basin in the interim.

As development continues to the upstream tributary areas in Meridian Ranch to Pond E, the model will be re-analyzed at the final plat process for each subdivision and the increased flow will be mitigated by the proposed detention pond. The current estimated detained outflow at H08 will be 155 cfs for the 100-year storm event and 62 cfs at H09. These calculations can be found in the appendix.

Historic Condition - SCS Calculation Method

Following is a tabulation of the surface drainage characteristics under Existing Conditions using the SCS calculation method. Please refer to Figure 4 - Meridian Ranch SCS Calculations - Historic Basin Map.

Table 5: Historic Drainage Basins – SCS

HISTORIC					
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q_{100} (CFS)	TOTAL VOLUME Q_{100} (AC. FT.)	DISCHARGE PEAK Q_5 (CFS)	TOTAL VOLUME Q_5 (AC. FT.)
HG07	0.0984	41	5.3	5	1.2
HG07-G11	0.0984	41	5.3	5	1.2
HG08	0.1328	77	7.2	10	1.6
G11	0.2312	104	12.5	12	2.8
G11-G12	0.2312	104	12.4	11	2.7
HG09	0.1781	82	9.7	10	2.1
G12	0.4093	185	22.1	20	4.9
G12-H08	0.4093	183	21.8	20	4.8
HG10	0.1375	49	7.4	6	1.6
H08	0.5468	232	29.2	22	6.4
HG11	0.2047	87	11.1	11	2.4
H09	0.2047	87	11.1	11	2.4
HG15	0.2563	80	13.9	11	3.0
H13	0.2563	80	13.9	11	3.0

Developed Condition - SCS Calculation Method

Following is a tabulation of the surface drainage characteristics for the post developed conditions of Filing 11A using the SCS calculation method. Please refer to Figure 5 - Meridian Ranch SCS Calculations – Developed Basins Map

Table 6: Developed Condition Basins-SCS

FILING 11A					
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q_{100} (CFS)	TOTAL VOLUME Q_{100} (AC. FT.)	DISCHARGE PEAK Q_5 (CFS)	TOTAL VOLUME Q_5 (AC. FT.)
HG08	0.1375	107	10.5	24	3.1
FG08-POND D	0.1375	107	10.5	24	3.1
FG13	0.1188	80	8.5	16	2.4
FG11	0.0608	85	7.2	30	2.8
FG09	0.0500	51	4.1	13	1.3
G05	0.1108	134	11.4	42	4.1
G05-POND D	0.1108	134	11.4	42	4.1
FG12	0.0328	55	4.1	21	1.7
POND D	**0.3999**	**64**	**29.6**	**8**	**8.0**
POND D-G17	0.3999	64	29.6	8	8.0
HG15	0.1344	58	7.5	8	1.7
FG15a	0.0156	20	1.4	6	0.4
G17	0.5499	91	38.4	11	10.1
G17-G18	0.5499	91	38.4	11	10.1
FG16	0.0773	97	8.0	31	2.9
G18	0.6272	161	46.4	41	13.0
G18-POND E	0.6272	161	46.4	41	13.0
FG31	0.0922	123	11.6	45	4.7
HG30	0.0766	49	4.2	6	0.9
HG30-POND HS	0.0766	48	4.1	6	0.9
POND HS	**0.1688**	**126**	**15.8**	**27**	**5.6**
HG18	0.1484	67	8.7	10	2.1
POND E	**0.9444**	**141**	**65.2**	**18**	**18.4**
FG33	0.0109	13	1.0	4	0.3
H08	0.9553	**74**	66.2	**12**	18.7
H09		**67**		**6.3**	
*** FROM OUTLET STAGE-STORAGE CALCULATION**					

A comparison of the peak flow rates at Eastonville Road for the design storms may be found in Table 5 – Eastonville Road at DP G6 (above). As a result of the grading of the Meridian Ranch Filing 11A area, the calculations do show that the project does not adversely affect the existing drainage facilities.

Future Condition - SCS Calculation Method

Following is a tabulation of the surface drainage characteristics for the future developed conditions using the SCS calculation method. Please refer to Figure 6 - Meridian Ranch SCS Calculations – Future Basins Map

Table 7: Future Drainage Basins-SCS

FUTURE					
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q_{100} (CFS)	TOTAL VOLUME Q_{100} (AC. FT.)	DISCHARGE PEAK Q_5 (CFS)	TOTAL VOLUME Q_5 (AC. FT.)
FG08	0.1453	170	15.8	55	5.8
FG11	0.0608	85	7.2	30	2.8
FG09	0.0416	53	4.0	16	1.4
G05	0.2477	302	27.1	99	10.0
G05-POND D	0.2477	301	27.0	98	10.0
FG10	0.0953	94	9.2	27	3.2
FG13	0.075	53	5.2	10	1.4
FG12	0.0328	55	4.1	21	1.7
POND D	**0.4508**	**105**	**40.3**	**15**	**12.8**
POND D-G17	0.4508	105	40.3	15	12.8
FG15	0.1188	132	11.2	38	3.7
FG14	0.0313	47	3.6	17	1.4
FG14-G17	0.0313	47	3.6	16	1.4
G17a	0.1501	179	14.7	54	5.1
FG15a	0.0156	27	1.8	10	0.7
G17	0.6165	212	56.8	63	18.6
G17-G18	0.6165	212	56.7	63	18.6
FG16	0.0773	109	8.8	37	3.4
G18	0.6938	319	65.6	99	21.9
G18-POND E	0.6938	317	65.6	99	21.9
FG18	0.1641	198	16.9	62	6.0
FG18-POND E	0.1641	198	16.9	62	6.0
FG19	0.0977	203	13.2	83	5.6
FG31	0.0922	123	11.6	45	4.7
POND HS	0.0922	79	11.6	25	4.7
POND E	**1.0478**	**217**	**92.1**	**24**	**27.7**
FG33	0.0109	15	1.0	4	0.3
H08	1.0587	**155**	93.1	**15.8**	28
H09		**62**		**8.7**	
* FROM OUTLET STAGE-STORAGE CALCULATION					

A comparison of the peak flow rates at Eastonville Road for the design storms may be found in Table 5 – Eastonville Road at DP H08 and H09 (below). As a result of the development of Meridian Ranch Filing 11A and future development, the calculations do show that the project does not adversely affect the existing drainage facilities.

Proposed On-site Surface Drainage-Rational Calculation Method

Following is a discussion and tabulation of the on-site surface drainage characteristics for the developed conditions using the rational calculation method. Figure 7 - Meridian Ranch Rational Calculations – Basin Map found in the back pockets of this report, illustrates the sub-basin boundaries used for the hydrologic analysis for each of the basins located within the developed areas. Note that the SCS basin designations do not correspond to those used for developed conditions rational method analysis.

- Basin 1 (4.5 acres, Q_5= 6.9 cfs, Q_{100} = 15 cfs) contains lots along the south side of Evening Vista Dr. and a portion of Boulder Ridge Dr. The surface runoff will sheet flow off of the residential lots and be conveyed to a proposed 20' Type R flow-by inlet located at DP 101. The flow captured by this inlet (Q_5= 5.0 cfs, Q_{100} = 9.6 cfs) is conveyed via an 18" RCP to Junction J03. The remaining surface runoff (Q_5= 1.9 cfs, Q_{100} = 5.6 cfs) continues along the curb and gutter toward DP 108.

- Basin 2 (2.0 acres, Q_5= 3.5 cfs, Q_{100} = 7.8 cfs) contains lots along the north side of Evening Vista Dr. The surface runoff will sheet flow off of the residential lots and be conveyed to a proposed 15' Type R flow-by inlet located at DP 102. The captured by this inlet (Q_5= 2.5 cfs, Q_{100} = 4.9 cfs) is conveyed via an 18" RCP to Junction J03. The remaining surface runoff (Q_5= 1.0 cfs, Q_{100} = 2.9 cfs) continues along the curb and gutter toward DP 103. The total flow (Q_5= 7.1 cfs, Q_{100} = 14 cfs) with flow from is conveyed to Junction J04 via an 18" RCP.

- The pipe flow from Pond D (Q_5= 12 cfs, Q_{100} = 100 cfs) was calculated using the SCS method and then a T_c was estimated based on the flow rate calculated and upstream density tributary to Pond D. An existing 48" RCP conveys the flow to J01 where the pipe is downsized to a 42" RCP, this existing section of pipe exceeds the allowable velocity. The 42" continues to carry the flow to J02 and J05 where it is combined with pipe flow from J04. The total combined flow (Q_5= 13 cfs, Q_{100} = 102 cfs) at DP05 is conveyed passed J06 to Junction J07 via a 42" RCP, this section of pipe exceeds the allowable velocity and will require Class IV RCP.

- Basin 3 (2.8 acres, Q_5= 4.5 cfs, Q_{100} = 9.8 cfs) contains lots along the north side of Park Gate Dr. The residential runoff will sheet flow on to the curb and gutter of the streets and will travel to Inlet I03.

- Inlet I03 is a 15' Type R forced sump inlet that receives the total flow of 5.2 cfs for the 5-year storm and 12 cfs for the 100-year. The flow captured by the inlet is conveyed to J07, where it will combine with the flow from J06. The total combined flow (Q_5= 14 cfs, Q_{100} = 104 cfs) at J07 is conveyed to Existing Junction EJ07 via an 54" RCP.

- The pipe flow from areas upstream of Existing EJ07 (Q_5= 54 cfs, Q_{100} = 179 cfs) was calculated using the SCS method and then a T_c was estimated based on the flow rate calculated and upstream density tributary to Existing EJ07. An existing 60" RCP conveys the flow to Existing EJ08. The total combined flow at DP08 is 54 cfs for the 5-year storm and 207 cfs for the 100-year.

- Basin 4 (1.1 acres, Q_5= 2.1 cfs, Q_{100} = 5.2 cfs) contains the rear of lots along the west side of Lambert Road and the west half of Lambert Road. The runoff will sheet flow on to the curb and gutter of the street and will travel to Existing Inlet EI05.

- Existing Inlet EI05 is an existing 10' Type R flow-by inlet that receives the total flow of 2.1 cfs for the 5-year storm and 5.2 cfs for the 100-year storm and captures most of it. The flow captured by the inlet is conveyed to Existing EJ08, where it will combine with the flow from Existing EJ07. The total combined flow (Q_5= 55 cfs, Q_{100} = 207 cfs) at Existing EJ08 is conveyed to Existing Junction EJ09 via an 60" RCP. The remaining flow <u>not</u> captured by the EI05 inlet (Q_5 = 0.6 cfs , Q_{100} = 2.0 cfs) continues southerly toward Existing Inlet EI07.

- Basin 6 (6.5 acres, Q_5= 8.2 cfs, Q_{100} = 19 cfs) contains lots along the west side of Park Meadows Dr. The runoff will sheet flow on to the curb and gutter of the street and will travel to Inlet I04.

- Inlet I04 is a 20' Type R forced sump inlet that receives the total flow of 8.2 cfs for the 5-year storm and 19 cfs for the 100-year storm and captures most of it. The remaining flow <u>not</u> captured by the I04 inlet (Q_{100} = 0.5 cfs) crosses the centerline to Inlet I05. The flow captured by the inlet is conveyed to J08, where it will combine with the flow from I05.

- Basin 7 (5.0 acres, Q_5= 7.5 cfs, Q_{100} = 17 cfs) contains lots along the east side of Park Meadows Dr. and the west side of Boulder Ridge Dr. The runoff will sheet flow on to the curb and gutter of the street and will travel to Inlet I05.

- Inlet I05 is a 20' Type R forced sump inlet that receives the total flow of 7.5 cfs for the 5-year storm and 18 cfs for the 100-year storm and captures all of it. The flow captured by the inlet is conveyed to J08, where it will combine with the flow from I06. The total combined flow (Q_5= 16 cfs, Q_{100} = 37 cfs) at J08 is conveyed to Junction J09 via a 24" RCP.

- Basin 8 (5.0 acres, Q_5= 7.5 cfs, Q_{100} = 16 cfs) contains lots along the east side of Boulder Ridge Dr. and the west side of Prairie Ridge Ct. The runoff will sheet flow on to the curb and gutter of the street and will travel to Inlet I06.

- Inlet I06 is a 15' Type R forced sump inlet that receives the total flow of 7.5 cfs for the 5-year storm and 16 cfs for the 100-year storm and captures most of it. The remaining flow <u>not</u> captured by the I05 inlet (Q_{100} = 1.5 cfs) continues easterly toward Inlet I08. The flow captured by the inlet is conveyed to J09, where it will combine with the flow from I04 and I05. The total combined flow (Q_5= 23 cfs, Q_{100} = 50 cfs) at J09 is conveyed to Junction J10 via a 24" RCP.

- Basin 9 (4.6 acres, Q_5= 7.2 cfs, Q_{100} = 16 cfs) contains lots along the west side of Prairie Ridge Ct. and the west side of Evening Vista Dr. The runoff will sheet flow on to the curb and gutter of the street and will travel to Inlet I08.

- Inlet I08 is a 20' Type R forced sump inlet that receives the total flow of 8.0 cfs for the 5-year storm and 20 cfs for the 100-year storm and captures most of it. The remaining flow not captured by the I08 inlet (Q_{100} = 1.4 cfs) continues easterly toward Inlet I09. The flow captured by the inlet is conveyed to J10, where it will combine with the flow from J09.

- Basin 10 (2.1 acres, Q_5= 4.1 cfs, Q_{100} = 9.0 cfs) contains lots along the south side of Park Meadows Dr. The runoff will sheet flow on to the curb and gutter of the street and will travel to Inlet I07.

- Inlet I07 is a 10' Type R forced sump inlet that receives the total flow of 4.1 cfs for the 5-year storm and 9.0 cfs for the 100-year storm and captures all of it. The flow captured by the inlet is conveyed to J10. The total combined flow (Q_5= 33 cfs, Q_{100} = 75 cfs) at J10 is conveyed to Junction J11 via a 36" RCP.

- Basin 11 (5.1 acres, Q_5= 7.4 cfs, Q_{100} = 16 cfs) contains lots along the west side of Evening Vista Dr. and the west side of Hidden Park Wy. The runoff will sheet flow on to the curb and gutter of the street and will travel to Inlet I09.

- Inlet I09 is a 15' Type R forced sump inlet that receives the total flow of 7.4 cfs for the 5-year storm and 16 cfs for the 100-year storm and captures most of it. The remaining flow not captured by the I09 inlet (Q_{100} = 1.4 cfs) continues easterly toward Inlet I10. The flow captured by the inlet is conveyed to J12 and J14, where it will combine with the flow from J13. The total combined flow (Q_5= 52 cfs, Q_{100} = 111 cfs) at J14 is conveyed to Junction J15 via a 42" RCP, this section of pipe exceeds the allowable velocity and will require Class IV RCP.

- Basin 12 (5.5 acres, Q_5= 8.5 cfs, Q_{100} = 19 cfs) contains lots along the west side of Hidden Park Wy. and the west side of Park Meadows Dr. The runoff will sheet flow on to the curb and gutter of the street and will travel to Inlet I10.

- Inlet I10 is a 10' Type R sump inlet that receives the total flow of 8.5 cfs for the 5-year storm and 19 cfs for the 100-year storm and captures most of it. The remaining flow not captured by the I10 inlet (Q_{100} = 0.9 cfs) crosses easterly across the centerline toward Inlet I11. The flow captured by the inlet is conveyed to Junction J13, where it will combine with the flow from I11.

- Basin 13 (3.8 acres, Q_5= 6.4 cfs, Q_{100} = 14 cfs) contains lots along the south and east sides of Park Meadows Dr. The runoff will sheet flow on to the curb and gutter of the street and will travel to Inlet I11.

- Inlet I11 is a 10' Type R sump inlet that receives the peak flow of 6.4 cfs for the 5-year storm and 14 cfs for the 100-year storm at a TC of 15.6 min. and captures all of it. The peak flow-by from inlet I10 arrives later providing flow rates of 11 cfs for the 100-year storm and 4.7 cfs for the 5-year. The flow captured by the inlet is conveyed to J13 and J14. The total combined flow (Q_5= 52 cfs, Q_{100} = 111 cfs) at J14 is conveyed to Junction J15 via a 42" RCP. The flow is conveyed to Existing EJ09 via a 48" RCP. At Existing EJ09 the pipe flow from J15 and Existing EJ08 are combined (Q_5= 95 cfs, Q_{100} = 303 cfs) and sent southerly toward Existing EJ10.

- Basin 5 (1.6 acres, Q_5= 3.5 cfs, Q_{100} = 7.9 cfs) contains the rear of lots along the west side of Lambert Road. The runoff will sheet flow on to the curb and gutter of the street and will travel to Existing Inlet EI07.

- Existing Inlet EI07 is an existing 10' Type R sump inlet that receives the total flow of 3.5 cfs for the 5-year storm and 9.1 cfs for the 100-year storm and captures all of it. The flow captured by the inlet is conveyed to Existing EJ10, where it will combine with the flow from Existing EJ09 and Existing EI08.

- Basin 20 (1.7 acres, Q_5= 3.9 cfs, Q_{100} = 8.4 cfs) contains area along the east side of Lambert Road. The runoff will sheet flow on to the curb and gutter of the street and will travel to Existing Inlet EI08.

- Existing Inlet EI08 is an existing 10' Type R flow-by inlet that receives the total flow of 3.9 cfs for the 5-year storm and 8.4 cfs for the 100-year storm and captures most of it. The remaining flow <u>not</u> captured by the inlet (Q_5 = 0.9 cfs, Q_{100} = 2.7 cfs) continues easterly through on Londonderry Drive toward Eastonville Road. The flow captured by the inlet is conveyed to Existing EJ10, where it will combine with the flow from Existing EI07 and Existing EJ09. The total combined flow (Q_5= 96 cfs, Q_{100} = 307 cfs) at Existing EJ10 is conveyed to Existing Junction EJ11 via a 66" RCP.

- Basin 14 (2.4 acres, Q_5= 4.7 cfs, Q_{100} = 11 cfs) contains area along the east side of Rainbow Bridge Drive and the north side of Londonderry Drive. The runoff will sheet flow on to the curb and gutter of the street and will travel to Existing Inlet EI01.

- Existing Inlet EI01 is an existing 15' Type R flow-by inlet that receives the total flow of 4.7 cfs for the 5-year storm and 11 cfs for the 100-year storm and captures most of it. The remaining flow <u>not</u> captured by the inlet (Q_5 = 1.1 cfs, Q_{100} = 3.6 cfs) continues easterly toward Existing Inlet EI03. The flow captured by the inlet is conveyed to Existing EJ01, where it will combine with the flow from EI02, this existing section of pipe exceeds the allowable velocity.

- Basin 15 (1.9 acres, Q_5= 4.0 cfs, Q_{100} = 9.4 cfs) contains area along the south side of Londonderry Drive. The runoff will sheet flow on to the curb and gutter of the street and will travel to Existing Inlet EI02.

- Existing Inlet EI02 is an existing 10' Type R flow-by inlet that receives the total flow of 4.0 cfs for the 5-year storm and 9.4 cfs for the 100-year storm and captures most of it. The remaining flow not captured by the inlet (Q_5 = 1.3 cfs, Q_{100} = 4.3 cfs) continues easterly through Basin 19 toward the intersection of Londonderry Drive and Lambert Road where it will travel overland southeasterly toward Pond E. Ultimately the by-pass flow will be intercepted by a future inlet located on a future street south of Londonderry Drive within a future single family residential development. The flow captured by the inlet is conveyed to Existing EJ01, where it will combine with the flow from Existing EI01. The total combined flow (Q_5= 6.0 cfs, Q_{100} = 12 cfs) at Existing EJ01 is conveyed to Existing Junction EJ02 and Existing EJ03 via a 24" RCP.

- Basin 16 (1.5 acres, Q_5= 2.9 cfs, Q_{100} = 7.2 cfs) contains area along the north side of Londonderry Drive. The runoff will sheet flow on to the curb and gutter of the street and will travel to Existing Inlet EI03.

- Existing Inlet EI03 is an existing 20' Type R flow-by inlet that receives the total flow of 3.2 cfs for the 5-year storm and 8.9 cfs for the 100-year storm and captures most of it. The remaining flow not captured by the inlet (Q_5 = 0.7 cfs, Q_{100} = 3.1 cfs) continues easterly toward Existing Inlet EI04. The flow captured by the inlet is conveyed to Existing EJ03, where it will combine with the flow from Existing EJ03. The total combined flow (Q_5= 8.0 cfs, Q_{100} = 17 cfs) at Existing EJ03 is conveyed to Existing Junction EJ04 and Existing EJ05 via a 24" RCP, this existing section of pipe exceeds the allowable velocity.

- Basin 17 (1.7 acres, Q_5= 3.2 cfs, Q_{100} = 8.0 cfs) contains area along the north side of Londonderry Drive. The runoff will sheet flow on to the curb and gutter of the street and will travel to Existing Inlet EI04.

- Existing Inlet EI04 is an existing 20' Type R flow-by inlet that receives the total flow of 3.2 cfs for the 5-year storm and 8.5 cfs for the 100-year storm and captures most of it. The remaining flow not captured by the inlet (Q_5 = 0.7 cfs, Q_{100} = 2.9 cfs) continues easterly toward Existing Inlet EI06. The flow captured by the inlet is conveyed to Existing EJ05, where it will combine with the flow from Existing EJ04. The total combined flow (Q_5= 9.9 cfs, Q_{100} = 21 cfs) at Existing EJ05 is conveyed to Existing Junction EJ06 via a 30" RCP.

- Basin 18 (1.7 acres, Q_5= 3.0 cfs, Q_{100} = 7.2 cfs) contains area along the north side of Londonderry Drive. The runoff will sheet flow on to the curb and gutter of the street and will travel to Existing Inlet EI06.

- Existing Inlet EI06 is an existing 15' Type R flow-by inlet that receives the total flow of 3.0 cfs for the 5-year storm and 7.9 cfs for the 100-year storm and captures most of it. The remaining flow not captured by the inlet (Q_5 = 0.5 cfs, Q_{100} = 2.3 cfs) continues easterly toward Existing Inlet EI07. The flow captured by the inlet is conveyed to Existing EJ06, where it will combine with the flow from Existing EJ05.

The total combined flow (Q_5= 12 cfs, Q_{100} = 27 cfs) at Existing EJ05 is conveyed to Existing Junction EJ11 via a 30" RCP. The total combined flow (Q_5= 99 cfs, Q_{100} = 312 cfs) at Existing EJ11 is conveyed to Pond E via a 66" RCP. Portions of this existing section of pipe exceeds the allowable velocity.

- Basin 19 (3.8 acres, Q_5= 7.3 cfs, Q_{100} = 18 cfs) contains area along the south side of Londonderry Drive. The runoff will sheet flow on to the curb and gutter of the street and will travel to Design Point DP02 at the intersection of Londonderry Drive and Lambert Road. Ultimately the by-pass flow will be intercepted by a future inlet located on a future street south of Londonderry Drive within a future single family residential development. The flow at the end of the curb on Lambert will be 7.3 cfs for the 5-year storm and 18 cfs for the 100-year storm. This runoff will sheet flow overland to Pond E in the interim. Ultimately, sheet flow will be conveyed southerly by gutter in Lambert to an inlet.

DRAINAGE FEES

The proposed development falls in the Gieck Drainage Basin. The entire development occupies 105.8 acres of residential development of which 35.8 acres are residential development and 19.2 acres are designated as right-of-way, 30.6 open space and 17.9 acres for the detention pond, the remainder is designated landscape tract.

The following is the imperviousness calculation:

Filing 11A (86.7 acres)

	Acres	Assumed Imperviousness	Impervious Acres
Open Space	30.6	3%	0.92
Right-of-way	15.5	85%	13.18
Residential Lots	20.4	45% (118 Lots)	9.18
Landscape Tract	2.3	10%	0.23
Detention Pond	17.9	3%	0.54
Future Filing 11B	19.1	0%[1]	0.00
Total	105.8		24.05=27.73% imperv

Gieck Drainage Basin Fees: There are no drainage fees for this basin.

[1]See calculation below

Bridge Fees: There are no bridge fees for this basin.

Future Filing 11B (19.1 acres)

	Acres	Assumed Imperviousness	Impervious Acres
Right-of-way	3.7	85%	3.15
Residential Lots	15.4	45% (118 Lots)	6.93
Total	19.1		10.08=52.77% imperv

Gieck Drainage Basin Fees: There are no drainage fees for this basin.

Bridge Fees: There are no bridge fees for this basin.

EROSION CONTROL DESIGN

General Concept

Historically, erosion on this property has been held to a minimum by a variety of natural features and agricultural practices including:

- Substantial prairie grass growth
- Construction of drainage arresting berms
- Construction of multiple stock ponds along drainage courses

Existing detention ponds will also help to minimize erosion by reducing both the volume and velocity of the peak runoff.

During construction, best management practices (BMP) for erosion control will be employed based on El Paso county Criteria. BMP's will be utilized as deemed necessary by the contractor and/or engineer and are not limited to the measures shown on the construction drawing set. The contractor shall minimize the amount of area disturbed during all construction activities. Final erosion control plans will be prepared with final plat submittal.

In general the following shall be applied in developing the sequence of major activities:

- Install down-slope and side-slope perimeter BMP's before the land disturbing activity occurs.
- Do not disturb an area until it is necessary for the construction activity to proceed
- Cover or stabilize as soon as possible.
- Time the construction activities to reduce the impacts from seasonal climatic changes or weather events.
- The construction of filtration BMP's should wait until the end of the construction project when upstream drainage areas have been stabilized.
- Do not remove the temporary perimeter controls until after all upstream areas are stabilized.

Detention Pond

The proposed detention pond, once in place, will act as the primary sedimentation control facility for the areas upstream. Runoff will be diverted into the detention pond where practical. The pond will serve a dual purpose: first, by facilitating the settling of sediment in runoff during and after construction (by means of the WQCV) and, second, by maintaining runoff at or below existing levels.

Silt Fence

Silt fence will be place along downstream limits of disturbed areas. This will prevent suspended sediment from leaving the site during infrastructure construction. Silt fencing is to remain in place until vegetation is reestablished.

Erosion Bales

Erosion bales will be placed ten (10) feet from the inlet of all culverts during construction to prevent culverts from filling with sediment. Erosion bales will remain in place until vegetation is reestablished. Erosion bale checks will be used on slopes greater than 1 percent to reduce flow velocities until vegetation is reestablished.

Miscellaneous

Best erosion control practices will be utilized as deemed necessary by the Contractor or Engineer and are not limited to the measures described above.

REFERENCES

1. "Volume 2, El Paso County/City of Colorado Springs Drainage Criteria Manual- Stormwater Quality Policies, Procedures and Best Management Practices" November 1, 2002.

2. "City of Colorado Springs/El Paso County Drainage Criteria Manual" September, 1987, Revised November 1991, Revised October 1994.

3. Flood Insurance Rate Study for El Paso County, Colorado and Incorporated Areas. Federal Emergency Management Agency, Revised March 17, 1997.

4. Soils Survey of El Paso County area, Natural Resources Conservation Services of Colorado.

5. Master Development Drainage Plan Meridian Ranch. May 2012. Prepared by Tech Contractors.

Appendices

Appendix A - Rational Calculation Tables and Figures

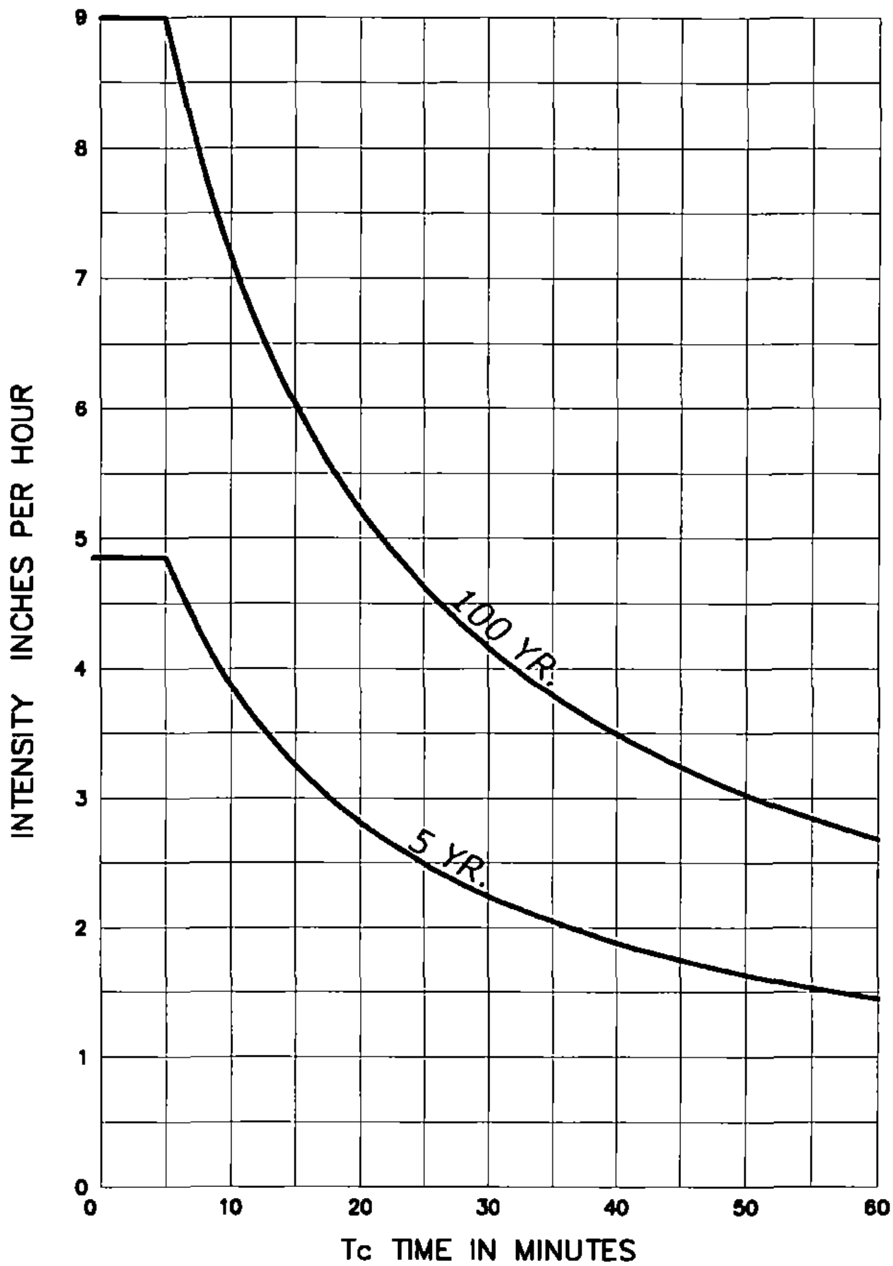
TABLE 5-1

RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	"C" FREQUENCY 10 A&B*	10 C&D*	100 A&B*	100 C&D*
Business					
Commercial Areas	95	0.90	0.90	0.90	0.90
Neighborhood Areas	70	0.75	0.75	0.80	0.80
Residential					
1/8 Acre or less	65	0.60	0.70	0.70	0.80
1/4 Acre	40	0.50	0.60	0.60	0.70
1/3 Acre	30	0.40	0.50	0.55	0.60
1/2 Acre	25	0.35	0.45	0.45	0.55
1 Acre	20	0.30	0.40	0.40	0.50
Industrial					
Light Areas	80	0.70	0.70	0.80	0.80
Heavy Areas	90	0.80	0.80	0.90	0.90
Parks and Cemeteries	7	0.30	0.35	0.55	0.60
Playgrounds	13	0.30	0.35	0.60	0.65
Railroad Yard Areas	40	0.50	0.55	0.60	0.65
Undeveloped Areas					
Historic Flow Analysis- Greenbelts, Agricultural	2	0.15	0.25	0.20	0.30
Pasture/Meadow	0	0.25	0.30	0.35	0.45
Forest	0	0.10	0.15	0.15	0.20
Exposed Rock	100	0.90	0.90	0.95	0.95
Offsite Flow Analysis (when land use not defined)	45	0.55	0.60	0.65	0.70
Streets					
Paved	100	0.90	0.90	0.95	0.95
Gravel	80	0.80	0.80	0.85	0.85
Drive and Walks	100	0.90	0.90	0.95	0.95
Roofs	90	0.90	0.90	0.95	0.95
Lawns	0	0.25	0.30	0.35	0.45

* Hydrologic Soil Group

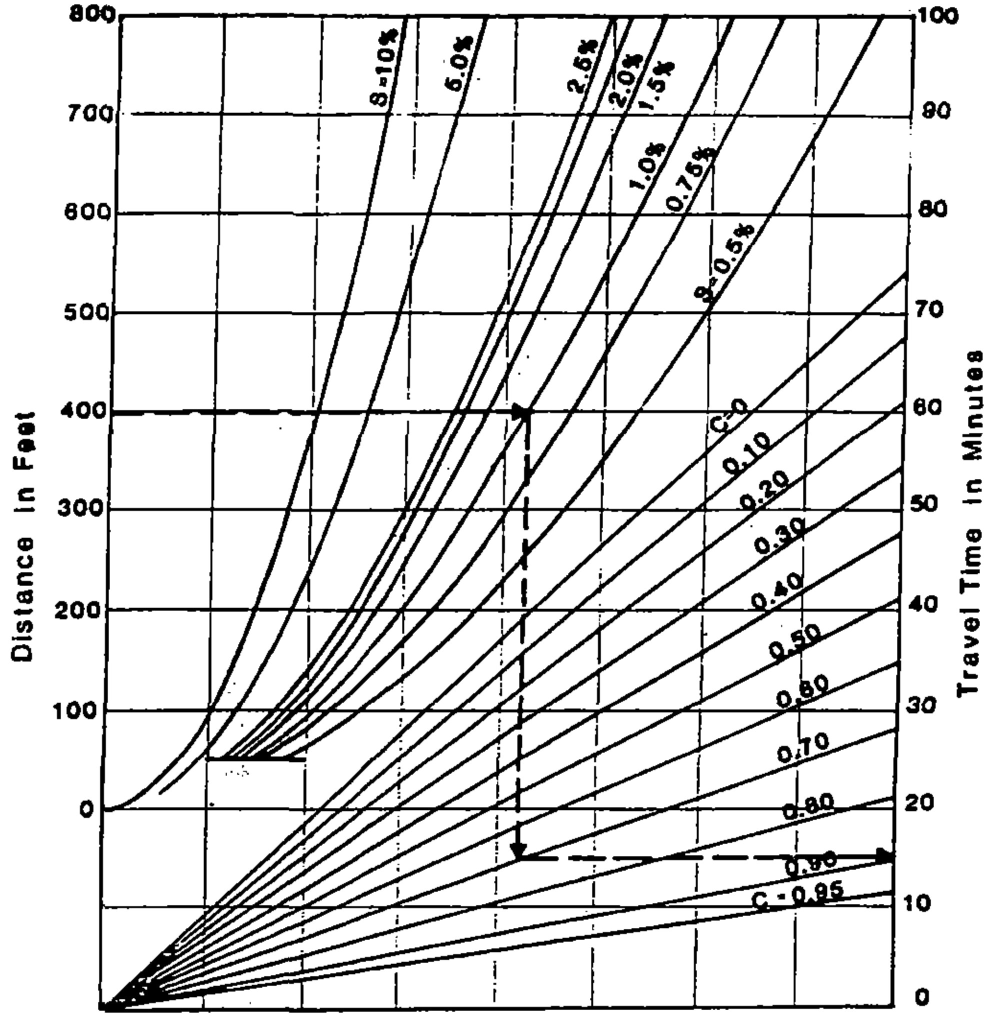
9/30/90



RE: BASED UPON PIKES PEAK AREA COUNCIL OF GOVERNMENTS/ AREAWIDE URBAN RUNOFF CONTROL MANUAL.

N.T.S.

MERIDIAN RANCH STORM RAINFALL TIME INTENSITY-FREQUENCY CURVES	TECH CONTRACTORS 12311 REX ROAD FALCON, CO 80831 TELEPHONE: 719.495.7444 FAX: 719.495.2457
FIGURE 6	



REFERENCE : Wright - McLaughlin Engineers, Urban Storm Drainage Criteria Manual, Vol. 1, Denver Regional Council of Governments, Denver, Co. 1977

The City of Colorado Springs / El Paso County Drainage Criteria Manual	Date OCT. 1987
Overland Flow Curves	Figure 5-2

HDR Infrastructure, Inc. A Centerra Company

Appendix B - Rational Hydrology Calculations

COMPOSITE 'C' FACTORS

PROJECT: Rational Calcs for Meridian Ranch Filing 11A | DESIGNED BY: TK

BASIN DESIGNATION	AREA (AC.) UNDEVELOPED	5 DU/AC	6 DU/AC	STREETS	PARKS/ OPEN SP	SCHOOL	TOTAL	COMPOSITE FACTOR 5-year	100-year
				DEVELOPED					
1		4.5					4.5	**0.53**	**0.63**
2		2.0					2.0	**0.53**	**0.63**
3		2.8					2.8	**0.53**	**0.63**
4				0.4	0.7		1.1	**0.52**	**0.70**
5		0.7		0.5	0.4		1.6	**0.59**	**0.71**
6		5.0			1.5		6.5	**0.47**	**0.61**
7		5.0					5.0	**0.53**	**0.63**
8		5.0					5.0	**0.53**	**0.63**
9		4.6					4.6	**0.53**	**0.63**
10		2.1					2.1	**0.53**	**0.63**
11		5.1					5.1	**0.53**	**0.63**
12		5.5					5.5	**0.53**	**0.63**
13		3.8					3.8	**0.53**	**0.63**
14				1.2	1.2		2.4	**0.60**	**0.75**
15				0.9	1.0		1.9	**0.58**	**0.74**
16				0.5	1.0		1.5	**0.50**	**0.68**
17		0.4		0.4	0.9		1.7	**0.49**	**0.66**
18		0.9		0.2	0.6		1.7	**0.49**	**0.64**
19				1.8	2.0		3.8	**0.58**	**0.74**
20				1.2	0.5		1.7	**0.72**	**0.83**

TIME OF CONCENTRATION

Rational Calculations

PROJECT: Meridian Ranch Filing 11A DESIGNED BY: TAK DATE: 3/10/2014

SUBBASIN DATA BASIN DESIGNATION	C5	AREA (AC)	INIT./OVERLAND TIME (Ti) LENGTH (FT)	SLOPE %	Ti (Min.)*	TRAVEL TIME (Tt) LENGTH (FT)	DIF. EL.	VEL. (FPS)	Tt(Min.)**	TOTAL Ti+Tt(Min.)
1	0.53	4.5	300	2.7	12.9	805	19	2.35	5.7	18.6
2	0.53	2.0	192	3.7	9.3	660	20	2.47	4.4	13.8
3	0.53	2.8	272	2.6	12.5	620	14	2.18	4.7	17.2
4	0.52	1.1	20	2.0	5.0	650	8	1.74	6.2	11.2
5	0.59	1.6	65	15.4	5.0	565	7	1.69	5.6	10.6
6	0.47	6.5	148	1.4	12.4	1065	11	1.79	9.9	22.3
7	0.53	5.0	245	2.9	11.4	575	3	1.22	7.9	19.2
8	0.53	5.0	300	2.3	13.5	544	5	1.49	6.1	19.6
9	0.53	4.6	295	3.1	12.3	620	9	1.84	5.6	17.9
10	0.53	2.1	143	3.5	8.2	510	19	2.52	3.4	11.5
11	0.53	5.1	268	1.5	14.8	670	10	1.89	5.9	20.7
12	0.53	5.5	250	2.4	12.2	680	9	1.81	6.3	18.5
13	0.53	3.8	134	2.2	9.2	690	9	1.81	6.4	15.6
14	0.60	2.4	28	2.0	5.0	1485	29	2.52	9.8	14.8
15	0.58	1.9	45	2.0	5.0	995	23	2.45	6.8	11.8
16	0.50	1.5	45	2.0	5.8	815	33	2.90	4.7	10.4
17	0.49	1.7	45	2.0	5.8	700	28	2.79	4.2	10.0
18	0.49	1.7	145	3.4	8.8	400	10	2.05	3.3	12.0
19	0.58	3.8	45	2.0	5.0	2015	73	3.42	9.8	14.8
20	0.72	1.7	12	2.0	5.0	1285	16	2.05	10.5	15.5

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)
SURFACE ROUTING

Date: 3/10/2014

PROJECT: **Meridian Ranch Filing 11A**

EL PASO COUNTY

	DIRECT RUNOFF											TOTAL RUNOFF							OVERLAND TRAVEL TIME						
				I (in./ hr.)		COEFF. C		CA		Q			I (in./ hr.)		CA		Q								
DESIGN POINT	BASIN	AREA (AC)	Tc (Min.)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	**(5 YR)**	**(100 YR)**	Sum Tc (min.)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	**(5 YR)**	**(100 YR)**	DITCH OR GUTTER	ROUGHNESS	DESTINATION DP	SLOPE %	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME Tt
	1	4.5	18.6	2.92	5.41	0.53	0.63	2.36	2.81	**7.0**	**15**						**7.0**	**15**	G	0.015	I08	1.35%	620	2.3	4.4
	2	2.0	13.8	3.38	6.26	0.53	0.63	1.05	1.25	**3.5**	**7.8**						**3.5**	**7.8**	G	0.015	I03	2.04%	785	2.9	4.6
	3	2.8	17.2	3.04	5.63	0.53	0.63	1.47	1.75	**4.5**	**9.8**	18.3	2.94	5.45	1.77	2.22	**5.2**	**12**							
	4	1.1	11.2	3.69	6.84	0.52	0.70	0.57	0.77	**2.1**	**5.2**						**2.1**	**5.2**	G	0.015	EI07	1.25%	565	2.2	4.2
	5	1.6	10.6	3.78	7.01	0.59	0.71	0.94	1.13	**3.5**	**7.9**	23.8	2.56	4.74	1.29	1.91	**3.5**	**9.1**							
	6	6.5	22.3	2.65	4.92	0.47	0.61	3.09	3.96	**8.2**	**19**						**8.2**	**19**	G	0.015	I05	3.38%	60	3.7	0.3
	7	5.0	19.2	2.87	5.32	0.53	0.63	2.63	3.13	**7.5**	**17**	22.6	2.64	4.88	2.63	3.65	**7.5**	**18**							
	8	5.0	19.6	2.84	5.27	0.53	0.63	2.63	3.13	**7.5**	**16**						**7.5**	**16**	G	0.015	I08	3.73%	340	3.9	1.5
	9	4.6	17.9	2.98	5.52	0.53	0.63	2.42	2.88	**7.2**	**16**	23.1	2.61	4.83	3.09	4.21	**8.1**	**20**	G	0.015	I09	1.50%	325	2.4	2.2
	10	2.1	11.5	3.65	6.77	0.53	0.63	1.12	1.33	**4.1**	**9.0**						**4.1**	**9.0**							
	11	5.1	20.7	2.76	5.11	0.53	0.63	2.68	3.19	**7.4**	**16**	25.3	2.48	4.59	2.68	3.47	**7.4**	**16**	G	0.015	I10	1.50%	375	2.4	2.6
	12	5.5	18.5	2.93	5.43	0.53	0.63	2.89	3.44	**8.5**	**19**	27.8	2.34	4.34	2.89	3.70	**8.5**	**19**	G	0.015	I11	2.00%	30	2.8	0.2
	13	3.8	15.6	3.19	5.91	0.53	0.63	2.00	2.39	**6.4**	**14**	28.0	2.34	4.33	2.00	2.56	**6.4**	**14**							
	14	2.4	14.8	3.26	6.05	0.60	0.75	1.44	1.80	**4.7**	**11**						**4.7**	**11**	G	0.015	EI03	4.00%	805	4.0	3.4
	15	1.9	11.8	3.62	6.71	0.58	0.74	1.11	1.41	**4.0**	**9.4**						**4.0**	**9.4**	G	0.015	DP02	4.00%	2015	4.0	8.4
	16	1.5	10.4	3.80	7.05	0.50	0.68	0.75	1.03	**2.9**	**7.2**	18.2	2.95	5.47	1.09	1.63	**3.2**	**8.9**	G	0.015	EI04	4.00%	700	4.0	2.9
	17	1.7	10.0	3.87	7.17	0.49	0.66	0.84	1.12	**3.2**	**8.0**	21.1	2.73	5.07	1.07	1.68	**3.2**	**8.5**	G	0.015	EI06	2.00%	410	2.8	2.4
	18	1.7	12.0	3.59	6.65	0.49	0.64	0.83	1.08	**3.0**	**7.2**	23.5	2.58	4.78	1.09	1.65	**3.0**	**7.9**	G	0.015	EI07	2.00%	50	2.8	0.3
	19	3.8	14.8	3.27	6.05	0.58	0.74	2.22	2.81	**7.3**	**17**	20.2	2.80	5.19	2.59	3.44	**7.3**	**18**							
	20	1.7	15.5	3.20	5.93	0.72	0.83	1.23	1.42	**3.9**	**8.4**						**3.9**	**8.4**							

STORM DRAINAGE SYSTEM DESIGN

INLET CALCULATIONS

PROJECT: Meridian Ranch Filing 11A

Date. 3/10/2014

DP	Inlet size L(i)	Proposed or Existing[2]	INLET TYPE	CROSS SLOPE	STREET SLOPE	T_c	Q_{Total} Q_5 (cfs)	Q_{Total} Q_{100} (cfs)	$Q_{Capture}$ Q_5 (cfs)	$Q_{Capture}$ Q_{100} (cfs)	$Q_{Capture}$ CA_{eqv} (5-yr)	$Q_{Capture}$ CA_{eqv} (100-yr)	$Q_{Flow-by}$ Q_5 (cfs)	$Q_{Flow-by}$ Q_{100} (cfs)	$Q_{Flow-by}$ CA_{eqv} (5-yr)	$Q_{Flow-by}$ CA_{eqv} (100-yr)	DEPTH (max) Q_5 (ft)	DEPTH (max) Q_{100} (ft)	SPREAD Q_5 (ft)	SPREAD Q_{100} (ft)
PROPOSED INLETS																				
I01	20	PROP.	FLOW-BY	2.0%	2.7%	18.6	7.0	15	5.0	9.6	1.72	1.77	2.0	5.6	0.68	1.04	0.33	0.42	12.4	16.6
I02	15	PROP.	FLOW-BY	2.0%	2.7%	13.8	3.5	7.8	2.5	4.9	0.75	0.78	1.0	2.9	0.30	0.47	0.28	0.34	9.6	12.9
I03	15	PROP.	SUMP[1]	2.0%		18.3	5.2	12	5.2	12	1.77	2.22	-	-	-	-	0.50	0.50		
I04	20	PROP.	SUMP[1]	2.0%		22.3	8.2	19	8.2	19	3.09	3.85	-	0.5	-	0.11	0.50	0.50		
I05	20	PROP.	SUMP[1]	2.0%		22.6	7.5	18	7.5	18	2.86	3.65	-	-	-	-	0.50	0.50		
I06	15	PROP.	SUMP[1]	2.0%		19.6	7.5	16	7.5	15	2.63	2.83	-	1.5	-	0.29	0.50	0.50		
I07	10	PROP.	SUMP[1]	2.0%		11.5	4.1	9.0	4.1	9.0	1.12	1.33	-	-	-	-	0.50	0.50		
I08	20	PROP.	SUMP[1]	2.0%		23.1	8.1	20	8.1	19	3.09	3.93	-	1.4	-	0.29	0.50	0.50		
I09	15	PROP.	SUMP[1]	2.0%		20.7	7.4	16	7.4	15	2.68	2.92	-	1.4	-	0.27	0.50	0.50		
I10	10	PROP.	SUMP	2.0%		18.5	8.5	19	8.5	18	2.89	3.27	-	0.9	-	0.17	0.50	0.70		
I11	10	PROP.	SUMP	2.0%		15.6	6.4	14	6.4	14	2.00	2.39	-	-	-	-	0.50	0.70		
EXISTING INLETS																				
EI01	15	EXIST.	FLOW-BY	2.0%	1.0%	14.8	4.7	11	3.6	7.2	1.10	1.20	1.1	3.6	0.34	0.60	0.34	0.44	12.9	17.6
EI02	10	EXIST.	FLOW-BY	2.0%	1.0%	11.8	4.0	9.4	2.7	5.2	0.74	0.77	1.3	4.3	0.37	0.63	0.33	0.42	12.1	16.7
EI03	20	EXIST.	FLOW-BY	2.0%	4.0%	18.2	3.2	8.9	2.5	5.9	0.85	1.07	0.7	3.1	0.24	0.56	0.26	0.34	8.6	12.6
EI04	20	EXIST.	FLOW-BY	2.0%	4.0%	21.1	3.2	8.5	2.5	5.6	0.92	1.11	0.7	2.9	0.26	0.57	0.26	0.33	8.6	12.4
EI05	10	EXIST.	FLOW-BY	2.0%	1.3%	11.2	2.1	5.2	1.5	3.3	0.41	0.48	0.6	2.0	0.16	0.29	0.27	0.34	9.1	12.9
EI06	15	EXIST.	FLOW-BY	2.0%	1.0%	23.5	3.0	7.9	2.5	5.5	0.96	1.16	0.5	2.3	0.20	0.49	0.30	0.40	10.9	15.6
EI07	10	EXIST.	SUMP	2.0%		23.8	3.5	9.1	3.5	9.1	1.39	1.91	-	-	-	-	0.50	0.60		
EI08	15	EXIST.	FLOW-BY	2.0%	1.3%	15.5	3.9	8.4	3.0	5.7	0.95	0.96	0.9	2.7	0.28	0.46	0.32	0.39	11.6	15.3

[1] Forced sump at intersection

[2] Existing inlets were constructed as a part of the Londonderry and Lambert Improvements in 2007

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

PIPE ROUTING

PROJECT: MERIDIAN RANCH FILING 11A EL PASO COUNTY Date 3/10/2014

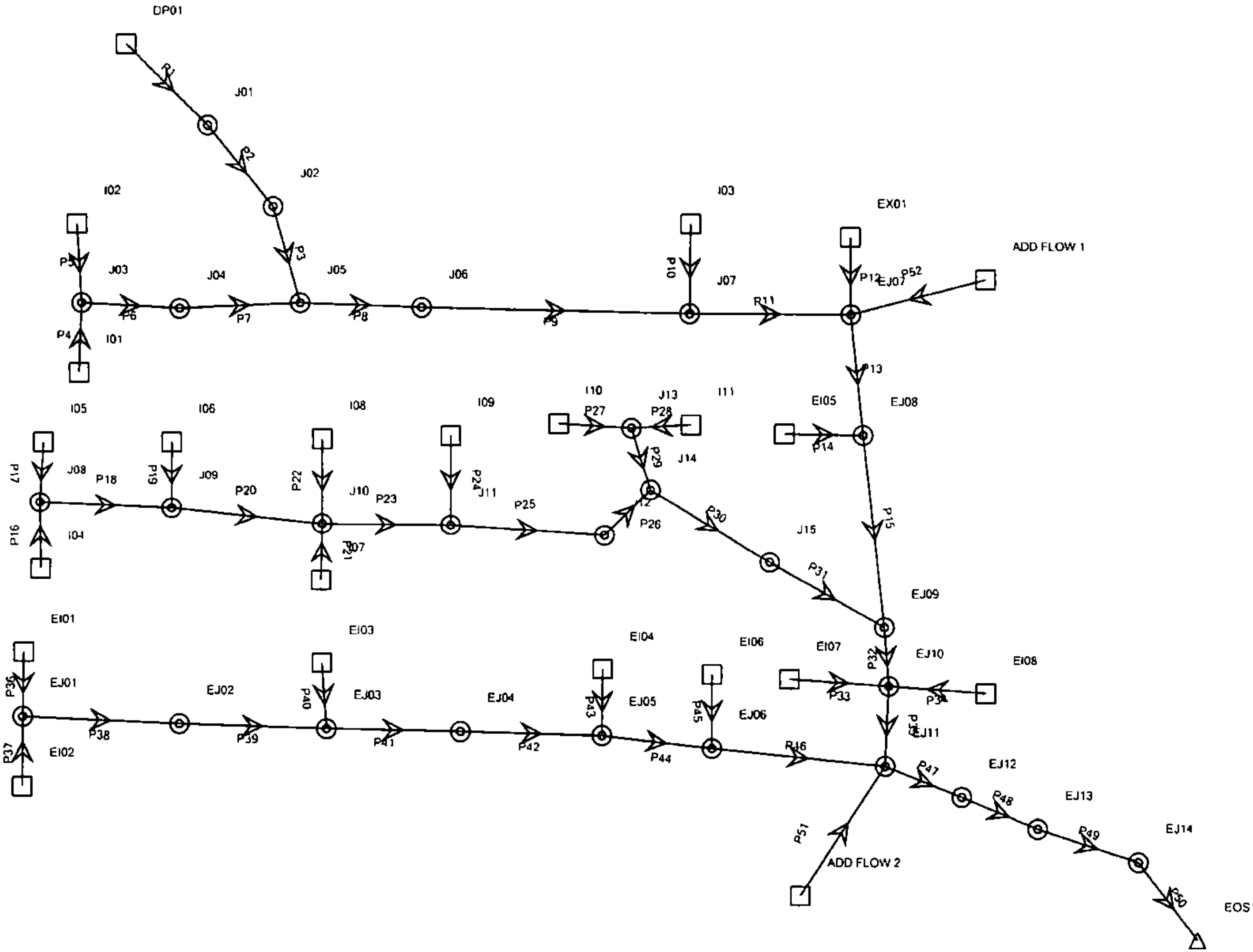
		INLET FLOW							SYSTEM FLOW							TRAVEL TIME						
			I (in./hr.)		CA		Q			I (in./hr.)		CA		Q								
UPSTREAM BASIN	UPSTREAM DESIGN POINT	Tc (Min.)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	Sum Tc (min.)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	(5 YR)	(100 YR)	PIPE DIA	ROUGHNESS (n)	DESTINATION DP	SLOPE %	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME Tt
	POND D	206.0	0.60	1.10	20.00	90.17	12	100						12	100	48	0.013	J01	7.28%	145.9	30.9	0.1
	J01								206.1	0.60	1.10	20.00	90.17	12	100	42	0.013	J02	1.48%	600	12.8	0.8
	J02								206.9	0.59	1.10	20.00	90.17	12	99	42	0.013	J05	1.84%	201.1	14.2	0.2
1	I01	18.6	2.92	5.41	1.72	1.77	5.0	9.6						5.0	9.6	18	0.013	J03	3.98%	8.8	11.9	0.0
2	I02	13.8	3.38	6.26	0.75	0.78	2.5	4.9						2.5	4.9	18	0.013	J03	1.00%	25.1	6.0	0.1
	J03								18.6	2.92	5.41	2.47	2.55	7.2	14	18	0.013	J04	1.32%	26.6	6.8	0.1
	J04								18.7	2.91	5.40	2.47	2.55	7.2	14	18	0.013	J05	1.70%	170.3	7.8	0.4
	J05								207.1	0.59	1.10	22.47	92.72	13	102	42	0.013	J06	1.35%	452.9	12.2	0.6
	J06								207.7	0.59	1.10	22.47	92.72	13	102	42	0.013	J07	4.17%	161.8	21.4	0.1
3	I03	18.3	2.94	5.45	1.77	2.22	5.2	12						5.2	12	18	0.013	J07	2.22%	4.5	8.9	0.0
	J07								207.8	0.59	1.10	24.24	94.94	14	104	54	0.013	EJ07	0.49%	66.8	8.7	0.1
OFFSITE	EX01	51.7	1.60	2.98	33.75	60.00	54	178						54	178	54	0.013	EJ07	2.82%	52.8	20.8	0.0
	EJ07								208.0	0.59	1.10	91.99	188.94	54	207	60	0.013	EJ08	1.14%	545.8	14.2	0.6
4	EI05	11.2	3.69	6.84	0.41	0.48	1.5	3.3						1.5	3.3	18	0.013	EJ08	3.57%	35	11.3	0.1
	EJ08								208.6	0.59	1.09	92.40	189.41	55	207	60	0.013	EJ09	1.39%	499.2	15.7	0.5
6	I04	22.3	2.65	4.92	3.09	3.85	8.2	19						8.2	19	24	0.013	J08	3.28%	32	13.1	0.0
7	I05	22.6	2.64	4.88	2.86	3.65	7.5	18						7.5	18	18	0.013	J08	1.19%	25.2	6.5	0.1
J08									22.7	2.63	4.88	5.94	7.51	16	37	24	0.013	J09	3.23%	295	13.0	0.4
8	I06	19.6	2.84	5.27	2.63	2.83	7.5	15						7.5	15	24	0.013	J09	1.03%	25.2	7.3	0.1
J09									23.0	2.61	4.83	8.57	10.34	22	50	24	0.013	J10	4.11%	303.8	14.6	0.3
9	I07	11.5	3.65	6.77	1.12	1.33	4.1	9.0						4.1	9.0	24	0.013	J10	6.27%	31.9	18.1	0.0
10	I08	23.1	2.61	4.83	3.09	3.93	8.1	19						8.1	19	18	0.013	J10	6.67%	25.5	15.4	0.0
	J10								23.1	2.60	4.82	12.78	15.60	33	75	36	0.013	J11	1.81%	295.8	12.7	0.4
11	I09	20.7	2.76	5.11	2.68	2.92	7.4	15						7.4	15	24	0.013	J11	1.00%	25	7.2	0.1
	J11								23.5	2.58	4.78	15.46	18.52	40	89	36	0.013	J12	1.63%	322.9	12.1	0.4
	J12								23.9	2.55	4.73	15.46	18.52	39	88	42	0.013	J14	1.13%	35.4	11.1	0.1
12	I10	18.5	2.93	5.43	2.89	3.27	8.5	18						8.6	18	18	0.013	J13	1.03%	25.2	6.0	0.1
13	I11	15.6	3.19	5.91	2.00	2.39	6.4	14						6.4	14	18	0.013	J13	5.00%	5.2	13.3	0.0
	J13								15.6	3.19	5.91	4.89	5.65	16	33	24	0.013	J14	2.32%	46.6	11.0	0.1
	J14								25.1	2.49	4.61	20.35	24.17	52	111	42	0.013	J15	5.54%	172.8	24.7	0.1
	J15								25.2	2.48	4.60	20.35	24.17	51	111	48	0.013	EJ09	1.55%	94.2	14.3	0.1
	EJ09								209.1	0.59	1.09	160.22	277.81	94	303	66	0.013	EJ10	0.63%	90.5	11.2	0.1
5	EI07	23.8	2.56	4.74	1.39	1.91	3.5	9.1						3.5	9	18	0.013	EJ10	4.47%	42.7	12.6	0.1
20	EI08	15.5	3.20	5.93	0.95	0.96	3.0	5.7						3.0	6	18	0.013	EJ10	13.82%	15.7	22.2	0.0
	EJ10								209.3	0.59	1.09	162.55	280.68	96	306	66	0.013	EJ11	0.76%	34	12.4	0.0
14	EI01	14.8	3.26	6.05	1.10	1.20	3.6	7.2						3.6	7.2	18	0.013	EJ01	42.55%	5.5	38.9	0.0
15	EI02	11.8	3.62	6.71	0.74	0.77	2.7	5.2						2.7	5.2	18	0.013	EJ01	4.53%	61.4	12.7	0.1
	EJ01								14.8	3.26	6.05	1.85	1.97	6.0	12	24	0.013	EJ02	3.34%	466.3	13.2	0.6
	EJ02								15.4	3.20	5.94	1.85	1.97	5.9	12	24	0.013	EJ03	4.16%	350.7	14.7	0.4
16	EI03	18.2	2.95	5.47	0.85	1.07	2.5	5.9						2.5	5.9	18	0.013	EJ03	5.96%	5.2	14.6	0.0
	EJ03								18.2	2.95	5.47	2.69	3.04	8.0	17	24	0.013	EJ04	4.06%	358.1	14.5	0.4
	EJ04								18.6	2.92	5.41	2.69	3.04	7.9	16	24	0.013	EJ05	3.92%	347.2	14.3	0.4
17	EI04	21.1	2.73	5.07	0.92	1.11	2.5	5.6						2.5	5.6	18	0.013	EJ05	21.92%	5.2	27.9	0.0
	EJ05								21.1	2.73	5.07	3.62	4.15	9.9	21	30	0.013	EJ06	2.38%	431.6	12.9	0.6
18	EI06	23.5	2.58	4.78	0.96	1.16	2.5	5.5						2.5	5.5	18	0.013	EJ06	1.54%	5.2	7.4	0.0
	EJ06								21.7	2.70	5.00	4.57	5.31	12	27	30	0.013	EJ11	3.78%	73.3	16.3	0.1
	EJ11								209.3	0.59	1.09	167.12	285.99	98	312	66	0.013	EJ12	1.16%	386	15.3	0.4
	EJ12								209.7	0.59	1.09	167.12	285.99	98	312	66	0.013	EJ13	0.88%	448.3	13.3	0.6
	EJ13								210.3	0.59	1.09	167.12	285.99	98	311	66	0.013	EJ14	2.77%	452.2	23.6	0.3
	EJ14								210.6	0.59	1.09	167.12	285.99	98	311	66	0.013	EOS1	0.67%	134.1	11.6	0.2

STORM DRAINAGE SYSTEM DESIGN
HYDRAULICS

Calc. by. TAK
Date. 3/10/2014

PROJECT: **Meridian Ranch Filing 11A**

Label	Upstream Node	Downstream Node	Inlet CA (acres)	Inlet Tc (min)	Inlet Flow (ft³/s)	System CA (acres)	System Flow Time (min)	System Intensity (in/hr)	Length (ft)	Section Size (in)	Slope (%)	Capacity (Full Flow) (ft³/s)	System Flow (ft³/s)	Velocity (Average) (ft/s)	Elevation Ground (Upstream) (ft)	Hydraulic Grade Line (Upstream) (ft)	Invert (Upstream) (ft)	Elevation Ground (Downstream) (ft)	Hydraulic Grade Line (Out) (ft)	Invert (Downstream) (ft)
P1	DP01	J01	289.00	206.0	100.4	90.17	206.0	1.11	145.9	48	7.28%	388	100	25.9	7054.80	7,051.5	7,048.50	7,050.00	7,039.4	7,037.88
P2	J01	J02	(N/A)	0.0	0.0	90.17	206.1	1.10	600.0	42	1.48%	122	100	14.2	7050.00	7,040.5	7,037.38	7,036.50	7,031.7	7,028.50
P3	J02	J05	(N/A)	0.0	0.0	90.17	206.8	1.10	201.1	42	1.84%	137	100	15.5	7036.50	7,031.1	7,028.00	7,032.30	7,028.3	7,024.30
P4	I01	J03	1.77	18.6	9.7	1.77	18.6	5.41	8.6	18	4.07%	21	10	11.7	7034.94	7,032.1	7,030.90	7,035.23	7,032.1	7,030.55
P5	I02	J03	0.78	13.8	4.9	0.78	13.8	6.25	25.2	18	0.99%	11	5	5.8	7034.82	7,031.8	7,030.80	7,035.23	7,031.8	7,030.55
P6	J03	J04	(N/A)	0.0	0.0	2.55	18.6	5.41	26.6	18	1.32%	12	14	7.9	7035.23	7,031.6	7,030.05	7,034.37	7,031.1	7,029.70
P7	J04	J05	(N/A)	0.0	0.0	2.55	18.7	5.40	170.3	18	1.70%	14	14	8.8	7034.37	7,030.6	7,029.20	7032.30	7,027.6	7,026.30
P8	J05	J06	(N/A)	0.0	0.0	92.72	207.0	1.10	452.9	42	1.35%	117	103	13.7	7032.30	7,026.9	7,023.80	7,025.72	7,020.3	7,017.70
P9	J06	J07	(N/A)	0.0	0.0	92.72	207.6	1.10	161.8	42	4.17%	206	103	21.4	7025.72	7,020.3	7,017.20	7,018.68	7,013.6	7,010.45
P10	I03	J07	2.22	18.3	12.2	2.22	18.3	5.46	4.5	18	2.22%	16	12	6.9	7018.23	7,014.1	7,012.55	7,018.68	7,014.0	7,012.45
P11	J07	EJ07	(N/A)	0.0	0.0	94.94	207.7	1.10	67.4	54	0.49%	138	105	9.5	7018.68	7,013.5	7,009.45	7,019.36	7,013.4	7,009.12
P12	EX01	EJ07	96.00	51.7	179.0	60.00	51.7	2.96	52.8	54	2.82%	330	179	21.2	7019.60	7,014.5	7,010.61	7,019.36	7,013.1	7,009.12
P13	EJ07	EJ08	(N/A)	0.0	0.0	154.94	207.8	1.10	545.8	60	1.14%	278	208	15.5	7019.36	7,012.7	7,008.62	7,011.86	7,005.6	7,002.41
P14	EI05	EJ08	0.48	11.2	3.3	0.48	11.2	6.85	35.0	18	3.57%	20	3	8.3	7010.96	7,007.6	7,006.86	7,011.86	7,007.7	7,005.61
P15	EJ08	EJ09	(N/A)	0.0	0.0	155.42	208.4	1.10	499.2	60	1.39%	307	208	16.8	7011.86	7,006.2	7,002.11	7,005.16	7,002.2	6,995.16
P16	I04	J08	3.85	22.3	19.1	3.85	22.3	4.92	32.0	24	3.28%	41	19	12.8	7,049.13	7,046.0	7,044.45	7,048.68	7,045.6	7,043.40
P17	I05	J08	3.65	22.6	18.0	3.65	22.6	4.88	25.2	18	1.19%	12	18	10.2	7048.30	7,047.3	7,044.20	7,048.68	7,046.6	7,043.90
P18	J08	J09	(N/A)	0.0	0.0	7.50	22.6	4.88	295.0	24	3.23%	41	37	14.7	7048.68	7,044.8	7,042.90	7,039.32	7,035.5	7,033.38
P19	I06	J09	2.83	19.6	15.0	2.83	19.6	5.27	25.2	24	1.03%	23	15	7.8	7038.14	7,035.6	7,033.64	7,039.32	7,035.5	7,033.38
P20	J09	J10	(N/A)	0.0	0.0	10.33	23.0	4.84	303.8	30	4.11%	83	50	17.7	7039.32	7,035.2	7,032.88	7,026.96	7,023.1	7,020.40
P21	I07	J10	1.33	11.5	9.1	1.33	11.5	6.77	31.9	24	4.70%	49	9	11.9	7026.99	7,024.1	7,022.40	7,026.96	7,024.1	7,020.90
P22	I08	J10	3.93	23.1	19.1	3.93	23.1	4.83	25.2	18	4.76%	23	19	10.8	7026.70	7,024.9	7,022.60	7,026.96	7,024.1	7,021.40
P23	J10	J11	(N/A)	0.0	0.0	15.59	23.3	4.81	295.8	36	2.11%	97	76	15.1	7026.96	7,022.6	7,019.90	7,021.17	7,015.7	7,013.67
P24	I09	J11	2.92	25.3	13.5	2.92	25.3	4.59	24.3	24	4.65%	49	14	13.3	7020.38	7,017.1	7,015.80	7,021.17	7,017.1	7,014.67
P25	J11	J12	(N/A)	0.0	0.0	18.51	25.3	4.58	322.7	42	1.49%	123	86	13.8	7021.17	7,016.1	7,013.17	7016.39	7,012.9	7,008.35
P26	J12	J14	(N/A)	0.0	0.0	18.51	25.7	4.55	35.3	42	0.99%	100	85	8.8	7016.39	7,012.1	7,007.85	7,015.97	7,011.9	7,007.50
P27	I10	J13	3.27	18.5	17.9	3.27	18.5	5.43	25.2	18	1.03%	11	18	10.1	7015.24	7,013.7	7,011.24	7,015.51	7,013.0	7,010.98
P28	I11	J13	2.39	15.6	14.2	2.39	15.6	5.91	5.2	18	5.00%	24	14	8.1	7015.24	7,012.9	7,011.24	7,015.51	7,012.8	7,010.98
P29	J13	J14	(N/A)	0.0	0.0	5.66	18.5	5.42	46.6	24	2.32%	34	31	12.4	7015.51	7,012.4	7,010.48	7,015.97	7,011.4	7,009.40
P30	J14	J15	(N/A)	0.0	0.0	24.17	25.8	4.54	172.8	42	5.31%	232	111	23.8	7015.97	7,010.2	7,007.00	7,010.25	7,004.4	6,997.82
P31	J15	EJ09	(N/A)	0.0	0.0	24.17	25.9	4.53	94.2	48	1.55%	179	110	8.8	7010.25	7,004.2	6,997.32	7,005.16	7,003.6	6,995.86
P32	EJ09	EJ10	(N/A)	0.0	0.0	179.59	208.9	1.09	90.5	66	0.63%	267	305	12.8	7005.16	7,001.8	6,994.76	7,004.39	7,001.0	6,994.19
P33	EI07	EJ10	1.91	23.8	9.1	1.91	23.8	4.75	42.7	18	4.47%	22	9	5.2	7,003.77	7,003.1	6,999.80	7,004.39	7,002.7	6,997.89
P34	EI08	EJ10	0.96	15.5	5.7	0.96	15.5	5.92	15.7	18	13.82%	39	6	3.2	7003.93	7,002.8	7,000.06	7,004.39	7,002.7	6,997.89
P35	EJ10	EJ11	(N/A)	0.0	0.0	182.46	209.0	1.09	34.0	66	0.76%	294	308	12.9	7004.39	7,000.6	6,993.89	7,004.13	7,000.3	6,993.63
P36	EI01	EJ01	1.20	14.8	7.3	1.20	14.8	6.05	5.5	18	42.55%	69	7	25.3	7077.47	7,074.2	7,073.11	7,077.74	7,071.3	7,070.77
P37	EI02	EJ01	0.77	11.8	5.2	0.77	11.8	6.70	61.4	18	4.53%	22	5	10.3	7077.47	7,074.3	7,073.45	7,077.74	7,071.2	7,070.67
P38	EJ01	EJ02	(N/A)	0.0	0.0	1.97	14.8	6.05	466.3	24	3.34%	41	12	11.4	7077.74	7,071.2	7,069.97	7,060.13	7,055.1	7,054.40
P39	EJ02	EJ03	(N/A)	0.0	0.0	1.97	15.5	5.93	350.7	24	4.16%	46	12	12.3	7060.13	7,055.2	7,054.00	7,045.89	7,040.1	7,039.42
P40	EI03	EJ03	1.07	18.2	5.9	1.07	18.2	5.47	5.2	18	5.96%	26	6	11.8	7045.62	7,041.1	7,040.13	7,045.89	7,040.9	7,039.82
P41	EJ03	EJ04	(N/A)	0.0	0.0	3.04	18.2	5.47	358.1	24	4.06%	46	17	13.4	7045.89	7,040.4	7,038.92	7,031.38	7,025.2	7,024.38
P42	EJ04	EJ05	(N/A)	0.0	0.0	3.04	18.7	5.41	347.2	24	3.92%	45	17	13.2	7031.38	7,025.7	7,024.18	7,017.38	7,011.4	7,010.56
P43	EI04	EJ05	1.11	21.1	5.7	1.11	21.1	5.07	5.2	18	21.92%	49	6	18.6	7017.11	7,013.0	7,012.10	7,017.38	7,011.9	7,010.96
P44	EJ05	EJ06	(N/A)	0.0	0.0	4.15	21.1	5.07	431.6	30	2.38%	63	21	11.6	7017.38	7,011.5	7,009.96	7,005.70	7,000.7	6,999.70
P45	EI06	EJ06	1.16	23.5	5.6	1.16	23.5	4.78	5.2	18	1.54%	13	6	3.2	7004.98	7,001.6	7,000.08	7,005.70	7,001.6	7,000.00
P46	EJ06	EJ11	(N/A)	0.0	0.0	5.31	23.5	4.78	73.3	30	3.78%	80	26	14.5	7005.70	7,001.1	6,999.40	7,004.13	6,999.0	6,996.63
P47	EJ11	EJ12	(N/A)	0.0	0.0	187.77	209.1	1.09	386.0	66	1.16%	362	313	17.2	7004.13	6,998.2	6,993.33	6,999.34	6,992.8	6,988.84
P48	EJ12	EJ13	(N/A)	0.0	0.0	187.77	209.4	1.09	448.3	66	0.88%	315	313	15.1	6999.34	6,993.4	6,988.54	6,995.10	6,989.5	6,984.60
P49	EJ13	EJ14	(N/A)	0.0	0.0	187.77	209.9	1.09	452.2	66	2.77%	559	313	24.2	6995.10	6,989.1	6,984.30	6,982.27	6,978.1	6,971.77
P50	EJ14	EOS1	(N/A)	0.0	0.0	187.77	210.2	1.09	134.1	66	0.67%	275	313	13.2	6982.27	6,976.8	6,971.47	6,980.00	6,975.4	6,970.57


DP01
P1
J01
P2
J02
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P3
I03
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J04
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P10
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EJ06
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P34
P35
EJ11
P38
P39
P41
P42
P44
P46
P37
EI02
P47
EJ12
P48
EJ13
P49
EJ14
P51
ADD FLOW 2
P50
EOS1

Appendix C – Street Flow Data

Worksheet for Ramp Full Street Section

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	0.75	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.00
0+13	-0.25
0+14	-0.75
0+15	-0.59
0+30	-0.29
0+45	-0.59
0+46	-0.75
0+48	-0.25
0+60	0.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+13, -0.25)	0.030
(0+13, -0.25)	(0+15, -0.59)	0.013
(0+15, -0.59)	(0+45, -0.59)	0.015
(0+45, -0.59)	(0+48, -0.25)	0.013
(0+48, -0.25)	(0+60, 0.00)	0.030
<None>	(0+60, 0.00)	0.030

Options

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

Worksheet for Ramp Full Street Section

Results

Discharge		42.54	ft^3/s
Elevation Range	-0.75 to 0.00 ft		
Flow Area		19.32	ft^2
Wetted Perimeter		60.21	ft
Hydraulic Radius		0.32	ft
Top Width		60.00	ft
Normal Depth		0.75	ft
Critical Depth		0.66	ft
Critical Slope		0.01121	ft/ft
Velocity		2.20	ft/s
Velocity Head		0.08	ft
Specific Energy		0.83	ft
Froude Number		0.68	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.75	ft
Critical Depth	0.66	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.01121	ft/ft

Cross Section for Ramp Full Street Section

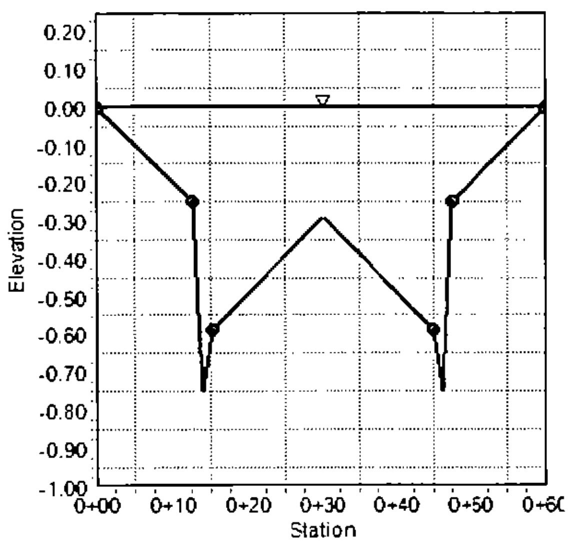
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	0.75	ft
Discharge	42.54	ft³/s

Cross Section Image



RESIDENTIAL STREET SECTION
RAMP CURB

5-Year Storm Event Maximum Allowable Street Flows (Maximum Flow to Top of Curb)									
Channel Slope (ft/ft)	Full Street Width					Half Street Width			
	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	19	2.5	7.45	35.2	35.0	9.4	2.5	3.7	17.5
0.0063	21	2.8	7.45	35.2	35.0	11	2.8	3.7	17.5
0.0075	23	3.1	7.45	35.2	35.0	12	3.1	3.7	17.5
0.0088	25	3.4	7.45	35.2	35.0	12	3.3	3.7	17.5
0.0100	27	3.6	7.45	35.2	35.0	13	3.6	3.7	17.5
0.0113	28	3.8	7.45	35.2	35.0	14	3.8	3.7	17.5
0.0125	30	4.0	7.45	35.2	35.0	15	4.0	3.7	17.5
0.0138	31	4.2	7.45	35.2	35.0	16	4.2	3.7	17.5
0.0150	33	4.4	7.45	35.2	35.0	16	4.4	3.7	17.5
0.0163	34	4.6	7.45	35.2	35.0	17	4.5	3.7	17.5
0.0175	35	4.7	7.45	35.2	35.0	18	4.7	3.7	17.5
0.0188	37	4.9	7.45	35.2	35.0	18	4.9	3.7	17.5
0.0200	38	5.1	7.45	35.2	35.0	19	5.0	3.7	17.5
0.0213	39	5.2	7.45	35.2	35.0	19	5.2	3.7	17.5
0.0225	40	5.4	7.45	35.2	35.0	20	5.4	3.7	17.5
0.0238	41	5.5	7.45	35.2	35.0	20	5.5	3.7	17.5
0.0250	42	5.7	7.45	35.2	35.0	21	5.6	3.7	17.5
0.0263	43	5.8	7.45	35.2	35.0	22	5.8	3.7	17.5
0.0275	44	5.9	7.45	35.2	35.0	22	5.9	3.7	17.5
0.0288	45	6.1	7.45	35.2	35.0	23	6.0	3.7	17.5
0.0300	46	6.2	7.45	35.2	35.0	23	6.2	3.7	17.5
0.0313	47	6.3	7.45	35.2	35.0	23	6.3	3.7	17.5
0.0325	48	6.5	7.45	35.2	35.0	24	6.4	3.7	17.5
0.0338	49	6.6	7.45	35.2	35.0	24	6.6	3.7	17.5
0.0350	50	6.7	7.45	35.2	35.0	25	6.7	3.7	17.5
0.0363	51	6.8	7.45	35.2	35.0	25	6.8	3.7	17.5
0.0375	52	6.9	7.45	35.2	35.0	26	6.9	3.7	17.5
0.0388	53	7.1	7.45	35.2	35.0	26	7.0	3.7	17.5
0.0400	53	7.2	7.45	35.2	35.0	27	7.1	3.7	17.5

100-Year Storm Event Maximum Allowable Street Flows (Maximum Flow to Right-of-Way)									
Channel Slope (ft/ft)	Full Street Width					Half Street Width			
	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	43	2.2	19.32	60.2	60.0	21	2.2	9.7	30
0.0063	48	2.5	19.32	60.2	60.0	24	2.4	9.7	30
0.0075	52	2.7	19.32	60.2	60.0	26	2.7	9.7	30
0.0088	56	2.9	19.32	60.2	60.0	28	2.9	9.7	30
0.0100	60	3.1	19.32	60.2	60.0	30	3.1	9.7	30
0.0113	64	3.3	19.32	60.2	60.0	32	3.3	9.7	30
0.0125	67	3.5	19.32	60.2	60.0	33	3.5	9.7	30
0.0138	71	3.7	19.32	60.2	60.0	35	3.6	9.7	30
0.0150	74	3.8	19.32	60.2	60.0	36	3.8	9.7	30
0.0163	77	4.0	19.32	60.2	60.0	38	3.9	9.7	30
0.0175	80	4.1	19.32	60.2	60.0	39	4.1	9.7	30
0.0188	82	4.3	19.32	60.2	60.0	41	4.2	9.7	30
0.0200	85	4.4	19.32	60.2	60.0	42	4.4	9.7	30
0.0213	88	4.5	19.32	60.2	60.0	43	4.5	9.7	30
0.0225	90	4.7	19.32	60.2	60.0	45	4.6	9.7	30
0.0238	93	4.8	19.32	60.2	60.0	46	4.8	9.7	30
0.0250	95	4.9	19.32	60.2	60.0	47	4.9	9.7	30
0.0263	97	5.0	19.32	60.2	60.0	48	5.0	9.7	30
0.0275	100	5.2	19.32	60.2	60.0	49	5.1	9.7	30
0.0288	102	5.3	19.32	60.2	60.0	50	5.2	9.7	30
0.0300	104	5.4	19.32	60.2	60.0	52	5.3	9.7	30
0.0313	106	5.5	19.32	60.2	60.0	53	5.5	9.7	30
0.0325	108	5.6	19.32	60.2	60.0	54	5.6	9.7	30
0.0338	111	5.7	19.32	60.2	60.0	55	5.7	9.7	30
0.0350	113	5.8	19.32	60.2	60.0	56	5.8	9.7	30
0.0363	115	5.9	19.32	60.2	60.0	57	5.9	9.7	30
0.0375	117	6.0	19.32	60.2	60.0	58	6.0	9.7	30
0.0388	118	6.1	19.32	60.2	60.0	59	6.1	9.7	30
0.0400	120	6.2	19.32	60.2	60.0	60	6.2	9.7	30

Street Flows Ramp Curb
(Maximum Flow to Crown of Roadway)

Channel Slope (ft/ft)	Full Street Width: Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Half Street Width: Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	13	2.2	6.05	35.0	34.8	6.7	2.2	3.0	17.4
0.0063	15	2.5	6.05	35.0	34.8	7.5	2.5	3.0	17.4
0.0075	16	2.7	6.05	35.0	34.8	8.2	2.7	3.0	17.4
0.0088	18	2.9	6.05	35.0	34.8	8.9	2.9	3.0	17.4
0.0100	19	3.1	6.05	35.0	34.8	9.5	3.1	3.0	17.4
0.0113	20	3.3	6.05	35.0	34.8	10	3.3	3.0	17.4
0.0125	21	3.5	6.05	35.0	34.8	11	3.5	3.0	17.4
0.0138	22	3.7	6.05	35.0	34.8	11	3.7	3.0	17.4
0.0150	23	3.8	6.05	35.0	34.8	12	3.8	3.0	17.4
0.0163	24	4.0	6.05	35.0	34.8	12	4.0	3.0	17.4
0.0175	*25*	*4.1*	*6.05*	*35.0*	*34.8*	*13*	*4.1*	*3.0*	*17.4*
0.0188	26	4.3	6.05	35.0	34.8	13	4.3	3.0	17.4
0.0200	27	4.4	6.05	35.0	34.8	13	4.4	3.0	17.4
0.0213	28	4.6	6.05	35.0	34.8	14	4.6	3.0	17.4
0.0225	28	4.7	6.05	35.0	34.8	14	4.7	3.0	17.4
0.0238	29	4.8	6.05	35.0	34.8	15	4.8	3.0	17.4
0.0250	30	5.0	6.05	35.0	34.8	15	5.0	3.0	17.4
0.0263	31	5.1	6.05	35.0	34.8	15	5.1	3.0	17.4
0.0275	31	5.2	6.05	35.0	34.8	16	5.2	3.0	17.4
0.0288	32	5.3	6.05	35.0	34.8	16	5.3	3.0	17.4
0.0300	33	5.4	6.05	35.0	34.8	16	5.4	3.0	17.4
0.0313	34	5.5	6.05	35.0	34.8	17	5.5	3.0	17.4
0.0325	34	5.7	6.05	35.0	34.8	17	5.6	3.0	17.4
0.0338	35	5.8	6.05	35.0	34.8	17	5.8	3.0	17.4
0.0350	35	5.9	6.05	35.0	34.8	18	5.9	3.0	17.4
0.0363	36	6.0	6.05	35.0	34.8	18	6.0	3.0	17.4
0.0375	37	6.1	6.05	35.0	34.8	18	6.1	3.0	17.4
0.0388	37	6.2	6.05	35.0	34.8	19	6.2	3.0	17.4
0.0400	38	6.3	6.05	35.0	34.8	19	6.3	3.0	17.4

Worksheet for Vertical Full Street Section

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	0.75	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.00
0+13	-0.25
0+13	-0.25
0+13	-0.75
0+15	-0.58
0+30	-0.28
0+45	-0.58
0+47	-0.75
0+47	-0.25
0+48	-0.25
0+60	0.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+13, -0.25)	0.030
(0+13, -0.25)	(0+15, -0.58)	0.013
(0+15, -0.58)	(0+45, -0.58)	0.015
(0+45, -0.58)	(0+48, -0.25)	0.013
(0+48, -0.25)	(0+60, 0.00)	0.030
<None>	(0+60, 0.00)	0.030

Options

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

Worksheet for Vertical Full Street Section

Options

Closed Channel Weighting Method	Pavlovskii's Method	

Results

Discharge	41.33	ft^3/s
Elevation Range	-0.75 to 0.00 ft	
Flow Area	19.04	ft^2
Wetted Perimeter	61.02	ft
Hydraulic Radius	0.31	ft
Top Width	60.00	ft
Normal Depth	0.75	ft
Critical Depth	0.66	ft
Critical Slope	0.01143	ft/ft
Velocity	2.17	ft/s
Velocity Head	0.07	ft
Specific Energy	0.82	ft
Froude Number	0.68	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.75	ft
Critical Depth	0.66	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.01143	ft/ft

Cross Section for Vertical Full Street Section

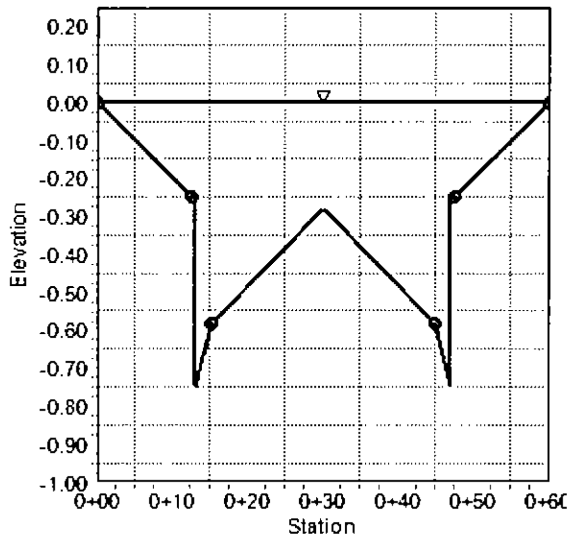
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00500	ft/ft
Normal Depth	0.75	ft
Discharge	41.33	ft³/s

Cross Section Image



RESIDENTIAL STREET SECTION
RAMP CURB

5-Year Storm Event Maximum Allowable Street Flows (Maximum Flow to Top of Curb)									
Channel Slope (ft/ft)	Full Street Width					Half Street Width			
	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	19	2.5	7.45	35.2	35.0	9.4	2.5	3.7	17.5
0.0063	21	2.8	7.45	35.2	35.0	11	2.8	3.7	17.5
0.0075	23	3.1	7.45	35.2	35.0	12	3.1	3.7	17.5
0.0088	25	3.4	7.45	35.2	35.0	12	3.3	3.7	17.5
0.0100	27	3.6	7.45	35.2	35.0	13	3.6	3.7	17.5
0.0113	28	3.8	7.45	35.2	35.0	14	3.8	3.7	17.5
0.0125	30	4.0	7.45	35.2	35.0	15	4.0	3.7	17.5
0.0138	31	4.2	7.45	35.2	35.0	16	4.2	3.7	17.5
0.0150	33	4.4	7.45	35.2	35.0	16	4.4	3.7	17.5
0.0163	34	4.6	7.45	35.2	35.0	17	4.5	3.7	17.5
0.0175	35	4.7	7.45	35.2	35.0	18	4.7	3.7	17.5
0.0188	37	4.9	7.45	35.2	35.0	18	4.9	3.7	17.5
0.0200	38	5.1	7.45	35.2	35.0	19	5.0	3.7	17.5
0.0213	39	5.2	7.45	35.2	35.0	19	5.2	3.7	17.5
0.0225	40	5.4	7.45	35.2	35.0	20	5.4	3.7	17.5
0.0238	41	5.5	7.45	35.2	35.0	20	5.5	3.7	17.5
0.0250	42	5.7	7.45	35.2	35.0	21	5.6	3.7	17.5
0.0263	43	5.8	7.45	35.2	35.0	22	5.8	3.7	17.5
0.0275	44	5.9	7.45	35.2	35.0	22	5.9	3.7	17.5
0.0288	45	6.1	7.45	35.2	35.0	23	6.0	3.7	17.5
0.0300	46	6.2	7.45	35.2	35.0	23	6.2	3.7	17.5
0.0313	47	6.3	7.45	35.2	35.0	23	6.3	3.7	17.5
0.0325	48	6.5	7.45	35.2	35.0	24	6.4	3.7	17.5
0.0338	49	6.6	7.45	35.2	35.0	24	6.6	3.7	17.5
0.0350	50	6.7	7.45	35.2	35.0	25	6.7	3.7	17.5
0.0363	51	6.8	7.45	35.2	35.0	25	6.8	3.7	17.5
0.0375	52	6.9	7.45	35.2	35.0	26	6.9	3.7	17.5
0.0388	53	7.1	7.45	35.2	35.0	26	7.0	3.7	17.5
0.0400	53	7.2	7.45	35.2	35.0	27	7.1	3.7	17.5

100-Year Storm Event Maximum Allowable Street Flows (Maximum Flow to Right-of-Way)									
Channel Slope (ft/ft)	Full Street Width					Half Street Width			
	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft^3/s)	Velocity (ft/s)	Flow Area (ft^2)	Top Width (ft)
0.0050	43	2.2	19.32	60.2	60.0	21	2.2	9.7	30
0.0063	48	2.5	19.32	60.2	60.0	24	2.4	9.7	30
0.0075	52	2.7	19.32	60.2	60.0	26	2.7	9.7	30
0.0088	56	2.9	19.32	60.2	60.0	28	2.9	9.7	30
0.0100	60	3.1	19.32	60.2	60.0	30	3.1	9.7	30
0.0113	64	3.3	19.32	60.2	60.0	32	3.3	9.7	30
0.0125	67	3.5	19.32	60.2	60.0	33	3.5	9.7	30
0.0138	71	3.7	19.32	60.2	60.0	35	3.6	9.7	30
0.0150	74	3.8	19.32	60.2	60.0	36	3.8	9.7	30
0.0163	77	4.0	19.32	60.2	60.0	38	3.9	9.7	30
0.0175	80	4.1	19.32	60.2	60.0	39	4.1	9.7	30
0.0188	82	4.3	19.32	60.2	60.0	41	4.2	9.7	30
0.0200	85	4.4	19.32	60.2	60.0	42	4.4	9.7	30
0.0213	88	4.5	19.32	60.2	60.0	43	4.5	9.7	30
0.0225	90	4.7	19.32	60.2	60.0	45	4.6	9.7	30
0.0238	93	4.8	19.32	60.2	60.0	46	4.8	9.7	30
0.0250	95	4.9	19.32	60.2	60.0	47	4.9	9.7	30
0.0263	97	5.0	19.32	60.2	60.0	48	5.0	9.7	30
0.0275	100	5.2	19.32	60.2	60.0	49	5.1	9.7	30
0.0288	102	5.3	19.32	60.2	60.0	50	5.2	9.7	30
0.0300	104	5.4	19.32	60.2	60.0	52	5.3	9.7	30
0.0313	106	5.5	19.32	60.2	60.0	53	5.5	9.7	30
0.0325	108	5.6	19.32	60.2	60.0	54	5.6	9.7	30
0.0338	111	5.7	19.32	60.2	60.0	55	5.7	9.7	30
0.0350	113	5.8	19.32	60.2	60.0	56	5.8	9.7	30
0.0363	115	5.9	19.32	60.2	60.0	57	5.9	9.7	30
0.0375	117	6.0	19.32	60.2	60.0	58	6.0	9.7	30
0.0388	118	6.1	19.32	60.2	60.0	59	6.1	9.7	30
0.0400	120	6.2	19.32	60.2	60.0	60	6.2	9.7	30

Street Flows Ramp Curb (Maximum Flow to Crown of Roadway)										
Channel Slope (ft/ft)	Full Street Width					Half Street Width				
	Discharge (ft³/s)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)	Discharge (ft³/s)	Velocity (ft/s)	Flow Area (ft²)	Top Width (ft)
0.0050	13	2.2	6.05	35.0	34.8	6.7	2.2	3.0	17.4
0.0063	15	2.5	6.05	35.0	34.8	7.5	2.5	3.0	17.4
0.0075	16	2.7	6.05	35.0	34.8	8.2	2.7	3.0	17.4
0.0088	18	2.9	6.05	35.0	34.8	8.9	2.9	3.0	17.4
0.0100	19	3.1	6.05	35.0	34.8	9.5	3.1	3.0	17.4
0.0113	20	3.3	6.05	35.0	34.8	10	3.3	3.0	17.4
0.0125	21	3.5	6.05	35.0	34.8	11	3.5	3.0	17.4
0.0138	22	3.7	6.05	35.0	34.8	11	3.7	3.0	17.4
0.0150	23	3.8	6.05	35.0	34.8	12	3.8	3.0	17.4
0.0163	24	4.0	6.05	35.0	34.8	12	4.0	3.0	17.4
0.0175	25	4.1	6.05	35.0	34.8	13	4.1	3.0	17.4
0.0188	26	4.3	6.05	35.0	34.8	13	4.3	3.0	17.4
0.0200	27	4.4	6.05	35.0	34.8	13	4.4	3.0	17.4
0.0213	28	4.6	6.05	35.0	34.8	14	4.6	3.0	17.4
0.0225	28	4.7	6.05	35.0	34.8	14	4.7	3.0	17.4
0.0238	29	4.8	6.05	35.0	34.8	15	4.8	3.0	17.4
0.0250	30	5.0	6.05	35.0	34.8	15	5.0	3.0	17.4
0.0263	31	5.1	6.05	35.0	34.8	15	5.1	3.0	17.4
0.0275	31	5.2	6.05	35.0	34.8	16	5.2	3.0	17.4
0.0288	32	5.3	6.05	35.0	34.8	16	5.3	3.0	17.4
0.0300	33	5.4	6.05	35.0	34.8	16	5.4	3.0	17.4
0.0313	34	5.5	6.05	35.0	34.8	17	5.5	3.0	17.4
0.0325	34	5.7	6.05	35.0	34.8	17	5.6	3.0	17.4
0.0338	35	5.8	6.05	35.0	34.8	17	5.8	3.0	17.4
0.0350	35	5.9	6.05	35.0	34.8	18	5.9	3.0	17.4
0.0363	36	6.0	6.05	35.0	34.8	18	6.0	3.0	17.4
0.0375	37	6.1	6.05	35.0	34.8	18	6.1	3.0	17.4
0.0388	37	6.2	6.05	35.0	34.8	19	6.2	3.0	17.4
0.0400	38	6.3	6.05	35.0	34.8	19	6.3	3.0	17.4

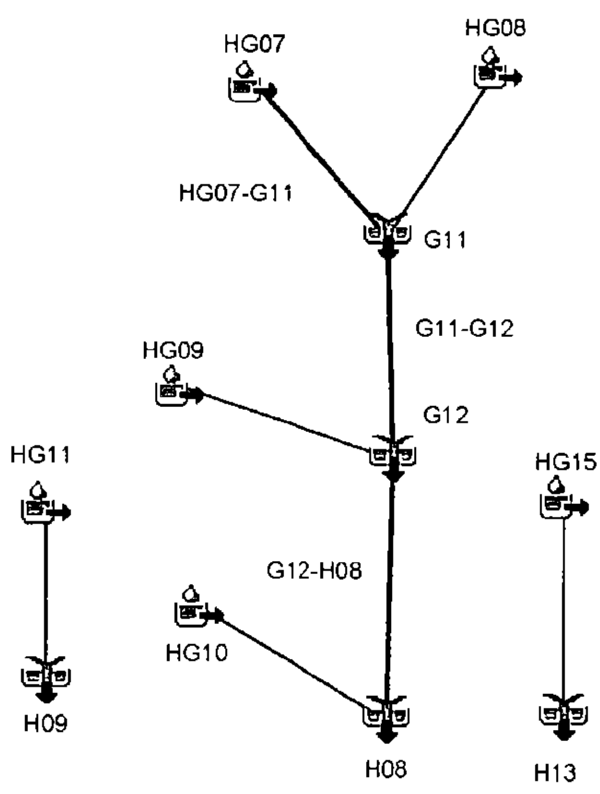
Appendix D - HEC-HMS Data

COMPOSITE 'C' FACTORS

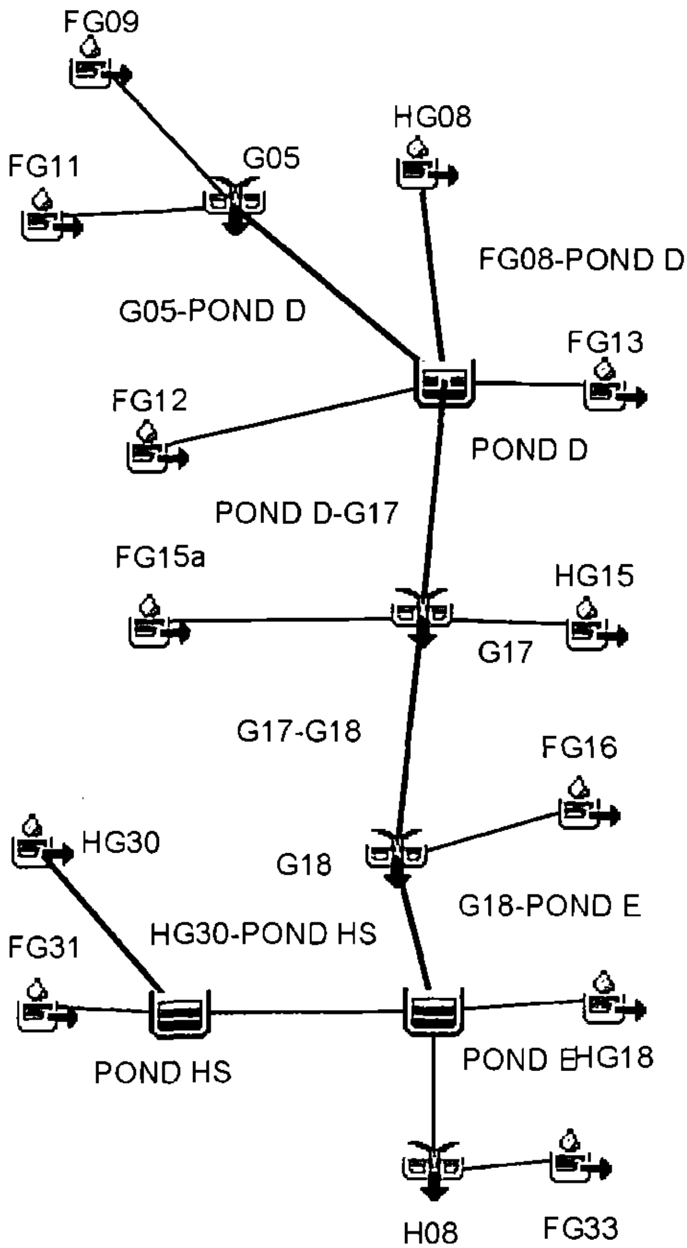
PROJECT: SCS — SCS Calcs for Meridian Ranch Filing 11A — Date 3/10/2014

BASIN DESIGNATION	AREA (AC.) UNDEVELOPED	GRADED	5 DU/AC	6 DU/AC	STREETS	OPEN SPACE PARKS/GC	TOTAL	AREA (MI^2)	COMPOSITE 'C' FACTOR
HISTORIC									
HG07	63.0						63	0.0984	**61.0**
HG08	85.0						85	0.1328	**61.0**
HG09	114.0						114	0.1781	**61.0**
HG10	88.0						88	0.1375	**61.0**
HG11	131.0						131	0.2047	**61.0**
HG15	164 0						164	0.2563	**61.0**
DEVELOPED									
HG08		83 1		4.9			88	0 1375	**68.7**
FG09		26 3		5.7			32	0.0500	**70.1**
FG11	FROM APPROVED MERIDIAN RANCH MDDP DATED MAY 2012						39	0.0609	**78.4**
FG12							21	0.0328	**80.0**
FG13	30.6	35.3		10 1			76	0.1188	**66.8**
HG15	80 0	6 0					86	0.134	**61.5**
FG15a		6.3	3 0			0.7	10	0.016	**70.6**
FG16		12.2	25.9		4.1	7.3	50	0.077	**74.8**
HG17	72.0						72	0.113	**61.0**
HG18	72.5	22 5					95	0.148	**62.7**
HG30	49.0						49	0.077	**61.0**
FG31	FROM APPROVED MERIDIAN RANCH MDDP DATED MAY 2012 (OLD FG17)						59	0.0922	**80.0**
FG32	15				2.0		17	0.0273	**66.2**
FG33	5				2.0		7	0.0109	**71.6**
FUTURE									
FG08	FROM APPROVED MERIDIAN RANCH MDDP DATED MAY 2012						93	0.1453	**76.0**
FG09							27	0.0422	**72.9**
FG10							61	0.0953	**73.1**
FG11							39	0.0609	**78.4**
FG12							21	0.0328	**80.0**
FG13				10.1		37.9	48	0.0750	**65.8**
FG14	FROM APPROVED MERIDIAN RANCH MDDP DATED MAY 2012						20	0.0313	**77.4**
FG15			49 0			27.0	76	0.1188	**72.3**
FG15a			9 3			0.7	10	0.0156	**76.9**
FG16			38.1		4 1	7.3	50	0.0773	**77.3**
FG18	FROM APPROVED MERIDIAN RANCH MDDP DATED MAY 2012						105	0.1641	**74.5**
FG19							71	0.1109	**82.0**
FG31	FROM APPROVED MERIDIAN RANCH MDDP DATED MAY 2012 (OLD FG17)						59	0.0922	**80.0**
FG32	12.0				2.0		14	0 0219	**66.3**
FG33	5.0				2.0		7	0 0109	**71.6**

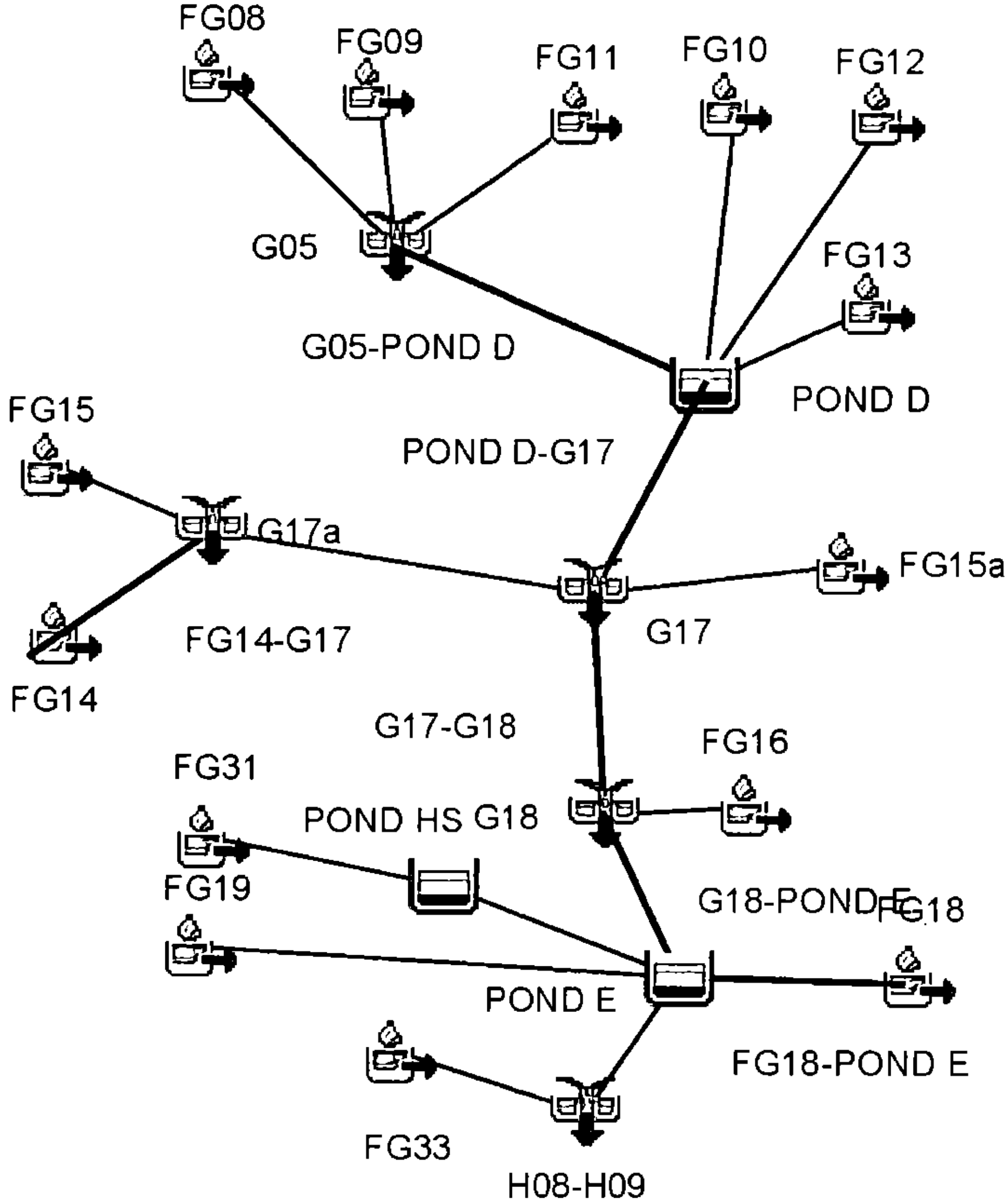
HISTORIC					
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q_{100} (CFS)	TOTAL VOLUME Q_{100} (AC. FT.)	DISCHARGE PEAK Q_5 (CFS)	TOTAL VOLUME Q_5 (AC. FT.)
HG07	0.0984	41	5.3	5	1.2
HG07-G11	0.0984	41	5.3	5	1.2
HG08	0.1328	77	7.2	10	1.6
G11	0.2312	104	12.5	12	2.8
G11-G12	0.2312	104	12.4	11	2.7
HG09	0.1781	82	9.7	10	2.1
G12	0.4093	185	22.1	20	4.9
G12-H08	0.4093	183	21.8	20	4.8
HG10	0.1375	49	7.4	6	1.6
H08	0.5468	232	29.2	22	6.4
HG11	0.2047	87	11.1	11	2.4
H09	0.2047	87	11.1	11	2.4
HG15	0.2563	80	13.9	11	3.0
H13	0.2563	80	13.9	11	3.0



FILING 11A					
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q_{100} (CFS)	TOTAL VOLUME Q_{100} (AC. FT.)	DISCHARGE PEAK Q_5 (CFS)	TOTAL VOLUME Q_5 (AC. FT.)
HG08	0.1375	107	10.5	24	3.1
FG08-POND D	0.1375	107	10.5	24	3.1
FG13	0.1188	80	8.5	16	2.4
FG11	0.0608	85	7.2	30	2.8
FG09	0.0500	51	4.1	13	1.3
G05	0.1108	134	11.4	42	4.1
G05-POND D	0.1108	134	11.4	42	4.1
FG12	0.0328	55	4.1	21	1.7
POND D	**0.3999**	**64**	**29.6**	**8**	**8.0**
POND D-G17	0.3999	64	29.6	8	8.0
HG15	0.1344	58	7.5	8	1.7
FG15a	0.0156	20	1.4	6	0.4
G17	0.5499	91	38.4	11	10.1
G17-G18	0.5499	91	38.4	11	10.1
FG16	0.0773	97	8.0	31	2.9
G18	0.6272	161	46.4	41	13.0
G18-POND E	0.6272	161	46.4	41	13.0
FG31	0.0922	123	11.6	45	4.7
HG30	0.0766	49	4.2	6	0.9
HG30-POND HS	0.0766	48	4.1	6	0.9
POND HS	**0.1688**	**126**	**15.8**	**27**	**5.6**
HG18	0.1484	67	8.7	10	2.1
POND E	**0.9444**	**141**	**65.2**	**18**	**18.4**
FG33	0.0109	13	1.0	4	0.3
H08	0.9553	**74**	66.2	**12**	18.7
H09		**67**		**6.3**	
*** FROM OUTLET STAGE-STORAGE CALCULATION**					


FG09
HG08
FG11
G05
FG08-POND D
G05-POND D
FG13
FG12
POND D
POND D-G17
FG15a
HG15
G17
G17-G18
FG16
HG30
G18
G18-POND E
HG30-POND HS
FG31
POND HS
POND E
HG18
H08
FG33

FUTURE					
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q_{100} (CFS)	TOTAL VOLUME Q_{100} (AC. FT.)	DISCHARGE PEAK Q_5 (CFS)	TOTAL VOLUME Q_5 (AC. FT.)
FG08	0.1453	170	15.8	55	5.8
FG11	0.0608	85	7.2	30	2.8
FG09	0.0416	53	4.0	16	1.4
G05	0.2477	302	27.1	99	10.0
G05-POND D	0.2477	301	27.0	98	10.0
FG10	0.0953	94	9.2	27	3.2
FG13	0.075	53	5.2	10	1.4
FG12	0.0328	55	4.1	21	1.7
POND D	**0.4508**	**105**	**40.3**	**15**	**12.8**
POND D-G17	0.4508	105	40.3	15	12.8
FG15	0.1188	132	11.2	38	3.7
FG14	0.0313	47	3.6	17	1.4
FG14-G17	0.0313	47	3.6	16	1.4
G17a	0.1501	179	14.7	54	5.1
FG15a	0.0156	27	1.8	10	0.7
G17	0.6165	212	56.8	63	18.6
G17-G18	0.6165	212	56.7	63	18.6
FG16	0.0773	109	8.8	37	3.4
G18	0.6938	319	65.6	99	21.9
G18-POND E	0.6938	317	65.6	99	21.9
FG18	0.1641	198	16.9	62	6.0
FG18-POND E	0.1641	198	16.9	62	6.0
FG19	0.0977	203	13.2	83	5.6
FG31	0.0922	123	11.6	45	4.7
POND HS	0.0922	79	11.6	25	4.7
POND E	**1.0478**	**217**	**92.1**	**24**	**27.7**
FG33	0.0109	15	1.0	4	0.3
H08	1.0587	**155**	93.1	**15.8**	28
H09		**62**		**8.7**	
*** FROM OUTLET STAGE-STORAGE CALCULATION**					


FG08
FG09
FG11
FG10
FG12
G05
FG13
G05-POND D
POND D
FG15
POND D-G17
G17a
FG15a
FG14-G17
G17
FG14
G17-G18
FG16
FG31
POND HS
G18
FG19
G18-POND E
FG18
POND E
FG18-POND E
FG33
H08-H09

Appendix E - Detention Pond Information

FILING 11 DEVELOPED CONDITION
Simulation Run: F11A-100 YR Reservoir: POND D

Start of Run:	09May2008, 08:00	Basin Model:	Estates Rough Grading
End of Run:	10May2008, 08:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	07Mar2014, 15:02:03	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	361 (CFS)	Date/Time of Peak Inflow:	09May2008, 14:14
Peak Outflow:	64 (CFS)	Date/Time of Peak Outflow:	09May2008, 15:04
Total Inflow :	34.5 (AC-FT)	Peak Storage:	16.3 (AC-FT)
Total Outflow:	29.6 (AC-FT)	Peak Elevation:	7055.7 (FT)

Simulation Run: F11A-005 YR Reservoir: POND D

Start of Run:	09May2008, 08:00	Basin Model:	Estates Rough Grading
End of Run:	10May2008, 08:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	07Mar2014, 14:33:20	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	95 (CFS)	Date/Time of Peak Inflow:	09May2008, 14:18
Peak Outflow:	8 (CFS)	Date/Time of Peak Outflow:	09May2008, 16:24
Total Inflow :	11.2 (AC-FT)	Peak Storage:	6.0 (AC-FT)
Total Outflow:	8.0 (AC-FT)	Peak Elevation:	7053.5 (FT)

Simulation Run: F11A-100 YR Reservoir: POND E

Start of Run:	09May2008, 08:00	Basin Model:	Estates Rough Grading
End of Run:	10May2008, 08:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	07Mar2014, 15:02:03	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	333(CFS)	Date/Time of Peak Inflow:	09May2008, 14:24
Peak Outflow:	141 (CFS)	Date/Time of Peak Outflow:	09May2008, 15:20
Total Inflow :	70.9 (AC-FT)	Peak Storage:	17.6 (AC-FT)
Total Outflow:	65.2 (AC-FT)	Peak Elevation:	6971.2 (FT)

Simulation Run: F11A-005 YR Reservoir: POND E

Start of Run:	09May2008, 08:00	Basin Model:	Estates Rough Grading
End of Run:	10May2008, 08:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	07Mar2014, 14:33:20	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	66 (CFS)	Date/Time of Peak Inflow:	09May2008, 14:20
Peak Outflow:	18 (CFS)	Date/Time of Peak Outflow:	09May2008, 16:52
Total Inflow :	20.6 (AC-FT)	Peak Storage:	6.2 (AC-FT)
Total Outflow:	18.4 (AC-FT)	Peak Elevation:	6969.7 (FT)

FINAL FUTURE CONDITION
Simulation Run: F-100 YR Reservoir: POND D

Start of Run:	09May2008, 08:00	Basin Model:	Estates Rough Grading
End of Run:	10May2008, 08:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	10Mar2014, 10:00:30	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	495 (CFS)	Date/Time of Peak Inflow:	09May2008, 14:14
Peak Outflow:	105 (CFS)	Date/Time of Peak Outflow:	09May2008, 14:56
Total Inflow :	45.7 (AC-FT)	Peak Storage:	21.1 (AC-FT)
Total Outflow:	40.3 (AC-FT)	Peak Elevation:	7056.4 (FT)

Simulation Run: F-005 YR Reservoir: POND D

Start of Run:	09May2008, 08:00	Basin Model:	Estates Rough Grading
End of Run:	10May2008, 08:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	10Mar2014, 09:50:40	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	153 (CFS)	Date/Time of Peak Inflow:	09May2008, 14:16
Peak Outflow:	15 (CFS)	Date/Time of Peak Outflow:	09May2008, 16:06
Total Inflow :	16.3 (AC-FT)	Peak Storage:	8.4 (AC-FT)
Total Outflow:	12.8 (AC-FT)	Peak Elevation:	7054.1 (FT)

FINAL FUTURE CONDITION
Simulation Run: F-100 YR Reservoir: POND E

Start of Run:	09May2008, 08:00	Basin Model:	MERIDIAN RANCH
End of Run:	10May2008, 08:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	10Mar2014, 10:00:30	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	707 (CFS)	Date/Time of Peak Inflow:	09May2008, 14:10
Peak Outflow:	217 (CFS)	Date/Time of Peak Outflow:	09May2008, 15:02
Total Inflow :	107.3 (AC-FT)	Peak Storage:	33.4 (AC-FT)
Total Outflow:	92.1 (AC-FT)	Peak Elevation:	6972.6 (FT)

Simulation Run: F-005 YR Reservoir: POND E

Start of Run:	09May2008, 08:00	Basin Model:	MERIDIAN RANCH
End of Run:	10May2008, 08:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	10Mar2014, 09:50:40	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	233 (CFS)	Date/Time of Peak Inflow:	09May2008, 14:12
Peak Outflow:	24 (CFS)	Date/Time of Peak Outflow:	09May2008, 18:22
Total Inflow :	38.2 (AC-FT)	Peak Storage:	17.1 (AC-FT)
Total Outflow:	27.7 (AC-FT)	Peak Elevation:	6971.1 (FT)

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond D - Interim AS-BUILT

Heagler Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	710
embankment elev =	7060
spillway length =	100
spillway elevation =	7058
100 year storage elev.=	7055.8
100 year storage vol.=	16.8
100 year discharge=	57
5 year storage elev.=	7053.5
5 year storage vol.=	6.0
5 year discharge=	8
WQCV storage vol.=	1.0
WQCV depth=	2.3
1/2 WQCV storage vol.=	0.50

Data for outlet pipe and grate:

Type			Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)			
Rectangular		Orifice 1:	0.03	2.3		Area =	0.069	Elev to cl =		7050.15
Circular		Orifice 2:			8	Area =	0.349	Elev to cl =		7051.3
Rectangular		Orifice 3:	5	0.5		Area =	2.500	Elev to cl =		7053.25
None Selected		Orifice 4:				Area =	0.000	Elev to cl =		

Stand Pipe Dimensions

Rec Grate		3	x	4.25	Elev =	7054.8
Circ. Grate			dia.		Elev =	

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		4	**Circular**
Area	12.6		TOP		
Outlet I. E.	7048.5		7052.9		
Wall Thick.	5	in.			

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1	2	3	4	**Rectangular**	1	2	OUTFLOW	FLOW
7049	0	0	0.0	0.00	0.0			-								
7050	1	10705	0.2	0.1	0.12	-	-	0.2	-	-	-	-	13		0.2	0.150
7051	2	36676	0.8	0.5	0.67	-	-	0.3	0	-	-	-	33		0.8	0.791
7052	3	71989	1.7	1.2	1.91	-	-	0.5	1	-	-	-	60		1.9	1.858
7053	4	133440	3.1	2.4	4.27	-	-	0.6	2.2	-	-	-	90		2.8	2.752
7054	5	178828	4.1	3.6	7.86	-	-	0 7	2.8	10.4	-	-	119		13.8	13.838
7055	6	221269	5.1	4.6	12.45	-	-	0.7	3.2	15.9	-	3.1	139		23	22.975
7055.5	6 5	245509	5.6	2.7	15.13	-	-	0.8	3.4	18.1	-	20.2	148		42	42.475
7056	7	269749	6.2	5 6	18.08	-	-	0.8	3.6	20	-	45	157		70	69 761
7058	9	337508	7.7	13.9	32.03	-	-	0.9	4.4	26	-	110	188		141	141.336
7060	11	405520	9.3	31.0	49.09	-	848.5	1.0	5.0	31	-	140	214		177	1,025.796
						-	-	-	-	-	-	-			-	-

Notes: 1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond E-TEMP CMP RISER (TOTAL FLOWS)

Gieck Basin - El Paso County, Colorado

INTERIM - FILING 11A

Data for spillway and embankment:

embankment length =	1860
embankment elev =	6976
spillway length =	200
spillway elevation =	6974.5
100 year storage elev.=	6971.2
100 year storage vol.=	17.6
100 year discharge=	141
5 year storage elev.=	6969.7
5 year storage vol.=	6 2
5 year discharge=	18
WQCV storage elev.=	6967.9
WQCV storage vol.=	0.3
WQCV depth =	0.9
1/2 WQCV storage elev.=	6967.8
1/2 WQCV storage vol.=	0.2

STAGE		STORAGE				TOTAL DISCHARGE											
ELEV	HEIGHT	AREA		VOLUME		TOP OF BANK	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)		PIPE		REALIZED CULVERT OUTFLOW	TOTAL FLOW
		sqft	acre	acft	cum acft			1	2	3	4	Circular		1	2		
6967	0	3110	0.07	0.0	0.0			-	-	-	-	-	-	0.9	-	-	-
6968	1	49719	1.14	0.6	0.6	-	-	0.19	-	-	-	-	-	17.7	-	0.2	0.186
6969	2	148073	3.40	2.3	2.9	-	-	0.4	-	7.6	-	-	-	51.6	-	7.9	7.929
6970	3	282553	6.49	4.9	7.8	-	-	0.5	11.7	10.7	-	-	-	97.2	-	23	22.833
6970.5	3.5	345630	7.93	3.6	11.4	-	-	0.5	35.6	12.0	-	-	-	121.6	-	48	48.041
6971	4	408706	9.38	7.9	15.8	-	-	0.6	67.3	13.1	-	11.4	-	145.4	-	92	92.316
6971.25	4 25	428868	9.85	2.4	18.2	-	-	0 6	85.4	13.6	-	167.3	-	157.4	-	157	157
6971.5	4.5	449030	10.31	4.9	20.7	-	-	0 6	96.9	14.1	-	415.2	-	168.2	-	168	168
6971.75	4.75	469192	10.77	2.6	23.3	-	-	0 6	106.1	14.6	-	728.3	-	178.2	-	178	178
6972	5	489354	11.23	5.4	26.1	-	-	0.6	114.6	15.1	-	1,095.2	-	187.2	-	187	187
6972.25	5.25	496911	11.41	2.8	28.9	-	-	0.7	122.6	15 6	-	1,508.7	-	195.4	-	195	195
6972.5	5.5	504468	11.58	5.7	31.8	-	-	0.7	130.0	16.0	-	1,964.2	-	203.4	-	203	203
6973	6	519582	11.93	11.6	37.6	-	-	0.7	143.7	16.9	-	2,987 6	-	218.8	-	219	219
6974	7	532469	12.22	12.1	49.7	-	-	0.8	167.8	18.5	-	5,421.8	-	247.3	-	247	247
6976	9	557640	12.80	25.0	74.7	-	1,102	0.9	207.8	21.4	-	11,551.3	-	297.1	-	297	1,399

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond E-TEMP CMP RISER (H08)

Gieck Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	1860
embankment elev =	6975
spillway length =	200
spillway elevation =	6974
100 year storage elev.=	6971.2
100 year storage vol.=	17.6
100 year discharge=	74
5 year storage elev.=	6969.7
5 year storage vol.=	6.2
5 year discharge=	12
WQCV storage elev.=	6967.9
WQCV storage vol.=	0.3
1/2 WQCV storage elev.=	6967.8
1/2 WQCV storage vol.=	0.2

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)		
Rectangular	Orifice 1:	V	0.0310	1.00		Area =	0.031	Elev to cl =	6967.50
Rectangular	Orifice 2:	V	8	1.5		Area =	12.000	Elev to cl =	6970.20
Circular	Orifice 3:	H			12	Area =	0.785	Elev to cl =	6968.00
None Selected	Orifice 4:	V				Area =	0.000	Elev to cl =	6967.50

Stand Pipe Dimensions

Rec Grate			x		Elev =	6970.95
Circ. Grate		54	dia.		Elev =	6970.95

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		3.5	**Circular**
Area	9.6		TOP		
Outlet I. E.	6966.8		6970 67		
Wall Thick.	5	in.			

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1	2	3	4	Circular	1	2	OUTFLOW	FLOW
6967	0	3110	0 07	0.0	0 0			-	-	-	-	-	0		-	-
6968	1	49719	1.14	0.6	0.6			0.1	-	-	-	-	9		0.1	0.093
6969	2	148073	3.40	2.3	2.9			0.2	-	3.8	-	-	26		4.0	3.964
6970	3	282553	6.49	4.9	7.8			0.2	9.8	5.3	-	-	49		15	15.373
6970.5	3.5	345629.5	7.93	3.6	11.4			0.3	25.8	6.0	-	-	61		32	32.060
6971	4	408706	9.38	7.9	15.8			0.3	46 3	6 6	-	6	73		59	58.833
6971.25	4 25	428868	9 85	2.4	18.2			0.3	58.0	6 8	-	84	78		78	78.450
6971.5	4.5	449030	10.31	4.9	20.7			0.3	65.9	7.1	-	208	83		83	83
6971.75	4 75	469192	10 77	2.6	23.3			0.3	71.9	7.3	-	364	88		88	88
6972	5	489354	11.23	5.4	26.1			0.3	77.5	7.6	-	548	92		92	92
6972.25	5.25	496911	11.41	2.8	28.9			0.3	82.7	7.8	-	754	97		97	97
6972.5	5 5	504468	11.58	5.7	31.8			0.3	87.6	8.0	-	982	101		101	101
6973	6	519582	11.93	11.6	37.6			0.4	96.7	8.5	-	1,494	108		108	108
6974	7	532469	12.22	12.1	49.7			0.4	112.6	9.3	-	2,711	122		122	122
6976	9	557640	12.80	25.0	74.7			0 4	139.2	10.7	-	5,776	146		146	146

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond E-TEMP CMP RISER (H09)

Gieck Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	1860
embankment elev =	6976
spillway length =	200
spillway elevation =	*6974.5*
100 year storage elev.=	6971.2
100 year storage vol.=	17.6
100 year discharge=	67
5 year storage elev.=	6969.7
5 year storage vol.=	6.2
5 year discharge=	6.3
WQCV storage elev.=	6967.9
WQCV storage vol.=	0.3
1/2 WQCV storage elev.=	6967.8
1/2 WQCV storage vol =	0.2

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)		
Rectangular	Orifice 1:	V	0.0310	1.00		Area =	0.031	Elev to cl =	6967.50
Rectangular	Orifice 2:	V	5	1.2		Area =	6.000	Elev to cl =	6970.35
Circular	*Orifice 3:*	*H*			12	*Area =*	*0.785*	*Elev to cl =*	*6968.00*
None Selected	Orifice 4:	V				Area =	0.000	Elev to cl =	6967.33

Stand Pipe Dimensions

Rec Grate			x		Elev =	6970.95
Circ. Grate		54	dia.		Elev =	6970.95

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		3.5	**Circular**
Area	9.6		TOP		
Outlet I. E.	6966.8		6970.67		
Wall Thick.	*5*	*in.*			

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT OUTFLOW	TOTAL FLOW
		sqft	acre	acft	cum acft	BANK		1	2	3	4	Circular	1	2		
6967	0	3110	0.07	0.0	0 0			-	-	-	-	-	0.5		-	-
6968	1	49719	1.14	0 6	0 6			0.1	-	-	-	-	8.8		0.1	0.1
6969	2	148073	3.40	2.3	2.9			0.2	-	3.8	-	-	26		4.0	4.0
6970	3	282553	6 49	4.9	7.8			0.2	1.9	5.3	-	-	49		7.5	7.5
6970.5	3.5	345629.5	7.93	3.6	11.4			0.3	9.7	6.0	-	-	61		16.0	16
6971	4	408706	9.38	7.9	15.8			0.3	21.0	6 6	-	6	73		33.5	33.5
6971.25	4.25	428868	9.85	2.4	18.2			0.3	27 4	6 8	-	84	79		78.9	78.9
6971.5	4.5	449030	10.31	4 9	20.7			0.3	31.0	7.1	-	208	85		84.7	85
6971.75	4.75	469192	10.77	2.6	23.3			0.3	34.2	7.3	-	364	90		90.1	90
6972	5	489354	11.23	5.4	26.1			0.3	37.1	7.6	-	548	95		94.8	95
6972.25	5.25	496911	11.41	2.8	28.9			0.3	39.8	7.8	-	754	99		98.7	99
6972.5	5.5	504468	11.58	5.7	31.8			0.3	42.4	8 0	-	982	103		102.7	103
6973	6	519582	11.93	11.6	37.6			0.4	47.0	8.5	-	1,494	111		110.5	111
6974	7	532469	12.22	12.1	49.7			0.4	55.2	9.3	-	2,711	125		125.3	125
6976	9	557640	12.80	25.0	74.7			0.4	68.7	10.7	-	5,776	151		151.4	151

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

POND E OUTLET PIPE HYDRAULICS
OUTLET AT H08 INTERIM – F11A

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	6,974.50 ft	Headwater Depth/Height	1.19
Computed Headwater Eleva	6,970.88 ft	Discharge	70.00 cfs
Inlet Control HW Elev.	6,970.83 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	6,970.88 ft	Control Type	Outlet Control

Grades			
Upstream Invert	6,966.72 ft	Downstream Invert	6,966.44 ft
Length	66.68 ft	Constructed Slope	0.004199 ft/ft

Hydraulic Profile			
Profile	M2	Depth, Downstream	2.62 ft
Slope Type	Mild	Normal Depth	3.23 ft
Flow Regime	Subcritical	Critical Depth	2.62 ft
Velocity Downstream	9.05 ft/s	Critical Slope	0.005838 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.50 ft
Section Size	42 inch	Rise	3.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	6,970.88 ft	Upstream Velocity Head	1.04 ft
Ke	0.20	Entrance Loss	0.21 ft

Inlet Control Properties			
Inlet Control HW Elev.	6,970.83 ft	Flow Control	Transition
Inlet Type	Groove end w/headwall	Area Full	9.6 ft²
K	0.00180	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	2
C	0.02920	Equation Form	1
Y	0.74000		

POND E OUTLET PIPE HYDRAULICS
OUTLET AT H09 INTERIM

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,974.50 ft	Headwater Depth/Height	1.01
Computed Headwater Eleva	6,970.27 ft	Discharge	55.00 cfs
Inlet Control HW Elev.	6,970.16 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	6,970.27 ft	Control Type	Entrance Control

Grades

Upstream Invert	6,966.72 ft	Downstream Invert	6,966.34 ft
Length	69.88 ft	Constructed Slope	0.005438 ft/ft

Hydraulic Profile

Profile	S2	Depth, Downstream	2.24 ft
Slope Type	Steep	Normal Depth	2.24 ft
Flow Regime	Supercritical	Critical Depth	2.32 ft
Velocity Downstream	8.44 ft/s	Critical Slope	0.004932 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.50 ft
Section Size	42 inch	Rise	3.50 ft
Number Sections	1		

Outlet Control Properties

Outlet Control HW Elev.	6,970.27 ft	Upstream Velocity Head	1.02 ft
Ke	0.20	Entrance Loss	0.20 ft

Inlet Control Properties

Inlet Control HW Elev.	6,970.16 ft	Flow Control	Unsubmerged
Inlet Type	Beveled ring, 33.7° bevels	Area Full	9.6 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

POND E OUTLET RATING TABLE
42" RCP Flows

@ H08

Range Data:

	Minimum	Maximum	Increment
Allowable HW E	6,967.00	6,976.00	0.50 ft

HW Elev. (ft)	Discharge (cfs)
6,967.00	0.46
6,967.50	3.40
6,968.00	8.83
6,968.50	16.41
6,969.00	25.78
6,969.50	36.56
6,970.00	48.58
6,970.50	60.89
6,971.00	72.78
6,971.50	83.46
6,972.00	92.47
6,972.50	100.68
6,973.00	108.26
6,973.50	115.35
6,974.00	122.03
6,974.50	128.36
6,975.00	134.39
6,975.50	140.16
6,976.00	145.71

@ H09

Range Data:

	Minimum	Maximum	Increment
Allowable HW E	6,967.00	6,976.00	0.50 ft

HW Elev. (ft)	Discharge (cfs)
6,967.00	0.45
6,967.50	3.40
6,968.00	8.83
6,968.50	16.41
6,969.00	25.78
6,969.50	36.56
6,970.00	48.35
6,970.50	60.72
6,971.00	72.62
6,971.50	84.73
6,972.00	94.76
6,972.50	102.71
6,973.00	110.53
6,973.50	118.08
6,974.00	125.31
6,974.50	132.24
6,975.00	138.88
6,975.50	145.26
6,976.00	151.40

The above tables are used to cross check the flows within the 42" RCP versus the flows allowed into the control structure. The lower of the two flows governs the total outflow of the pond.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond D - Future AS-BUILT

Heagler Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	710
embankment elev =	7060
spillway length =	100
spillway elevation =	7058
100 year storage elev.=	7056.4
100 year storage vol.=	21.1
100 year discharge=	105
5 year storage elev.=	7054.1
5 year storage vol =	8.4
5 year discharge=	15
WQCV storage vol.=	1.0
WQCV depth =	2.3
1/2 WQCV storage vol.=	0 50

Data for outlet pipe and grate:

Type			Dimensions Width (ft.)	X Height (ft.)	Dia (in)		(sqft)			
Rectangular		Orifice 1:	0.03	2.3		Area =	0.069	Elev to cl =		7050.15
Circular		Orifice 2:			8	Area =	0.349	Elev to cl =		7051.30
Rectangular		Orifice 3:	5	0.5		Area =	2.500	Elev to cl =		7053.25
None Selected		Orifice 4:				Area =	0.000	Elev to cl =		

Stand Pipe Dimensions

Rec Grate		6	x	4.25	Elev =	7054.8
Circ. Grate			dia.		Elev =	

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		4	**Circular**
Area	*12.6*		*TOP*		
Outlet I. E.	7048.5		7052.9		
Wall Thick.	5	in.			

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1	2	3	4	Rectangular	1	2	OUTFLOW	FLOW
7049	0	0	0.0	0.00	0.0			-								
7050	1	10705	0.2	0.1	0.1	-	-	0.2	-	-	-	-	13		0.2	0.15
7051	2	36676	0.8	0.5	0.7	-	-	0.3	0.5	-	-	-	33		0.8	0.79
7052	3	71989	1.7	1.2	1.9	-	-	0.5	1.4	-	-	-	60		1.9	1.9
7053	4	133440	3.1	2.4	4.3	-	-	0.6	2.2	-	-	-	90		2.8	2.8
7054	5	178828	4.1	3 6	7.9	-	-	0.7	2 8	10.4	-	-	119		13.8	14
7055	6	221269	5.1	4.6	12.4	-	-	0.7	3.2	15.9	-	3.9	139		24	24
7056	7	269749	6 2	5.6	18.1	-	-	0.8	3.6	20	-	57	157		82	82
7058	9	337508	7.7	13.9	32.0	-	-	0.9	4 4	26	-	220	188		188	188
7060	11	405520	9.3	31.0	49.1	-	848.5	1.0	5.0	31	-	280	214		214	1,063
						-	-	-	-	-	-	-			-	-

Notes:

1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond E- FINAL FUTURE (TOTAL FLOWS)

Gieck Basin - El Paso County, Colorado

FINAL

embankment length =	1860
embankment elev =	6976
spillway length =	200
spillway elevation =	6974.5
100 year storage elev.=	6972.6
100 year storage vol.=	33.4
100 year discharge=	217
5 year storage elev.=	6971.1
5 year storage vol.=	17.1
5 year discharge=	24
WQCV storage elev.=	6968.4
WQCV storage vol.=	1.6
WQCV depth =	1.4
1/2 WQCV storage elev.=	6968.1
1/2 WQCV storage vol.=	0 8

STAGE		STORAGE				TOTAL DISCHARGE											
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)		PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1	2	3	4	Rectangular		1	2	OUTFLOW	FLOW
6967	0	3110	0 07	0 0	0.0			-	-	-	-	-	-	1.4	-	-	-
6968	1	49719	1.14	0 6	0.6	-	-	0.5	-	-	-	-	-	26	-	0.5	0.53
6969	2	148073	3.40	2.3	2.9	-	-	1.4	-	4.2	-	-	-	77	-	5.6	5.6
6970	3	282533	6 49	4.9	7.8	-	-	1.8	-	6.9	-	-	-	146	-	8.7	8.7
6970.5	3.5	345630	7.93	3.6	11	-	-	2.0	0.9	7.9	-	-	-	183	-	11	10 8
6971	4	408706	9.38	7.9	16	-	-	2.2	7.9	8.8	-	-	-	218	-	19	18.8
6971.25	4.25	428868	9.85	2.4	18	-	-	2.2	11.7	9 2	-	5.9	-	236	-	29	29.0
6971.5	4.5	449030	10.31	4.9	21	-	-	2.3	14.1	9.6	-	19.9	-	252	-	46	45.9
6971.75	4.75	469192	10.77	2.6	23	-	-	2.4	16.1	10.0	-	42.4	-	266	-	71	70.9
6972	5	489354	11.23	5 4	26	-	-	2.5	17.9	10.4	-	73.8	-	280	-	105	105
6972.25	5.25	496911	11.41	2.8	29	-	-	2.5	19.6	10.7	-	111.4	-	292	-	144	144
6972.5	5.5	504468	11.58	5.7	32	-	-	2.6	21.1	11.1	-	154.1	-	304	-	189	189
6973	6	519582	11.93	11.6	38	-	-	2.7	23.8	11.7	-	253.1	-	327	-	291	291
6974	7	532469	12.22	12.1	50	-	-	3.0	28.5	12.9	-	495.5	-	369	-	369	369
6976	9	557640	12.80	25 0	75	-	1,102	3.4	36.1	15.1	-	886.5	-	443	-	443	1,545

Notes:

1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)

2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)

3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)

4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond E-FINAL DESIGN (H08)

Gieck Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	1860
embankment elev =	6975
spillway length =	200
spillway elevation =	6974
100 year storage elev.=	6972.6
100 year storage vol.=	33.4
100 year discharge=	155
5 year storage elev.=	6971.1
5 year storage vol.=	17.1
5 year discharge=	15.8
WQCV storage elev.=	6968.4
WQCV storage vol.=	1.6
1/2 WQCV storage elev.=	6968.1
1/2 WQCV storage vol.=	0.8

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)		
Rectangular	Orifice 1:	V	0.0879	1.40		Area =	0.123	Elev to cl =	6967.70
Rectangular	Orifice 2:	V	4	0.5		Area =	2.000	Elev to cl =	6970.80
Circular	Orifice 3:	H			12	Area =	0.785	Elev to cl =	6968.40
None Selected	*Orifice 4:*	V				Area =	0.000	Elev to cl =	

Stand Pipe Dimensions

Rec Grate		10	x	6	Elev =	6971.05
Circ. Grate			dia.		Elev =	6971.05

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		3.5	**Circular**
Area	9.6		TOP		
Outlet I. E.	6966.8		6970.58		
Wall Thick.	4	in			

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT OUTFLOW	TOTAL FLOW
		sqft	acre	acft	cum acft	BANK		1	2	3	4	**Rectangular**	1	2		
6967	0	3110	0.07	0 0	0.0			-	-	-	-	-	1		-	-
6968	1	49719	1.14	0 6	0 6			0.3	-	-	-	-	18		0.3	0.3
6969	2	148073	3.40	2.3	2.9			0.7	-	2.9	-	-	52		3.6	3.6
6970	3	282553	6 49	4.9	7.8			0.9	-	4 8	-	-	97		6	5.7
6970.5	3.5	345629.5	7.93	3 6	11			1.0	-	5.5	-	-	122		6	6.5
6971	4	408706	9.38	7.9	16			1.1	3.6	6.1	-	-	146		11	11
6971.25	4.25	428868	9.85	2 4	18			1.1	6.5	6.4	-	6	157		20	20
6971.5	4.5	449030	*10.31*	4.9	*21*			*1.2*	*8.1*	*6.7*	-	*20*	*167*		*36*	*36*
6971.75	4.75	469192	10.77	2.6	23			1.2	9.4	6.9	-	39	176		56	56
6972	5	489354	11.23	5.4	26			1.2	10.5	7 2	-	61	185		80	80
6972.25	5.25	496911	11.41	2.8	29			1.3	11.6	7 4	-	87	193		107	107
6972.5	5.5	504468	11.58	5.7	32			1.3	12.6	7.7	-	115	201		137	137
6973	6	519582	11.93	11.6	38			1.4	14.3	8.1	-	180	217		203	203
6974	7	532469	12.22	12.1	50			1.5	17.2	8.9	-	334	244		244	244
6976	9	557640	12.80	25.0	75			1.7	22 0	10 4	-	643	291		291	291

Notes.
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond E-FINAL DESIGN (H09)

Gieck Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	1860
embankment elev =	6976
spillway length =	200
spillway elevation =	6974.5
100 year storage elev.=	6972.6
100 year storage vol.=	33.4
100 year discharge=	62
5 year storage elev.=	6971.1
5 year storage vol.=	17.1
5 year discharge=	8.7
WQCV storage elev.=	6968.4
WQCV storage vol.=	1.6
1/2 WQCV storage elev.=	6968.1
1/2 WQCV storage vol.=	0.8

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.)	X Height (ft.)	Dia (in)		(sqft)		
Rectangular	Orifice 1:	V	0.0879	1.40		Area =	0.123	Elev to cl =	6967.70
Rectangular	Orifice 2:	V	2.5	0.5		Area =	1.250	Elev to cl =	6970.50
Circular	Orifice 3:	H			8	Area =	0.349	Elev to cl =	6968.40
None Selected	Orifice 4:	V				Area =	0.000	Elev to cl =	6967.33

Stand Pipe Dimensions

Rec Grate		6	x	4	Elev =	6971.55
Circ. Grate			dia.		Elev =	6971.55

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		3.5	**Circular**
Area	9.6		TOP		
Outlet I. E.	6966.8		6970.7		
Wall Thick.	5	in			

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1	2	3	4	Rectangular	1	2	OUTFLOW	FLOW
6967	0	3110	0.07	0.0	0.0			-	-	-	-	-	0.5		-	-
6968	1	49719	1.14	0.6	0.6			0.3	-	-	-	-	8.8		0.3	0.3
6969	2	148073	3.40	2.3	2.9			0.7	-	1.3	-	-	26		2.0	2.0
6970	3	282553	6.49	4.9	7.8			0.9	-	2.1	-	-	48		3.0	3.0
6970.5	3.5	345629.5	7.93	3.6	11			1.0	0.9	2.4	-	-	61		4.4	4.4
6971	4	408706	9.38	7.9	16			1.1	4.3	2.7	-	-	73		8.0	8.0
6971.25	4.25	428868	9.85	2.4	18			1.1	5.2	2.8	-	-	79		9.2	9.2
6971.5	4.5	449030	10.31	4.9	21			1.2	6.0	3.0	-	-	85		10.1	10.1
6971.75	4.75	469192	10.77	2.6	23			1.2	6.7	3.1	-	4	90		14.8	15
6972	5	489354	11.23	5.4	26			1.2	7.4	3.2	-	13	95		24.5	24
6972.25	5.25	496911	11.41	2.8	29			1.3	8.0	3.3	-	25	99		37.1	37
6972.5	5.5	504468	11.58	5.7	32			1.3	8.5	3.4	-	39	103		52.1	52
6973	6	519582	11.93	11.6	38			1.4	9.5	3.6	-	73	111		87.8	88
6974	7	532469	12.22	12.1	50			1.5	11.3	4.0	-	161	125		125.3	125
6976	9	557640	12.80	25.0	75			1.7	14.1	4.6	-	244	151		151.4	151

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No 5 for formulas 26 & 27.

POND E OUTLET PIPE HYDRAULICS
OUTLET AT H08 FUTURE

Solve For: Headwater Elevation

Culvert Summary

Allowable HW Elevation	6,974.50 ft	Headwater Depth/Height	1.29
Computed Headwater Elev:	6,971.25 ft	Discharge	157.00 cfs
Inlet Control HW Elev.	6,971.25 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	6,971.25 ft	Control Type	Outlet Control

Grades

Upstream Invert	6,966.72 ft	Downstream Invert	6,966.44 ft
Length	66.68 ft	Constructed Slope	0.004199 ft/ft

Hydraulic Profile

Profile	M2	Depth, Downstream	2.77 ft
Slope Type	Mild	Normal Depth	N/A ft
Flow Regime	Subcritical	Critical Depth	2.77 ft
Velocity Downstream	9.61 ft/s	Critical Slope	0.006510 ft/ft

Section

Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.50 ft
Section Size	42 inch	Rise	3.50 ft
Number Sections	2		

Outlet Control Properties

Outlet Control HW Elev.	6,971.25 ft	Upstream Velocity Head	1.15 ft
Ke	0.20	Entrance Loss	0.23 ft

Inlet Control Properties

Inlet Control HW Elev.	6,971.25 ft	Flow Control	Submerged
Inlet Type	Groove end w/headwall	Area Full	19.2 ft²
K	0.00180	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	2
C	0.02920	Equation Form	1
Y	0.74000		

POND E OUTLET PIPE HYDRAULICS
OUTLET AT H09 FUTURE

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	6,974.50 ft	Headwater Depth/Height	1.09
Computed Headwater Eleva	6,970.55 ft	Discharge	62.00 cfs
Inlet Control HW Elev.	6,970.45 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	6,970.55 ft	Control Type	Entrance Control

Grades			
Upstream Invert	6,966.72 ft	Downstream Invert	6,966.34 ft
Length	69.88 ft	Constructed Slope	0.005438 ft/ft

Hydraulic Profile			
Profile	S2	Depth, Downstream	2.45 ft
Slope Type	Steep	Normal Depth	2.45 ft
Flow Regime	Supercritical	Critical Depth	2.47 ft
Velocity Downstream	8.63 ft/s	Critical Slope	0.005315 ft/ft

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	3.50 ft
Section Size	42 inch	Rise	3.50 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev.	6,970.55 ft	Upstream Velocity Head	1.14 ft
Ke	0.20	Entrance Loss	0.23 ft

Inlet Control Properties			
Inlet Control HW Elev.	6,970.45 ft	Flow Control	Unsubmerged
Inlet Type	Beveled ring, 33.7° bevels	Area Full	9.6 ft²
K	0.00180	HDS 5 Chart	3
M	2.50000	HDS 5 Scale	B
C	0.02430	Equation Form	1
Y	0.83000		

POND E OUTLET FUTURE RATING TABLES

@ H08 - 2-42" RCP Flows

Range Data:

	Minimum	Maximum	Increment
Allowable HW E	6,967.00	6,976.00	0.50 ft

HW Elev. (ft)	Discharge (cfs)
6,967.00	0.91
6,967.50	6.80
6,968.00	17.66
6,968.50	32.81
6,969.00	51.56
6,969.50	73.13
6,970.00	97.16
6,970.50	121.78
6,971.00	145.55
6,971.50	166.92
6,972.00	184.94
6,972.50	201.35
6,973.00	216.53
6,973.50	230.70
6,974.00	244.06
6,974.50	256.72
6,975.00	268.78
6,975.50	280.33
6,976.00	291.42

@ H09 - 42" RCP Flow

Range Data:

	Minimum	Maximum	Increment
Allowable HW E	6,967.00	6,976.00	0.50 ft

HW Elev. (ft)	Discharge (cfs)
6,967.00	0.45
6,967.50	3.40
6,968.00	8.83
6,968.50	16.41
6,969.00	25.78
6,969.50	36.56
6,970.00	48.35
6,970.50	60.72
6,971.00	72.62
6,971.50	84.73
6,972.00	94.76
6,972.50	102.71
6,973.00	110.53
6,973.50	118.08
6,974.00	125.31
6,974.50	132.24
6,975.00	138.88
6,975.50	145.26
6,976.00	151.40

The above tables were used to cross check the flows within the 42" RCP versus the flows allowed into the control structure. The lower of the two flows governs the total outflow of the pond.

Rip Rap Outlet Protection Design

H08

Q 155 cfs

Circular: 42 Dia (in)

TW 24.0 Tailwater (in)

Box Culvert: Height (in) / Width (in)

TYPE: **Circular**

HYDRAULIC CHARACTERISTICS

	36 00	Normal Depth (in)	
Y_o/D =	1	1 00	
TW/Y_o =	0 67	**LOW**	**TAILWATER DEPTH**
Y_o =	36 00	Brink Depth (in)	
A =	1255	Brink Area (sq in)	
	8 7	Brink Area (sf)	
V_o =	17.8	Brink Velocity (fps)	
Y_e =	2 09	Equivalent Brink Depth (ft)	
F =	2.17	Froude	

Supercritical Test. **Supercritical**

D = 39.0

$Q/D^{2.5}$ =	6 76	Rounded:	7.00
$Q/D^{1.5}$ =	26 45	Rounded:	26 45
TW/D =	0.57	Rounded:	0 55
If TW unknown use.	0 40	TW:	2 00

RIP-RAP SIZING

$$\text{Rip-Rap Sizing} \quad \frac{\left(\frac{d_{50}}{D}\right)\left(\frac{TW}{D}\right)^{1.2}}{\left(\frac{Q}{D^{2.5}}\right)}$$

d_{50} =	**18**	**inch**
Rip-rap Type:	**H**	

EXTENT OF PROTECTION

$$L_p = \left(\frac{1}{2\tan\Theta}\right)\left(\frac{A_t}{TW} - W\right)$$

L_p = Length of Protection
W = Width of the conduit
TW = Tailwater depth
Θ = Expansion angle of the culvert flow
A_t = Required area of flow at allowable velocity

A_t = 28 2 sf

$\frac{1}{2\tan\Theta}$ Expansion Factor 3.00

L_p = 32

Rip Rap Outlet Protection Design

H09

Q 62 cfs

Circular: 42 Dia (in)

TW 12.0 Tailwater (in)

Box Culvert: Height (in) / Width (in)

TYPE: **Circular**

HYDRAULIC CHARACTERISTICS

	30 00	Normal Depth (in)	
Y_o/D =	0 56	0 55	
TW/Y_o =	0 51	**LOW**	**TAILWATER DEPTH**
Y_o =	23.52	Brink Depth (in)	
A =	798	Brink Area (sq in)	
	5.5	Brink Area (sf)	
V_o =	11.2	Brink Velocity (fps)	
Y_e =	1 66	Equivalent Brink Depth (ft)	
F =	1.53	Froude	

Supercritical Test: **Supercritical**

D = 32 8

$Q/D^{2.5}$ =	2.71	Rounded:	2.50
$Q/D^{1.5}$ =	13 75	Rounded:	13.75
TW/D =	0 29	Rounded:	0 30
If TW unknown use.	0 40	TW:	1.00

RIP-RAP SIZING

$$\text{Rip-Rap Sizing} \quad \frac{\left(\frac{d_{50}}{D}\right)\left(\frac{TW}{D}\right)^{1.2}}{\left(\frac{Q}{D^{2.5}}\right)}$$

d_{50} =	**12**	**inch**
Rip-rap Type:	**M**	

EXTENT OF PROTECTION

$$L_p = \left(\frac{1}{2\tan\Theta}\right)\left(\frac{A_t}{TW} - W\right)$$

L_p = Length of Protection
W = Width of the conduit
TW = Tailwater depth
Θ = Expansion angle of the culvert flow
A_t = Required area of flow at allowable velocity

A_t = 11.3 sf

$\frac{1}{2\tan\Theta}$ Expansion Factor 3.43

L_p = 27

WQCV Control Riser Calculations

POND D

WQCV Control Riser Calculations

TRIBUTARY AREA		289	acres
DRAIN TIME		6	hr
	a	0.7	
IMPERVIOUSNESS RATIO	*i*	0.35	
DEPTH OF OUTLET		2.3	
WQCV		0.12	inches
WQCV DESIGN VOL		1.0	ac-ft
	K_{40}	0.47	
AREA PER ROW[1]	a	1.05	in^2
No. of columns		3	per riser
Hole size		11/16	in
Steel Plate Thickness		3/8	in
		9	rows of holes per riser

[1] AREA PER ROW PER RISER

Actual area per row per riser:	1.11	in^2
Actual area per riser:	10.0	in^2
Actual area per riser:	0.069	ft^2

TABLE SB-2							
Hole Dia (in)		Area per Row (in^2)					
Holes per Row		1	2	3	4	5	6
Min steel thickness		1/4	5/16	3/8	3/8	3/8	1/2
1/4	0.2500	0.05	0.10	0.15	0.20	0.25	0.29
5/16	0.3125	0.08	0.15	0.23	0.31	0.38	0.46
3/8	0.3750	0.11	0.22	0.33	0.44	0.55	0.66
7/16	0.4375	0.15	0.30	0.45	0.60	0.75	0.90
1/2	0.5000	0.20	0.39	0.59	0.79	0.98	1.18
9/16	0.5625	0.25	0.50	0.75	0.99	1.24	1.49
5/8	0.6250	0.31	0.61	0.92	1.23	1.53	1.84
11/16	0.6875	0.37	0.74	1.11	1.48	1.86	2.23
3/4	0.7500	0.44	0.88	1.33	1.77	2.21	2.65
7/8	0.8750	0.60	1.20	1.80	2.41	3.01	3.61
1	1.0000	0.79	1.57	2.36	3.14	3.93	4.71
1 1/8	1.1250	0.99	1.99	2.98	3.98	4.97	5.96
1 1/4	1.2500	1.23	2.45	3.68	4.91	6.14	7.36
1 3/8	1.3750	1.48	2.97	4.45	5.94	7.42	8.91
1 1/2	1.5000	1.77	3.53	5.30	7.07	8.84	10.60
1 5/8	1.6250	2.07	4.15	6.22	8.30	10.37	12.44
1 3/4	1.7500	2.41	4.81	7.22	9.62	12.03	14.43
1 7/8	1.8750	2.76	5.52	8.28	11.04	13.81	16.57
2	2.0000	3.14	6.28	9.42	12.57	15.71	18.85
n = Number of columns of perforations							

INTERIM FILING 11A POND E

WQCV Control Riser Calculations

TRIBUTARY AREA		241	acres
DRAIN TIME		6	hr
	a	0.7	
IMPERVIOUSNESS RATIO	*i*	0.19	
DEPTH OF OUTLET		1.0	
WQCV		0.08	inches
WQCV DESIGN VOL		0.3	ac-ft
	K_{40}	0.13	
AREA PER ROW[1]	a	1.11	in^2
No. of columns		3	per riser
Hole size		11/16	in
Steel Plate Thickness		3/8	in
		4	rows of holes per riser

[1] AREA PER ROW PER RISER

Actual area per row per riser:	1.11	in^2
Actual area per riser:	4.4	in^2
Actual area per riser:	0.031	ft^2

TABLE SB-2							
Hole Dia (in)		Area per Row (in^2)					
Holes per Row		1	2	3	4	5	6
Min steel thickness		1/4	5/16	3/8	3/8	3/8	1/2
1/4	0.2500	0.05	0.10	0.15	0.20	0.25	0.29
5/16	0.3125	0.08	0.15	0.23	0.31	0.38	0.46
3/8	0.3750	0.11	0.22	0.33	0.44	0.55	0.66
7/16	0.4375	0.15	0.30	0.45	0.60	0.75	0.90
1/2	0.5000	0.20	0.39	0.59	0.79	0.98	1.18
9/16	0.5625	0.25	0.50	0.75	0.99	1.24	1.49
5/8	0.6250	0.31	0.61	0.92	1.23	1.53	1.84
11/16	0.6875	0.37	0.74	1.11	1.48	1.86	2.23
3/4	0.7500	0.44	0.88	1.33	1.77	2.21	2.65
7/8	0.8750	0.60	1.20	1.80	2.41	3.01	3.61
1	1.0000	0.79	1.57	2.36	3.14	3.93	4.71
1 1/8	1.1250	0.99	1.99	2.98	3.98	4.97	5.96
1 1/4	1.2500	1.23	2.45	3.68	4.91	6.14	7.36
1 3/8	1.3750	1.48	2.97	4.45	5.94	7.42	8.91
1 1/2	1.5000	1.77	3.53	5.30	7.07	8.84	10.60
1 5/8	1.6250	2.07	4.15	6.22	8.30	10.37	12.44
1 3/4	1.7500	2.41	4.81	7.22	9.62	12.03	14.43
1 7/8	1.8750	2.76	5.52	8.28	11.04	13.81	16.57
2	2.0000	3.14	6.28	9.42	12.57	15.71	18.85
n = Number of columns of perforations							

FUTURE POND E

WQCV Control Riser Calculations

TRIBUTARY AREA		332 acres
DRAIN TIME		6 hr
	a	0.7
IMPERVIOUSNESS RATIO	*i*	0 44
DEPTH OF OUTLET		1.4
WQCV		0.13 inches
WQCV DESIGN VOL		**1.6** ac-ft
	K_{40}	0.23
AREA PER ROW[1]	a	3.46 in^2
No. of columns		2 per riser
Hole size		1 1/2 in
Steel Plate Thickness		5/16 in
		5 rows of holes per riser

[1] **AREA PER ROW PER RISER**

Actual area per row per riser:	3.53 in^2
Actual area per riser:	17.7 in^2
Actual area per riser:	0.123 ft^2

TABLE SB-2

Hole Dia (in)		Area per Row (in^2)					
Holes per Row		1	2	3	4	5	6
Min steel thickness		1/4	5/16	3/8	3/8	3/8	1/2
1/4	0.2500	0.05	0.10	0.15	0.20	0.25	0.29
5/16	0.3125	0 08	0.15	0.23	0.31	0.38	0.46
3/8	0.3750	0.11	0.22	0.33	0.44	0.55	0 66
7/16	0 4375	0.15	0.30	0.45	0.60	0.75	0.90
1/2	0.5000	0.20	0.39	0.59	0.79	0.98	1.18
9/16	0.5625	0.25	0.50	0.75	0.99	1.24	1.49
5/8	0.6250	0.31	0.61	0.92	1.23	1.53	1.84
11/16	0.6875	0.37	0.74	1.11	1.48	1.86	2.23
3/4	0.7500	0.44	0.88	1.33	1.77	2.21	2.65
7/8	0.8750	0.60	1.20	1.80	2.41	3.01	3.61
1	1.0000	0.79	1.57	2.36	3.14	3.93	4.71
1 1/8	1.1250	0.99	1.99	2.98	3.98	4.97	5.96
1 1/4	1.2500	1.23	2.45	3.68	4.91	6.14	7.36
1 3/8	1.3750	1.48	2.97	4.45	5.94	7.42	8.91
1 1/2	1.5000	1.77	3.53	5.30	7.07	8.84	10.60
1 5/8	1.6250	2.07	4.15	6.22	8.30	10.37	12.44
1 3/4	1.7500	2.41	4.81	7.22	9.62	12.03	14.43
1 7/8	1.8750	2.76	5.52	8.28	11.04	13.81	16.57
2	2.0000	3.14	6.28	9.42	12.57	15.71	18.85

n = Number of columns of perforations

Appendix F – Drainage Channel Calculations

Rating Table for OPEN SPACE CHANNEL

Project Description

Friction Method	Manning Formula
Solve For	*Normal Depth*

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.04300	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	10.00	ft
Discharge	33.00	ft³/s

Channel Slope (ft/ft)	Normal Depth (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.00500	0.89	2.75	12.01	17.31	17.09
0.01000	0.73	3.48	9.47	16.04	15.86
0.01500	0.65	4.00	8.24	15.39	15.23
0.02000	0.60	4.41	7.48	14.97	14.82
0.02500	0.57	4.75	6.94	14.67	14.53
0.03000	0.54	5.05	6.53	14.43	14.30
0.03500	0.51	5.32	6.20	14.24	14.11
0.04000	0.49	5.57	5.93	14.08	13.96
0.04500	0.48	5.79	5.70	13.95	13.83
0.05000	0.46	5.99	5.51	13.83	13.72

Appendix G – Filing 11A –Temporary Sedimentation Ponds

MERIDIAN RANCH FILING 11A FINAL PLAT

TEMPORARY SEDIMENTATION SIZING

SEDIMENTATION #1

Tributary Area:	Required Volume	Depth at Outlet
6.5 ac.	0.3 ac-ft	3.4 ft.

Area required per Row

0.45 in^2

WS Elev: 7053.9

No. of columns	Hole size
1	3/4 in

STAGE			STORAGE			
STAGE	ELEV	HEIGHT	AREA		VOLUME	
			sqft	acre	acft	cum acft
1	7050.5	0		0.000	0.000	0.00
2	7051	0.5	679.1	0.02	0.00	0.00
3	7052	1.5	3762	0.09	0.05	0.05
4	7053	2.5	5924	0.14	0.11	0.17
5	7054	3.5	7738	0.18	0.16	0.32

TABLE SB-2

Minimum steel thickness		1	2	3	4	5	6
		1/4	5/16	3/8	3/8	3/8	1/2
1/4	0.2500	0.05	0.10	0.15	0.20	0.25	0.29
5/16	0.3125	0.08	0.15	0.23	0.31	0.38	0.46
3/8	0.3750	0.11	0.22	0.33	0.44	0.55	0.66
7/16	0.4375	0.15	0.30	0.45	0.60	0.75	0.90
1/2	0.5000	0.20	0.39	0.59	0.79	0.98	1.18
9/16	0.5625	0.25	0.50	0.75	0.99	1.24	1.49
5/8	0.6250	0.31	0.61	0.92	1.23	1.53	1.84
11/16	0.6875	0.37	0.74	1.11	1.48	1.86	2.23
3/4	0.7500	0.44	0.88	1.33	1.77	2.21	2.65
7/8	0.8750	0.60	1.20	1.80	2.41	3.01	3.61
1	1.0000	0.79	1.57	2.36	3.14	3.93	4.71
1 1/8	1.1250	0.99	1.99	2.98	3.98	4.97	5.96
1 1/4	1.2500	1.23	2.45	3.68	4.91	6.14	7.36
1 3/8	1.3750	1.48	2.97	4.45	5.94	7.42	8.91
1 1/2	1.5000	1.77	3.53	5.30	7.07	8.84	10.60
1 5/8	1.6250	2.07	4.15	6.22	8.30	10.37	12.44
1 3/4	1.7500	2.41	4.81	7.22	9.62	12.03	14.43
1 7/8	1.8750	2.76	5.52	8.28	11.04	13.81	16.57
2	2.0000	3.14	6.28	9.42	12.57	15.71	18.85

MERIDIAN RANCH FILING 11A FINAL PLAT
TEMPORARY SEDIMENTATION SIZING
SEDIMENTATION #2

Tributary Area:	Required Volume	Depth at Outlet
3.4 ac.	0.1 ac-ft	0.8 ft.

Area required per Row

1.60 in^2

WS Elev: 7049.4

No. of columns	Hole size
2	1 in

STAGE			STORAGE			
STAGE	ELEV	HEIGHT	AREA		VOLUME	
			sqft	acre	acft	cum acft
1	7048.6	0		0.000	0.000	0.00
2	7049	0.4	3439	0.08	0.02	0.02
3	7050	1.4	13888	0.32	0.20	0.21

TABLE SB-2							
Minimum steel thickness		1	2	3	4	5	6
		1/4	5/16	3/8	3/8	3/8	1/2
1/4	0.2500	0.05	0.10	0.15	0.20	0.25	0.29
5/16	0.3125	0.08	0.15	0.23	0.31	0.38	0.46
3/8	0.3750	0.11	0.22	0.33	0.44	0.55	0.66
7/16	0.4375	0.15	0.30	0.45	0.60	0.75	0.90
1/2	0.5000	0.20	0.39	0.59	0.79	0.98	1.18
9/16	0.5625	0.25	0.50	0.75	0.99	1.24	1.49
5/8	0.6250	0.31	0.61	0.92	1.23	1.53	1.84
11/16	0.6875	0.37	0.74	1.11	1.48	1.86	2.23
3/4	0.7500	0.44	0.88	1.33	1.77	2.21	2.65
7/8	0.8750	0.60	1.20	1.80	2.41	3.01	3.61
1	1.0000	0.79	1.57	2.36	3.14	3.93	4.71
1 1/8	1.1250	0.99	1.99	2.98	3.98	4.97	5.96
1 1/4	1.2500	1.23	2.45	3.68	4.91	6.14	7.36
1 3/8	1.3750	1.48	2.97	4.45	5.94	7.42	8.91
1 1/2	1.5000	1.77	3.53	5.30	7.07	8.84	10.60
1 5/8	1.6250	2.07	4.15	6.22	8.30	10.37	12.44
1 3/4	1.7500	2.41	4.81	7.22	9.62	12.03	14.43
1 7/8	1.8750	2.76	5.52	8.28	11.04	13.81	16.57
2	2.0000	3.14	6.28	9.42	12.57	15.71	18.85

MERIDIAN RANCH FILING 11A FINAL PLAT

TEMPORARY SEDIMENTATION SIZING

SEDIMENTATION #3

Tributary Area:	Required Volume	Depth at Outlet
5.8 ac.	0.2 ac-ft	3.4 ft.

Area required per Row

$0.30\ in^2$

WS Elev: 7039.9

No. of columns	Hole size
1	5/8 in

STAGE			STORAGE			
STAGE	ELEV	HEIGHT	AREA		VOLUME	
			sqft	acre	acft	cum acft
1	7036.5	0		0.000	0.000	0.00
2	7037	0.5	1502	0.03	0.01	0.01
3	7038	1.5	2355	0.05	0.04	0.05
4	7039	2.5	3322	0.08	0.07	0.12
5	7040	3.5	4630	0.11	0.09	0.21

TABLE SB-2							
Minimum steel thickness		1	2	3	4	5	6
		1/4	5/16	3/8	3/8	3/8	1/2
1/4	0.2500	0.05	0.10	0.15	0.20	0.25	0.29
5/16	0.3125	0.08	0.15	0.23	0.31	0.38	0.46
3/8	0.3750	0.11	0.22	0.33	0.44	0.55	0.66
7/16	0.4375	0.15	0.30	0.45	0.60	0.75	0.90
1/2	0.5000	0.20	0.39	0.59	0.79	0.98	1.18
9/16	0.5625	0.25	0.50	0.75	0.99	1.24	1.49
5/8	0.6250	0.31	0.61	0.92	1.23	1.53	1.84
11/16	0.6875	0.37	0.74	1.11	1.48	1.86	2.23
3/4	0.7500	0.44	0.88	1.33	1.77	2.21	2.65
7/8	0.8750	0.60	1.20	1.80	2.41	3.01	3.61
1	1.0000	0.79	1.57	2.36	3.14	3.93	4.71
1 1/8	1.1250	0.99	1.99	2.98	3.98	4.97	5.96
1 1/4	1.2500	1.23	2.45	3.68	4.91	6.14	7.36
1 3/8	1.3750	1.48	2.97	4.45	5.94	7.42	8.91
1 1/2	1.5000	1.77	3.53	5.30	7.07	8.84	10.60
1 5/8	1.6250	2.07	4.15	6.22	8.30	10.37	12.44
1 3/4	1.7500	2.41	4.81	7.22	9.62	12.03	14.43
1 7/8	1.8750	2.76	5.52	8.28	11.04	13.81	16.57
2	2.0000	3.14	6.28	9.42	12.57	15.71	18.85

Appendix H – Filing 11B – Drainage Calculation Addendum

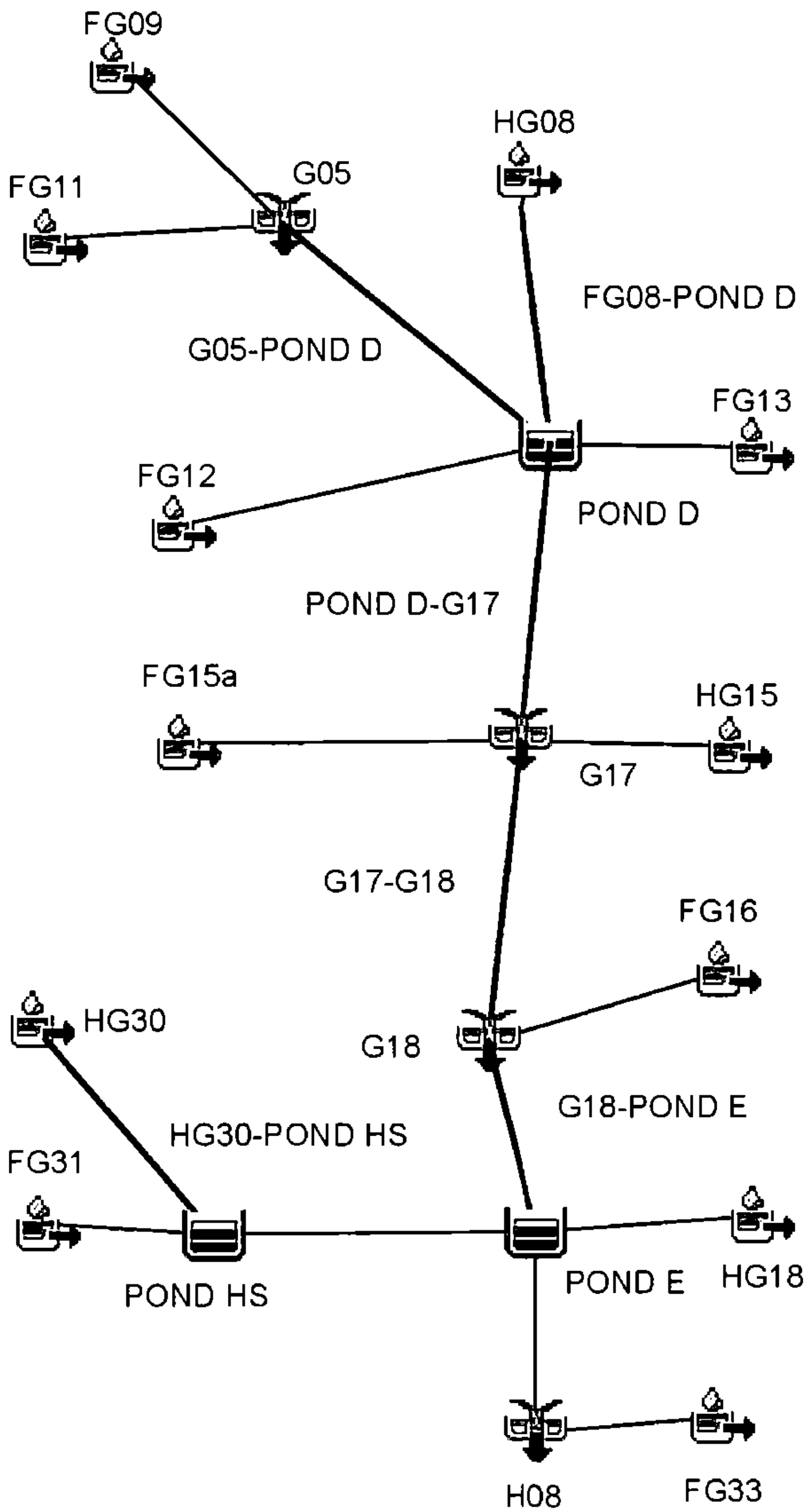
- HEC-HMS Data and Results
- Pond E Summary Sheets
- Pond E Stage Storage Tables

This appendix shows the impact that the development of Meridian Ranch Filings 11B will have to the storage capacity of Pond E. The below information includes the data input, schematic diagram and results of the proposed conditions for the development of Meridian Ranch Filing 11B. The calculations show a minor increase in total flow volume into Pond E. A fifty percent reduction of the opening on the Pond D top grate will reduce the peak flow out of Pond D and thus providing no major impact on Pond E. The additional development of Filing 11B does not adversely impact the property downstream of the project or Meridian Ranch.

Input Data

BASIN	AREA (acre)	AREA (mi^2)	CURVE NO.	LAG TIME (min)	
FILING 11B					
FG15a	10	0.0156	0.0	11.5	FILING 11A & 11B
FG16	50	0.0773	0.0	18.3	FILING 11A & 11B
HG17	72	0.1125	61.0	29.6	+
HG18	95	0.1484	62.7	27.5	
HG30	49	0.0766	61.0	14.8	
FG31	59	0.0922	80.0	24.0	* (FG17)
FG32	17	0.0273	65.2	14.5	+
FG33	7	0.0109	71.6	11.7	

* FROM APPR MERIDIAN RANCH MDDP
+ RATIONAL METHOD CALCULATION


FG09
HG08
FG11
G05
FG08-POND D
G05-POND D
FG13
FG12
POND D
POND D-G17
FG15a
HG15
G17
G17-G18
FG16
HG30
G18
G18-POND E
HG30-POND HS
FG31
POND HS
POND E
HG18
H08
FG33

FILING 11B					
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q_{100} (CFS)	TOTAL VOLUME Q_{100} (AC. FT.)	DISCHARGE PEAK Q_5 (CFS)	TOTAL VOLUME Q_5 (AC. FT.)
HG08	0.1375	107	10.5	24	3.1
FG08-POND D	0.1375	107	10.5	24	3.1
FG13	0.1188	80	8.5	16	2.4
FG11	0.0608	85	7.2	30	2.8
FG09	0.0500	51	4.1	13	1.3
G05	0.1108	134	11.4	42	4.1
G05-POND D	0.1108	134	11.4	42	4.1
FG12	0.0328	55	4.1	21	1.7
POND D	**0.3999**	**57**	**29.5**	**8**	**8.0**
POND D-G17	0.3999	57	29.5	8	8.0
HG15	0.1344	58	7.5	8	1.7
FG15a	0.0156	27	1.8	10	0.7
G17	0.5499	85	38.7	13	10.3
G17-G18	0.5499	85	38.7	13	10.3
FG16	0.0773	109	8.8	37	3.4
G18	0.6272	175	47.6	50	13.7
G18-POND E	0.6272	175	47.5	50	13.7
FG31	0.0922	123	11.6	45	4.7
HG30	0.0766	49	4.2	6	0.9
HG30-POND HS	0.0766	48	4.1	6	0.9
POND HS	**0.1688**	**126**	**15.8**	**27**	**5.6**
HG18	0.1484	67	8.6	10	2.0
POND E	**0.9444**	**141**	**66.2**	**19**	**19.1**
FG33	0.0109	13	1.0	4	0.3
H08	0.9553	**73**	67.2	**14**	19.4
H09		**67**		**6.2**	
*** FROM OUTLET STAGE-STORAGE CALCULATION**					

FILINGS 11A & 11B DEVELOPED CONDITION

Simulation Run: F11A&B-100 YR Reservoir: POND D

Start of Run:	09May2008, 08:00	Basin Model:	Estates Rough Grading
End of Run:	10May2008, 08:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	07Mar2014, 08:32:23	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	361 (CFS)	Date/Time of Peak Inflow:	09May2008, 14:14
Peak Outflow:	57 (CFS)	Date/Time of Peak Outflow:	09May2008, 15:08
Total Inflow :	34.5 (AC-FT)	Peak Storage:	16.7 (AC-FT)
Total Outflow:	29.5 (AC-FT)	Peak Elevation:	7055.8 (FT)

Simulation Run: F11A&B-005 YR Reservoir: POND D

Start of Run:	09May2008, 08:00	Basin Model:	Estates Rough Grading
End of Run:	10May2008, 08:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	06Mar2014, 11:52:28	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	95 (CFS)	Date/Time of Peak Inflow:	09May2008, 14:18
Peak Outflow:	8 (CFS)	Date/Time of Peak Outflow:	09May2008, 16:24
Total Inflow :	11.2 (AC-FT)	Peak Storage:	6.0 (AC-FT)
Total Outflow:	8.0 (AC-FT)	Peak Elevation:	7053.5 (FT)

Simulation Run: F11A&B-100 YR Reservoir: POND E

Start of Run:	09May2008, 08:00	Basin Model:	Estates Rough Grading
End of Run:	10May2008, 08:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	07Mar2014, 08:32:23	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	340(CFS)	Date/Time of Peak Inflow:	09May2008, 14:24
Peak Outflow:	141 (CFS)	Date/Time of Peak Outflow:	09May2008, 15:16
Total Inflow :	71.9 (AC-FT)	Peak Storage:	17.5 (AC-FT)
Total Outflow:	66.2 (AC-FT)	Peak Elevation:	6971.2 (FT)

Simulation Run: F11A&B-005 YR Reservoir: POND E

Start of Run:	09May2008, 08:00	Basin Model:	Estates Rough Grading
End of Run:	10May2008, 08:00	Meteorologic Model:	SCS TYPE IIA 100YR
Compute Time:	06Mar2014, 11:52:28	Control Specifications:	24 HR-2 MIN.

Volume Units: AC-FT

Computed Results:

Peak Inflow:	73 (CFS)	Date/Time of Peak Inflow:	09May2008, 14:18
Peak Outflow:	19 (CFS)	Date/Time of Peak Outflow:	09May2008, 16:46
Total Inflow :	21.3 (AC-FT)	Peak Storage:	6.5 (AC-FT)
Total Outflow:	19.1 (AC-FT)	Peak Elevation:	6969.7 (FT)

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond D - Interim AS-BUILT

MERIDIAN RANCH FILINGS 11A & 11B

Heagler Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	710
embankment elev =	7060
spillway length =	100
spillway elevation =	7058
100 year storage elev.=	7055.8
100 year storage vol.=	16.8
100 year discharge=	57
5 year storage elev.=	7053.5
5 year storage vol.=	6.0
5 year discharge=	8
WQCV storage vol.=	1.0
WQCV depth=	2.3
1/2 WQCV storage vol.=	0.50

Data for outlet pipe and grate:

Type			Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)			
Rectangular		Orifice 1:	0.03	2.3		Area =	0.069	Elev to cl =		7050.15
Circular		Orifice 2:			8	Area =	0.349	Elev to cl =		7051.3
Rectangular		Orifice 3:	5	0.5		Area =	2.500	Elev to cl =		7053.25
None Selected		Orifice 4:				Area =	0.000	Elev to cl =		

Stand Pipe Dimensions

Rec Grate		3	x	4.25	Elev =	7054.8
Circ. Grate			dia.		Elev =	

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		4	**Circular**
Area	12.6		TOP		
Outlet I. E.	7048.5		7052.9		
Wall Thick.	5	in.			

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT OUTFLOW	TOTAL FLOW
		sqft	acre	acft	cum acft	BANK		1	2	3	4	**Rectangular**	1	2		
7049	0	0	0.0	0.00	0.0			-								
7050	1	10705	0.2	0.1	0.12	-	-	0.2	-	-	-	-	13		0.2	0.150
7051	2	36676	0.8	0.5	0.67	-	-	0.3	0	-	-	-	33		0.8	0.791
7052	3	71989	1.7	1.2	1.91	-	-	0.5	1	-	-	-	60		1.9	1.858
7053	4	133440	3.1	2.4	4.27	-	-	0.6	2.2	-	-	-	90		2.8	2.752
7054	5	178828	4.1	3.6	7.86	-	-	0.7	2.8	10.4	-	-	119		13.8	13.838
7055	6	221269	5.1	4.6	12.45	-	-	0.7	3.2	15.9	-	3.1	139		23	22.975
7055.5	6.5	245509	5.6	2.7	15.13	-	-	0.8	3.4	18.1	-	20.2	148		42	42.475
7056	7	269749	6.2	5.6	18.08	-	-	0.8	3.6	20	-	45	157		70	69.761
7058	9	337508	7.7	13.9	32.03	-	-	0.9	4.4	26	-	110	188		141	141.336
7060	11	405520	9.3	31.0	49.09	-	848.5	1.0	5.0	31	-	140	214		177	1,025.796
						-	-	-	-	-	-	-			-	-

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3 Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond E-TEMP CMP RISER (TOTAL FLOWS)

Gieck Basin - El Paso County, Colorado

INTERIM - FILINGS 11A & 11B

Data for spillway and embankment:

embankment length =	1860
embankment elev =	6976
spillway length =	200
spillway elevation =	6974.5
100 year storage elev.=	6971.2
100 year storage vol.=	17.5
100 year discharge=	141
5 year storage elev.=	6969.7
5 year storage vol.=	6.5
5 year discharge=	19
WQCV storage elev.=	6968.4
WQCV storage vol.=	1.6
1/2 WQCV storage elev.=	6968.1
1/2 WQCV storage vol.=	0.8

STAGE		STORAGE				TOTAL DISCHARGE											
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)		PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1	2	3	4	Circular		1	2	OUTFLOW	FLOW
6967	0	3110	0.07	0.0	0.0			-	-	-	-	-	-	0.9	-	-	-
6968	1	49719	1.14	0.6	0.6	-	-	0.2	-	-	-	-	-	17.7	-	0.2	0.2
6969	2	148073	3.40	2.3	2.9	-	-	0.4	-	7 6	-	-	-	51.6	-	7.9	7.9
6970	3	282553	6.49	4.9	7.8	-	-	0.5	11.7	10.7	-	-	-	97.2	-	23	23
6970.5	3.5	345630	7.93	3.6	11.4	-	-	0.5	35.6	12.0	-	-	-	121.6	-	48	48
6971	4	408706	9.38	7.9	15.8	-	-	0.6	67.3	13.1	-	11.4	-	145.4	-	92	92
6971.25	4.25	428868	9.85	2.4	18.2	-	-	0.6	85.4	13.6	-	167.3	-	157.4	-	157	157
6971.5	4.5	449030	10.31	4.9	20 7	-	-	0.6	96.9	14.1	-	415.2	-	168.2	-	168	168
6971.75	4.75	469192	10.77	2.6	23.3	-	-	0.6	106.1	14.6	-	728.3	-	178.2	-	178	178
6972	5	489354	11.23	5.4	26.1	-	-	0.6	114.6	15.1	-	1,095.2	-	187.2	-	187	187
6972.25	5.25	496911	11.41	2.8	28.9	-	-	0.7	122.6	15.6	-	1,508.7	-	195.4	-	195	195
6972.5	5.5	504468	11.58	5.7	31.8	-	-	0.7	130.0	16.0	-	1,964.2	-	203.4	-	203	203
6973	6	519582	11.93	11.6	37.6	-	-	0.7	143.7	16.9	-	2,987.6	-	218.8	-	219	219
6974	7	532469	12.22	12.1	49.7	-	-	0.8	167.8	18.5	-	5,421.8	-	247.3	-	247	247
6976	9	557640	12.80	25.0	74.7	-	1,102	0.9	207.8	21.4	-	11,551.3	-	297.1	-	297	1,399

Notes:

1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)

2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)

3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F. Orifice Flow Q=4.815*AH^0.5)

4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond E-TEMP CMP RISER (H08)

Gieck Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	1860
embankment elev =	6975
spillway length =	200
spillway elevation =	6974
100 year storage elev.=	6971.2
100 year storage vol.=	17.5
100 year discharge=	73
5 year storage elev.=	6969.7
5 year storage vol.=	6.5
5 year discharge=	12
WQCV storage elev.=	6968.4
WQCV storage vol.=	1.6
1/2 WQCV storage elev.=	6968.1
1/2 WQCV storage vol.=	0.8

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)		
Rectangular	Orifice 1:	V	0.0310	1.00		Area =	0.031	Elev to cl =	6967.50
Rectangular	Orifice 2:	V	8	1.5		Area =	12.000	Elev to cl =	6970.20
Circular	Orifice 3:	H			12	Area =	0.785	Elev to cl =	6968.00
None Selected	Orifice 4:	V				Area =	0.000	Elev to cl =	6967.50

Stand Pipe Dimensions

Rec Grate			x		Elev =	6970.95
Circ. Grate		54	dia.		Elev =	6970.95

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		3.5	**Circular**
Area	9.6		TOP		
Outlet I. E.	6966.8		6970.67		
Wall Thick.	5	in.			

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT OUTFLOW	TOTAL FLOW
		sqft	acre	acft	cum acft	BANK		1	2	3	4	**Circular**	1	2		
6967	0	3110	0.07	0.0	0.0			-	-	-	-	-	0		-	-
6968	1	49719	1.14	0.6	0.6			0.1	-	-	-	-	9		0.1	0.093
6969	2	148073	3.40	2.3	2.9			0.2	-	3.8	-	-	26		4.0	3.964
6970	3	282553	6.49	4.9	7.8			0.2	9.8	5.3	-	-	49		15	15.373
6970.5	3.5	345629.5	7.93	3.6	11.4			0.3	25.8	6.0	-	-	61		32	32.060
6971	4	408706	9.38	7.9	15.8			0.3	46.3	6.6	-	6	73		59	58.833
6971.25	4.25	428868	9.85	2.4	18.2			0.3	58.0	6.8	-	84	78		78	78.450
6971.5	4.5	449030	10.31	4.9	20.7			0.3	65.9	7.1	-	208	83		83	83
6971.75	4.75	469192	10.77	2.6	23.3			0.3	71.9	7.3	-	364	88		88	88
6972	5	489354	11.23	5.4	26.1			0.3	77.5	7.6	-	548	92		92	92
6972.25	5.25	496911	11.41	2.8	28.9			0.3	82.7	7.8	-	754	97		97	97
6972.5	5.5	504468	11.58	5.7	31.8			0.3	87.6	8.0	-	982	101		101	101
6973	6	519582	11.93	11.6	37.6			0.4	96.7	8.5	-	1,494	108		108	108
6974	7	532469	12.22	12.1	49.7			0.4	112.6	9.3	-	2,711	122		122	122
6976	9	557640	12.80	25.0	74.7			0.4	139.2	10.7	-	5,776	146		146	146

Notes:
1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No. 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No. 5 for formulas 26 & 27.

STAGE/STORAGE/DISCHARGE CURVES FOR DETENTION POND ANALYSIS

Meridian Ranch Proposed Detention Pond E-TEMP CMP RISER (H09)

Gieck Basin - El Paso County, Colorado

Data for spillway and embankment:

embankment length =	1860
embankment elev =	6976
spillway length =	200
spillway elevation =	6974.5
100 year storage elev.=	6971.2
100 year storage vol.=	17.5
100 year discharge=	67
5 year storage elev.=	6969.7
5 year storage vol.=	6.5
5 year discharge=	6.6
WQCV storage elev.=	6968.4
WQCV storage vol.=	1.6
1/2 WQCV storage elev.=	6968.1
1/2 WQCV storage vol.=	0.8

Data for outlet pipe and grate:

Type		H or V	Dimensions Width (ft.)	X Height (ft.)	Dia.(in)		(sqft)		
Rectangular	Orifice 1:	V	0.0310	1.00		Area =	0.031	Elev to cl =	6967.50
Rectangular	Orifice 2:	V	5	1.2		Area =	6.000	Elev to cl =	6970.35
Circular	Orifice 3:	H			12	Area =	0.785	Elev to cl =	6968.00
None Selected	Orifice 4:	V				Area =	0.000	Elev to cl =	6967.33

Stand Pipe Dimensions

Rec Grate			x		*Elev =*	6970.95
Circ. Grate		54	dia.		Elev =	6970.95

Outlet Culvert Dimensions

	Width (ft.)		Height (ft.)	Dia. (ft.)	Type
Outlet Culvert		x		3.5	**Circular**
Area	9.6		TOP		
Outlet I. E.	6966.8		6970.67		
Wall Thick.	5	in.			

STAGE		STORAGE				DISCHARGE										
ELEV	HEIGHT	AREA		VOLUME		TOP OF	SPILLWAY	ORIFICE (max outflow)				GRATE (max outflow)	PIPE		REALIZED CULVERT	TOTAL
		sqft	acre	acft	cum acft	BANK		1	2	3	4	Circular	1	2	OUTFLOW	FLOW
6967	0	3110	0.07	0.0	0.0			-	-	-	-	-	0.5		-	-
6968	1	49719	1.14	0.6	0.6			0.1	-	-	-	-	8.8		0.1	0.1
6969	2	148073	3.40	2.3	2.9			0.2	-	3.8	-	-	26		4.0	4.0
6970	3	282553	6.49	4.9	7.8			0.2	1.9	5.3	-	-	49		7.5	7.5
6970.5	3.5	345629.5	7.93	3.6	11.4			0.3	9.7	6.0	-	-	61		16.0	16
6971	4	408706	9.38	7.9	15.8			0.3	21.0	6.6	-	6	73		33.5	33
6971.25	4.25	428868	9.85	2.4	18.2			0.3	27.4	6.8	-	84	79		78.9	79
6971.5	4.5	449030	10.31	4.9	20.7			0.3	31.0	7.1	-	208	85		84.7	85
6971.75	4.75	469192	10.77	2.6	23.3			0.3	34.2	7.3	-	364	90		90.1	90
6972	5	489354	11.23	5.4	26.1			0.3	37.1	7.6	-	548	95		94.8	95
6972.25	5.25	496911	11.41	2.8	28.9			0.3	39.8	7.8	-	754	99		98.7	99
6972.5	5.5	504468	11.58	5.7	31.8			0.3	42.4	8.0	-	982	103		102.7	103
6973	6	519582	11.93	11.6	37.6			0.4	47.0	8.5	-	1,494	111		110.5	111
6974	7	532469	12.22	12.1	49.7			0.4	55.2	9.3	-	2,711	125		125.3	125
6976	9	557640	12.80	25.0	74.7			0.4	68.7	10.7	-	5,776	151		151.4	151

Notes:

1) Top-of-bank and spillway flows are weir equations from section 11.3.1 in the DCM. Q=CLH^1.5 (C=3.0)
2) Orifice flows are also from section 11.3.1. Q=CA(2gH)^.5 (C=.6)
3) Grate flows are determined from equations 7-2 and 7-3. Weir Flow Q=(3PH^1.5)/F, Orifice Flow Q=4.815*AH^0.5)
4) Pipe flows use the lesser of: 1) Inlet control equations 27 & 28, page 146 of HDS No 5 - or - 2) Allowable Pipe Flow equation on page 11-9 of the DCM. Use Table 9, page 147-148, HDS No 5 for formulas 26 & 27.

Appendix I – Soil Resource Report

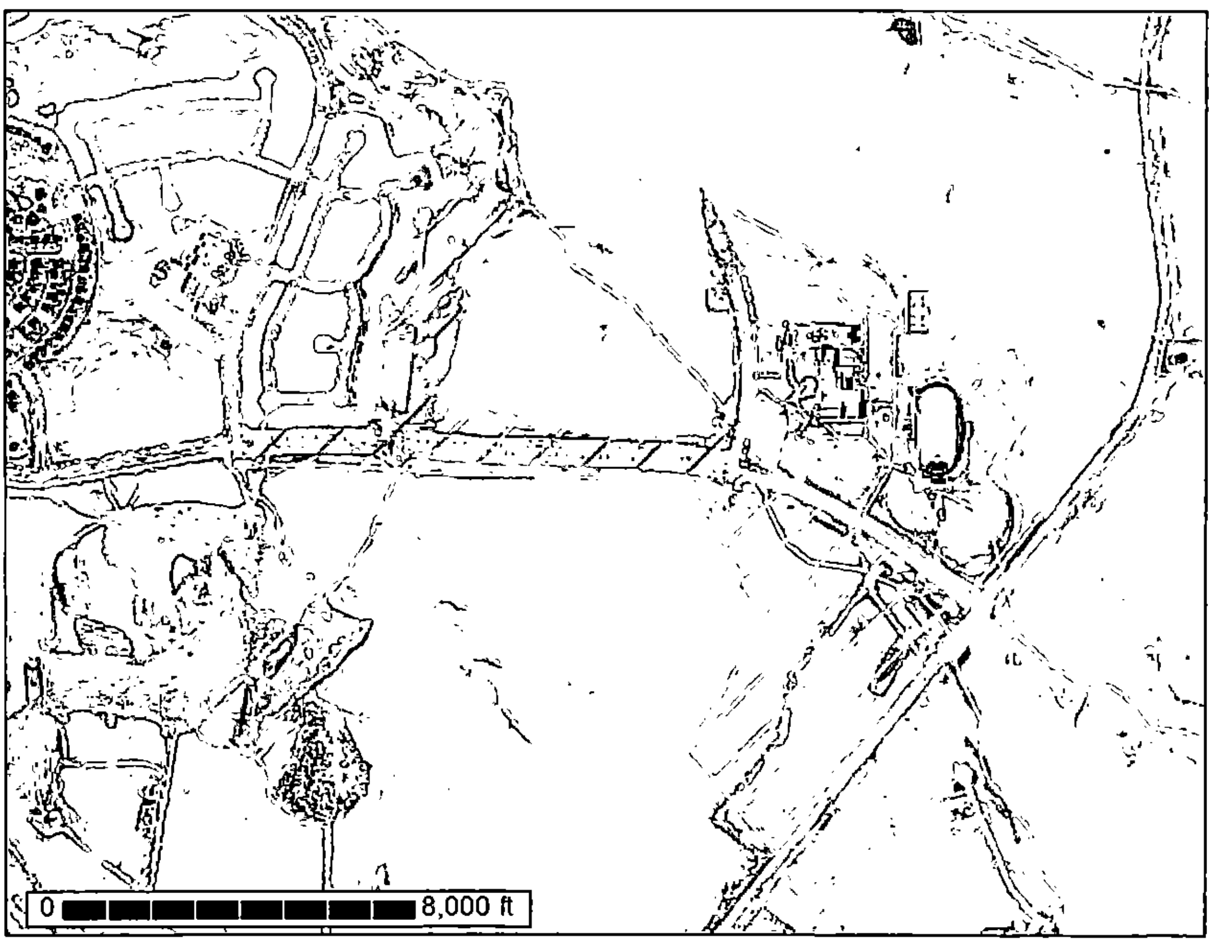
USDA United States Department of Agriculture

NRCS Natural Resources Conservation Service

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

Custom Soil Resource Report for

El Paso County Area, Colorado



October 28, 2013

Preface

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

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

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

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

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

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

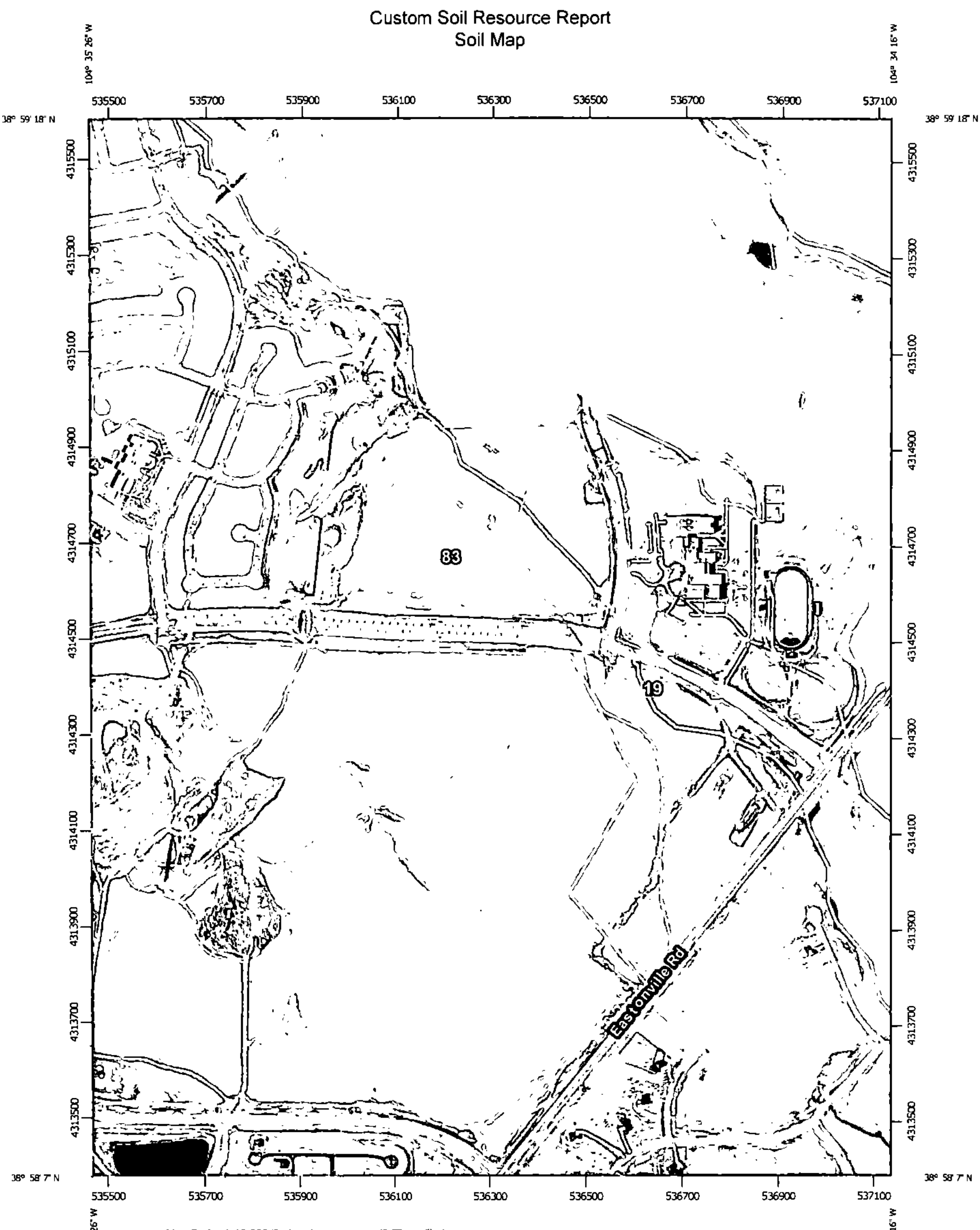
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Soil Map



Map Scale: 1:10,800 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 150, 300, 600, 900

Feet: 0, 500, 1000, 2000, 3000

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
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 9, Sep 17, 2012

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.

Map Unit Legend

El Paso County Area, Colorado (CO625)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	53.7	34.7%
83	Stapleton sandy loam, 3 to 8 percent slopes	100.9	65.3%
Totals for Area of Interest		**154.5**	**100.0%**

Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days

Map Unit Composition

Columbine and similar soils: 85 percent

Description of Columbine

Setting

Landform: Fan terraces, fans, flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Very low (about 2.5 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability classification (irrigated): 4e
Land capability (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: Gravelly Foothill (R049BY214CO)

Typical profile

0 to 14 inches: Gravelly sandy loam
14 to 60 inches: Very gravelly loamy sand

Minor Components

Fluvaquentic haplaquolls

Percent of map unit:
Landform: Swales

Other soils

Percent of map unit:

Pleasant

Percent of map unit:
Landform: Depressions

83—Stapleton sandy loam, 3 to 8 percent slopes

Map Unit Setting

Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days

Map Unit Composition

Stapleton and similar soils: 80 percent

Description of Stapleton

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.7 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: Gravelly Foothill (R049BY214CO)

Typical profile

0 to 11 inches: Sandy loam
11 to 17 inches: Gravelly sandy loam
17 to 60 inches: Gravelly loamy sand

Minor Components

Fluvaquentic haplaquolls

Percent of map unit:
Landform: Swales

Other soils

Percent of map unit:

Pleasant

Percent of map unit:

Landform: Depressions

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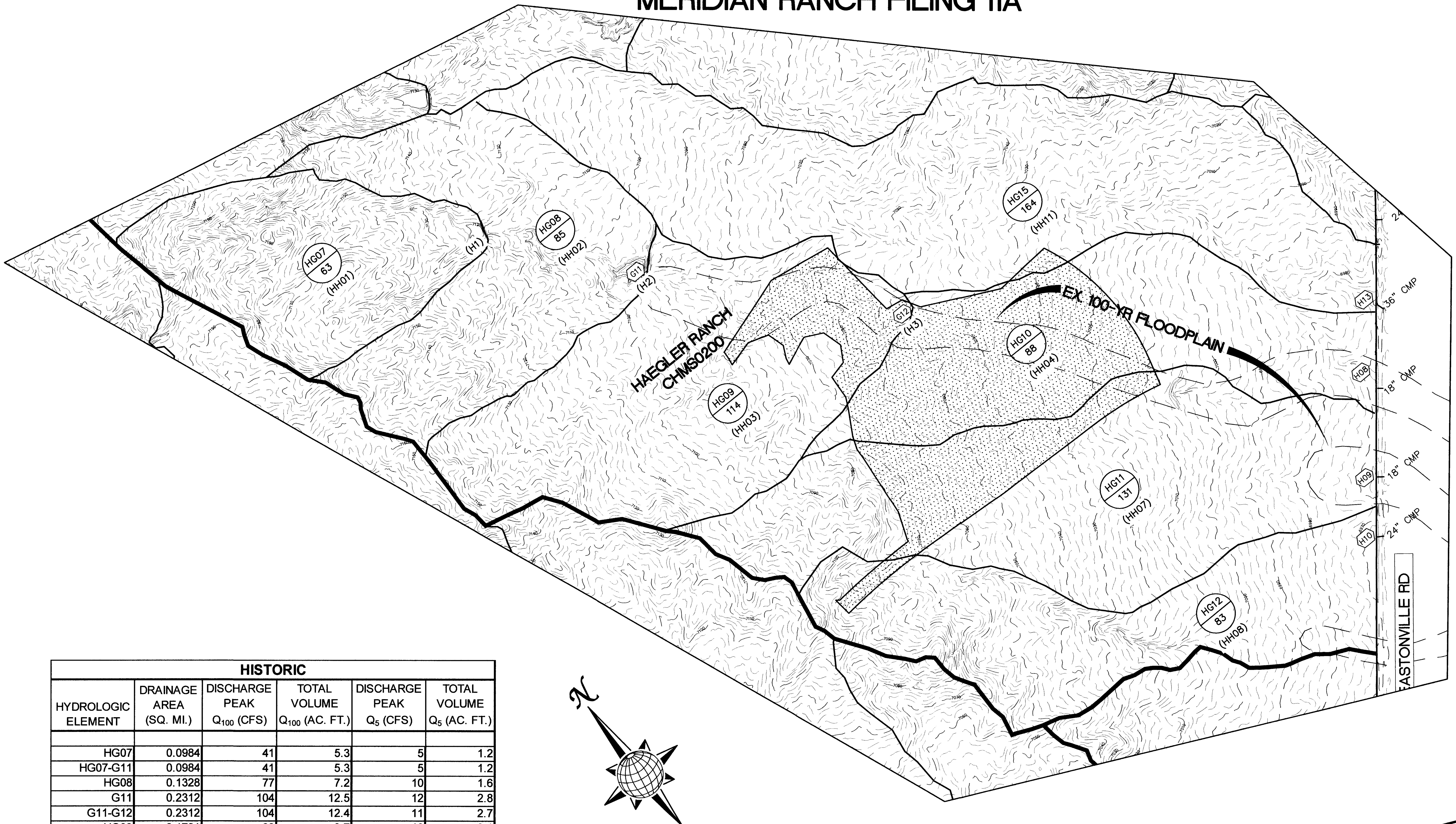
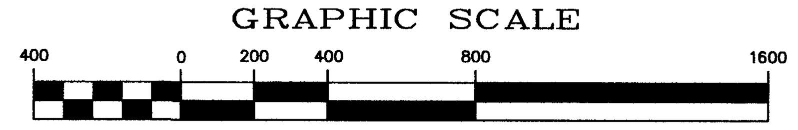
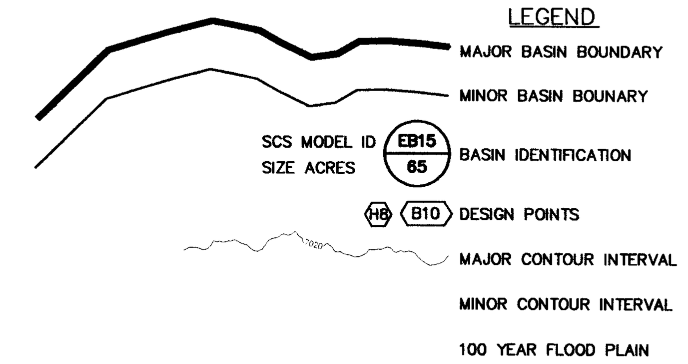
SCS DRAINAGE MAP
MERIDIAN RANCH FILING 11A



HISTORIC					
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q_{100} (CFS)	TOTAL VOLUME Q_{100} (AC. FT.)	DISCHARGE PEAK Q_5 (CFS)	TOTAL VOLUME Q_5 (AC. FT.)
HG07	0.0984	41	5.3	5	1.2
HG07-G11	0.0984	41	5.3	5	1.2
HG08	0.1328	77	7.2	10	1.6
G11	0.2312	104	12.5	12	2.8
G11-G12	0.2312	104	12.4	11	2.7
HG09	0.1781	82	9.7	10	2.1
G12	0.4093	185	22.1	20	4.9
G12-H08	0.4093	183	21.8	20	4.8
HG10	0.1375	49	7.4	6	1.6
H08	0.5468	232	29.2	22	6.4
HG11	0.2047	87	11.1	11	2.4
H09	0.2047	87	11.1	11	2.4
HG15	0.2563	80	13.9	11	3.0
H13	0.2563	80	13.9	11	3.0





FINAL DRAINAGE REPORT

HISTORIC CONDITIONS

TECH CONSTRUCTION CORP.
10305 ANGELES ROAD
PEYTON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.7608

MAR 2014

FIGURE 4

SCS DRAINAGE MAP
MERIDIAN RANCH FILING #11A

LEGEND

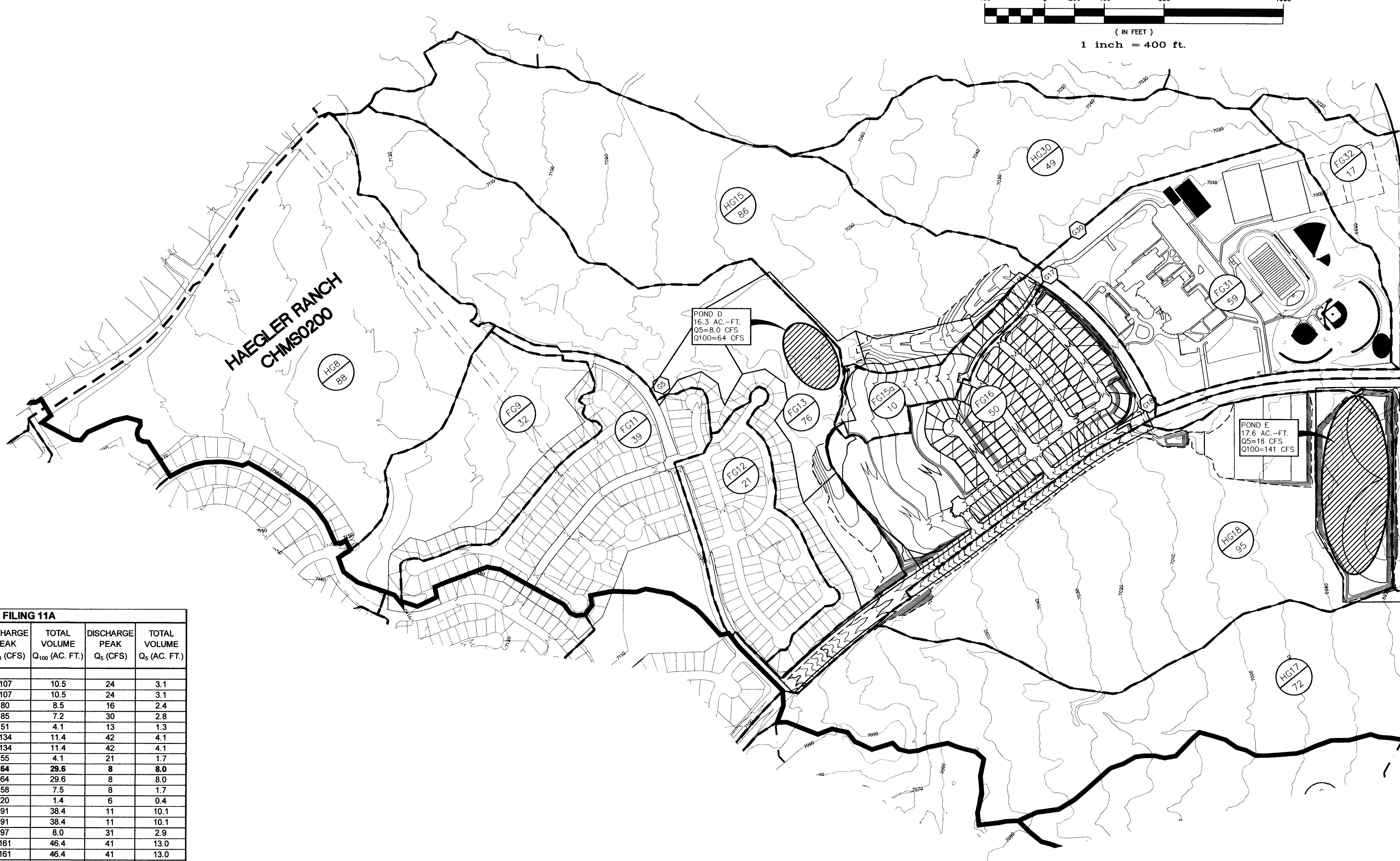
- MAJOR BASIN BOUNDARY
- MINOR BASIN BOUNARY
- SCS MODEL ID / SIZE ACRES (EB15 / 65) BASIN IDENTIFICATION
- (H8) (B10) DESIGN POINTS
- MAJOR CONTOUR INTERVAL
- MINOR CONTOUR INTERVAL
- 100 YEAR FLOOD PLAIN

GRAPHIC SCALE

400 0 200 400 800 1600

(IN FEET)

1 inch = 400 ft.



FILING 11A					
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q_{100} (CFS)	TOTAL VOLUME Q_{100} (AC. FT.)	DISCHARGE PEAK Q_5 (CFS)	TOTAL VOLUME Q_5 (AC. FT.)
HG08	0.1375	107	10.5	24	3.1
FG08-POND D	0.1375	107	10.5	24	3.1
FG13	0.1188	80	8.5	16	2.4
FG11	0.0608	85	7.2	30	2.8
FG09	0.0500	51	4.1	13	1.3
G05	0.1108	134	11.4	42	4.1
G05-POND D	0.1108	134	11.4	42	4.1
FG12	0.0328	55	4.1	21	1.7
POND D	**0.3999**	**64**	**29.6**	**8**	**8.0**
POND D-G17	0.3999	64	29.6	8	8.0
HG15	0.1344	58	7.5	8	1.7
FG15a	0.0156	20	1.4	6	0.4
G17	0.5499	91	38.4	11	10.1
G17-G18	0.5499	91	38.4	11	10.1
FG16	0.0773	97	8.0	31	2.9
G18	0.6272	161	46.4	41	13.0
G18-POND E	0.6272	161	46.4	41	13.0
FG31	0.0922	123	11.6	45	4.7
HG30	0.0766	49	4.2	6	0.9
HG30-POND HS	0.0766	48	4.1	6	0.9
POND HS	**0.1688**	**126**	**15.8**	**27**	**5.6**
HG18	0.1484	67	8.7	10	2.1
POND E	**0.9444**	**141**	**65.2**	**18**	**18.4**
FG33	0.0109	13	1.0	4	0.3
H08	0.9553	**74**	66.2	**12**	18.7
H09		**67**		**6.3**	
*** FROM OUTLET STAGE-STORAGE CALCULATION**					

FINAL DRAINAGE REPORT
DEVELOPED CONDITIONS FILING 11A

TECH CONSTRUCTION CORP.
12311 REX ROAD
PEYTON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

MAR 2014

FIGURE 5

SCS DRAINAGE MAP
MERIDIAN RANCH FILING #11B

LEGEND

MAJOR BASIN BOUNDARY

MINOR BASIN BOUNARY

SCS MODEL ID (EB15) SIZE ACRES (65) BASIN IDENTIFICATION

(H8) (B10) DESIGN POINTS

MAJOR CONTOUR INTERVAL

MINOR CONTOUR INTERVAL

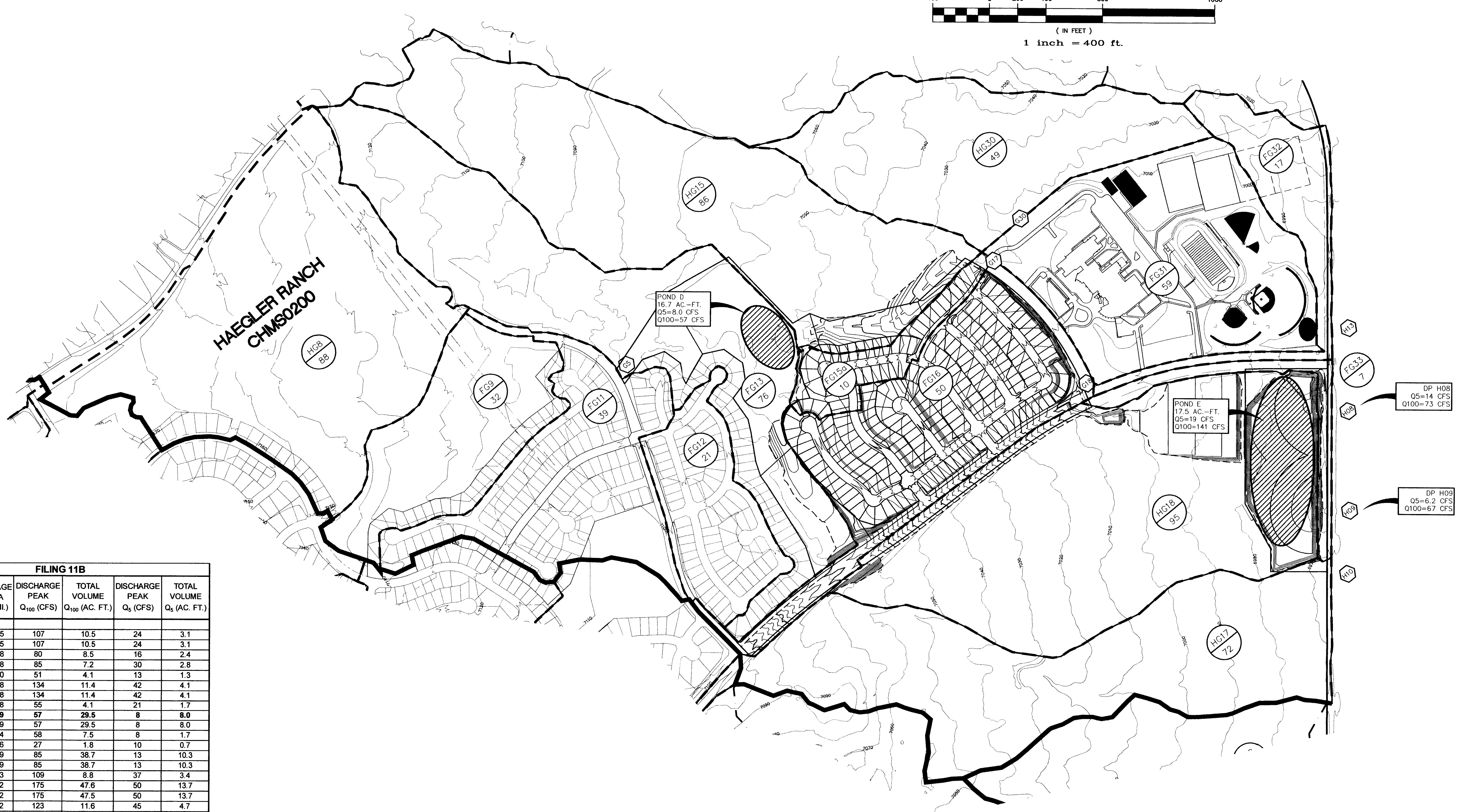
100 YEAR FLOOD PLAIN

GRAPHIC SCALE

400 0 200 400 800 1600

(IN FEET)

1 inch = 400 ft.



FILING 11B					
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q_{100} (CFS)	TOTAL VOLUME Q_{100} (AC. FT.)	DISCHARGE PEAK Q_5 (CFS)	TOTAL VOLUME Q_5 (AC. FT.)
HG08	0.1375	107	10.5	24	3.1
FG08-POND D	0.1375	107	10.5	24	3.1
FG13	0.1188	80	8.5	16	2.4
FG11	0.0608	85	7.2	30	2.8
FG09	0.0500	51	4.1	13	1.3
G05	0.1108	134	11.4	42	4.1
G05-POND D	0.1108	134	11.4	42	4.1
FG12	0.0328	55	4.1	21	1.7
POND D	**0.3999**	**57**	**29.5**	**8**	**8.0**
POND D-G17	0.3999	57	29.5	8	8.0
HG15	0.1344	58	7.5	8	1.7
FG15a	0.0156	27	1.8	10	0.7
G17	0.5499	85	38.7	13	10.3
G17-G18	0.5499	85	38.7	13	10.3
FG16	0.0773	109	8.8	37	3.4
G18	0.6272	175	47.6	50	13.7
G18-POND E	0.6272	175	47.5	50	13.7
FG31	0.0922	123	11.6	45	4.7
HG30	0.0766	49	4.2	6	0.9
HG30-POND HS	0.0766	48	4.1	6	0.9
POND HS	**0.1688**	**126**	**15.8**	**27**	**5.6**
HG18	0.1484	67	8.6	10	2.0
POND E	**0.9444**	**141**	**66.2**	**19**	**19.1**
FG33	0.0109	13	1.0	4	0.3
H08	0.9553	**73**	67.2	**14**	19.4
H09		**67**		**6.2**	
* FROM OUTLET STAGE-STORAGE CALCULATION					

FINAL DRAINAGE REPORT
DEVELOPED CONDITIONS FILING 11B

TECH CONSTRUCTION CORP.
12311 REX ROAD
PEYTON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

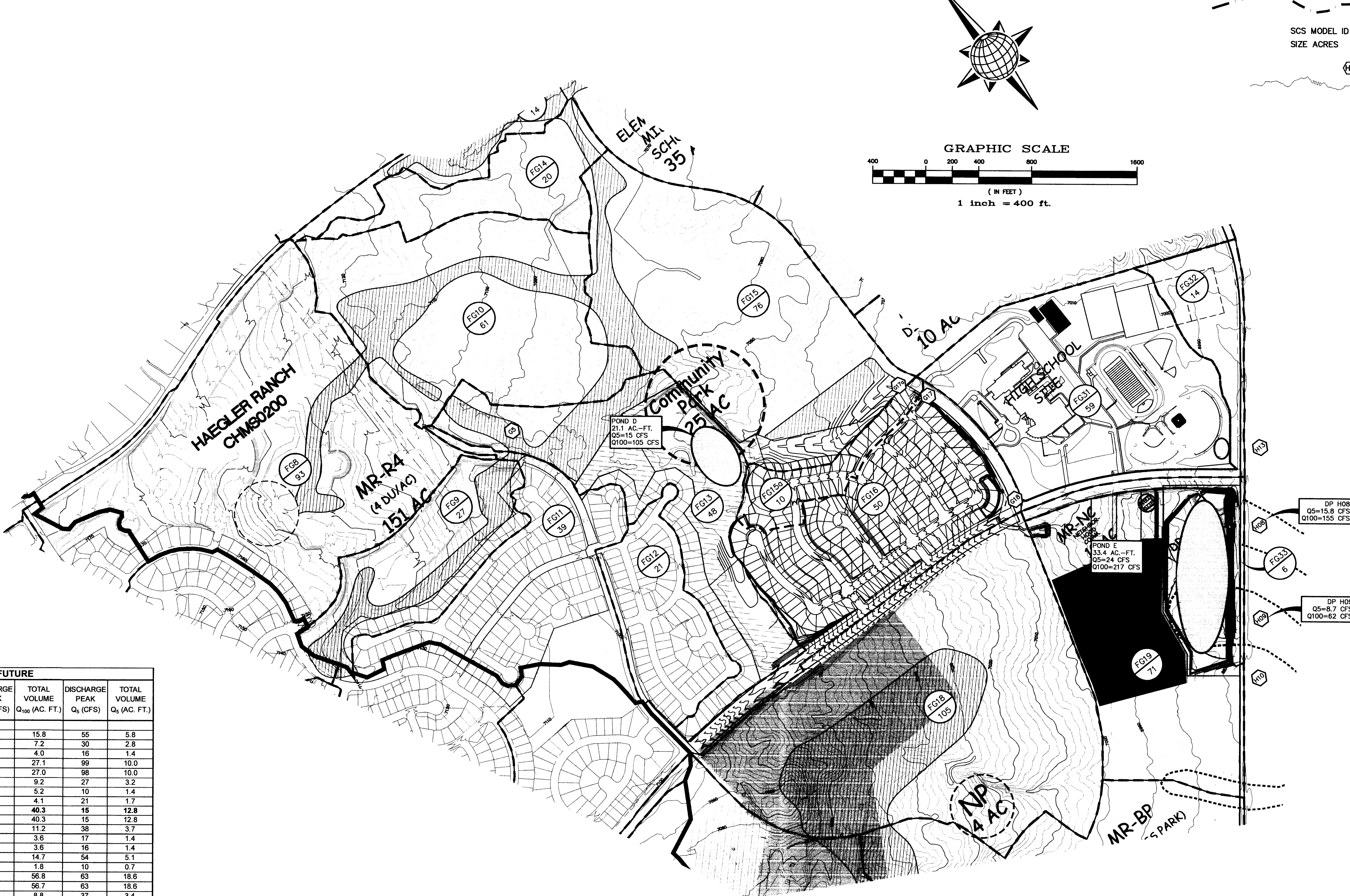
MAR 2014

FIGURE 6

SCS DRAINAGE MAP
MERIDIAN RANCH FILING 11A

LEGEND

- MAJOR BASIN BOUNDARY
- MINOR BASIN BOUNARY
- SCS MODEL ID / SIZE ACRES (EB15 / 65) BASIN IDENTIFICATION
- (H8) (B10) DESIGN POINTS
- MAJOR CONTOUR INTERVAL
- MINOR CONTOUR INTERVAL
- 100 YEAR FLOOD PLAIN



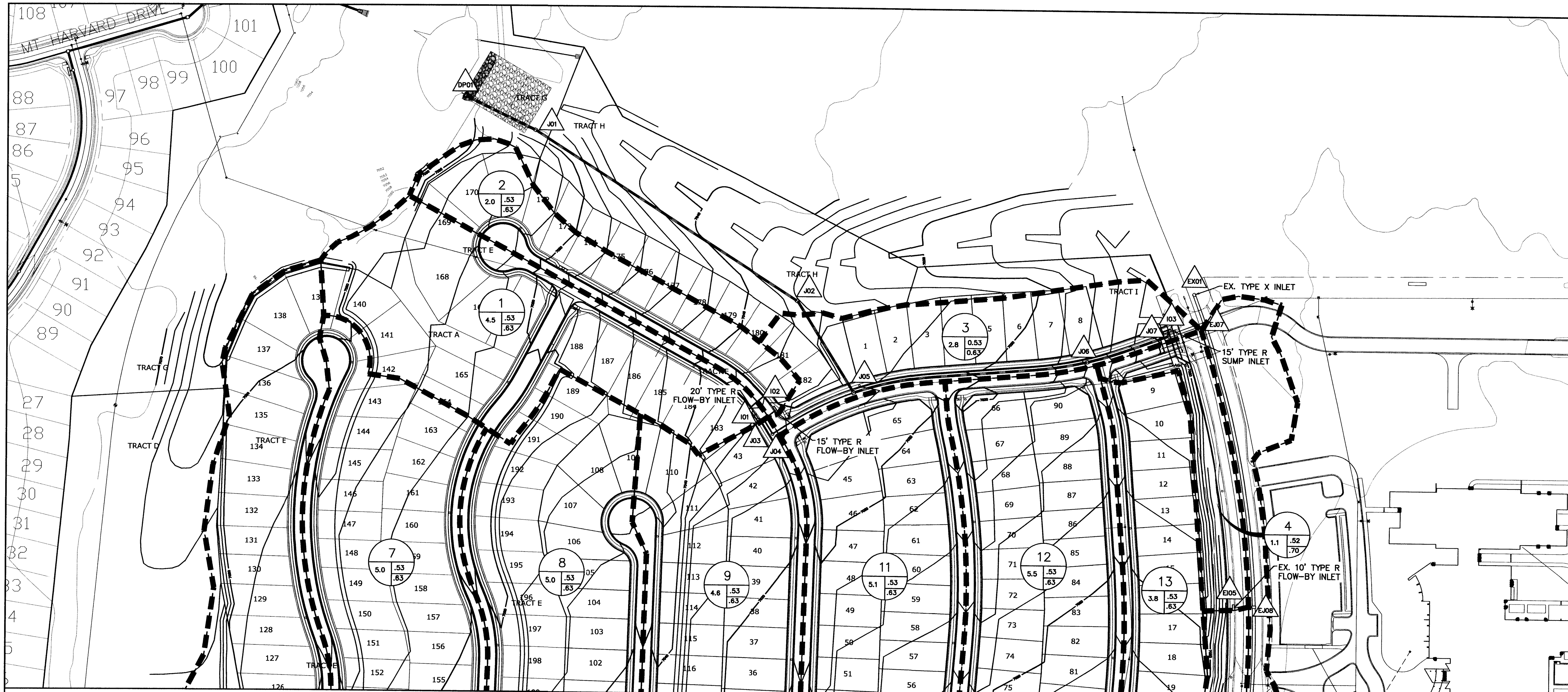
FUTURE					
HYDROLOGIC ELEMENT	DRAINAGE AREA (SQ. MI.)	DISCHARGE PEAK Q_{100} (CFS)	TOTAL VOLUME Q_{100} (AC. FT.)	DISCHARGE PEAK Q_5 (CFS)	TOTAL VOLUME Q_5 (AC. FT.)
FG08	0.1453	170	15.8	55	5.8
FG11	0.0608	85	7.2	30	2.8
FG09	0.0416	53	4.0	16	1.4
G05	0.2477	302	27.1	99	10.0
G05-POND D	0.2477	301	27.0	98	10.0
FG10	0.0953	94	9.2	27	3.2
FG13	0.075	53	5.2	10	1.4
FG12	0.0328	55	4.1	21	1.7
POND D	**0.4508**	**105**	**40.3**	**15**	**12.8**
POND D-G17	0.4508	105	40.3	15	12.8
FG15	0.1188	132	11.2	38	3.7
FG14	0.0313	47	3.6	17	1.4
FG14-G17	0.0313	47	3.6	16	1.4
G17a	0.1501	179	14.7	54	5.1
FG15a	0.0156	27	1.8	10	0.7
G17	0.6165	212	56.8	63	18.6
G17-G18	0.6165	212	56.7	63	18.6
FG16	0.0773	109	8.8	37	3.4
G18	0.6938	319	65.6	99	21.9
G18-POND E	0.6938	317	65.6	99	21.9
FG18	0.1641	198	16.9	62	6.0
FG18-POND E	0.1641	198	16.9	62	6.0
FG19	0.0977	203	13.2	83	5.6
FG31	0.0922	123	11.6	45	4.7
POND HS	0.0922	79	11.6	25	4.7
POND E	**1.0478**	**217**	**92.1**	**24**	**27.7**
FG33	0.0109	15	1.0	4	0.3
H08	1.0587	**155**	93.1	**15.8**	28
H09		**62**		**8.7**	
* FROM OUTLET STAGE-STORAGE CALCULATION					

FINAL DRAINAGE REPORT
FUTURE CONDITIONS

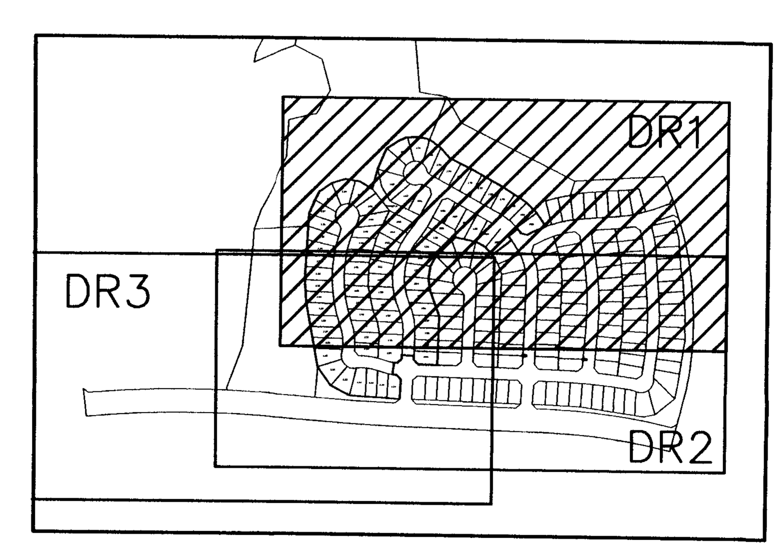
TECH CONSTRUCTION CORP.
12311 REX ROAD
PEYTON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.3349

MAR 2014

FIGURE 7



BASIN	AREA (AC)	Tc (Min.)	DIRECT RUNOFF I (in./ hr.) (5 YR)	I (in./ hr.) (100 YR)	COEFF. C (5 YR)	COEFF. C (100 YR)	CA (5 YR)	CA (100 YR)	Q (5 YR)	Q (100 YR)	TOTAL RUNOFF Sum Tc (min.)	I (in./ hr.) (5 YR)	I (in./ hr.) (100 YR)	CA (5 YR)	CA (100 YR)	Q (5 YR)	Q (100 YR)
1	4.5	18.6	2.92	5.41	0.53	0.63	2.36	2.81	**7.0**	**15**						**7.0**	**15**
2	2.0	13.8	3.38	6.26	0.53	0.63	1.05	1.25	**3.5**	**7.8**						**3.5**	**7.8**
3	2.8	17.2	3.04	5.63	0.53	0.63	1.47	1.75	**4.5**	**9.8**	18.3	2.94	5.45	1.77	2.22	**5.2**	**12**
4	1.1	11.2	3.69	6.84	0.52	0.70	0.57	0.77	**2.1**	**5.2**						**2.1**	**5.2**
5	1.6	10.6	3.78	7.01	0.59	0.71	0.94	1.13	**3.5**	**7.9**	23.8	2.56	4.74	1.29	1.91	**3.5**	**9.1**
6	6.5	22.3	2.65	4.92	0.47	0.61	3.09	3.96	**8.2**	**19**						**8.2**	**19**
7	5.0	19.2	2.87	5.32	0.53	0.63	2.63	3.13	**7.5**	**17**	22.6	2.64	4.88	2.63	3.65	**7.5**	**18**
8	5.0	19.6	2.84	5.27	0.53	0.63	2.63	3.13	**7.5**	**16**						**7.5**	**16**
9	4.6	17.9	2.98	5.52	0.53	0.63	2.42	2.88	**7.2**	**16**	23.1	2.61	4.83	3.09	4.21	**8.1**	**20**
10	2.1	11.5	3.65	6.77	0.53	0.63	1.12	1.33	**4.1**	**9.0**						**4.1**	**9.0**
11	5.1	20.7	2.76	5.11	0.53	0.63	2.68	3.19	**7.4**	**16**	25.3	2.48	4.59	2.68	3.47	**7.4**	**16**
12	5.5	18.5	2.93	5.43	0.53	0.63	2.89	3.44	**8.5**	**19**	27.8	2.34	4.34	2.89	3.70	**8.5**	**19**
13	3.8	15.6	3.19	5.91	0.53	0.63	2.00	2.39	**6.4**	**14**	28.0	2.34	4.33	2.00	2.56	**6.4**	**14**
14	2.4	14.8	3.26	6.05	0.60	0.75	1.44	1.80	**4.7**	**11**						**4.7**	**11**
15	1.9	11.8	3.62	6.71	0.58	0.74	1.11	1.41	**4.0**	**9.4**						**4.0**	**9.4**
16	1.5	10.4	3.80	7.05	0.50	0.68	0.75	1.03	**2.9**	**7.2**	18.2	2.95	5.47	1.09	1.63	**3.2**	**8.9**
17	1.7	10.0	3.87	7.17	0.49	0.66	0.84	1.12	**3.2**	**8.0**	21.1	2.73	5.07	1.07	1.68	**3.2**	**8.5**
18	1.7	12.0	3.59	6.65	0.49	0.64	0.83	1.08	**3.0**	**7.2**	23.5	2.58	4.78	1.09	1.65	**3.0**	**7.9**
19	3.8	14.8	3.27	6.05	0.58	0.74	2.22	2.81	**7.3**	**17**	20.2	2.80	5.19	2.59	3.44	**7.3**	**18**
20	1.7	15.5	3.20	5.93	0.72	0.83	1.23	1.42	**3.9**	**8.4**						**3.9**	**8.4**



INDEX MAP
NTS

NOTE:

COUNTY PLAN REVIEW IS PROVIDED ONLY FOR GNERAL CONFORMANCE WITH COUNTY DESIGN CRITERIA. THE COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. THE COUNTY THROUGH THE APPROVAL OF THIS DOCUMENT ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

LEGEND

- SUB-WATERSHED DESIGNATION
- DESIGN POINT DESIGNATION
- MAJOR BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- 6130 EXISTING CONTOUR
- 6130 PROPOSED COUNTOUR
- 24" RCP PROPOSED STORM SEWER

WATERSHED DESIGNATION

- BASIN DESIGNATION
- MINOR/MAJOR STORM COEFFICIENT
- BASIN AREA IN ACRES

PROJECT BENCHMARK

INTERSECTION OF WOODMEN RD AND MERIDIAN ROAD AT SW CORNER (BRASS CAP W/ NO. GF-9)

ELEVATION = 6874.00

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)

1 inch = 100 ft.

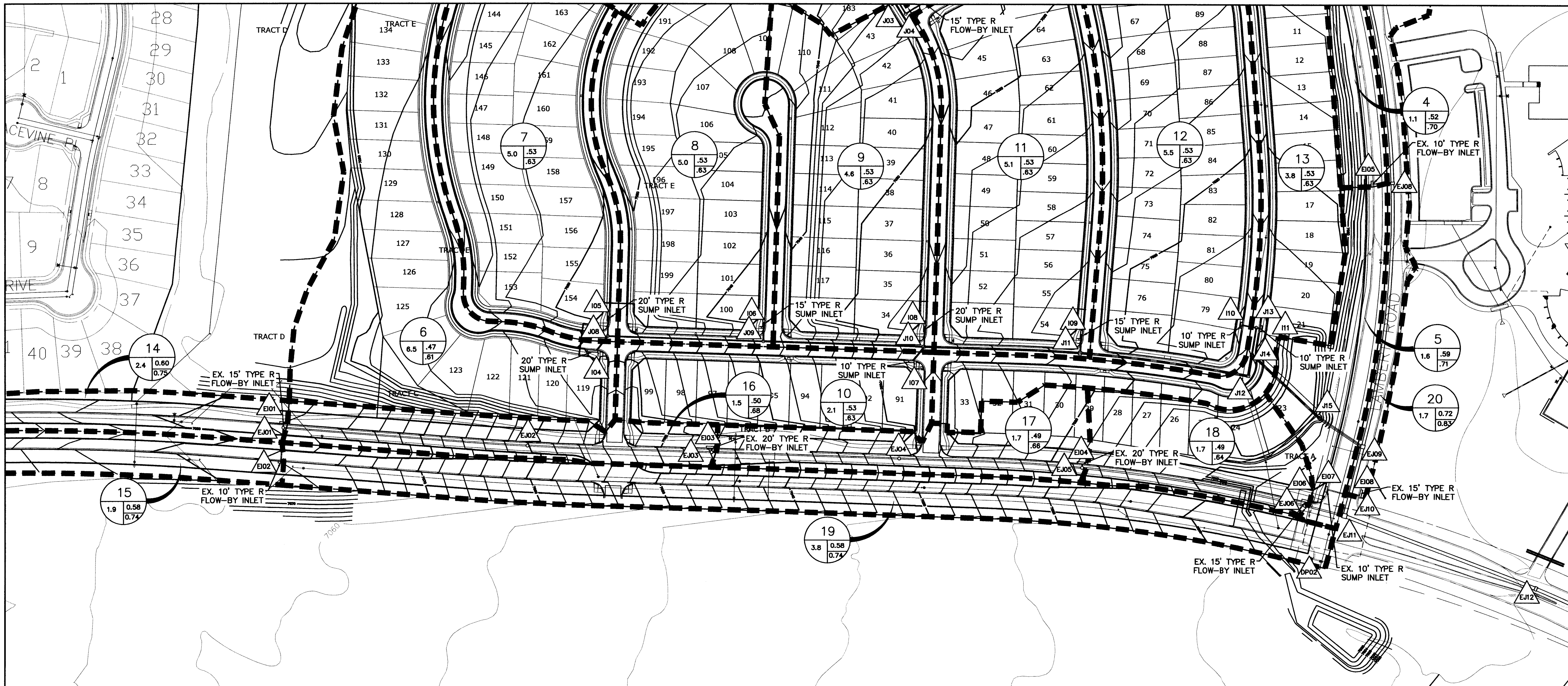
No.	Revisions	Date	Init.	Appr.	Date

TECH CONSTRUCITON CORP.
10305 ANGELES ROAD
PEYTON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.7608

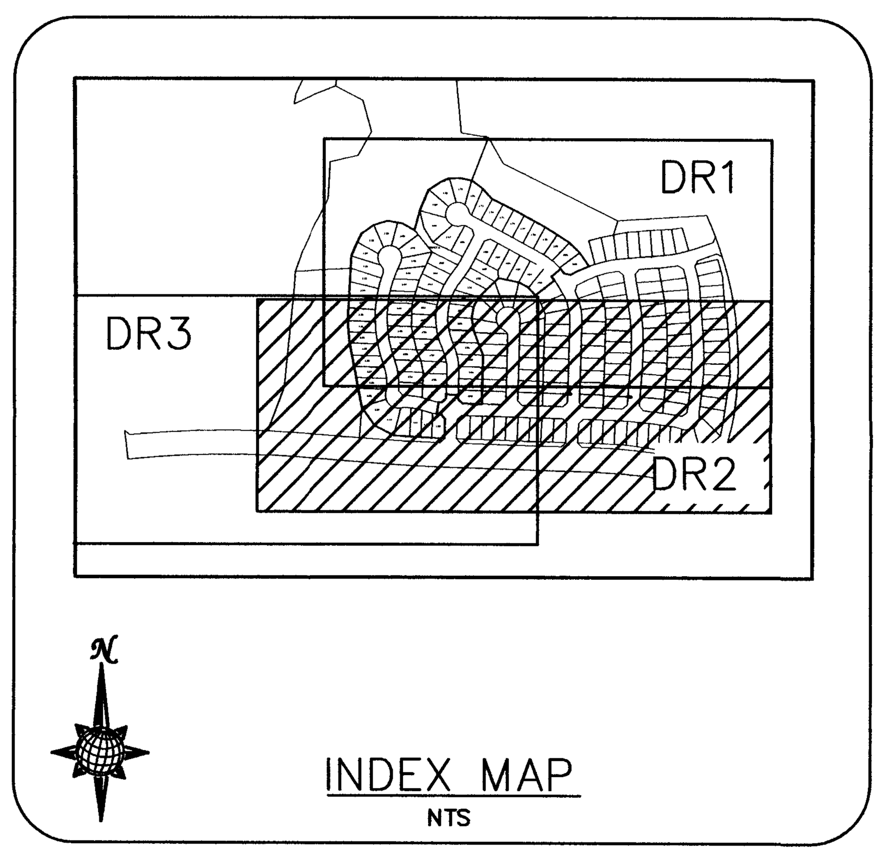
MERIDIAN RANCH

MERIDIAN RANCH ESTATES FILING 11
FINAL DRAINAGE PLAN
FIGURE 8

Drawn by LOG
Checked by TJK
Date FEB 2014
Scale AS SHOWN
Sheet Number DR1



BASIN	AREA (AC)	Tc (Min.)	DIRECT RUNOFF I (in./ hr.) (5 YR)	I (in./ hr.) (100 YR)	COEFF. C (5 YR)	COEFF. C (100 YR)	CA (5 YR)	CA (100 YR)	Q (5 YR)	Q (100 YR)	TOTAL RUNOFF Sum Tc (min.)	I (in./ hr.) (5 YR)	I (in./ hr.) (100 YR)	CA (5 YR)	CA (100 YR)	Q (5 YR)	Q (100 YR)
1	4.5	18.6	2.92	5.41	0.53	0.63	2.36	2.81	**7.0**	**15**						**7.0**	**15**
2	2.0	13.8	3.38	6.26	0.53	0.63	1.05	1.25	**3.5**	**7.8**						**3.5**	**7.8**
3	2.8	17.2	3.04	5.63	0.53	0.63	1.47	1.75	**4.5**	**9.8**	18.3	2.94	5.45	1.77	2.22	**5.2**	**12**
4	1.1	11.2	3.69	6.84	0.52	0.70	0.57	0.77	**2.1**	**5.2**						**2.1**	**5.2**
5	1.6	10.6	3.78	7.01	0.59	0.71	0.94	1.13	**3.5**	**7.9**	23.8	2.56	4.74	1.29	1.91	**3.5**	**9.1**
6	6.5	22.3	2.65	4.92	0.47	0.61	3.09	3.96	**8.2**	**19**						**8.2**	**19**
7	5.0	19.2	2.87	5.32	0.53	0.63	2.63	3.13	**7.5**	**17**	22.6	2.64	4.88	2.63	3.65	**7.5**	**18**
8	5.0	19.6	2.84	5.27	0.53	0.63	2.63	3.13	**7.5**	**16**						**7.5**	**16**
9	4.6	17.9	2.98	5.52	0.53	0.63	2.42	2.88	**7.2**	**16**	23.1	2.61	4.83	3.09	4.21	**8.1**	**20**
10	2.1	11.5	3.65	6.77	0.53	0.63	1.12	1.33	**4.1**	**9.0**						**4.1**	**9.0**
11	5.1	20.7	2.76	5.11	0.53	0.63	2.68	3.19	**7.4**	**16**	25.3	2.48	4.59	2.68	3.47	**7.4**	**16**
12	5.5	18.5	2.93	5.43	0.53	0.63	2.89	3.44	**8.5**	**19**	27.8	2.34	4.34	2.89	3.70	**8.5**	**19**
13	3.8	15.6	3.19	5.91	0.53	0.63	2.00	2.39	**6.4**	**14**	28.0	2.34	4.33	2.00	2.56	**6.4**	**14**
14	2.4	14.8	3.26	6.05	0.60	0.75	1.44	1.80	**4.7**	**11**						**4.7**	**11**
15	1.9	11.8	3.62	6.71	0.58	0.74	1.11	1.41	**4.0**	**9.4**						**4.0**	**9.4**
16	1.5	10.4	3.80	7.05	0.50	0.68	0.75	1.03	**2.9**	**7.2**	18.2	2.95	5.47	1.09	1.63	**3.2**	**8.9**
17	1.7	10.0	3.87	7.17	0.49	0.66	0.84	1.12	**3.2**	**8.0**	21.1	2.73	5.07	1.07	1.68	**3.2**	**8.5**
18	1.7	12.0	3.59	6.65	0.49	0.64	0.83	1.08	**3.0**	**7.2**	23.5	2.58	4.78	1.09	1.65	**3.0**	**7.9**
19	3.8	14.8	3.27	6.05	0.58	0.74	2.22	2.81	**7.3**	**17**	20.2	2.80	5.19	2.59	3.44	**7.3**	**18**
20	1.7	15.5	3.20	5.93	0.72	0.83	1.23	1.42	**3.9**	**8.4**						**3.9**	**8.4**



NOTE:

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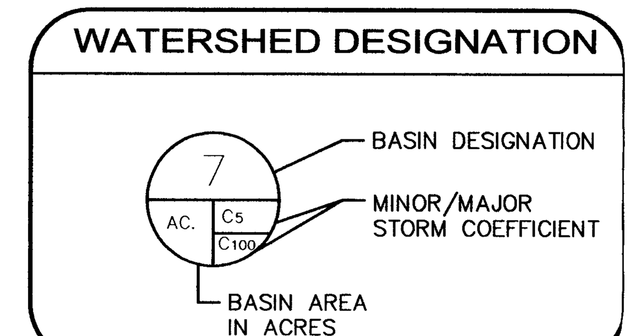
LEGEND

- SUB-WATERSHED DESIGNATION
- DESIGN POINT DESIGNATION
- MAJOR BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- EXISTING CONTOUR (6130)
- PROPOSED COUNTOUR (6130)
- PROPOSED STORM SEWER (24" RCP)

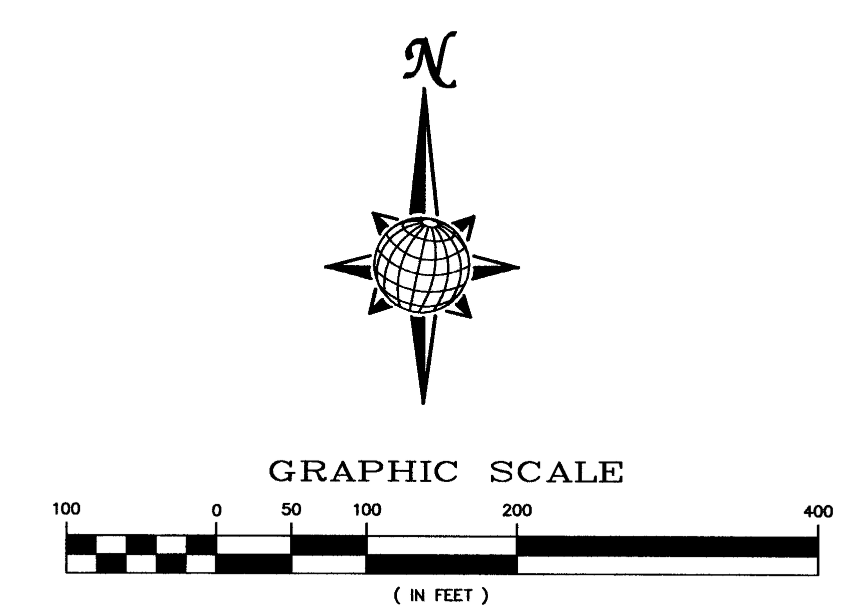
WATERSHED DESIGNATION



PROJECT BENCHMARK

INTERSECTION OF WOODMEN RD AND MERIDIAN ROAD AT SW CORNER (BRASS CAP W/ NO. GF-9)

ELEVATION = 6874.00



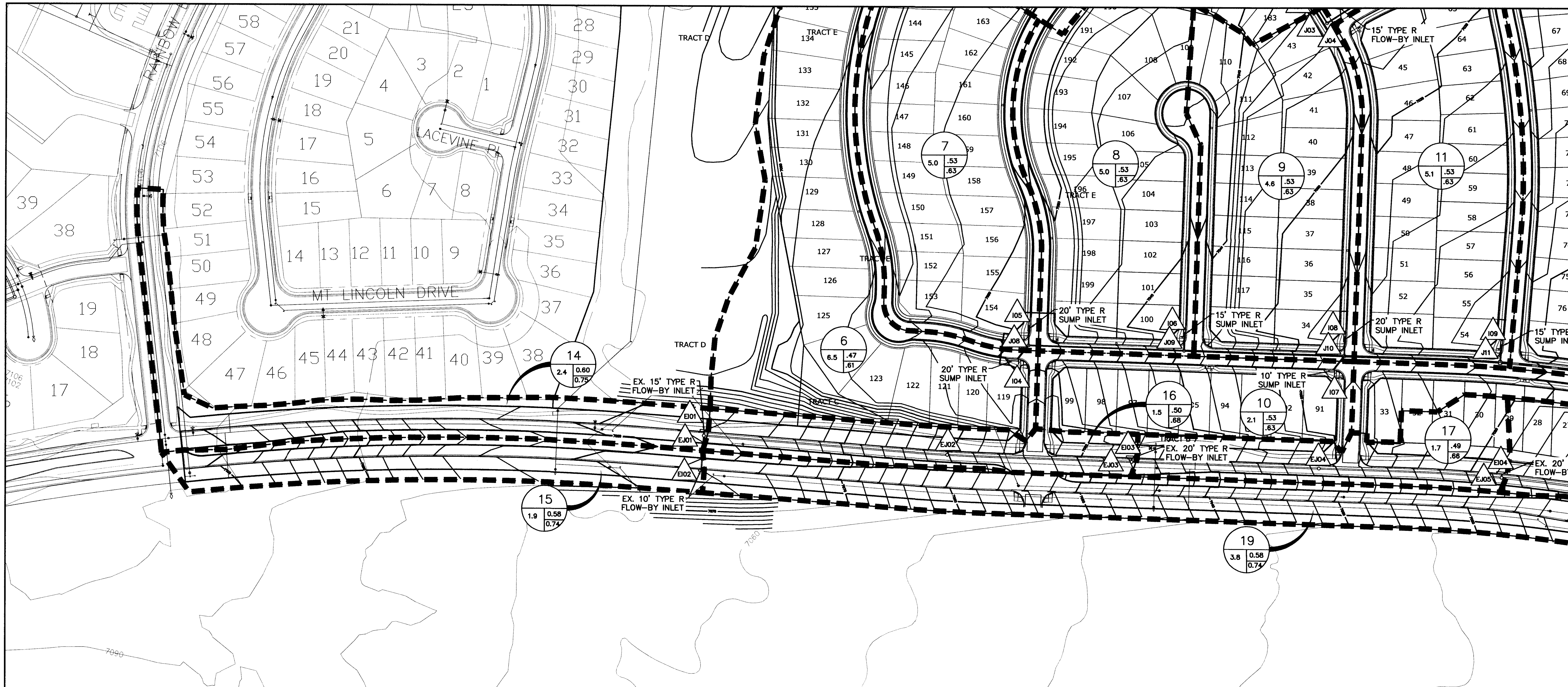
No.	Revisions	Date	Init.	Appr.	Date
-					
-					
-					
-					

TECH CONSTRUCITON CORP.
10305 ANGELES ROAD
PEYTON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.7608

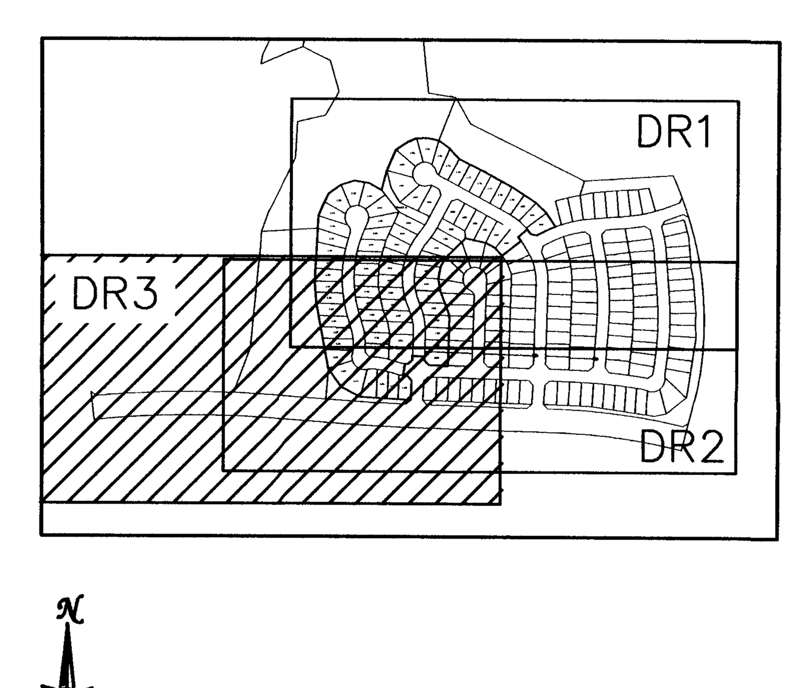
MERIDIAN RANCH

MERIDIAN RANCH ESTATES FILING 11
FINAL DRAINAGE PLAN
FIGURE 7

Drawn by LCG
Checked by TAK
Date OCT 2013
Scale AS SHOWN
Sheet Number DR2



BASIN	AREA (AC)	Tc (Min.)	DIRECT RUNOFF I (in./hr.) (5 YR)	I (100 YR)	COEFF. C (5 YR)	COEFF. C (100 YR)	CA (5 YR)	CA (100 YR)	Q (5 YR)	Q (100 YR)	TOTAL RUNOFF Sum Tc (min.)	I (in./hr.) (5 YR)	I (100 YR)	CA (5 YR)	CA (100 YR)	Q (5 YR)	Q (100 YR)
1	4.5	18.6	2.92	5.41	0.53	0.63	2.36	2.81	**7.0**	**15**						**7.0**	**15**
2	2.0	13.8	3.38	6.26	0.53	0.63	1.05	1.25	**3.5**	**7.8**						**3.5**	**7.8**
3	2.8	17.2	3.04	5.63	0.53	0.63	1.47	1.75	**4.5**	**9.8**	18.3	2.94	5.45	1.77	2.22	**5.2**	**12**
4	1.1	11.2	3.69	6.84	0.52	0.70	0.57	0.77	**2.1**	**5.2**						**2.1**	**5.2**
5	1.6	10.6	3.78	7.01	0.59	0.71	0.94	1.13	**3.5**	**7.9**	23.8	2.56	4.74	1.29	1.91	**3.5**	**9.1**
6	6.5	22.3	2.65	4.92	0.47	0.61	3.09	3.96	**8.2**	**19**						**8.2**	**19**
7	5.0	19.2	2.87	5.32	0.53	0.63	2.63	3.13	**7.5**	**17**	22.6	2.64	4.88	2.63	3.65	**7.5**	**18**
8	5.0	19.6	2.84	5.27	0.53	0.63	2.63	3.13	**7.5**	**16**						**7.5**	**16**
9	4.6	17.9	2.98	5.52	0.53	0.63	2.42	2.88	**7.2**	**16**	23.1	2.61	4.83	3.09	4.21	**8.1**	**20**
10	2.1	11.5	3.65	6.77	0.53	0.63	1.12	1.33	**4.1**	**9.0**						**4.1**	**9.0**
11	5.1	20.7	2.76	5.11	0.53	0.63	2.68	3.19	**7.4**	**16**	25.3	2.48	4.59	2.68	3.47	**7.4**	**16**
12	5.5	18.5	2.93	5.43	0.53	0.63	2.89	3.44	**8.5**	**19**	27.8	2.34	4.34	2.89	3.70	**8.5**	**19**
13	3.8	15.6	3.19	5.91	0.53	0.63	2.00	2.39	**6.4**	**14**	28.0	2.34	4.33	2.00	2.56	**6.4**	**14**
14	2.4	14.8	3.26	6.05	0.60	0.75	1.44	1.80	**4.7**	**11**						**4.7**	**11**
15	1.9	11.8	3.62	6.71	0.58	0.74	1.11	1.41	**4.0**	**9.4**						**4.0**	**9.4**
16	1.5	10.4	3.80	7.05	0.50	0.68	0.75	1.03	**2.9**	**7.2**	18.2	2.95	5.47	1.09	1.63	**3.2**	**8.9**
17	1.7	10.0	3.87	7.17	0.49	0.66	0.84	1.12	**3.2**	**8.0**	21.1	2.73	5.07	1.07	1.68	**3.2**	**8.5**
18	1.7	12.0	3.59	6.65	0.49	0.64	0.83	1.08	**3.0**	**7.2**	23.5	2.58	4.78	1.09	1.65	**3.0**	**7.9**
19	3.8	14.8	3.27	6.05	0.58	0.74	2.22	2.81	**7.3**	**17**	20.2	2.80	5.19	2.59	3.44	**7.3**	**18**
20	1.7	15.5	3.20	5.93	0.72	0.83	1.23	1.42	**3.9**	**8.4**						**3.9**	**8.4**



INDEX MAP
NTS

NOTE:

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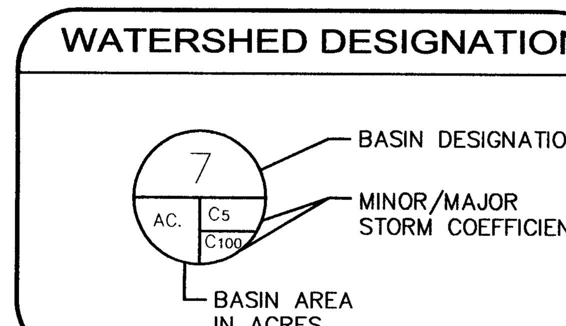
LEGEND

- SUB-WATERSHED DESIGNATION
- DESIGN POINT DESIGNATION
- MAJOR BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- 6130 EXISTING CONTOUR
- 6130 PROPOSED COUNTOUR
- 24" RCP PROPOSED STORM SEWER

WATERSHED DESIGNATION



PROJECT BENCHMARK

INTERSECTION OF WOODMEN RD AND MERIDIAN ROAD AT SW CORNER (BRASS CAP W/ NO. GF-9)

ELEVATION = 6874.00

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)

1 inch = 100 ft.

No.	Revisions	Date	Init.	Appr.	Date

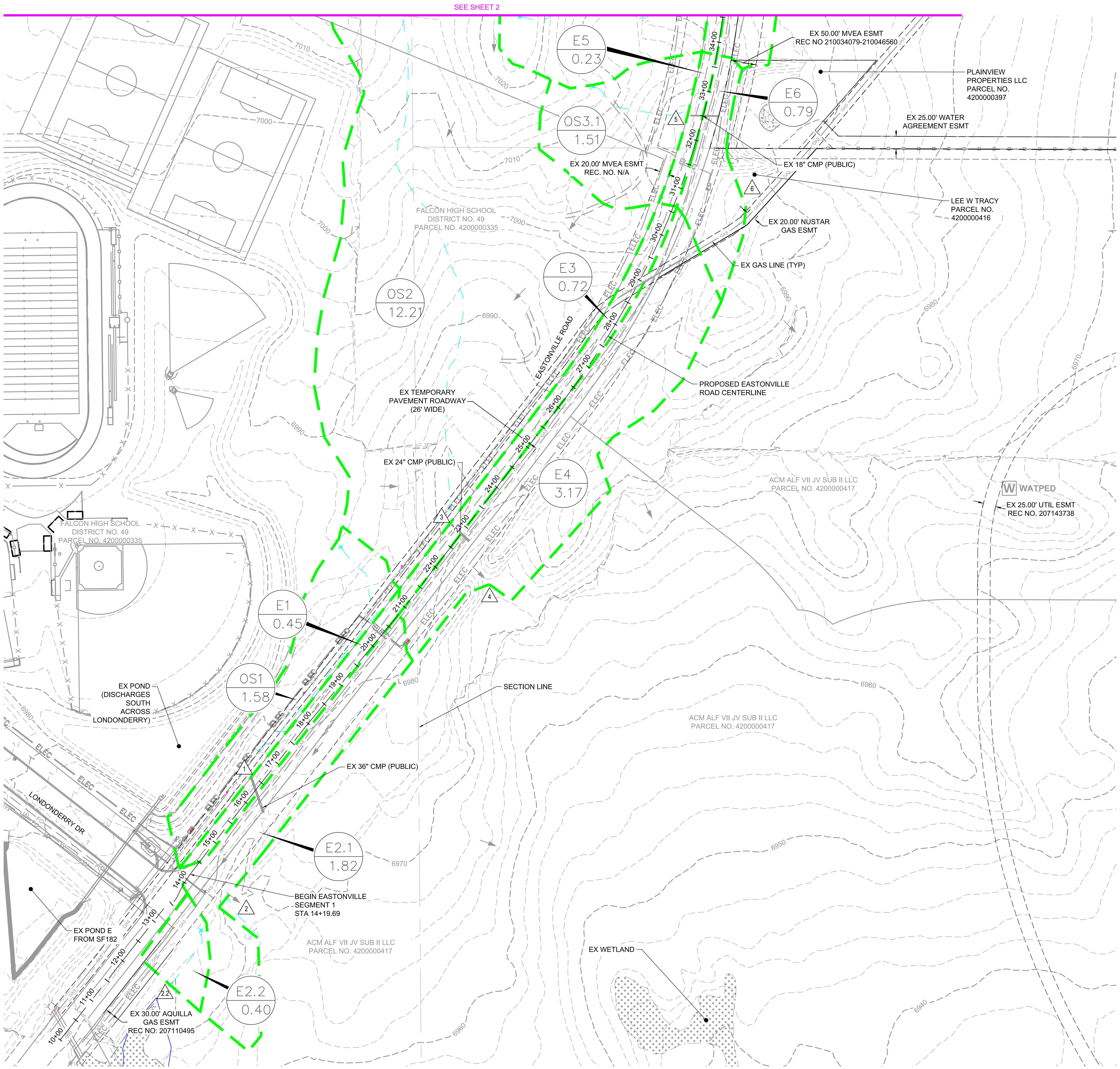
TECH CONSTRUCITON CORP.
10305 ANGELES ROAD
PEYTON, CO 80831
TELEPHONE: 719.495.7444
FAX: 719.495.7608

MERIDIAN RANCH

MERIDIAN RANCH ESTATES FILING 11
FINAL DRAINAGE PLAN
FIGURE 7

Drawn by LCG
Checked by TAK
Date OCT 2013
Scale AS SHOWN
Sheet Number DR3

APPENDIX F – DRAINAGE MAPS



LEGEND:

- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- EX STORM SEWER
- EX DRAINAGE SWALE
- EX PROPERTY LINE
- EXISTING FLOW DIRECTION
- PROPOSED DRAINAGE BASIN
- DESIGN POINT
- PROPOSED BASIN LABEL (NAME / AREA)

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q5 (cfs)	Q100 (cfs)
E1	0.47	46	0.7	1.7
E2.1	1.82	13	1.2	4.8
E2.2	0.40	2	0.1	1.0
E3	0.72	39	1.0	2.5
E4	3.17	12	1.9	7.8
E5	0.23	45	0.5	1.1
E6	0.79	14	0.7	2.6
E7	0.23	45	0.5	1.2
E8	0.70	16	0.6	2.1
E9	0.73	45	1.2	2.8
E10.1	2.61	15	1.9	7.0
E10.2	1.89	2	0.7	4.4
OS1	1.58	2	0.5	3.6
OS2	12.21	2	3.6	24.3
OS3.1	1.51	2	0.5	3.6
OS3.2	2.86	2	1.0	6.6
OS3.3	21.12	2	6.4	42.7

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	SQ5 (cfs)	SQ100 (cfs)
1	E1,OS1	1.2	4.9
2	E2,DP1	2.3	9.3
2.2	E2.2	0.1	1.0
3	E3,OS2	4.6	26.6
4	DP3,E4	6.3	33.9
5	E5,OS3.1	0.9	4.5
6	DP5,E6	1.5	6.7
7.1	E7,OS3.2	1.4	7.5
8.1	DP7.1,E8	1.9	9.4
7.2	OS3.3,E9	7.5	45.3
8.2	DP7.2,E10.1	9.2	51.6
8.3	E10.2	0.7	4.4

DRAWN BY: JOB DATE:
APPROVED: JOB NUMBER:
CAD DATE:
CAD FILE:

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NO.	DATE	BY	REVISION DESCRIPTION

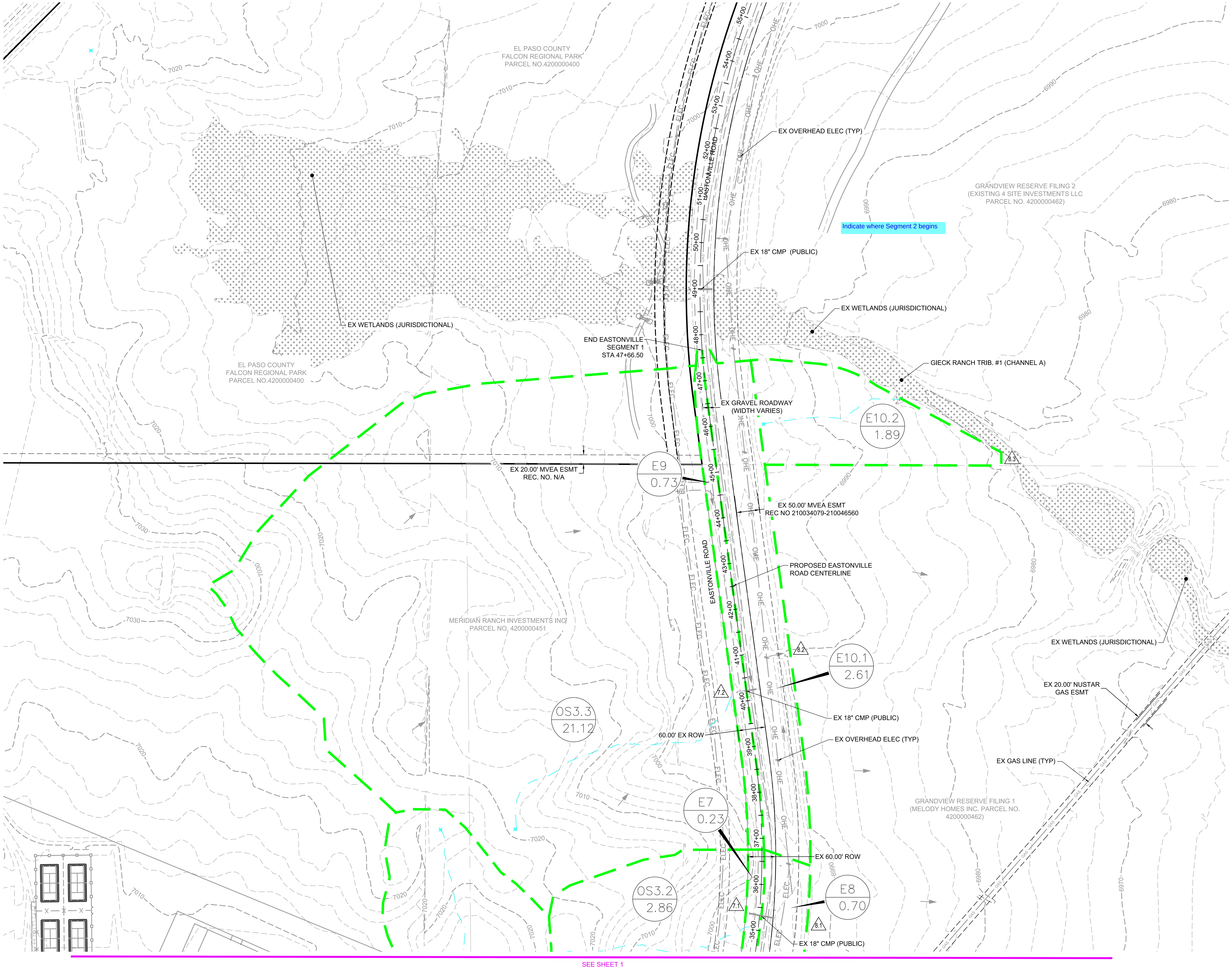
HRGreen
HR GREEN - COLORADO SPRINGS
1975 RESEARCH PKWY SUITE 230
COLORADO SPRINGS CO 80920
PHONE: 719.300.4140
FAX: 713.965.0044

EASTONVILLE ROAD
D.R. HORTON
EL PASO COUNTY, CO

D·R·HORTON America's Builder

EXISTING CONDITIONS - DRAINAGE MAP

SHEET



LEGEND:

- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- EX STORM SEWER
- EX DRAINAGE SWALE
- EX PROPERTY LINE
- EXISTING FLOW DIRECTION
- PROPOSED DRAINAGE BASIN
- DESIGN POINT
- PROPOSED BASIN LABEL (NAME / AREA)

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q5 (cfs)	Q100 (cfs)
E1	0.47	46	0.7	1.7
E2.1	1.82	13	1.2	4.8
E2.2	0.40	2	0.1	1.0
E3	0.72	39	1.0	2.5
E4	3.17	12	1.9	7.8
E5	0.23	45	0.5	1.1
E6	0.79	14	0.7	2.6
E7	0.23	45	0.5	1.2
E8	0.70	16	0.6	2.1
E9	0.73	45	1.2	2.8
E10.1	2.61	15	1.9	7.0
E10.2	1.89	2	0.7	4.4
OS1	1.58	2	0.5	3.6
OS2	12.21	2	3.6	24.3
OS3.1	1.51	2	0.5	3.6
OS3.2	2.86	2	1.0	6.6
OS3.3	21.12	2	6.4	42.7

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	SQ5 (cfs)	SQ100 (cfs)
1	E1,OS1	1.2	4.9
2	E2,DP1	2.3	9.3
2.2	E2.2	0.1	1.0
3	E3,OS2	4.6	26.6
4	DP3,E4	6.3	33.9
5	E5,OS3.1	0.9	4.5
6	DP5,E6	1.5	6.7
7.1	E7,OS3.2	1.4	7.5
8.1	DP7.1,E8	1.9	9.4
7.2	OS3.3,E9	7.5	45.3
8.2	DP7.2,E10.1	9.2	51.6
8.3	E10.2	0.7	4.4

DRAWN BY: ______ JOB DATE: ______
APPROVED: ______ JOB NUMBER: ______
CAD DATE: ______
CAD FILE: ______

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NO.	DATE	BY	REVISION DESCRIPTION

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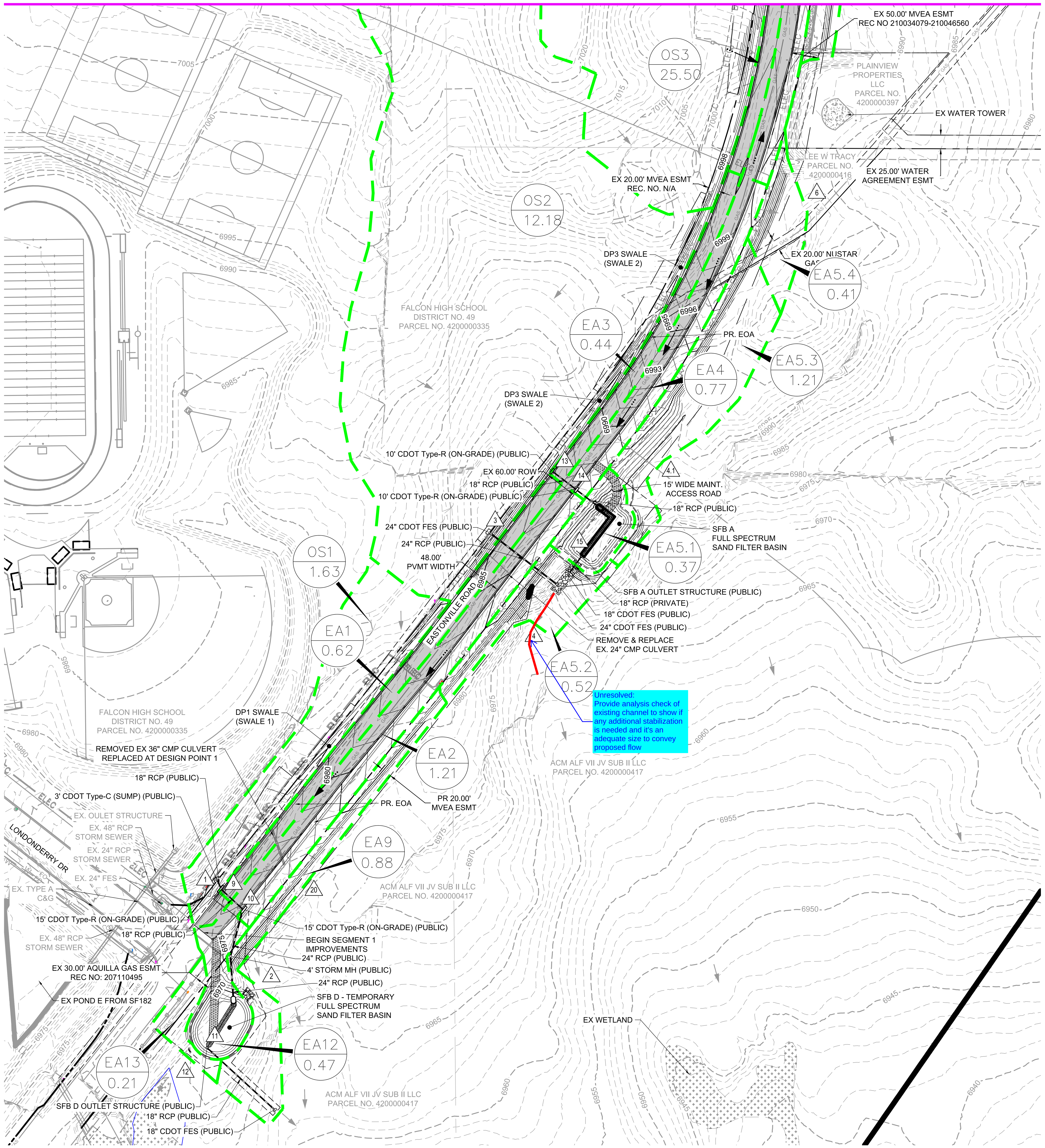
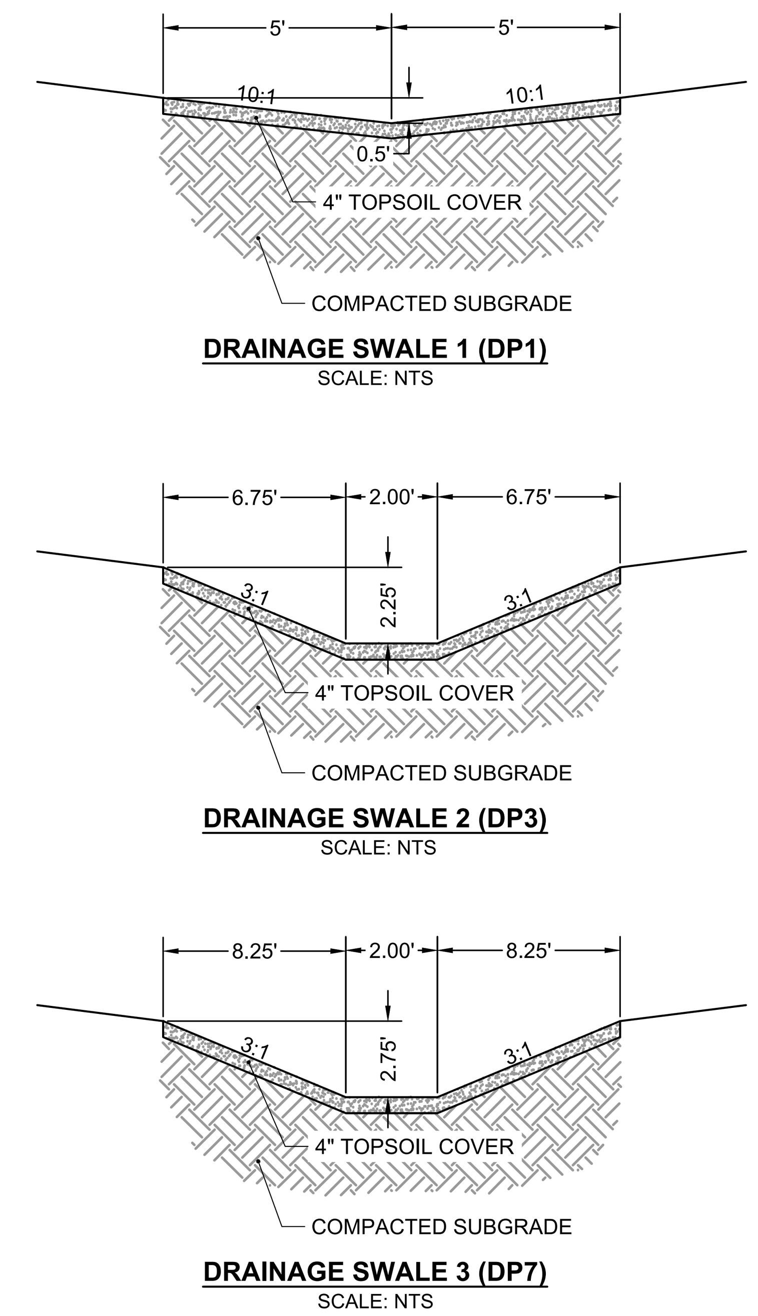
EASTONVILLE ROAD
D.R. HORTON
EL PASO COUNTY, CO

D·R·HORTON America's Builder

EXISTING CONDITIONS - DRAINAGE MAP

SHEET





LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM SEWER
- PROPOSED DRAINAGE SWALE
- PROPERTY LINE
- PROPOSED FLOW DIRECTION
- EXISTING FLOW DIRECTION
- PROPOSED DRAINAGE BASIN
- DESIGN POINT
- PROPOSED BASIN LABEL (NAME / AREA)
- PRELIMINARY 100-YR FLOODPLAIN
- WETLANDS

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q5 (cfs)	Q100 (cfs)
EA1	0.62	97	2.6	4.7
EA2	1.21	50	2.5	5.6
EA3	0.44	91	1.8	3.0
EA4	0.77	52	1.7	2.9
EA5.1	0.37	9	0.3	0.4
EA5.2	0.52	0	0.2	1.6
EA5.3	1.21	0	0.4	2.9
EA5.4	0.41	0	0.1	1.0
EA6	1.09	91	3.1	5.2
EA7	1.92	52	3.2	5.4
EA8	0.94	50	0.5	0.9
EA9	0.88	35	0.4	0.6
EA10.1	0.36	23	0.4	0.6
EA10.2	1.06	23	1.4	4.4
EA11	1.23	0	0.5	0.9
EA12	0.47	25	0.6	1.7
EA13	0.21	26	0.3	0.7
EA8 & EA9 *Per Segment 2 FDR	5.07	78	10.2	17.2
OS1	1.63	2	0.5	3.6
OS2	12.18	2	3.6	24.2
OS3	25.50	2	8.0	53.6

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	SQ5 (cfs)	SQ100 (cfs)
1	OS1	0.5	3.6
2	DP20, SFB D Release	0.7	5.0
3	OS2	3.6	24.2
4	EA 5.2, OS2, DP4.1, SFB A RELEASE	4.1	28.6
4.1	EA5.3	0.6	3.5
6	EA5.4	0.4	2.0
7	OS3	8.0	53.6
8.3	DP 22, OS3, EDB B RELEASE	9.7	58.1
8.2	EA10.2	1.4	4.0
9	DP1, EA1	3.3	9.3
10	DP9, EA2	5.4	13.9
11	DP10, EA12	5.8	15.2
12	EA13	0.3	0.7
13	EA3	1.8	3.0
14	DP13, EA4	3.3	5.6
15	DP14, EA5	3.5	5.9
16	EA6	3.1	5.2
17	DP16, EA7	6.2	10.3
18	DP17	6.2	10.3
19	DP18,EA8	6.6	11.1
18U	DP17, EA8 & EA9 *PER SEGMENT 2 FDR	15.5	26.0
19U	DP18U, EA8	15.8	26.6
20	EA9	0.4	0.6
8.1	EA10	0.4	0.6
22	EA11	0.5	0.9

NOTE: "U" DESIGNATION INDICATES ULTIMATE CONDITION AFTER CONSTRUCTION OF SEGMENT 2

NORTH
0 50 100

CALLAHAN, SEAN, 8/26/2024 2:07 PM

HR GREEN Xrefs: drain_map_legend; xc-row_662.08_Eastonville; xv-util_662; xv-dsgn_662; xc-dsgn-662.08_Eastonville_Seg_1; xg1-dh01_FDR_seg1; Roadside_Swale

DRAWN BY: NQJ	JOB DATE: 8/26/2024		
APPROVED: CM	JOB NUMBER: 201662.08		
CAD DATE: 8/26/2024			
CAD FILE: J:\2020\201662\CAD\Dwgs\C\Eastonville_Road_662.08\Drainage\201662.08_FDR_map_Seg1			

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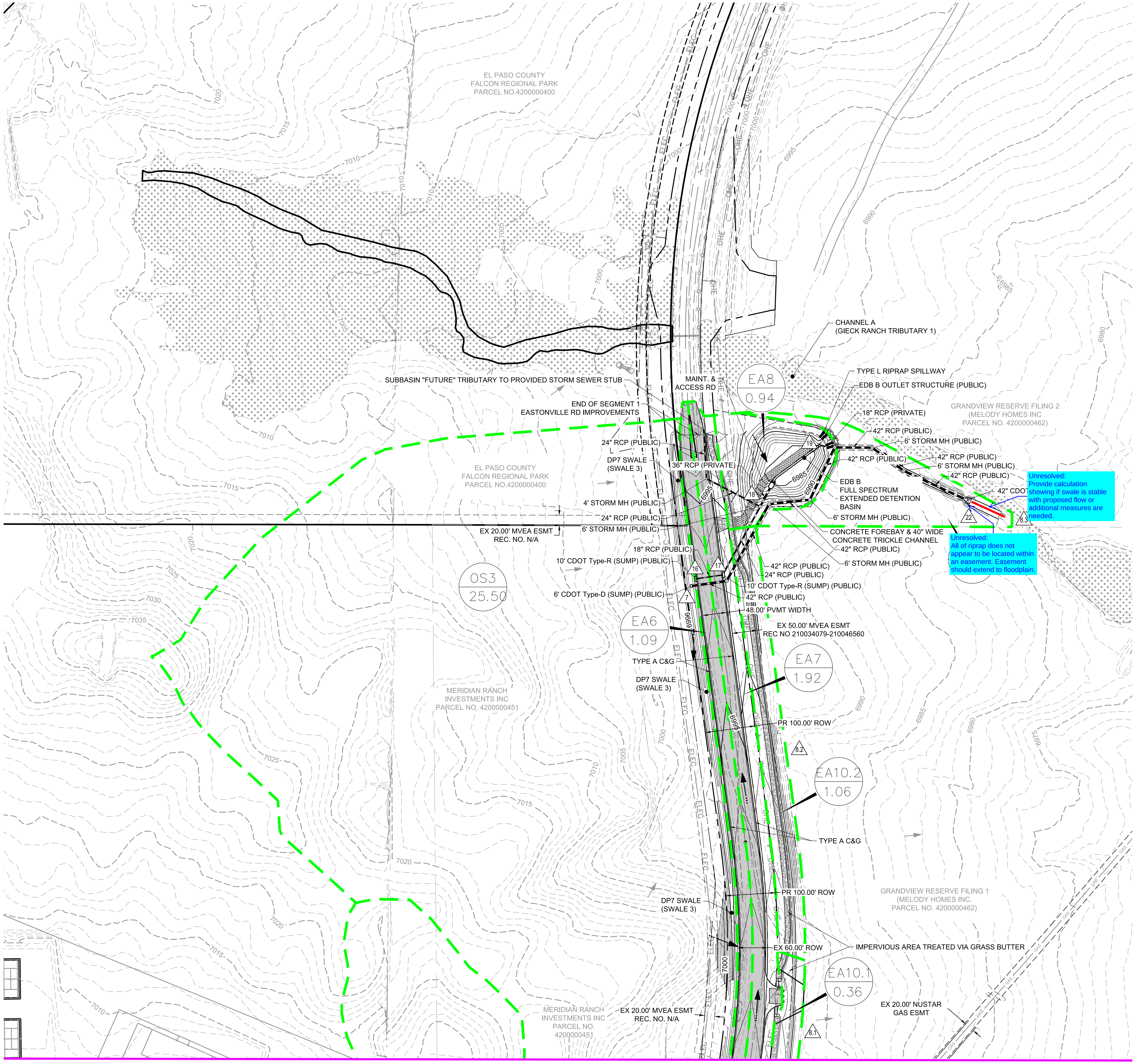
FAX: 713.965.0044

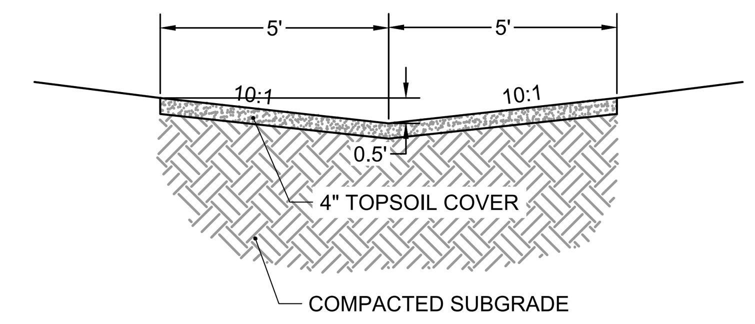
EASTONVILLE ROAD
D.R. HORTON
EL PASO COUNTY, CO

D·R·HORTON America's Builder

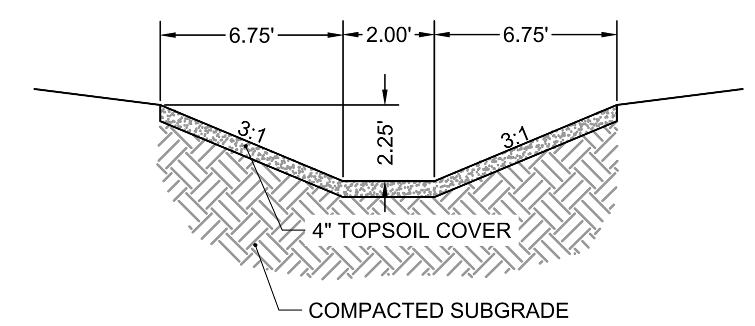
EASTONVILLE ROAD - SEGMENT 1
PROPOSED CONDITIONS DRAINAGE MAP

SHEET DRN 1





DRAINAGE SWALE 1 (DP1)
SCALE: NTS



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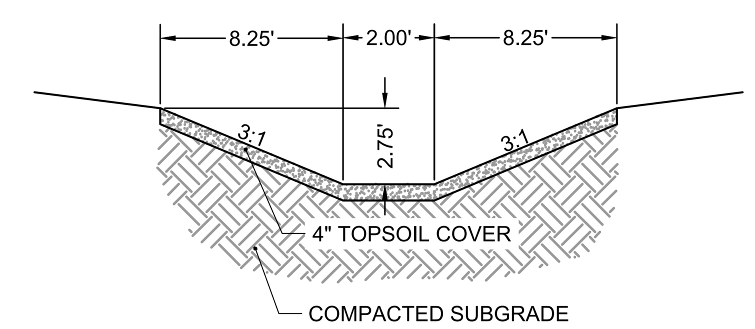
SCALE: NTS



DRAINAGE SWALE 3 (DP7)
SCALE: NTS

LEGEND:

- PROPOSED MAJOR CONTOUR — 5250
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR — 5250
- EXISTING MINOR CONTOUR
- PROPOSED STORM SEWER
- PROPOSED DRAINAGE SWALE
- PROPERTY LINE
- PROPOSED FLOW DIRECTION
- EXISTING FLOW DIRECTION
- PROPOSED DRAINAGE BASIN
- DESIGN POINT
- PROPOSED BASIN LABEL (NAME / AREA)
- PRELIMINARY 100-YR FLOODPLAIN
- WETLANDS

SUMMARY RUNOFF TABLE

BASIN	AREA (ac)	% IMPERVIOUS	Q5 (cfs)	Q100 (cfs)
EA1	0.62	97	2.6	4.7
EA2	1.21	50	2.5	5.6
EA3	0.44	91	1.8	3.0
EA4	0.77	52	1.7	2.9
EA5.1	0.37	9	0.3	0.4
EA5.2	0.52	0	0.2	1.6
EA5.3	1.21	0	0.4	2.9
EA5.4	0.41	0	0.1	1.0
EA6	1.09	91	3.1	5.2
EA7	1.92	52	3.2	5.4
EA8	0.94	50	0.5	0.9
EA9	0.88	35	0.4	0.6
EA10.1	0.36	23	0.4	0.6
EA10.2	1.06	23	1.4	4.4
EA11	1.23	0	0.5	0.9
EA12	0.47	25	0.6	1.7
EA13	0.21	26	0.3	0.7
EA8 & EA9 *Per Segment 2 FDR	5.07	78	10.2	17.2
OS1	1.63	2	0.5	3.6
OS2	12.18	2	3.6	24.2
OS3	25.50	2	8.0	53.6

DESIGN POINT SUMMARY TABLE

DESIGN POINT	CONTRIBUTING BASINS	SQ5 (cfs)	SQ100 (cfs)
1	OS1	0.5	3.6
2	DP20, SFB D Release	0.7	5.0
3	OS2	3.6	24.2
4	EA 5.2, OS2, DP4.1, SFB A RELEASE	4.1	28.6
4.1	EA5.3	0.6	3.5
6	EA5.4	0.4	2.0
7	OS3	8.0	53.6
8.3	DP 22, OS3, EDB B RELEASE	9.7	58.1
8.2	EA10.2	1.4	4.0
9	DP1, EA1	3.3	9.3
10	DP9, EA2	5.4	13.9
11	DP10, EA12	5.8	15.2
12	EA13	0.3	0.7
13	EA3	1.8	3.0
14	DP13, EA4	3.3	5.6
15	DP14, EA5	3.5	5.9
16	EA6	3.1	5.2
17	DP16, EA7	6.2	10.3
18	DP17	6.2	10.3
19	DP18,EA8	6.6	11.1
18U	DP17, EA8 & EA9 *PER SEGMENT 2 FDR	15.5	26.0
19U	DP18U, EA8	15.8	26.6
20	EA9	0.4	0.6
8.1	EA10	0.4	0.6
22	EA11	0.5	0.9

NOTE: "U" DESIGNATION INDICATES ULTIMATE CONDITION AFTER CONSTRUCTION OF SEGMENT 2

NORTH
0 50 100

DRAWN BY: NQJ
APPROVED: CM
CAD DATE: 8/26/2024
CAD FILE: J:\2020\201662\CAD\Dwgs\C\Eastonville_Road_662.08\Drainage\201662.08_FDR_map_Seg1

JOB DATE: 8/26/2024
JOB NUMBER: 201662.08

BAR IS ONE INCH ON OFFICIAL DRAWINGS.
0 1"
IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.

NO.	DATE	BY	REVISION DESCRIPTION

HRGreen
HR GREEN - COLORADO SPRINGS
1975 RESEARCH PKWY SUITE 230
COLORADO SPRINGS CO 80920
PHONE: 719.300.4140
FAX: 713.965.0044

EASTONVILLE ROAD
D.R. HORTON
EL PASO COUNTY, CO

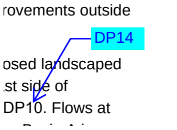
D·R·HORTON America's Builder

EASTONVILLE ROAD - SEGMENT 1
PROPOSED CONDITIONS DRAINAGE MAP

SHEET
DRN
2

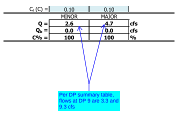
V3_Drainage Report Final - Segment 1.pdf Markup Summary

Callout (12)



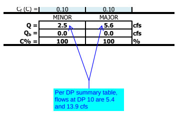
Subject: Callout
Page Label: 8
Author: CDurham
Date: 9/4/2024 5:29:03 PM
Status:
Color:
Layer:
Space:

DP14



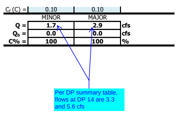
Subject: Callout
Page Label: 34
Author: CDurham
Date: 9/9/2024 11:20:54 AM
Status:
Color:
Layer:
Space:

Per DP summary table, flows at DP 9 are 3.3 and 9.3 cfs



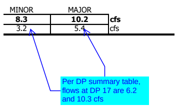
Subject: Callout
Page Label: 36
Author: CDurham
Date: 9/9/2024 11:23:53 AM
Status:
Color:
Layer:
Space:

Per DP summary table, flows at DP 10 are 5.4 and 13.9 cfs



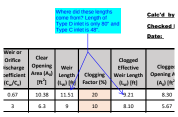
Subject: Callout
Page Label: 40
Author: CDurham
Date: 9/9/2024 11:26:16 AM
Status:
Color:
Layer:
Space:

Per DP summary table, flows at DP 14 are 3.3 and 5.6 cfs



Subject: Callout
Page Label: 44
Author: CDurham
Date: 9/9/2024 11:28:15 AM
Status:
Color:
Layer:
Space:

Per DP summary table, flows at DP 17 are 6.2 and 10.3 cfs

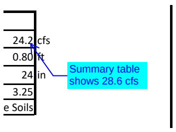


Subject: Callout
Page Label: 45
Author: CDurham
Date: 9/9/2024 11:37:00 AM
Status:
Color:
Layer:
Space:

Where did these lengths come from? Length of Type D inlet is only 80" and Type C inlet is 48".

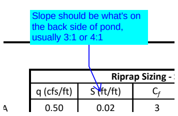
Subject: Callout
Page Label: 45
Author: CDurham
Date: 9/9/2024 11:50:25 AM
Status:
Color:
Layer:
Space:

Factors seem low



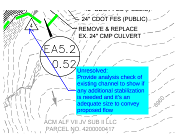
Subject: Callout
Page Label: 86
Author: CDurham
Date: 9/9/2024 12:43:36 PM
Status:
Color:
Layer:
Space:

Summary table shows 28.6 cfs



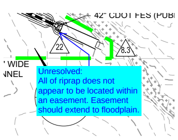
Subject: Callout
Page Label: 89
Author: CDurham
Date: 9/9/2024 12:52:31 PM
Status:
Color:
Layer:
Space:

Slope should be what's on the back side of pond, usually 3:1 or 4:1



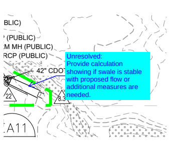
Subject: Callout
Page Label: [1] Segment-1
Author: CDurham
Date: 9/9/2024 1:14:28 PM
Status:
Color:
Layer:
Space:

Unresolved:
Provide analysis check of existing channel to show if any additional stabilization is needed and it's an adequate size to convey proposed flow



Subject: Callout
Page Label: [1] Segment-1.2
Author: CDurham
Date: 9/9/2024 1:25:17 PM
Status:
Color:
Layer:
Space:

Unresolved:
All of riprap does not appear to be located within an easement. Easement should extend to floodplain.



Subject: Callout
Page Label: [1] Segment-1.2
Author: CDurham
Date: 9/9/2024 1:27:19 PM
Status:
Color:
Layer:
Space:

Unresolved:
Provide calculation showing if swale is stable with proposed flow or additional measures are needed.

Checkmark (66)

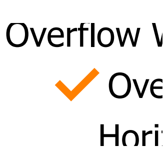
Subject: Checkmark
Page Label: 95
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:39:40 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 95
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:39:46 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 95
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:40:56 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 95
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:41:03 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 95
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:41:10 PM
Status:
Color:
Layer:
Space:



Subject: Checkmark
Page Label: 95
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:41:12 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 95
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:42:02 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 95
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:43:33 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 95
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:44:33 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 95
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:49:38 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 95
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:49:41 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 95
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:49:57 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 91
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:52:17 PM
Status:
Color:
Layer:
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Subject: Checkmark
Page Label: 91
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:52:20 PM
Status:
Color:
Layer:
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Subject: Checkmark
Page Label: 91
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:52:21 PM
Status:
Color:
Layer:
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Subject: Checkmark
Page Label: 91
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:52:31 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 91
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:52:33 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 107
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 4:46:45 PM
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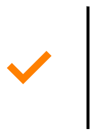
Space:



Subject: Checkmark
Page Label: 98
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:02:10 PM
Status:
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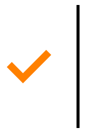
Space:



Subject: Checkmark
Page Label: 98
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:02:07 PM
Status:
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Layer:
Space:

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Page Label: 107
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 4:46:59 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 107
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 4:54:41 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 98
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:02:12 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 98
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:02:48 PM
Status:
Color:
Layer:
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Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:06:29 PM
Status:
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Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:06:31 PM
Status:
Color:
Layer:
Space:

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Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:07:44 PM
Status:
Color:
Layer:
Space:

In
top of Zone

Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:08:01 PM
Status:
Color:
Layer:
Space:

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of Zone us
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Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:08:06 PM
Status:
Color:
Layer:
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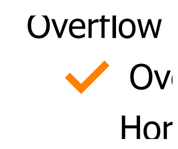
Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:08:08 PM
Status:
Color:
Layer:
Space:



Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:08:31 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:08:33 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:08:38 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:08:55 PM
Status:
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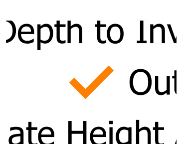

Subject: Checkmark
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Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:09:02 PM
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Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:09:22 PM
Status:
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Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:09:24 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:09:26 PM
Status:
Color:
Layer:
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Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:09:29 PM
Status:
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Layer:
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Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:09:39 PM
Status:
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Layer:
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Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 5:09:51 PM
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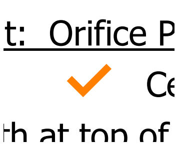

Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 7:37:58 AM
Status:
Color:
Layer:
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Ori

Subject: Checkmark
Page Label: 104
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 7:48:11 AM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 114
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:05:56 AM
Status:
Color:
Layer:
Space:

Wa

Subject: Checkmark
Page Label: 114
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:06:06 AM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 112
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:07:26 AM
Status:
Color:
Layer:
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Subject: Checkmark
Page Label: 112
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:22:04 AM
Status:
Color:
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Un

Subject: Checkmark
Page Label: 116
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:26:33 AM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 116
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:27:13 AM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 116
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:35:36 AM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 116
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:35:43 AM
Status:
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Layer:
Space:

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Page Label: 116
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:36:51 AM
Status:
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Layer:
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Page Label: 116
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:36:57 AM
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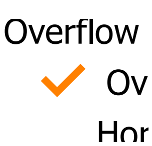

Subject: Checkmark
Page Label: 116
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:36:59 AM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 116
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:37:00 AM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 116
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:38:05 AM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 116
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:40:07 AM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 116
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:40:08 AM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 116
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:40:17 AM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 91
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:48:52 PM
Status:
Color:
Layer:
Space:

ft

Subject: Checkmark
Page Label: 112
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:56:14 PM
Status:
Color:
Layer:
Space:

Subject: Checkmark
Page Label: 98
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 5:02:57 PM
Status:
Color:
Layer:
Space:

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Subject: Checkmark
Page Label: 100
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 5:07:41 PM
Status:
Color:
Layer:
Space:

D_{IS}

Subject: Checkmark
Page Label: 100
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 5:07:43 PM
Status:
Color:
Layer:
Space:

A_M

Subject: Checkmark
Page Label: 100
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 5:07:50 PM
Status:
Color:
Layer:
Space:

D_{orific}

Subject: Checkmark
Page Label: 100
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 5:08:37 PM
Status:
Color:
Layer:
Space:

Highlight (8)

Subject: Highlight
Page Label: 45
Author: CDurham
Date: 9/9/2024 11:35:49 AM
Status:
Color:
Layer:
Space:

11.51

Subject: Highlight
Page Label: 45
Author: CDurham
Date: 9/9/2024 11:35:52 AM
Status:
Color:
Layer:
Space:

9.21

Subject: Highlight
Page Label: 45
Author: CDurham
Date: 9/9/2024 11:35:54 AM
Status:
Color:
Layer:
Space:

9

Subject: Highlight
Page Label: 45
Author: CDurham
Date: 9/9/2024 11:35:56 AM
Status:
Color:
Layer:
Space:

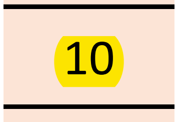
.10

Subject: Highlight
Page Label: 45
Author: CDurham
Date: 9/9/2024 11:35:58 AM
Status:
Color:
Layer:
Space:

8.10

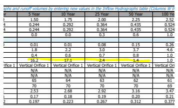
Subject: Highlight
Page Label: 45
Author: CDurham
Date: 9/9/2024 11:50:11 AM
Status:
Color:
Layer:
Space:

20



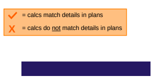
Subject: Highlight
Page Label: 45
Author: CDurham
Date: 9/9/2024 11:50:13 AM
Status:
Color:
Layer:
Space:

10

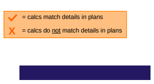


Subject: Highlight
Page Label: 104
Author: CDurham
Date: 9/9/2024 12:58:22 PM
Status:
Color:
Layer:
Space:

MHFD Calcs (2)

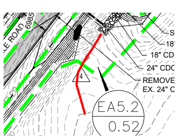


Subject: MHFD Calcs
Page Label: 95
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 3:49:27 PM
Status:
Color:
Layer:
Space:

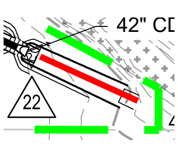


Subject: MHFD Calcs
Page Label: 116
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 9:37:51 AM
Status:
Color:
Layer:
Space:

PolyLine (2)



Subject: PolyLine
Page Label: [1] Segment-1
Author: CDurham
Date: 9/9/2024 1:15:25 PM
Status:
Color:
Layer:
Space:



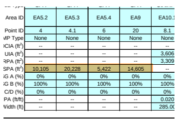
Subject: PolyLine
Page Label: [1] Segment-1.2
Author: CDurham
Date: 9/9/2024 1:26:40 PM
Status:
Color:
Layer:
Space:

SW - Highlight (1)

Subject: SW - Highlight
Page Label: 112
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:55:09 PM
Status:
Color:
Layer:
Space:

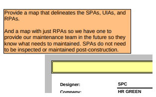
SFBD

SW - Rectangle (1)



Subject: SW - Rectangle
Page Label: 31
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 11:05:00 AM
Status:
Color:
Layer:
Space:

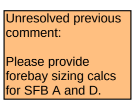
SW - Textbox (5)



Subject: SW - Textbox
Page Label: 31
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 12:11:49 PM
Status:
Color:
Layer:
Space:

Provide a map that delineates the SPAs, UIAs, and RPAs.

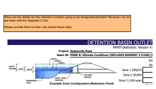
And a map with just RPAs so we have one to provide our maintenance team in the future so they know what needs to maintained. SPAs do not need to be inspected or maintained post-construction.



Subject: SW - Textbox
Page Label: 90
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:47:08 PM
Status:
Color:
Layer:
Space:

Unresolved previous comment:

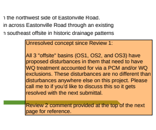
Please provide forebay sizing calcs for SFB A and D.



Subject: SW - Textbox
Page Label: 109
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:52:58 PM
Status:
Color:
Layer:
Space:

When are the details for this Ultimate Condition going to be designed/submitted? Because I do not see them with the Segment 2 CDs.

Please provide them so that I can review these calcs.

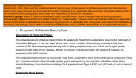


Subject: SW - Textbox
Page Label: 7
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 4:08:27 PM
Status:
Color:
Layer:
Space:

Unresolved concept since Review 1:

All 3 "offsite" basins (OS1, OS2, and OS3) have proposed disturbances in them that need to have WQ treatment accounted for via a PCM and/or WQ exclusions. These disturbances are no different than disturbances anywhere else on this project. Please call me to if you'd like to discuss this so it gets resolved with the next submittal.

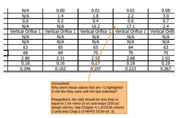
Review 2 comment provided at the top of the next page for reference.



Subject: SW - Textbox
Page Label: 8
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 4:08:36 PM
Status:
Color: ■
Layer:
Space:

Unresolved comment from Review 1:
Basins OS1, OS2, OS3, and the unnamed basins that are east of Eastonville Rd all have proposed soil disturbances within them, which all must be accounted for via WQ treatment or an applicable WQ exclusion. So please address this in the respective Basin paragraphs and create new proposed sub-basins as necessary.
Review 2 update: these 3 "offsite undeveloped areas" are still shown on the drainage map as having proposed disturbances. Meaning that they are neither "offsite" or "undeveloped." Please revise map and descriptions to add onsite basins for the areas of disturbance and discuss WQ treatment or applicable WQ exclusions. Just stating that infiltration is occuring is not enough. You'll need to show Runoff Reduction calcs for RPAs and/or SPAs or an applicable exclusion.

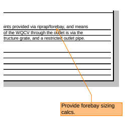
SW - Textbox with Arrow (30)



Subject: SW - Textbox with Arrow
Page Label: 104
Author: CDurham
Date: 9/9/2024 12:58:56 PM
Status:
Color: ■
Layer:
Space:

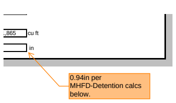
Unresolved:
Why aren't these values that are >1 highlighted in red like they were with the last submittal?

Rregardless, the ratio should be less than or equal to 1 for minor (5-yr) and major (100-yr) design storms. See Chapter 4.1 of DCM volume 2 (and also Chap 2 of MHFD DCM vol. 3).



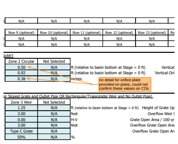
Subject: SW - Textbox with Arrow
Page Label: 92
Author: Glenn Reese - EPC Stormwater
Date: 9/10/2024 4:58:39 PM
Status:
Color: ■
Layer:
Space:

Provide forebay sizing calcs.



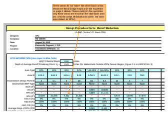
Subject: SW - Textbox with Arrow
Page Label: 112
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:55:38 PM
Status:
Color: ■
Layer:
Space:

0.94in per MHFD-Detention calcs below.



Subject: SW - Textbox with Arrow
Page Label: 116
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:57:02 PM
Status:
Color: ■
Layer:
Space:

no detail for orifice plate provided on plans, could not confirm these values on CDs



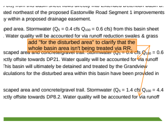
Subject: SW - Textbox with Arrow
Page Label: 31
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 12:11:41 PM
Status:
Color: ■
Layer:
Space:

These areas do not match the whole basin areas shown on the drainage maps or in the report text on page 9 above. Please clarify in the report text why these areas are less than the total basin area (ex: only the areas of disturbance within the basin area shown as SPAs).

Subject: SW - Textbox with Arrow
Page Label: 9
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 12:08:40 PM
Status:
Color: ■
Layer:
Space:

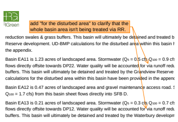
Revise these paragraphs per my comment on the Runoff Reduction calcs.

And clarify that these are treated via SPAs so it's clear that these areas are not actual PBMPs (ie: don't need to be inspected every 5-yrs post-construction.



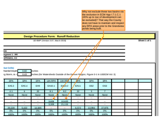
Subject: SW - Textbox with Arrow
Page Label: 9
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 12:06:40 PM
Status:
Color: ■
Layer:
Space:

add "for the disturbed area" to clarify that the whole basin area isn't being treated via RR.



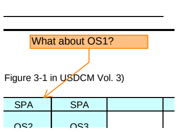
Subject: SW - Textbox with Arrow
Page Label: 10
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 2:44:10 PM
Status:
Color: ■
Layer:
Space:

add "for the disturbed area" to clarify that the whole basin area isn't being treated via RR.



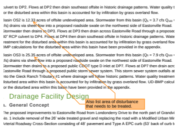
Subject: SW - Textbox with Arrow
Page Label: 31
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 12:29:44 PM
Status:
Color: ■
Layer:
Space:

Why not exclude these two basins via the exclusion in ECM App I.7.1.C.1 (20% up to 1ac of development can be excluded)? That way the County does not have to maintain and inspect any RPA areas prior to the Grandview ponds being built.



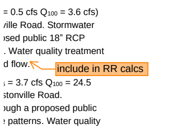
Subject: SW - Textbox with Arrow
Page Label: 31
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 12:33:02 PM
Status:
Color: ■
Layer:
Space:

What about OS1?



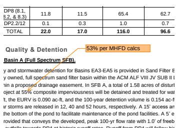
Subject: SW - Textbox with Arrow
Page Label: 10
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:09:38 PM
Status:
Color: ■
Layer:
Space:

Also list area of disturbance that needs to be treated.



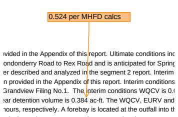
Subject: SW - Textbox with Arrow
Page Label: 10
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 12:33:43 PM
Status:
Color: ■
Layer:
Space:

include in RR calcs



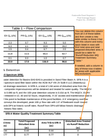
Subject: SW - Textbox with Arrow
Page Label: 11
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 12:35:11 PM
Status:
Color: ■
Layer:
Space:

53% per MHFD calcs



Subject: SW - Textbox with Arrow
Page Label: 12
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 12:36:34 PM
Status:
Color: ■
Layer:
Space:

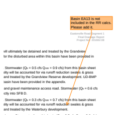
0.524 per MHFD calcs



Subject: SW - Textbox with Arrow
Page Label: 11
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 2:42:56 PM
Status:
Color: ■
Layer:
Space:

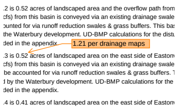
You can delete this column from all 3 of these tables and then create a new table similar to these 3 but with this column and every basin listed in rows with their total area and total proposed disturbed area. It would be a table for "Runoff Reduction WQ Treatment Summary Table."

If needed, add a column to any of these now 4 tables for areas with applicable WQ exclusions.



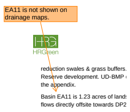
Subject: SW - Textbox with Arrow
Page Label: 10
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 2:45:42 PM
Status:
Color: ■
Layer:
Space:

Basin EA13 is not included in the RR calcs. Please add it.



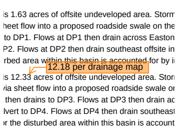
Subject: SW - Textbox with Arrow
Page Label: 9
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:07:39 PM
Status:
Color: ■
Layer:
Space:

1.21 per drainage maps



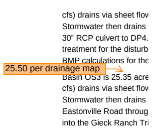
Subject: SW - Textbox with Arrow
Page Label: 10
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:09:20 PM
Status:
Color: ■
Layer:
Space:

EA11 is not shown on drainage maps.



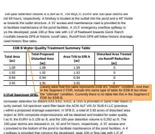
Subject: SW - Textbox with Arrow
Page Label: 10
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:09:46 PM
Status:
Color: ■
Layer:
Space:

12.18 per drainage map



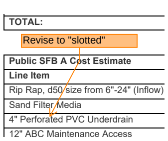
Subject: SW - Textbox with Arrow
Page Label: 10
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:10:08 PM
Status:
Color: ■
Layer:
Space:

25.50 per drainage map



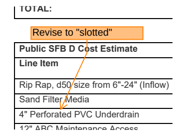
Subject: SW - Textbox with Arrow
Page Label: 12
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:21:11 PM
Status:
Color: ■
Layer:
Space:

Clearly label that this table represents EDB B's "interim" condition. And then in the Segment 2 FDR, include this same type of table for EDB B but show the "ultimate" condition. Currently there is no table like this in the Segment 2 FDR for EDB B.



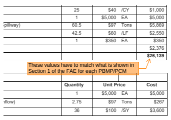
Subject: SW - Textbox with Arrow
Page Label: 14
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:40:31 PM
Status:
Color: ■
Layer:
Space:

Revise to "slotted"



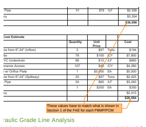
Subject: SW - Textbox with Arrow
Page Label: 15
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:40:39 PM
Status:
Color:
Layer:
Space:

Revise to "slotted"



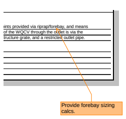
Subject: SW - Textbox with Arrow
Page Label: 14
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:41:33 PM
Status:
Color:
Layer:
Space:

These values have to match what is shown in Section 1 of the FAE for each PBMP/PCM



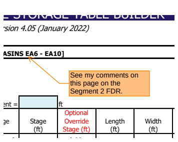
Subject: SW - Textbox with Arrow
Page Label: 15
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:41:42 PM
Status:
Color:
Layer:
Space:

These values have to match what is shown in Section 1 of the FAE for each PBMP/PCM



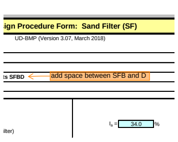
Subject: SW - Textbox with Arrow
Page Label: 113
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:46:43 PM
Status:
Color:
Layer:
Space:

Provide forebay sizing calcs.



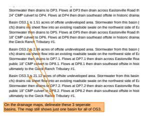
Subject: SW - Textbox with Arrow
Page Label: 107
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:52:03 PM
Status:
Color:
Layer:
Space:

See my comments on this page on the Segment 2 FDR.



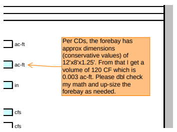
Subject: SW - Textbox with Arrow
Page Label: 112
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 3:55:24 PM
Status:
Color:
Layer:
Space:

add space between SFB and D



Subject: SW - Textbox with Arrow
Page Label: 7
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 4:01:02 PM
Status:
Color:
Layer:
Space:

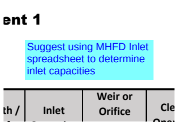
On the drainage maps, delineate these 3 seperate basins. The map still shows just one basin for all of OS3.



Subject: SW - Textbox with Arrow
Page Label: 98
Author: Glenn Reese - EPC Stormwater
Date: 9/11/2024 5:06:07 PM
Status:
Color:
Layer:
Space:

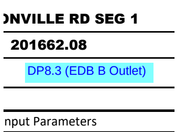
Per CDs, the forebay has approx dimensions (conservative values) of 12'x8'x1.25'. From that I get a volume of 120 CF which is 0.003 ac-ft. Please dbl check my math and up-size the forebay as needed.

Text Box (18)



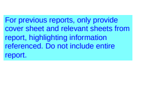
Subject: Text Box
Page Label: 45
Author: CDurham
Date: 9/9/2024 11:55:54 AM
Status:
Color:
Layer:
Space:

Suggest using MHFD Inlet spreadsheet to determine inlet capacities



Subject: Text Box
Page Label: 88
Author: CDurham
Date: 9/9/2024 12:46:19 PM
Status:
Color:
Layer:
Space:

DP8.3 (EDB B Outlet)



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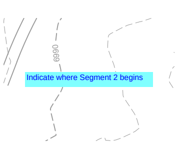

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Indicate where Segment 2 begins

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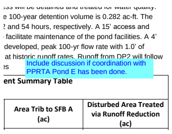

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Include discussion if coordination with PPRTA Pond E has been done.

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