



The Cottages at Mesa Ridge Final Drainage Report

December 2022

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I. General Purpose, Location and Description

a. Purpose

The purpose of this Final Drainage Report (FDR) is to describe the onsite and offsite drainage patterns, existing and proposed storm infrastructure, and the planned stormwater management for The Cottages at Mesa Ridge. This report will support the development plan that is currently in review with El Paso County.

b. Location

The Cottages at Mesa Ridge, referred to as 'the site' herein, is in a portion of the northeast quarter of section 29, the southeast quarter of section 20, the southwest quarter of section 21, and the northwest quarter of section 28, township 15 south, range 65 west of the 6th P.M., County of El Paso, Colorado. The site is bound by S. Powers Boulevard to the east, multi-family residential development to the south, single-family residential development to the west and undeveloped land to the north. Surrounding platted developments include Mesa Ridge Filing 8 and 9 to the south, Sunrise Ridge to the west and the Glen at Widefield to the east. A vicinity map is presented in Appendix A.

c. Description of Property

The site is approximately 10.22 acres of undeveloped land with existing vegetation consisting of native grasses. Once developed, the site will include 122 dwelling units, a club house and open space tracts. The site will be platted as a single lot. In general, the site slopes south towards the Fountain Mutual Irrigation Co canal. Onsite elevations range from 5750' - 5795' with slopes ranging 1 – 33%. Per a NRCS soil survey, the site is made up of Type B Stoneham sandy loam and Type B Nelson-Tassel fine sand loams. The NRCS soil survey is presented in Appendix A.

There are no major drainageways or irrigation facilities that traverse the site nor does the site fall within the Streamside Overlay Zone. Onsite, existing utilities include water, sewer, fiberoptic, underground gas and underground electric/telecommunication. An existing drainage map is presented in Appendix F.

d. Floodplain Statement

Based on FEMA Firm map 08041C0956G dated December 8, 2018, the site is Zone X, which are areas determined to be outside the 0.2% annual chance flood.

II. Drainage Basins and Subbasins

a. Major Basin Description

The site is located within West Fork Jimmy Camp Creek Drainage Basin. The site's drainage characteristics were previously studied in the following reports:

1. "West Fork Jimmy Camp Creek Drainage Basin Planning Study" prepared by Kiowa Engineering Corporation, October 2003, revised.
2. "Master Development Drainage Plan Mesa Ridge Development" prepared by Kiowa Engineering Corporation, December 17, 2006. (2006 MDDP)
3. "Mesa Ridge Development Master Development Drainage Plan Update" prepared by Kiowa Engineering Corporation, January 15, 2013. (2013 MDDP)

In the 2006 MDDP, the site was identified as Basin 1040 and Basin 1030. Basin 1040 was planned to be routed to Detention Basin D (located within Mesa Ridge Subdivision Filing 8) while Basin 1030 was routed to

Detention Basin 1031 (located on the east side of S. Powers Boulevard adjacent to the site). The 2013 MDDP did not alter the planned detention scenario for the site.

b. Existing Subbasin Description

The site's existing drainage is split into five basins. An existing drainage map is presented in Appendix B. See below for existing basin descriptions:

Basin EX1 is 5.69 acres of undeveloped area and existing single family residential lots. Existing stormwater from this basin ($Q_5 = 2.5$ cfs $Q_{100} = 13.7$ cfs) is conveyed onsite to DP1.

Basin EX2 is 3.12 acres of undeveloped area and a portion of S. Powers Boulevard. Existing stormwater from this basin ($Q_5 = 4.2$ cfs $Q_{100} = 12.4$ cfs) follows historic drainage patterns to an existing roadside swale to DP2. The flow is captured in an existing area inlet at DP2 and conveyed underneath S. Powers Boulevard in a 24" RCP culvert to an existing, temporary sediment basin.

Basin EX3 is 1.46 acres of undeveloped area. Existing stormwater from this basin ($Q_5 = 1.6$ cfs $Q_{100} = 5.1$ cfs) is conveyed to the existing irrigation canal to DP3.

Basin EX4 is 0.28 acres of undeveloped area. Existing stormwater from this basin ($Q_5 = 0.1$ cfs $Q_{100} = 0.8$ cfs) is conveyed in an existing roadside swale to DP4.

Basin EX5 is 3.38 acres of undeveloped area and existing single family residential lots. Existing stormwater from this basin ($Q_5 = 2.8$ cfs $Q_{100} = 11.9$ cfs) flows offsite along the site's southern boundary at DP5.

c. Proposed Subbasin Description

The proposed site has been divided into 9 subbasins for analysis. All storm sewer and appurtenances are private. A drainage map has been presented in Appendix F. See below for basin descriptions:

Basin 1 is 3.67 acres of single-family residential lots, duplex homes, roadway and landscaping. Stormwater from this basin ($Q_5 = 7.4$ cfs $Q_{100} = 15.3$ cfs) is conveyed in curb and gutter to a 15' Type R on-grade inlet at DP5. Bypass flows at DP5 continue downstream to DP8. Basin 1 stormwater is piped in proposed storm sewer along the north side of Landover Lane. From there, the flow is piped in an existing 48" culvert to the existing full spectrum detention pond (Basin D) for water quality and detention.

Basin 2 is 4.83 acres of single-family residential lots, duplex homes, roadway and landscaping. Stormwater from this basin ($Q_5 = 9.7$ cfs $Q_{100} = 20.5$ cfs) is conveyed in curb and gutter to a 15' Type R on-grade inlet at DP1. Bypass flows at DP1 continue downstream to DP8&9. Basin 2 stormwater is piped in proposed storm sewer along the north side of Landover Lane. From there, the flow is piped in an existing 48" culvert to the existing full spectrum detention pond (Basin D) for water quality and detention.

Basin 2A is 0.13 acres of club house and patio area. Stormwater from this basin ($Q_5 = 0.6$ cfs $Q_{100} = 1.1$ cfs) is conveyed in curb and gutter to 3' Type C sump inlet at DP1A. Basin 2A stormwater is piped in proposed storm sewer along the north side of Landover Lane. From there, the flow is piped in an existing 48" culvert to the existing full spectrum detention pond (Basin D) for water quality and detention.

Basin 3 is 3.03 acres of existing roadway (S. Powers Boulevard), a compacted breeze trail and undeveloped area. Stormwater from this basin ($Q_5 = 3.4$ cfs $Q_{100} = 9.7$ cfs) follows historic drainage patterns in an existing roadside swale to an existing Type C inlet at DP2. An existing 24" RCP culvert conveys to flow to an existing, temporary sediment basin. Per Section I.7.1.B.7 and I.7.1.B.9 of the EPC ECM Appendix I – Stormwater

Quality Policy and Procedures, Basin 3 will not be routed to a permanent stormwater control measure. The trail improvements associated with Basin 3 will not increase existing stormwater flows.

Basin 4 is 0.48 acres of landscaping and undeveloped area. Stormwater from this basin ($Q_5 = 0.3$ cfs $Q_{100} = 1.7$ cfs) follows historic drainage patterns towards the Fountain Irrigation Ditch at DP3. From there, flow is conveyed under S. Powers Blvd in an existing box culvert (size unknown) to an existing, temporary sediment basin. Per Section I.7.1.B.7 and I.7.1.B.9 of the EPC ECM Appendix I – Stormwater Quality Policy and Procedures, Basin 4 will not be routed to a permanent stormwater control measure. The basin will remain mostly undeveloped with a proposed trail and retaining wall. The trail and retaining wall improvements associated with Basin 4 will not increase existing stormwater flows.

Basin 5 is 1.63 acres of landscaping and a fire access road. Stormwater from this basin ($Q_5 = 2.6$ cfs $Q_{100} = 6.7$ cfs) is captured in a grass-lined swale and captured in a Type C inlet at DP4. Basin 5 stormwater is piped in proposed storm sewer along the north side of Landover Lane. From there, the flow is piped in an existing 48" culvert to the existing full spectrum detention pond (Basin D) for water quality and detention.

Basin 6 is 0.60 acres of undeveloped area. Stormwater from this basin ($Q_5 = 0.2$ cfs $Q_{100} = 1.2$ cfs) follows historic drainage patterns to an existing roadside swale along S. Powers Boulevard at DP6 and continues south along S. Powers in a roadside ditch that outfalls into existing Detention Basin D. Basin 6 will remain undeveloped and will not increase existing stormwater flows.

Basin 7 is 0.45 acres of landscaping and existing single family residential. Stormwater from this basin ($Q_5 = 0.4$ cfs $Q_{100} = 1.3$ cfs) follows historic drainage patterns towards DP7. From there, the flow continues into Mesa Ridge Subdivision Filing 8 where it is captured and detained in Basin D. See Basin 1040 from the Mesa Ridge Filing No. 8 FDR for additional detail.

Basin 8 is 0.26 acres of roadway. Stormwater from this basin ($Q_5 = 1.1$ cfs $Q_{100} = 2.1$ cfs) is conveyed in curb and gutter down Landover Lane to a 15' Type R inlet at DP8. Basin 8 stormwater is piped in proposed storm sewer along the north side of Landover Lane. From there, the flow is piped in an existing 48" culvert to the existing full spectrum detention pond (Basin D) for water quality and detention.

Basin 9 is 0.17 acres of roadway. Stormwater from this basin ($Q_5 = 0.8$ cfs $Q_{100} = 1.4$ cfs) is conveyed in curb and gutter down Landover Lane to a 10' Type R inlet at DP9. In the 100-year event, there is a total of 0.2 cfs that bypassed DP9. This flow continues down Landover Lane and is captured in existing sump inlets in Landover Lane, adjacent to Pond D. Basin 9 stormwater is piped in proposed storm sewer along the north side of Landover Lane. From there, the flow is piped in an existing 48" culvert to the existing full spectrum detention pond (Basin D) for water quality and detention.

III. Drainage Design Criteria

a. Development Criteria Reference

Storm drainage analysis and design criteria for the project were taken from the "*Drainage Criteria Manual of EL Paso County, Colorado*" Volumes 1 and 2 (EPCDCM), current adopted version, and Chapter 6 and Section 3.2.1 of Chapter 13 of the "*Colorado Springs Drainage Criteria Manual*" (CCSDCM), dated May 2014, as adopted by El Paso County, as well as the July 2019 El Paso County Engineering Criteria Manual update.

b. Hydrologic Criteria

Hydrologic data was obtained from the "*City of Colorado Springs Drainage Criteria Manual – Chapter 6 Hydrology*". Onsite drainage improvements are designed for the 5-year storm (minor event) and 100-year

storm (major event) using rainfall values from CCSDCM Table 6-2 below. Runoff was calculated per CCSDCM Section 6.3.0 - Rational Method. 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 – Full Spectrum Detention in addition to CUHP v.2.0.1 and EPA-SWMM v.5.1. Detention pond allowable release rate will be limited to less than or equal to those noted in the 2013 Mesa Ridge MDDP.

Return Period (yr)	5	100
1-hr Rainfall Depth (in)	1.50	2.52

IV. Drainage Facility Design

a. General Concept

Onsite stormwater will be conveyed via Type 5 curb and gutter to Type R inlets. Captured stormwater will be piped to and detained in an existing, full spectrum detention pond located in Mesa Ridge Filing 9 south of the site. The full spectrum detention pond will outfall at less than historic values to the east side of S. Powers Boulevard and to the site's historic outfall. See below section regarding the existing detention basin analysis and retrofit. The ultimate outfall for the site is Jimmy Camp Creek, south of Hale Reservoir.

b. Water Quality & Detention

The Cottages at Mesa Ridge will utilize the existing regional Full Spectrum Detention Basin D for water quality and detention. Detailed analysis performed with this Report indicates that in its existing condition, there is adequate 100-year volume in the Detention Basin D for development of The Cottages at Mesa Ridge site. However, there are some concerns regarding the detention pond drain times. See discussion below for details on the analysis completed on Detention Basin D.

This pond was included originally as flood control in the 2006 MDDP and was updated to provide Full Spectrum detention with the 2013 MDDP. In addition, the record drawings for the retrofit of the pond confirmed the use of an orifice plate to control the full spectrum volume. Record documents are titled: *Mesa Ridge Filings 8 & 9, Detention Basin 'D', Full Spectrum Detention Modifications, Final Design Drawings*, by Kiowa Engineering Corporation, dated October 2011. Both MDDPs show Basin 1040 routed to Full Spectrum Detention Basin D. However, the basin characteristics provided with the most recent MDDP included The Cottages at Mesa Ridge site as historic.

In order to confirm that the existing Full Spectrum Detention Basin D has capacity for development of The Cottages at Mesa Ridge, updated modeling with proposed basin 1040 characteristics is necessary and presented in Appendix D.

Hydrology and hydraulics included with the previous MDDPs utilized HEC-1 software to determine peak runoff quantities at specific design points and routing elements. These HEC-1 models were not available for use, so an effort was made to update them to the more current HEC-HMS program. However, there were too many unknown variables with the program to get it to provide reliable results.

Current CCSDCM V.1 CH.6 1.4 Selecting Methods for Estimating Design Flows notes in part that:

- For more complex drainage basins and routing requirements, the HEC-HMS model or the EPA SWMM method is better suited but requires more experience and expertise to properly apply. The EPA SWMM method also provides hydrographs, reservoir routing, and the ability to evaluate runoff reduction practices in detail.
- If detention facilities are to be sized based on hydrograph routing, or if hydrograph information is desired for any other reason, the EPA SWMM or the NRCS method must be used.

Therefore, CUHP and EPA SWMM methodology were selected as appropriate modeling programs to confirm volumes and release rates for Full Spectrum Detention Basin D are in line with the intent of the previous MDDPs and current CCSDCM criteria.

CUHP

A new CUHP model was prepared streamlined with only the MDDP basins being updated at this time and major basins tributary to Full Spectrum Detention Basin D. This includes Basin 1040, 6001, 6005, 6010, 6011 and 6020. Basin parameters included in the CUHP as follows:

- Basin parameters for Basin 1040 were updated based on the most current design information available and correspond to the Rational Method calculations noted elsewhere in this report. The area to Basin 1040 increased from what was accounted for in the previous MDDPs.
- Basins 6001, 6005, 6010, 6011 and 6020 used area and length parameters taken directly from the HEC-1 noted above.
- Basins 6001, 6005, 6010, 6011 and 6020 utilized percent impervious estimated from existing as-constructed land uses.
- All basins used the standard depression storage and infiltration parameters for Hydrologic Soil Type B.

Rainfall data was taken from NOAA Atlas 14 Point Precipitation for a 60-minute (1-hour) recurrence interval depth, 100=2.74 in. The 1-hour point precipitation was chosen in part because the MHFD-Detention worksheet uses the 1-hour depth as an input parameter to run the CUHP program in the background. This allows a more accurate review of the existing pond by using consistent storms across both the CUHP and MHFD-Detention software.

Input parameters and results for the 100-year event are included with Appendix D.

EPA SWMM

Similar to the CUHP modeling, a simplified hydraulic routing model was prepared. In this case, the U.S. Environmental Protection Agency Stormwater Management Model (EPA SWMM) software was used for the proposed conditions with the development of The Cottages at Mesa Ridge.

The model includes a stage-storage curve for Pond D extracted directly from the pond grading shown on the 2011 Full Spectrum Detention Modifications Plan noted above. The proposed Pond D stage-release curve was developed through an iterative process, described more in depth below.

The other separate existing pond (Detention Basin 6002) which is tributary to Pond D provides storage for Basin 6001. Parameters for modeling Detention Basin 6002 were taken directly from the 2013 MDDP HEC-1. Additionally, EPA SWMM element routing parameters such as channel length and size were taken directly from the previous HEC-1 model with the exception of elevations (not used in HEC-1). For this a reasonable starting (downstream) elevation was used from the Pond D plans, and slope/length parameters from HEC-1 used to set all other upstream elevations. A back-check was completed to ensure resultant upstream elevations seem reasonable given rough elevations on 2013 MDDP Exhibit.

Input parameters and results for the 100-year event are included with Appendix D.

Full Spectrum Detention Basin D

MHFD-Detention worksheets were set up using updated total watershed area and percent imperviousness for several reasons, they include:

- To confirm the updated full spectrum volume required within Pond D. Note, because an inflow hydrograph will be used for the 5-year and 100-year events only the resultant full spectrum volumes are relevant from this data.
- To review how the existing pond is functioning under the proposed condition by incorporating the as-built stage-storage and stage-release data into the workbook. Note, the release structure was surveyed to provide accurate structure parameters.
- To route the 5-year and 100-year hydrographs developed in the CUHP and EPA SWMM through the provided pond volume and as-built release structure.

MHFD-Detention (as-built) results from routing the proposed 100-year hydrograph through the as-built pond volume and release structure indicate that there is adequate 100-year volume in the existing pond for development of The Cottages at Mesa Ridge site. However, results also indicate that the existing pond is exceeding drain time limitations noted in current MHFD criteria and Colorado Revised Statute 37-92-602(8).

To rectify the drain times discrepancy a separate MHFD-Detention (proposed) worksheet was set up matching the previously noted stage-storage curve and input hydrograph but altering the release structure (and corresponding stage-release curve). The drain times were revised by enlarging the orifice areas and updating the detention stages to correlate with the new Full Spectrum volume. Once the 100-year peak release rate was confirmed to be at or below the threshold established with the 2013 MDDP (233 cfs) the resultant stage-release curve was transferred back to the prepared SWMM and re-run to confirm the same results as found with the MHFD-Detention (proposed) analysis. Note the existing structure box size becomes the limiting element controlling release in the 100-year event, not the restrictor plate.

Key pond parameters from the 2011 Full Spectrum Detention Modifications Plan along with the values determined with this Final Drainage Report are summarized below.

Full Spectrum Detention Basin D Summary			
	2011 Full Spectrum Modifications	As-Built Pond D without Modifications	As-Built Pond D with Proposed Modifications
Tributary Area (acres)	not provided	98.3	98.3
% Impervious (%)	not provided	49.0	49.0
Full Spectrum Volume (acre-ft)	4.2	5.1	5.1
Full Spectrum WSEL (ft)	5686.8	5687.2	5687.3
Full Spectrum Drain Time (hrs)	not provided	> 120	70
100-yr volume (acre-ft)	8.3	11.5	14.3
Release Rate (cfs)	219	252	229
100-yr WSEL (ft)	5690.2	5691.1	5692.7
100-yr Drain Time (hrs)	not provided	> 120	70

Conclusions from the analysis presented with this Report are that Full Spectrum Detention Basin D will function as intended in the proposed conditions taking into consideration the Basin 1040 changes (including increase in basin area) that will occur with development of The Cottages at Mesa Ridge. No modifications to the as-built volume are anticipated at this time. Modifications are required to the release structure to bring the existing pond in conformance with current drain time and stage-storage requirements. The detailed extent of modifications to the existing structure have been presented in Appendix E.

c. Operation and Maintenance

An Operation and Maintenance (O&M) manual was previously approved for Detention Basin D. The pond is privately maintained by Mesa Ridge Metropolitan District No. 1. The manual will be provided once made available. The manual specifies maintenance intervals and required actions to maintain the function of the extended detention basin and appurtenances.

d. Grading and Erosion Control Plan

Due to the project disturbance area, a separate Grading and Erosion Control plan will be required. The Grading and Erosion Control Plan has been submitted to El Paso County and City of Fountain in conjunction with the Final Drainage Report and Construction Drawings.

e. Four Step Method to Minimize Adverse Impacts of Urbanization

Step 1 – Reducing Runoff Volumes: Roof drains will route across landscape areas and grass lined swales are used for stormwater conveyance, whenever possible to promote infiltration.

Step 2 – Treat and slowly release the WQCV: An existing, regional full spectrum detention pond provides water quality for the site. The WQCV is released over a period of 41 hours.

Step 3 – Stabilize stream channels: Drainage swales will be lined with non-erosive soils and permanently seeded to provide stabilization. If required due to erosive velocities, additional protection will be provided in the form of riprap lining and drop structures to reduce stormwater velocities and provide 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.

f. Drainage and Bridge Fees

Cottages at Mesa Ridge is located within the West Fork Jimmy Camp Creek drainage basin. See below for drainage fees associated with The Cottages at Mesa Ridge development. Fees are due at time of platting.

2022 Drainage & Bridge Fees						
Site Acreage (ac)	Site Impervious (%)	Impervious Area (ac)	Drainage Fee/ Impervious Acre	Drainage Fee	Bridge Fee/ Impervious Acre	Bridge Fee
10.22	55	5.62	\$14,470	\$81,336	\$4,281	\$24,060

V. Summary

The Cottages at Mesa Ridge development remains consistent with pre-development drainage conditions with the construction of the recommended drainage improvements. The proposed development will not adversely affect downstream stormwater infrastructure or surrounding developments. This report meets the latest El Paso County Drainage criteria and is in accordance with the Mesa Ridge MDDP.

VI. Drawings

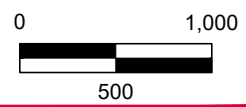
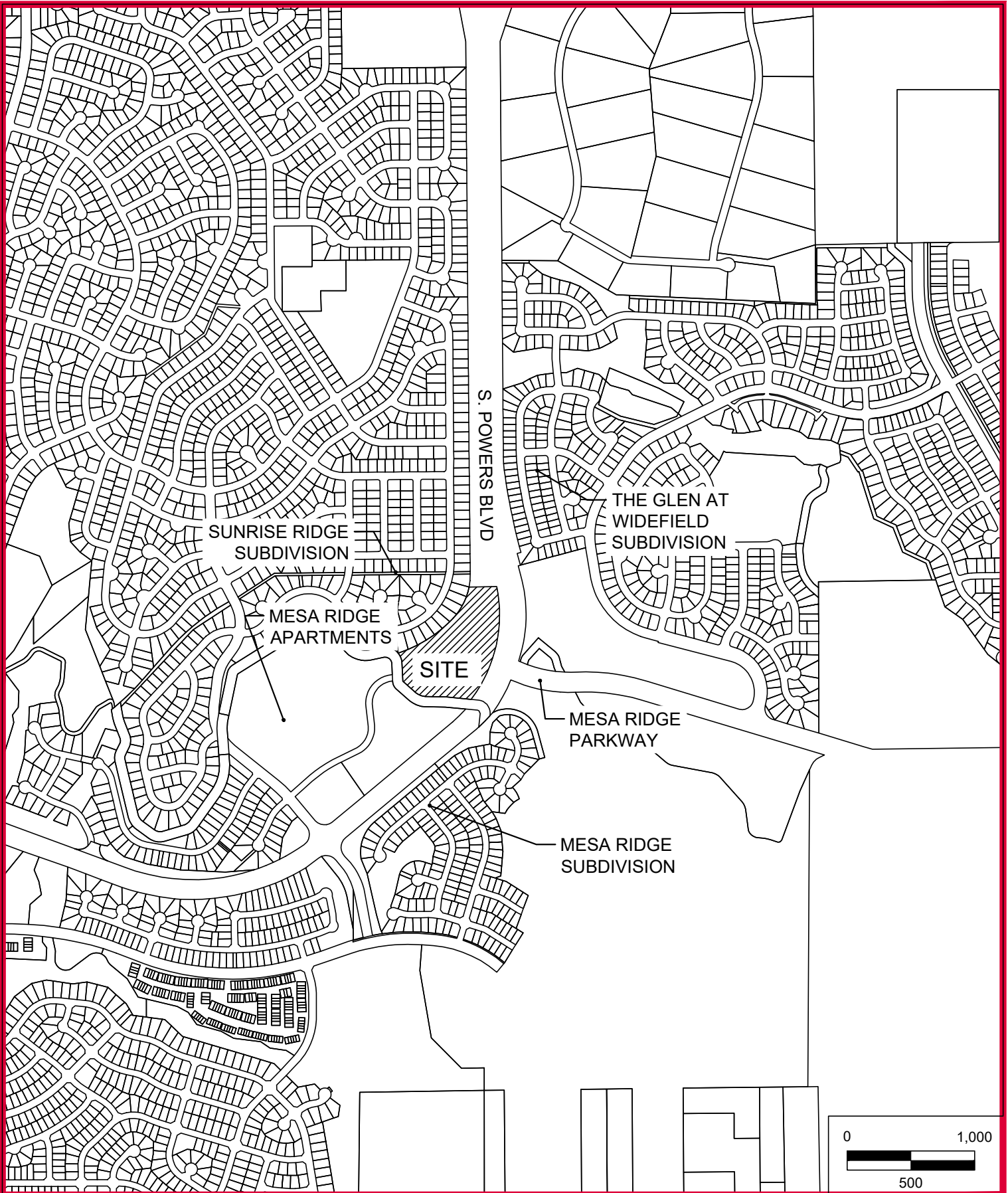
Please refer to the Appendix F for existing and proposed drainage maps.

VII. References

1. City of Colorado Springs – Drainage Criteria Manual, May 2014, Revised January 2021.
2. Urban Storm Drainage Criteria Manual, Mile High Flood District, January 2018.
3. *Master Development Drainage Plan Mesa Ridge Development*, Kiowa Engineering Corporation, December 17, 2006.
4. *Mesa Ridge Development Master Development Drainage Plan Update*, Kiowa Engineering Corporation, January 15, 2013.
5. *Mesa Ridge Filings 8 & 9, Detention Basin 'D', Full Spectrum Detention Modifications, Final Design Drawings*, by Kiowa Engineering Corporation, October 2011.
6. Colorado Unit Hydrograph Procedure (CUHP), Version 2.0.1, October 2019.
7. Environmental Protection Agency Stormwater Management Model (EPA SWMM), Version 5.1, 2020.
8. Mile High Flood District Detention Basin Design Workbook (MHFD-Detention), Version 4.04, February 2021.



APPENDIX A – VICINITY MAP, SOIL MAP, FEMA MAP



Xrefs: 8.5x11_Titleblock

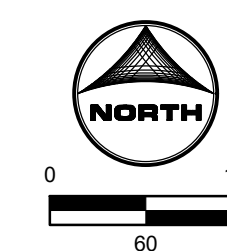


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SHEET
VICINITY MAP

SCALE: 1"=1,000'
DATE: 03/29/2021



DRAWN BY: YOU JOB DATE: 11/29/2022
 APPROVED: KEN JOB NUMBER: 200541
 CAD DATE: 11/29/2022
 CAD FILE: J:\2020\200541\CAD\Drawings\C\Drainage\FDR_aerial

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

NO.	DATE	BY	REVISION DESCRIPTION

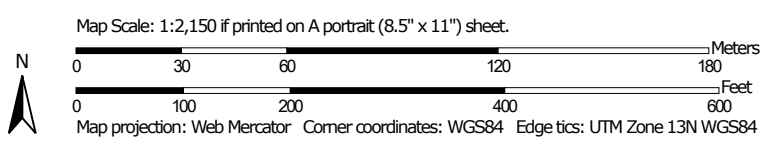
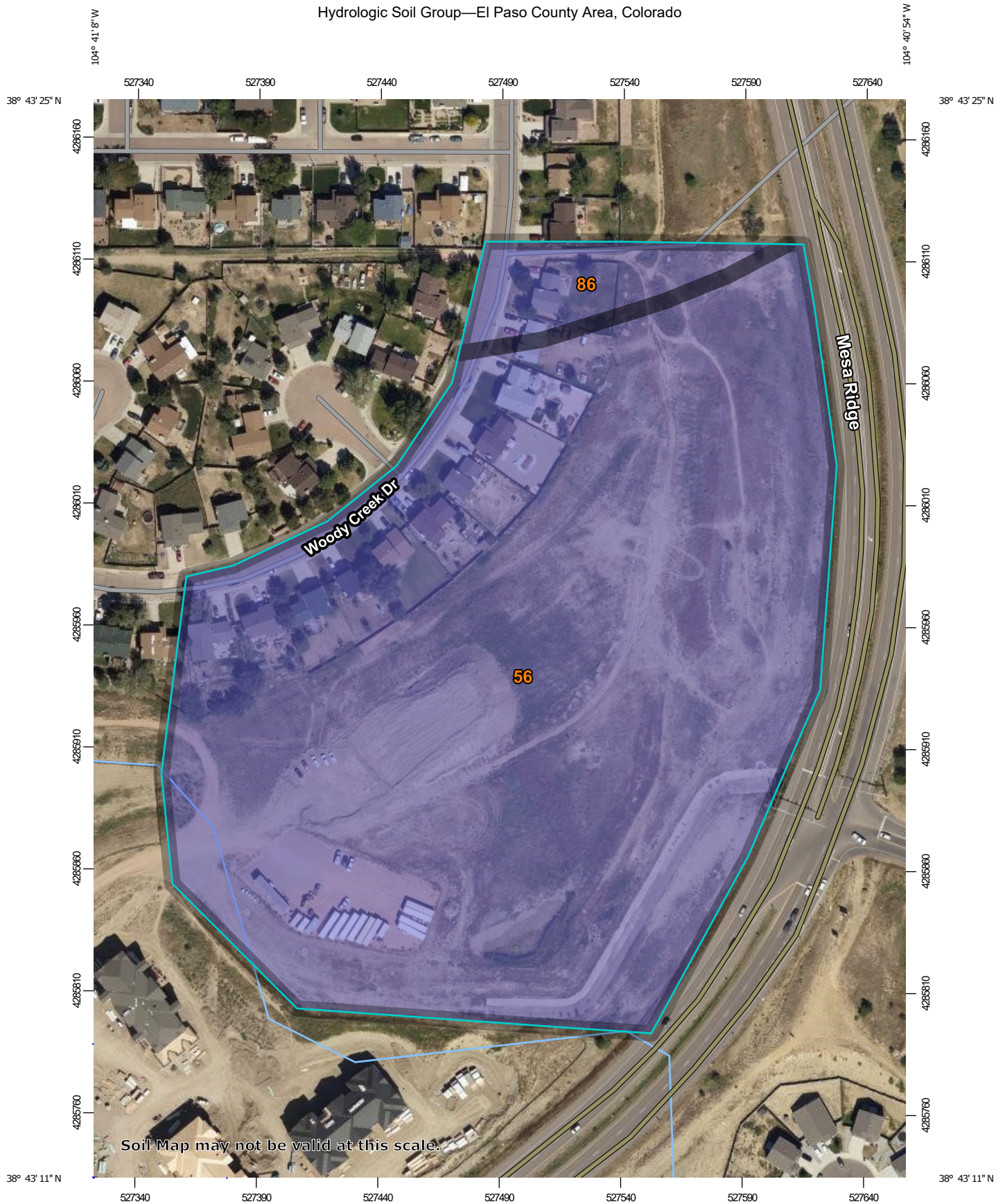
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THE COTTAGES AT MESA RIDGE
 GOODWIN KNIGHT
 EL PASO COUNTY, COLORADO

































COTTAGES AT MESA RIDGE - SITE AERIAL

SHEET DRN 1

Hydrologic Soil Group—El Paso County Area, Colorado



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
- Water Features**
 -  Streams and Canals
- Transportation**
 -  Rails
 -  Interstate Highways
 -  US Routes
 -  Major Roads
 -  Local Roads
- Background**
 -  Aerial Photography
- Other**
 -  C
 -  C/D
 -  D
 -  Not rated or not available

MAP INFORMATION

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

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

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

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

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

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

Soil Survey Area: El Paso County Area, Colorado
 Survey Area Data: Version 17, Sep 13, 2019

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

Date(s) aerial images were photographed: Aug 14, 2018—Sep 23, 2018

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
56	Nelson-Tassel fine sandy loams, 3 to 18 percent slopes	B	15.6	94.7%
86	Stoneham sandy loam, 3 to 8 percent slopes	B	0.9	5.3%
Totals for Area of Interest			16.5	100.0%

Description

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

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

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

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

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

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

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



* 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

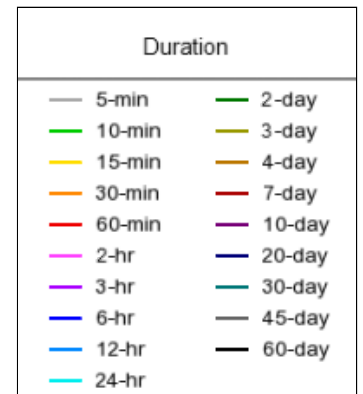
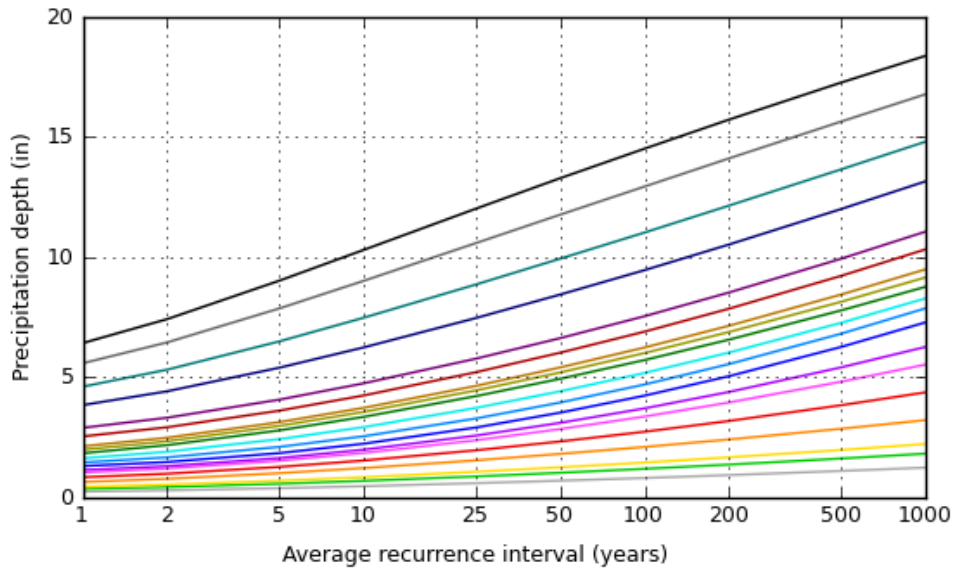
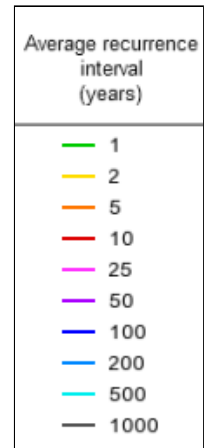
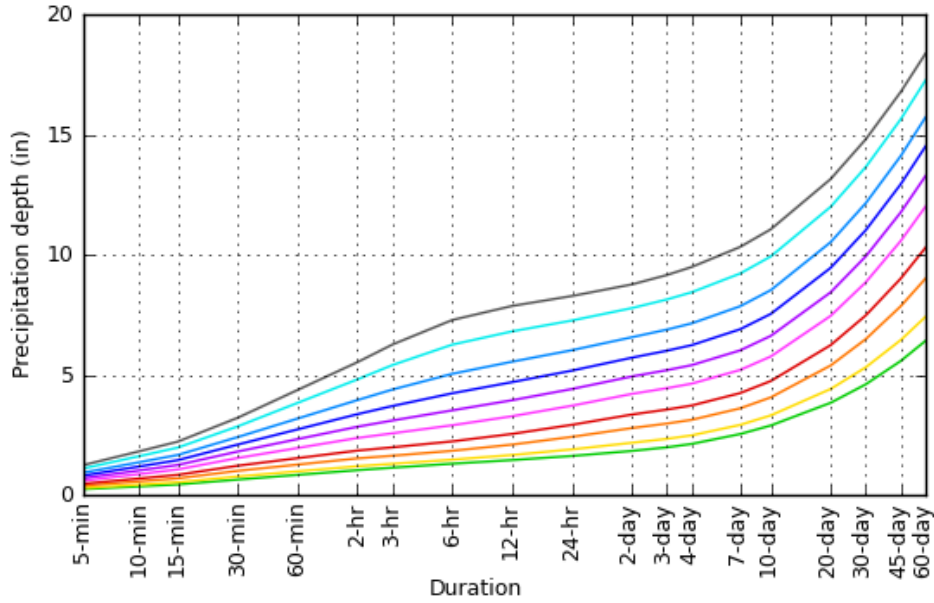
PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.253 (0.208-0.313)	0.304 (0.250-0.377)	0.395 (0.323-0.491)	0.478 (0.388-0.596)	0.603 (0.476-0.792)	0.707 (0.541-0.940)	0.819 (0.603-1.12)	0.940 (0.659-1.32)	1.11 (0.746-1.61)	1.25 (0.811-1.83)
10-min	0.371 (0.305-0.459)	0.446 (0.366-0.552)	0.579 (0.473-0.719)	0.700 (0.569-0.873)	0.883 (0.696-1.16)	1.04 (0.793-1.38)	1.20 (0.882-1.64)	1.38 (0.965-1.93)	1.63 (1.09-2.35)	1.83 (1.19-2.67)
15-min	0.452 (0.372-0.559)	0.544 (0.446-0.673)	0.706 (0.577-0.877)	0.854 (0.694-1.07)	1.08 (0.849-1.42)	1.26 (0.967-1.68)	1.46 (1.08-2.00)	1.68 (1.18-2.36)	1.99 (1.33-2.87)	2.23 (1.45-3.26)
30-min	0.655 (0.538-0.810)	0.785 (0.645-0.972)	1.02 (0.833-1.26)	1.23 (1.00-1.54)	1.55 (1.22-2.04)	1.82 (1.39-2.42)	2.11 (1.55-2.88)	2.42 (1.70-3.40)	2.87 (1.92-4.14)	3.23 (2.09-4.71)
60-min	0.851 (0.699-1.05)	0.998 (0.819-1.24)	1.28 (1.04-1.59)	1.55 (1.25-1.93)	1.97 (1.56-2.61)	2.34 (1.80-3.13)	2.74 (2.02-3.77)	3.19 (2.25-4.51)	3.84 (2.58-5.58)	4.38 (2.84-6.39)
2-hr	1.05 (0.865-1.29)	1.21 (1.00-1.49)	1.54 (1.26-1.90)	1.86 (1.52-2.31)	2.38 (1.92-3.16)	2.85 (2.21-3.81)	3.37 (2.52-4.62)	3.96 (2.81-5.57)	4.82 (3.27-6.97)	5.54 (3.62-8.03)
3-hr	1.15 (0.955-1.41)	1.31 (1.09-1.61)	1.65 (1.36-2.02)	2.00 (1.64-2.46)	2.58 (2.09-3.43)	3.11 (2.43-4.16)	3.71 (2.79-5.09)	4.40 (3.15-6.19)	5.42 (3.70-7.82)	6.27 (4.12-9.06)
6-hr	1.32 (1.10-1.60)	1.48 (1.24-1.81)	1.85 (1.54-2.26)	2.24 (1.85-2.75)	2.91 (2.38-3.87)	3.53 (2.79-4.71)	4.24 (3.21-5.79)	5.05 (3.65-7.08)	6.27 (4.33-9.00)	7.29 (4.84-10.5)
12-hr	1.47 (1.23-1.77)	1.68 (1.41-2.03)	2.11 (1.77-2.56)	2.55 (2.12-3.11)	3.29 (2.70-4.31)	3.96 (3.13-5.21)	4.71 (3.59-6.36)	5.56 (4.04-7.71)	6.82 (4.74-9.71)	7.87 (5.27-11.2)
24-hr	1.64 (1.39-1.97)	1.91 (1.62-2.30)	2.43 (2.05-2.93)	2.93 (2.46-3.55)	3.73 (3.06-4.80)	4.42 (3.52-5.75)	5.19 (3.97-6.91)	6.04 (4.41-8.27)	7.27 (5.09-10.2)	8.29 (5.60-11.7)
2-day	1.85 (1.57-2.20)	2.19 (1.86-2.61)	2.80 (2.37-3.35)	3.36 (2.83-4.04)	4.22 (3.47-5.35)	4.94 (3.94-6.34)	5.72 (4.40-7.54)	6.57 (4.83-8.91)	7.79 (5.48-10.9)	8.77 (5.98-12.3)
3-day	2.00 (1.71-2.37)	2.35 (2.01-2.79)	2.98 (2.54-3.56)	3.57 (3.02-4.27)	4.46 (3.68-5.63)	5.21 (4.17-6.65)	6.01 (4.64-7.89)	6.89 (5.09-9.30)	8.14 (5.77-11.3)	9.16 (6.28-12.8)
4-day	2.14 (1.83-2.53)	2.49 (2.14-2.96)	3.14 (2.68-3.73)	3.74 (3.17-4.46)	4.64 (3.84-5.85)	5.41 (4.35-6.90)	6.25 (4.84-8.17)	7.15 (5.30-9.63)	8.44 (6.00-11.7)	9.49 (6.54-13.3)
7-day	2.55 (2.20-3.00)	2.93 (2.52-3.45)	3.62 (3.10-4.28)	4.25 (3.62-5.05)	5.21 (4.34-6.52)	6.03 (4.88-7.63)	6.90 (5.38-8.97)	7.86 (5.87-10.5)	9.22 (6.60-12.7)	10.3 (7.16-14.4)
10-day	2.91 (2.51-3.41)	3.33 (2.87-3.91)	4.07 (3.51-4.80)	4.75 (4.07-5.63)	5.78 (4.82-7.17)	6.63 (5.38-8.34)	7.55 (5.90-9.75)	8.53 (6.39-11.4)	9.93 (7.14-13.6)	11.1 (7.71-15.3)
20-day	3.85 (3.35-4.49)	4.42 (3.85-5.16)	5.40 (4.68-6.32)	6.25 (5.38-7.35)	7.46 (6.24-9.14)	8.44 (6.88-10.5)	9.46 (7.44-12.1)	10.5 (7.93-13.8)	12.0 (8.69-16.3)	13.2 (9.25-18.1)
30-day	4.62 (4.04-5.36)	5.32 (4.65-6.19)	6.50 (5.65-7.57)	7.48 (6.47-8.76)	8.86 (7.41-10.7)	9.94 (8.11-12.2)	11.0 (8.70-14.0)	12.1 (9.18-15.9)	13.6 (9.92-18.4)	14.8 (10.5-20.3)
45-day	5.59 (4.91-6.46)	6.46 (5.66-7.48)	7.86 (6.87-9.13)	9.02 (7.83-10.5)	10.6 (8.86-12.7)	11.8 (9.63-14.4)	12.9 (10.2-16.3)	14.1 (10.7-18.3)	15.6 (11.4-20.9)	16.8 (11.9-22.9)
60-day	6.43 (5.66-7.41)	7.43 (6.53-8.57)	9.02 (7.90-10.4)	10.3 (8.98-12.0)	12.0 (10.1-14.4)	13.3 (10.9-16.2)	14.5 (11.5-18.2)	15.7 (12.0-20.3)	17.3 (12.6-23.0)	18.4 (13.1-25.0)

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

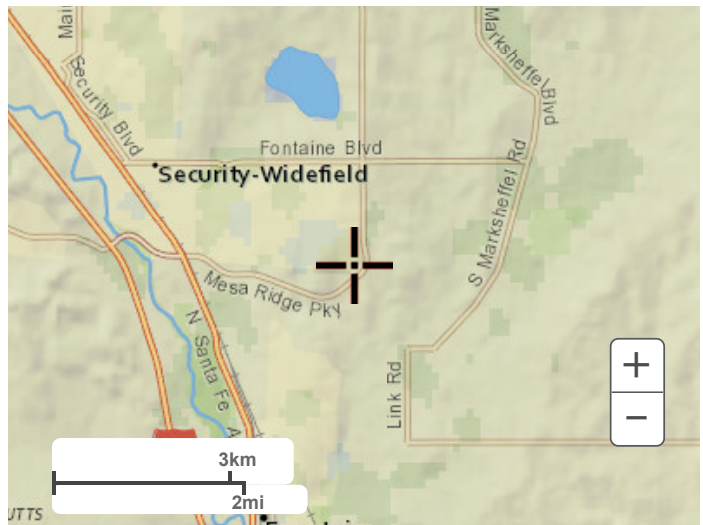
PDS-based depth-duration-frequency (DDF) curves
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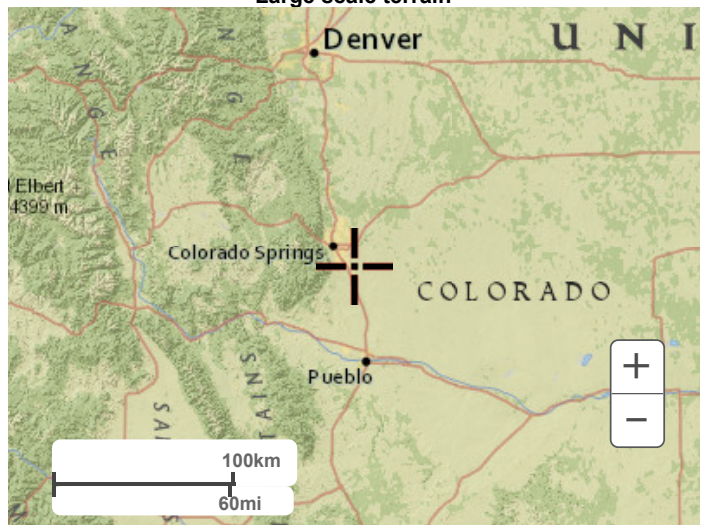
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Maps & aerials

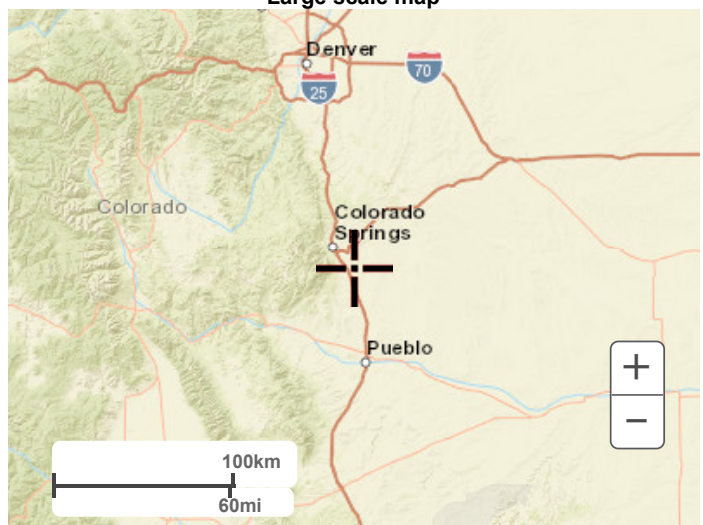
Small scale terrain



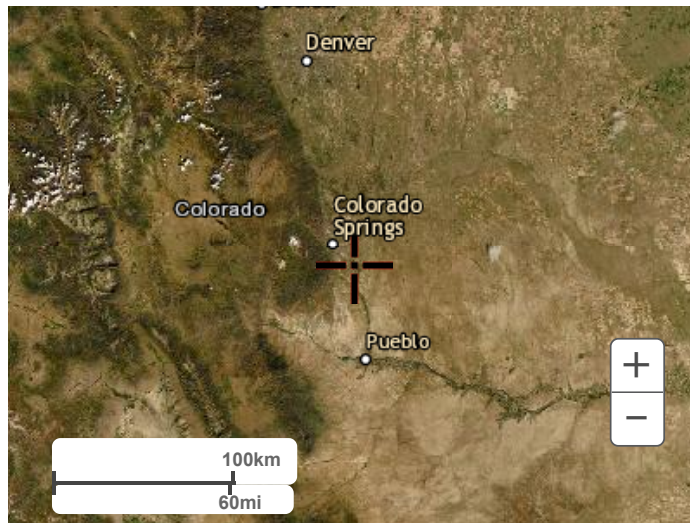
Large scale terrain



Large scale map



Large scale aerial



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APPENDIX B – HYDROLOGIC CALCULATIONS

**COTTAGES AT MESA RIDGE****Calc'd by:****NQJ****EXISTING CONDITIONS****Checked by:****LOCATION: COLORADO SPRINGS, COLORADO****Date:****12/6/2021****SUMMARY RUNOFF TABLE**

BASIN	AREA (ac)	% IMPERVIOUS	Q ₅ (cfs)	Q ₁₀₀ (cfs)
EX1	5.69	7	2.5	13.4
EX2	3.12	28	3.5	10.0
EX3	1.46	24	1.4	4.1
EX4	0.28	2	0.1	0.5
EX5	3.38	15	2.1	8.7

DESIGN POINT SUMMARY TABLE

DESIGN POINT	UPSTREAM BASIN	ΣQ ₅ (cfs)	ΣQ ₁₀₀ (cfs)
1	EX1	2.5	13.4
2	EX2	3.5	10.0
3	EX3	1.4	4.1
4	EX4	0.1	0.5
5	EX5	2.1	8.7



COTTAGES AT MESA RIDGE

NQJ

Calc'd by:

EXISTING CONDITIONS

Checked by:


LOCATION: COLORADO SPRINGS, COLORADO

12/6/2021

Date:

COMPOSITE 'C' FACTORS

BASIN	UNDEVELOPED	PAVED	SINGLE FAMILY LOT	TOTAL	SOIL TYPE	UNDEVELOPED			PAVED			SINGLE FAMILY LOT			COMPOSITE IMPERVIOUSNESS & C		
	ACRES					%I	C ₅	C ₁₀₀	%I	C ₅	C ₁₀₀	%I	C ₅	C ₁₀₀	%I	C ₅	C ₁₀₀
	EX1	5.25	0.00	0.44		5.69	B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	7
EX2	2.28	0.84	0.00	3.12	B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	28	0.31	0.52
EX3	1.13	0.33	0.00	1.46	B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	24	0.27	0.50
EX4	0.28	0.00	0.00	0.28	B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	2	0.09	0.36
EX5	2.70	0.00	0.68	3.38	B	2	0.09	0.36	100	0.90	0.96	65	0.45	0.59	15	0.16	0.41
Total				13.93											15.30		

	COTTAGES AT MESA RIDGE					Calc'd by:		NQJ			
	EXISTING CONDITIONS					Checked by:					
	LOCATION: COLORADO SPRINGS, COLORADO					Date:		12/6/2021			
TIME OF CONCENTRATION											
BASIN DATA			OVERLAND TIME (T_o)			TRAVEL TIME (T_t)					TOTAL
DESIGNATION	C _s	AREA (ac)	LENGTH (ft)	SLOPE %	t _o (min)	C _v	LENGTH (ft)	SLOPE %	V (ft/s)	t _t (min)	t _c (min)
EX1	0.12	5.69	100	25.0	6.2	10	750	3.2	1.8	7.0	13.1
EX2	0.31	3.12	158	7.1	9.5	10	620	6.5	2.5	4.1	13.5
EX3	0.27	1.46	25	25.0	2.6	20	520	0.1	0.6	13.7	16.3
EX4	0.09	0.28	75	1.0	16.0	10	305	5.4	2.3	2.2	18.2
EX5	0.16	3.38	42	1.8	9.2	10	440	4.2	2.0	3.6	12.7



COTTAGES AT MESA RIDGE

EXISTING CONDITIONS

DESIGN STORM: 5-YEAR

Calc'd by:

NQJ

Checked by:

Date:

12/6/2021

			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 (in)	LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min)	
	1	EX1	5.69	0.12	13.1	0.67	3.72	2.5															
	2	EX2	3.12	0.31	13.5	0.96	3.67	3.5															
	3	EX3	1.46	0.27	16.3	0.40	3.40	1.4															
	4	EX4	0.28	0.09	18.2	0.03	3.23	0.1															
	5	EX5	3.38	0.16	12.7	0.55	3.77	2.1															



COTTAGES AT MESA RIDGE

Calc'd by:

NQJ

EXISTING CONDITIONS

Checked by:

DESIGN STORM: 100-YEAR

Date:

8/10/2021

STREET	DESIGN POINT	BASIN ID	DIRECT RUNOFF						TOTAL RUNOFF				STREET			PIPE			TRAVEL TIME			REMARKS
			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)	
	1	EX1	5.69	0.39	13.1	2.19	6.24	13.7														
	2	EX2	3.12	0.63	12.9	1.97	6.28	12.4														
	3	EX3	1.46	0.61	16.1	0.89	5.73	5.1														
	4	EX4	0.28	0.51	17.1	0.14	5.58	0.8														
	5	EX5	3.38	0.55	12.2	1.85	6.43	11.9														



COTTAGES AT MESA RIDGE

Calc'd by:

NQJ

PROPOSED CONDITIONS

Checked by:

LOCATION: EL PASO COUNTY, COLORADO

Date:


11/29/2022

BASIN SUMMARY


BASIN	AREA (ac)	% IMPERVIOUS	Q ₅ (cfs)	Q ₁₀₀ (cfs)
1	3.67	61	7.4	15.3
2	4.83	62	9.7	20.5
2A	0.13	100	0.6	1.1
3	3.03	29	3.4	9.7
4	0.48	8	0.3	1.7
5	1.63	37	2.6	6.7
6	0.60	2	0.2	1.2
7	0.45	26	0.4	1.3
8	0.26	92	1.1	2.1
9	0.17	100	0.8	1.4

DESIGN POINT SUMMARY

DESIGN POINT	UPSTREAM BASIN	ΣQ ₅ (cfs)	ΣQ ₁₀₀ (cfs)
1A	2A	0.6	1.1
1	2	9.7	20.5
1.1	DP1A & DP1	8.1	14.2
2	3	3.4	9.7
3	4	0.3	1.7
4	5	2.6	6.7
4.1	DP1.1 & DP4	10.4	19.8
5	2	8.4	17.8
5.1	DP4.1 & DP5	18.0	32.7
6	6	0.2	1.2
7	7	0.4	1.3
8	8	1.5	5.8
9	9	1.5	4.4
9.1	DP6.1, DP8 & DP9	20.4	42.0

	COTTAGES AT MESA RIDGE															Calc'd by:			NQJ		
	PROPOSED CONDITIONS															Checked by:					
	LOCATION: EL PASO COUNTY, COLORADO															Date:			11/29/2022		

COMPOSITE 'C' FACTORS																						
BASIN	LANDSCAPING	PAVED	ROOFS	SINGLE FAMILY	TOTAL	SOIL TYPE	LANDSCAPING			PAVED			ROOFS			SINGLE FAMILY			COMPOSITE IMPERVIOUSNESS & C			
	ACRES						%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	
1	1.12	1.15	0.68	0.72	3.67	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	65	0.45	0.50	61.4	0.53	0.66	
2	1.60	1.75	1.21	0.27	4.83	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	61.7	0.56	0.70	
2A	0.00	0.13	0.00	0.00	0.13	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	100.0	0.90	0.96	
3	2.19	0.84	0.00	0.00	3.03	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	29.2	0.31	0.53	
4	0.45	0.03	0.00	0.00	0.48	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	8.1	0.14	0.40	
5	1.04	0.59	0.00	0.00	1.63	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	37.5	0.38	0.58	
6	0.60	0.00	0.00	0.00	0.60	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	2.0	0.09	0.36	
7	0.17	0.00	0.00	0.28	0.45	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	25.6	0.22	0.45	
8	0.02	0.24	0.00	0.00	0.26	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	92.5	0.84	0.91	
9	0.00	0.17	0.00	0.00	0.17	B	2	0.09	0.36	100	0.90	0.96	90	0.73	0.81	40	0.30	0.50	100.0	0.90	0.96	
Pond					11.74														55.5			
Total					15.25														48.7			

	COTTAGES AT MESA RIDGE						Calc'd by:		NQJ		
	PROPOSED CONDITIONS						Checked by:				
	LOCATION: EL PASO COUNTY, COLORADO						Date:		11/29/2022		
TIME OF CONCENTRATION											
BASIN DATA			OVERLAND TIME (T_i)			TRAVEL TIME (T_t)					TOTAL
DESIGNATION	C_s	AREA (ac)	LENGTH (ft)	SLOPE %	t_i (min)	C_v	LENGTH (ft)	SLOPE %	V (ft/s)	t_t (min)	t_c (min)
1	0.53	3.67	100	2.0	8.3	20	900	2.9	3.4	4.4	12.7
2	0.56	4.83	100	2.0	7.9	20	1160	2.5	3.2	6.1	14.0
2A	0.90	0.13	15	2.0	1.1	20	22	2.0	2.8	0.1	5.0
3	0.31	3.03	65	2.0	9.2	10	715	6.0	2.4	4.9	14.1
4	0.14	0.48	22	25.0	2.8	20	92	9.0	6.0	0.3	5.0
5	0.38	1.63	54	25.0	3.3	10	260	0.5	0.7	6.1	9.4
6	0.09	0.60	70	1.0	15.5	10	380	5.5	2.3	2.7	18.2
7	0.22	0.45	58	2.0	9.7	10	260	3.0	1.7	2.5	12.2
8	0.84	0.26	16	2.0	1.5	20	270	9.0	6.0	0.8	5.0
9	0.90	0.17	16	2.0	1.2	20	270	9.0	6.0	0.8	5.0



COTTAGES AT MESA RIDGE

PROPOSED CONDITIONS

DESIGN STORM: 5-YEAR

Calc'd by:

NQJ

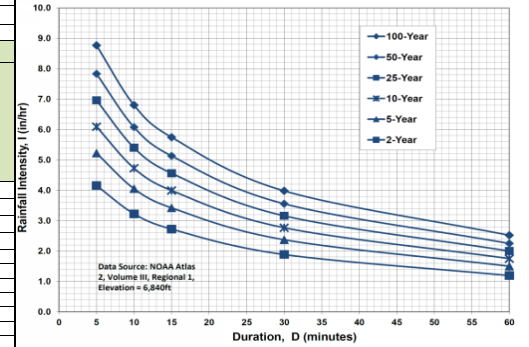
Checked by:

Date:

11/29/2022

STREET	DESIGN POINT	BASIN ID	DIRECT RUNOFF				TOTAL RUNOFF				STREET			PIPE			TRAVEL TIME			REMARKS			
			AREA (ac)	C _s	f _r (min)	C _p *A (ac)	f (in./hr.)	Q (cfs)	f _r (min)	C _p *A (ac)	f (in./hr.)	Q (cfs)	Q _{street} (cfs)	C _p *A (ac)	SLOPE %	Q _{pipe} (cfs)	C _p *A (ac)	SLOPE %	PIPE SIZE (IN)		LENGTH (FT)	VEL. (FPS)	TRAVEL TIME (min)
		1	3.67	0.53	12.7	1.96	3.78	7.4															BASIN 1 FLOW @ DP5
	1A	2A	0.13	0.90	5.0	0.12	5.17	0.6						0.6	0.12	6.0	10.0	83	17.6	0.08			BASIN 2A CAPTURED IN 3' TYPE C SUMP @ DP1A, PIPE TO DP1.1
	1	2	4.83	0.56	14.0	2.68	3.62	9.7			2.0	0.56	1.0	7.7	2.13			175	2.0	1.46			BASIN 2 CAPTURED IN 15' TYPE R ONGRADE @ DP1, PIPE TO DP1.1
	1.1								14.0	2.24	3.62	8.1		8.1	2.24	7.0	24	62	19.1	0.05			DP1 BYPASS FLOW, C&G FLOW TO DP5/DP9 DP1A & DP1 COMBINED, PIPE TO DP4.1
	2	3	3.03	0.31	14.1	0.95	3.62	3.4															BASIN 3 FLOW, SWALE FLOW TO EX TYPE C INLET @ DP2
	3	4	0.48	0.14	5.0	0.07	5.17	0.3						2.6	0.62	1.0	12	432	7.2	1.00			BASIN 4 FLOW, FOLLOW HISTORIC DRAINAGE PATTERNS TO DP3 BASIN 5 CAPTURED IN TYPE C INLET @ DP4, PIPE TO DP4.1
	4	5	1.63	0.38	9.4	0.62	4.22	2.6						10.4	2.87	1.0	18	205	7.2	0.47			COMBINED DP1.1 & DP4 FLOW @ DP4.1, PIPE TO DP5.1
	4.1								14.1	2.87	3.61	10.4		8.2	2.17	10.0	18	18	22.8	0.01			BASIN 1 & DP1 BYPASS CAPTURED IN 15' TYPE R ONGRADE @ DP5, PIPE TO DP5.1
	5								12.7	2.23	3.78	8.4	0.2	0.06	1.0			200	2.0	1.67			DP5 FLOWBY, C&G FLOW TO DP8
	5.1								14.6	5.04	3.57	18.0		18.0	5.04	5.4	24	195	16.7	0.19			COMBINED DP4.1 & DP5 @ DP5.1, PIPE TO DP9.1
	6	6	0.6	0.09	18.2	0.05	3.23	0.2															BASIN 6 FLOW @ DP6, FOLLOWS HISTORIC DRAINAGE PATTERNS
	7	7	0.45	0.22	12.2	0.10	3.83	0.4															BASIN 7 FLOW @ DP7, FOLLOWS HISTORIC DRAINAGE PATTERNS
	8	8	0.26	0.84	5.0	0.22	5.17	1.1	5.0	0.28	5.17	1.5		1.5	0.28	2.0	18	16	10.2	0.03			BASIN 8 & DP5 FLOWBY CAPTURED IN 15' TYPE R ON GRADE @ DP8, PIPE TO 9.1
	9	9	0.17	0.90	5.0	0.15	5.17	0.8	15.5	0.43	3.47	1.5		1.5	0.43	2.0	18	16	10.2	0.03			BASIN 9 AND DP1 FLOWBY CAPTURED IN 10' TYPE R ONGRADE @ DP9, PIPE TO DP9.1 DP9 FLOW BY, C&G FLOW TO LANDOVER LANE SUMP INLETS
	9.1								14.8	5.75	3.55	20.4											COMBINED DP5.1, DP8, & DP9 @ DP9.1, PIPE TO EX DETENTION POND D

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_5 = -1.50 \ln(D) + 7.583$

$I_2 = -1.19 \ln(D) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.



COTTAGES AT MESA RIDGE

PROPOSED CONDITIONS

DESIGN STORM: 100-YEAR

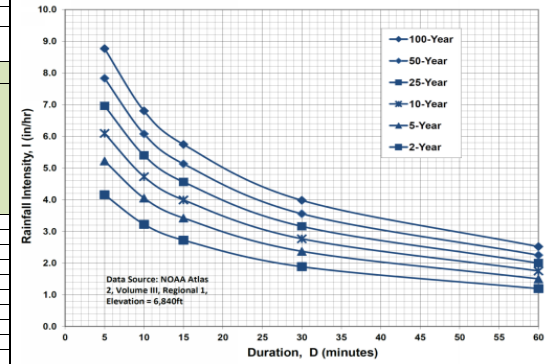
Calc'd by: **NQJ**

Checked by:

Date: **11/29/2022**

STREET	DESIGN POINT	BASIN ID	DIRECT RUNOFF					TOTAL RUNOFF					STREET			PIPE				TRAVEL TIME			REMARKS	
			AREA (ac)	C ₁₀₀	f _c (min)	C ₁₀₀ *A (ac)	I (in./hr.)	Q (cfs)	f _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 (in)	LENGTH (ft)	VEL. (ft/s)	TRAVEL TIME (min)		
		1	3.67	0.66	12.7	2.42	6.34	15.3															BASIN 1 FLOW @ DP5	
	1A	2A	0.13	0.96	5.0	0.12	8.68	1.1							1.1	0.12	6.0	10.0	83	17.6	0.08	BASIN 2A CAPTURED IN 3' TYPE C SUMP @ DP1A, PIPE TO DP1.1		
	1	2	4.83	0.70	14.0	3.37	6.08	20.5			7.1	1.17	9.0		13.4	2.20			280	6.0	0.78	BASIN 2 CAPTURED IN 15' TYPE R ON GRADE @ DP1, PIPE TO DP1.1		
	1.1								14.0	2.33	6.08	14.2		14.2	2.33	7.0	2	62	19.1	0.05		DP1 BYPASS FLOW, C&G FLOW TO DP5/DP9 DP1A & DP1 COMBINED, PIPE TO DP4.1		
	2	3	3.03	0.53	14.1	1.59	6.07	9.7														BASIN 3 FLOW, SWALE FLOW TO EX TYPE C INLET @ DP2		
	3	4	0.48	0.40	5.0	0.19	8.68	1.7							6.7	0.94	1.0	12	432	7.2	1.00	BASIN 4 FLOW, FOLLOW HISTORIC DRAINAGE PATTERNS TO DP3		
	4	5	1.63	0.58	9.4	0.94	7.08	6.7							19.8	3.27	1.0	18	205	7.2	0.47	BASIN 5 CAPTURED IN TYPE C INLET @ DP4, PIPE TO DP4.1		
	4.1								14.1	3.27	6.07	19.8			13.3	2.24	10.0	18	18	22.8	0.01	COMBINED DP1.1 & DP4 FLOW @ DP4.1, PIPE TO DP5.1		
	5								14.8	3.00	5.94	17.8	4.5	0.76	9.0			18	250	6.0	0.69	BASIN 1 & DP1 BYPASS CAPTURED IN 15' TYPE R ON GRADE @ DP5, PIPE TO DP5.1		
	5.1								14.8	5.51	5.94	32.7			32.7	5.51	5.4	24	195	16.7	0.19	DP5 FLOWBY, C&G FLOW TO DP8 COMBINED DP4.1 & DP5 @ DP5.1, PIPE TO DP9.1		
	6	6	0.6	0.36	18.2	0.22	5.42	1.2														BASIN 6 FLOW @ DP6, FOLLOWS HISTORIC DRAINAGE PATTERNS		
	7	7	0.45	0.45	12.2	0.20	6.42	1.3														BASIN 7 FLOW @ DP7, FOLLOWS HISTORIC DRAINAGE PATTERNS		
	8	8	0.26	0.91	5.0	0.24	8.68	2.1	15.5	1.00	5.83	5.8			5.8	1.00	9.0	18	16	21.6	0.01	BASIN 8 & DP5 FLOWBY CAPTURED IN 15' TYPE R ON GRADE @ DP8, PIPE TO 9.1		
	9	9	0.17	0.96	5.0	0.16	8.68	1.4	14.8	0.75	5.94	4.4	0.2	0.04	9.0			4.2	0.71	9.0	18	21.6	0.01	BASIN 9 AND DP1 FLOWBY CAPTURED IN 10' TYPE R ON GRADE @ DP9, PIPE TO DP9.1
	9.1								15.5	7.22	5.82	42.0											DP9 FLOW BY, C&G FLOW TO LANDOVER LANE SUMP INLETS	
																							COMBINED DP5.1, DP8, & DP9 @ DP9.1, PIPE TO EX DETENTION POND D	

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

$I_{100} = -2.52 \ln(D) + 12.735$

$I_{50} = -2.25 \ln(D) + 11.375$

$I_{25} = -2.00 \ln(D) + 10.111$

$I_{10} = -1.75 \ln(D) + 8.847$

$I_5 = -1.50 \ln(D) + 7.583$

$I_2 = -1.19 \ln(D) + 6.035$

Note: Values calculated by equations may not precisely duplicate values read from figure.

APPENDIX C – HYDRAULIC CALCULATIONS

Channel Report

MINOR STORM STREET CAPACITY - APISHAPA HEIGHTS W/ BASIN 1 FLOW (Q5 = 7.4)

User-defined

Invert Elev (ft) = 4.14
Slope (%) = 1.00
N-Value = 0.016

Highlighted

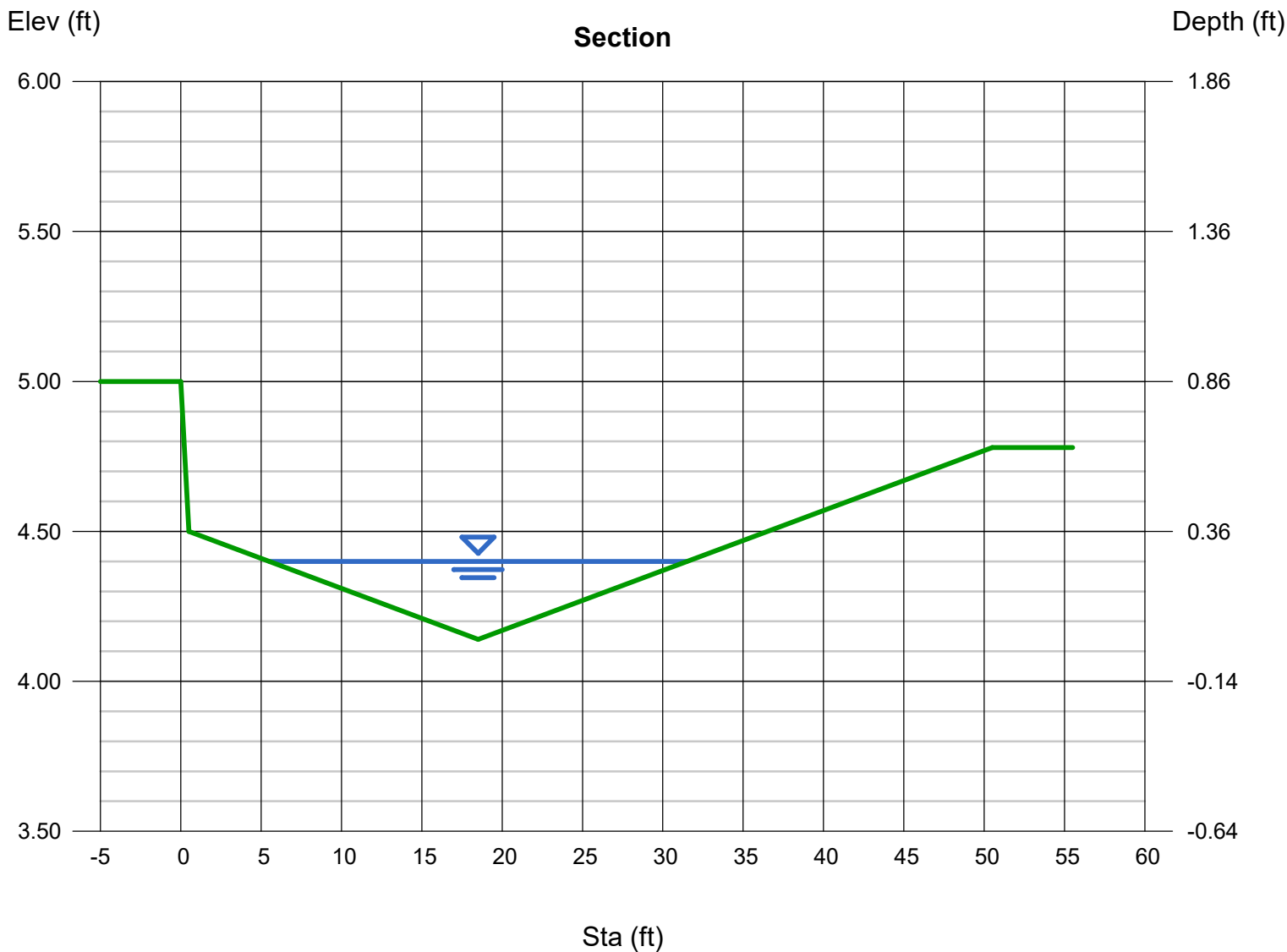
Depth (ft) = 0.26
Q (cfs) = 7.400
Area (sqft) = 3.38
Velocity (ft/s) = 2.19
Wetted Perim (ft) = 26.01
Crit Depth, Yc (ft) = 0.27
Top Width (ft) = 26.00
EGL (ft) = 0.33

Calculations

Compute by: Known Q
Known Q (cfs) = 7.40

(Sta, El, n)-(Sta, El, n)...

(0.00, 5.00)-(0.50, 4.50, 0.016)-(18.50, 4.14, 0.016)-(50.50, 4.78, 0.016)



Channel Report

MAJOR STORM STREET CAPACITY - APISHAPA HEIGHTS W/ BASIN 1 FLOW (Q100 = 1

User-defined

Invert Elev (ft) = 4.14
Slope (%) = 1.00
N-Value = 0.016

Highlighted

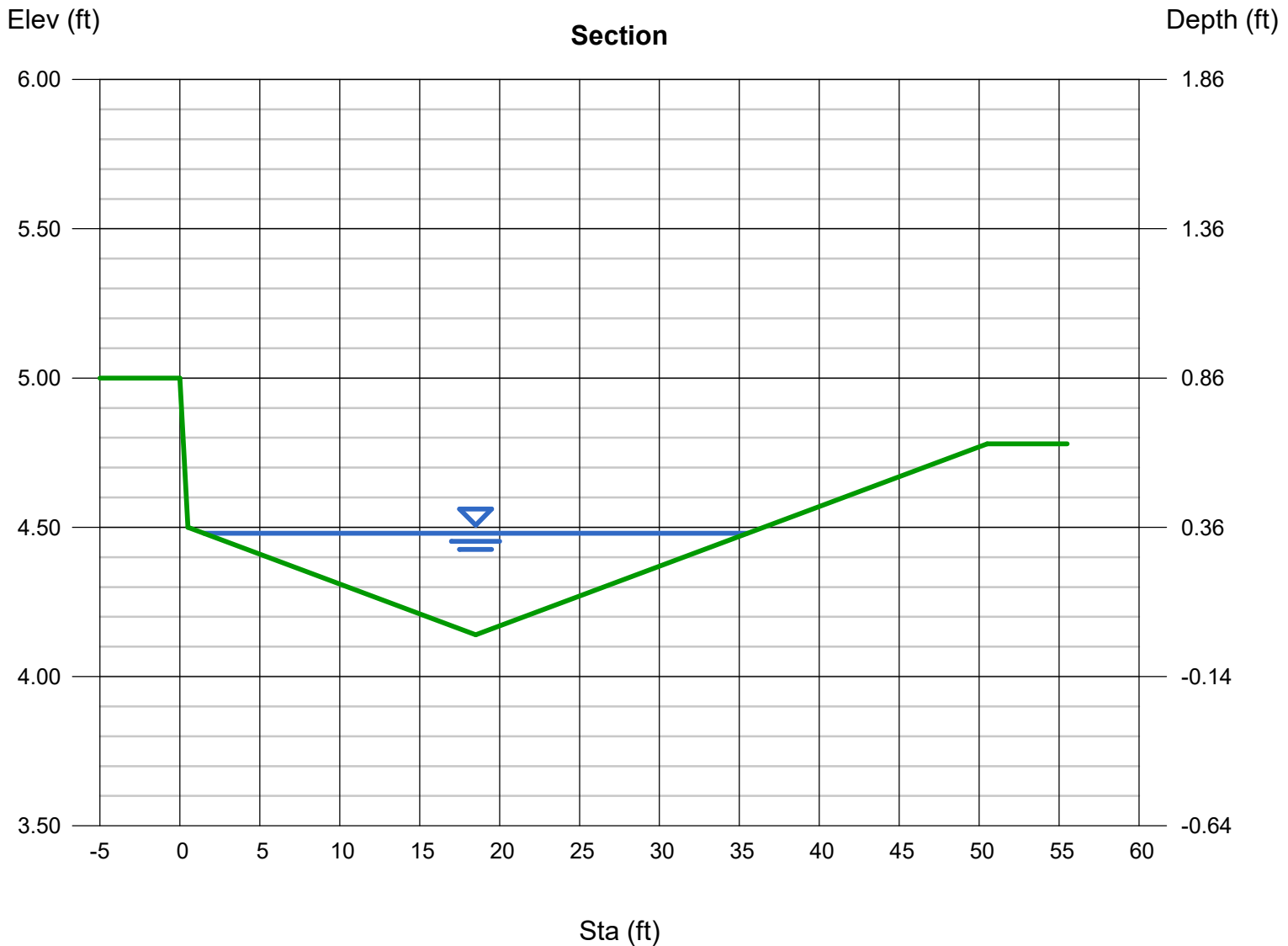
Depth (ft) = 0.34
Q (cfs) = 15.30
Area (sqft) = 5.78
Velocity (ft/s) = 2.65
Wetted Perim (ft) = 34.01
Crit Depth, Yc (ft) = 0.36
Top Width (ft) = 34.00
EGL (ft) = 0.45

Calculations

Compute by: Known Q
Known Q (cfs) = 15.30

(Sta, El, n)-(Sta, El, n)...

(0.00, 5.00)-(0.50, 4.50, 0.016)-(18.50, 4.14, 0.016)-(50.50, 4.78, 0.016)



Channel Report

MINOR STORM STREET CAPACITY - SEGUNDO GROVE W/ BASIN 2 FLOW (Q5 = 10.1)

User-defined

Invert Elev (ft) = 9.39
Slope (%) = 1.00
N-Value = 0.016

Highlighted

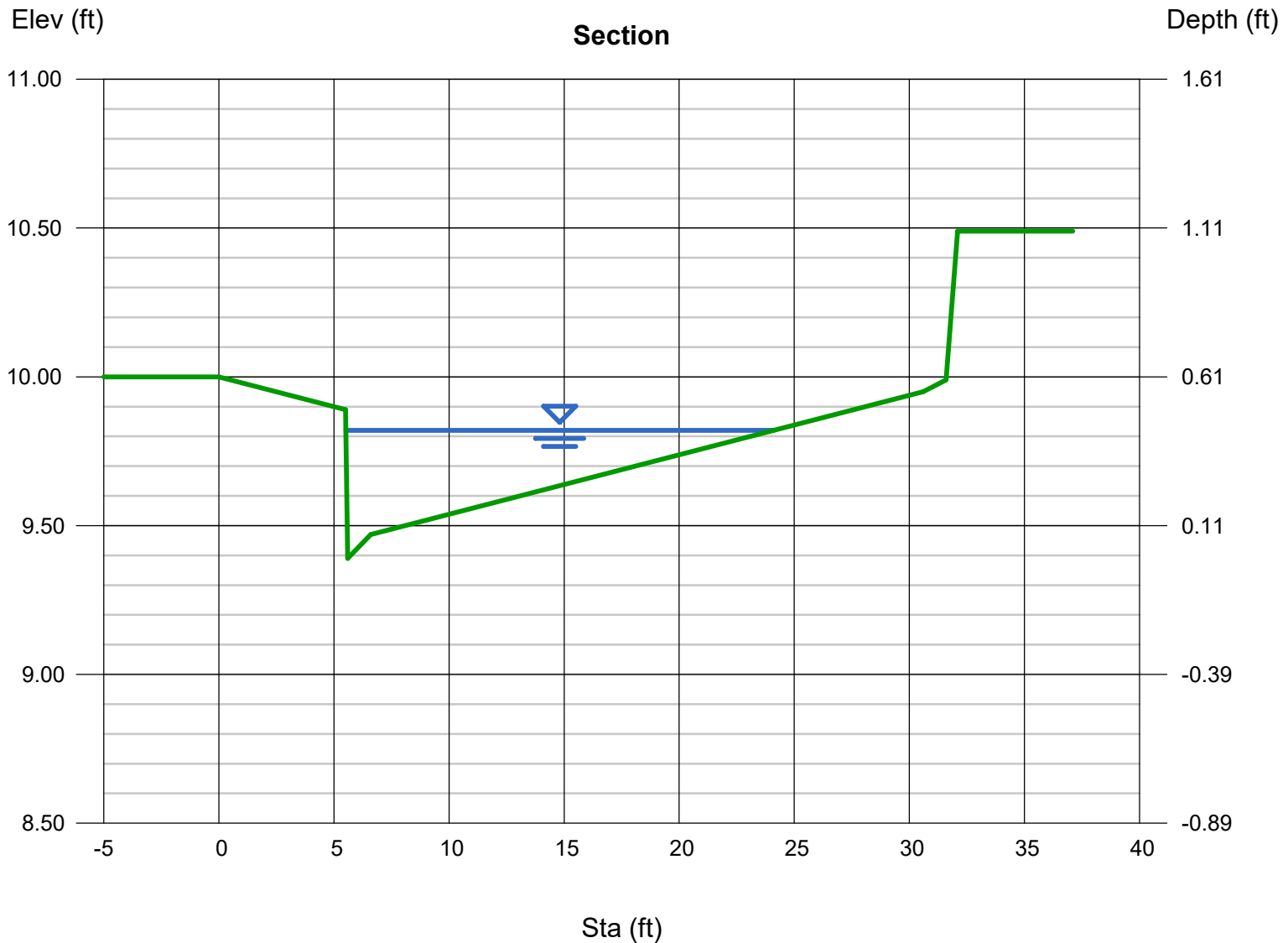
Depth (ft) = 0.43
Q (cfs) = 10.10
Area (sqft) = 3.47
Velocity (ft/s) = 2.91
Wetted Perim (ft) = 18.95
Crit Depth, Yc (ft) = 0.46
Top Width (ft) = 18.59
EGL (ft) = 0.56

Calculations

Compute by: Known Q
Known Q (cfs) = 10.10

(Sta, El, n)-(Sta, El, n)...

(0.00, 10.00)-(5.50, 9.89, 0.016)-(5.60, 9.39, 0.016)-(6.60, 9.47, 0.016)-(30.60, 9.95, 0.016)-(31.60, 9.99, 0.016)-(32.10, 10.49, 0.016)



Channel Report

MAJOR STORM STREET CAPACITY - SEGUNDO GROVE W/ BASIN 2 FLOW (Q100 = 21.3)

User-defined

Invert Elev (ft) = 9.39
Slope (%) = 1.00
N-Value = 0.016

Highlighted

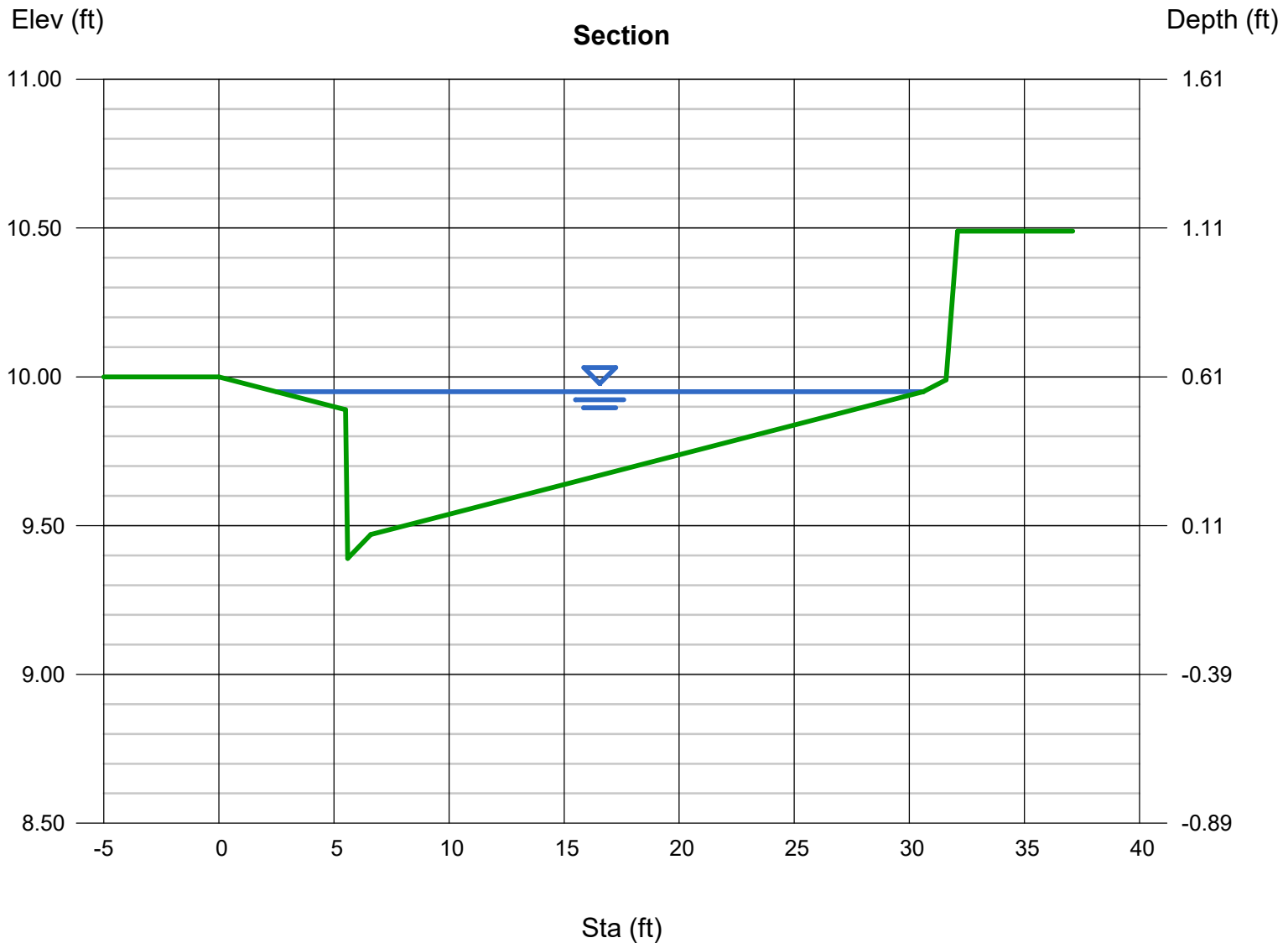
Depth (ft) = 0.56
Q (cfs) = 21.30
Area (sqft) = 6.40
Velocity (ft/s) = 3.33
Wetted Perim (ft) = 28.52
Crit Depth, Yc (ft) = 0.61
Top Width (ft) = 28.10
EGL (ft) = 0.73

Calculations

Compute by: Known Q
Known Q (cfs) = 21.30

(Sta, El, n)-(Sta, El, n)...

(0.00, 10.00)-(5.50, 9.89, 0.016)-(5.60, 9.39, 0.016)-(6.60, 9.47, 0.016)-(30.60, 9.95, 0.016)-(31.60, 9.99, 0.016)-(32.10, 10.49, 0.016)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc.

Monday, Aug 1 2022

MINOR STORM STREET CAPACITY - WAHATOYA POINT W/ BASIN 2 FLOW (Q5 = 10.1)

User-defined

Invert Elev (ft) = 3.90
Slope (%) = 1.00
N-Value = 0.016

Highlighted

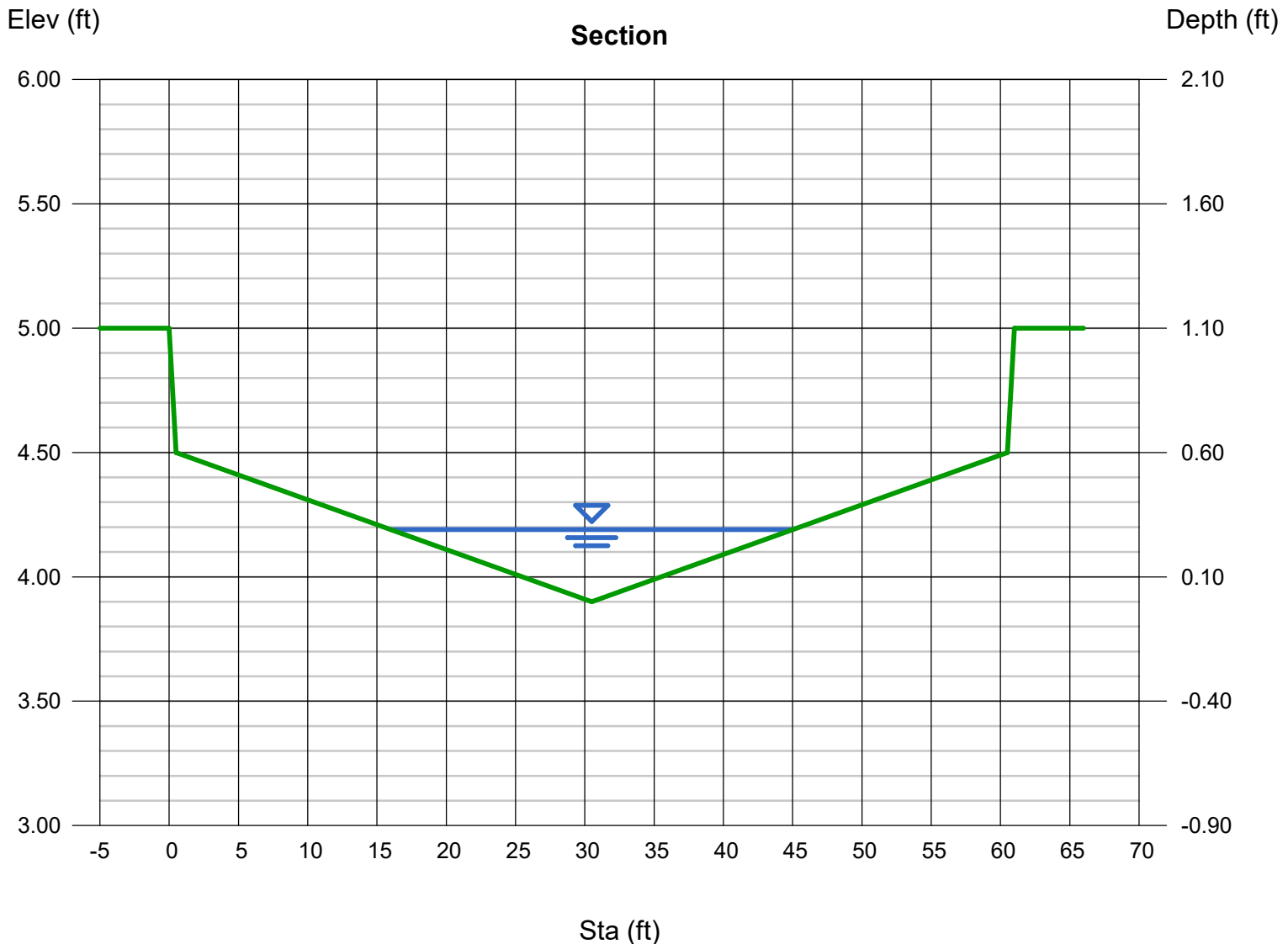
Depth (ft) = 0.29
Q (cfs) = 10.10
Area (sqft) = 4.20
Velocity (ft/s) = 2.40
Wetted Perim (ft) = 29.01
Crit Depth, Yc (ft) = 0.31
Top Width (ft) = 29.00
EGL (ft) = 0.38

Calculations

Compute by: Known Q
Known Q (cfs) = 10.10

(Sta, El, n)-(Sta, El, n)...

(0.00, 5.00)-(0.50, 4.50, 0.016)-(30.50, 3.90, 0.016)-(60.50, 4.50, 0.016)-(61.00, 5.00, 0.016)



Channel Report

MAJOR STORM STREET CAPACITY - WAHATOYA POINT W/ BASIN 2 FLOW (Q100 = 21.30)

User-defined

Invert Elev (ft) = 3.90
Slope (%) = 1.00
N-Value = 0.016

Highlighted

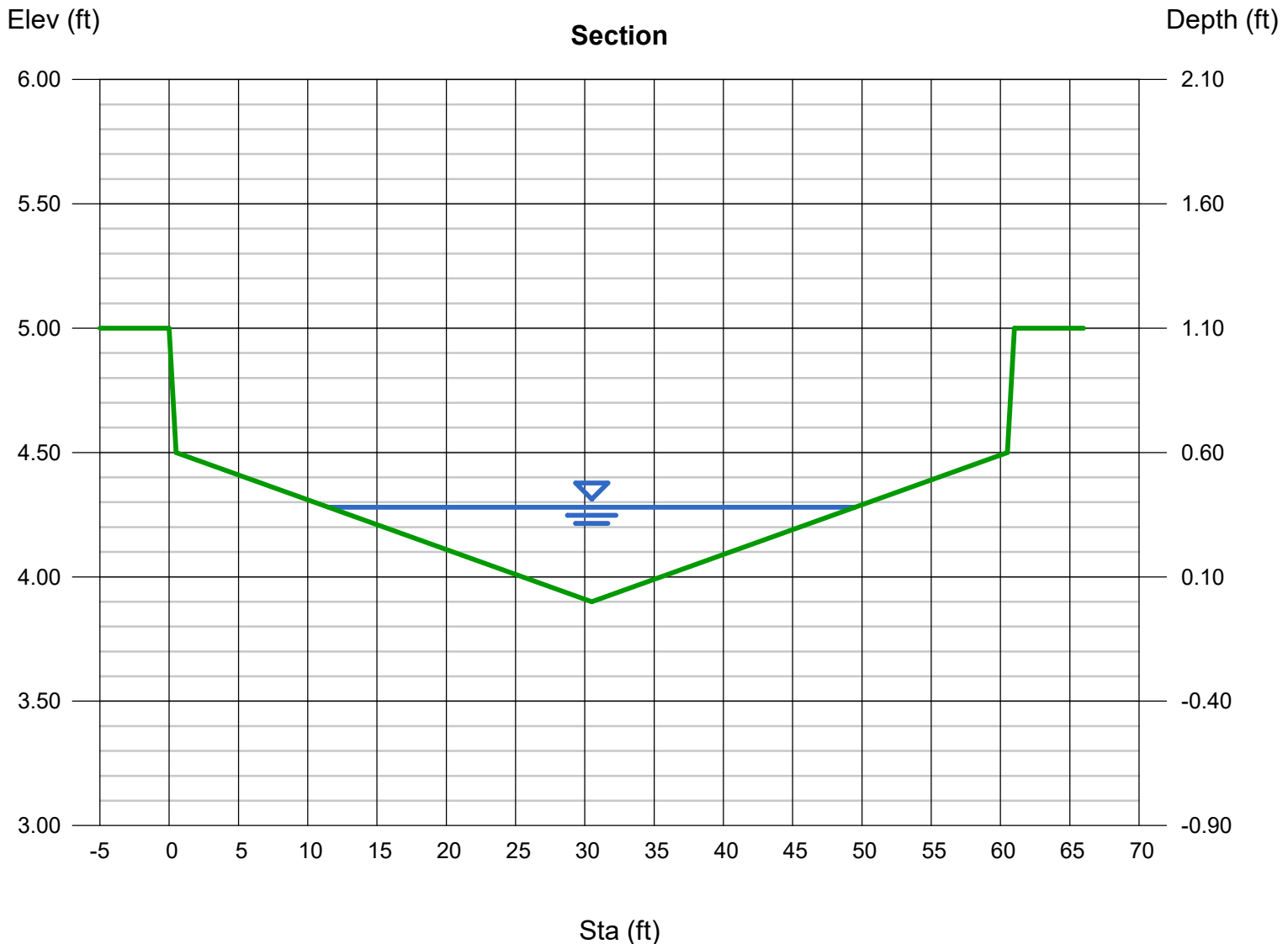
Depth (ft) = 0.38
Q (cfs) = 21.30
Area (sqft) = 7.22
Velocity (ft/s) = 2.95
Wetted Perim (ft) = 38.01
Crit Depth, Yc (ft) = 0.41
Top Width (ft) = 38.00
EGL (ft) = 0.52

Calculations

Compute by: Known Q
Known Q (cfs) = 21.30

(Sta, El, n)-(Sta, El, n)...

(0.00, 5.00)-(0.50, 4.50, 0.016)-(30.50, 3.90, 0.016)-(60.50, 4.50, 0.016)-(61.00, 5.00, 0.016)



INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP1	DP5	DP8	DP9
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET
Hydraulic Condition	On Grade	On Grade	On Grade	On Grade
Inlet Type	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening	CDOT Type R Curb Opening

USER-DEFINED INPUT

User-Defined Design Flows				
Minor Q_{known} (cfs)	9.7	8.4	1.5	1.5
Major Q_{known} (cfs)	20.5	17.8	5.8	4.4
Bypass (Carry-Over) Flow from Upstream				
Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0
Watershed Characteristics				
Subcatchment Area (acres)				
Percent Impervious				
NRCS Soil Type				
Watershed Profile				
Overland Slope (ft/ft)				
Overland Length (ft)				
Channel Slope (ft/ft)				
Channel Length (ft)				
Minor Storm Rainfall Input				
Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				
Major Storm Rainfall Input				
Design Storm Return Period, T_r (years)				
One-Hour Precipitation, P_1 (inches)				

CALCULATED OUTPUT

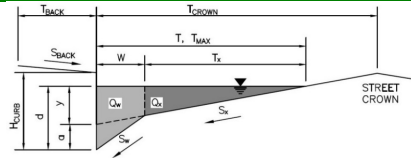
Minor Total Design Peak Flow, Q (cfs)	9.7	8.4	1.5	1.5
Major Total Design Peak Flow, Q (cfs)	20.5	17.8	5.8	4.4
Minor Flow Bypassed Downstream, Q_b (cfs)	1.0	0.2	0.0	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	7.1	4.5	0.0	0.2

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

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

Project: **COTTAGES AT MESA RIDGE**

Inlet ID: **DP1**



Gutter Geometry:

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

T _{BACK} =	5.5	ft
S _{BACK} =	0.020	ft/ft
n _{BACK} =	0.020	

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

H _{CURB} =	6.00	inches
T _{CROWN} =	25.0	ft
W =	1.00	ft
S _x =	0.020	ft/ft
S _w =	0.083	ft/ft
S _o =	0.010	ft/ft
n _{STREET} =	0.016	

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

	Minor Storm	Major Storm	
T _{MAX} =	25.0	25.0	ft
d _{MAX} =	6.7	6.7	inches
	<input type="checkbox"/>	<input type="checkbox"/>	

Warning 02

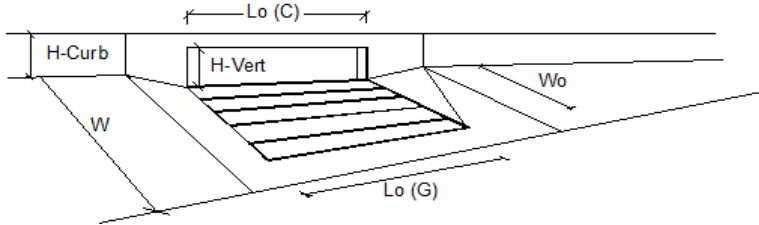
MINOR STORM Allowable Capacity is based on Depth Criterion
 MAJOR STORM Allowable Capacity is based on Depth Criterion

	Minor Storm	Major Storm	
Q _{allow} =	27.5	27.5	cfs

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

Warning 02: Max Allowable Depth for Minor Storm is greater than the Curb Height.

INLET ON A CONTINUOUS GRADE



Design Information (Input)

Type of Inlet: CDOT Type R Curb Opening
 Local Depression (additional to continuous gutter depression 'a')
 Total Number of Units in the Inlet (Grate or Curb Opening)
 Length of a Single Unit Inlet (Grate or Curb Opening)
 Width of a Unit Grate (cannot be greater than W, Gutter Width)
 Clogging Factor for a Single Unit Grate (typical min. value = 0.5)
 Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a _{LOCAL} =	3.0	3.0	inches
No =	3	3	
L _o =	5.00	5.00	ft
W _o =	N/A	N/A	ft
C _{r-G} =	N/A	N/A	
C-C =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity

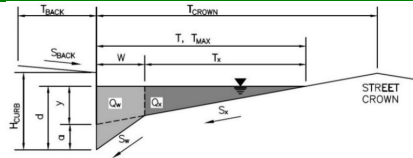
Total Inlet Interception Capacity
 Total Inlet Carry-Over Flow (flow bypassing inlet)
 Capture Percentage = Q_i/Q_o =

	MINOR	MAJOR	
Q =	8.7	13.4	cfs
Q _b =	1.0	7.1	cfs
C% =	90	65	%

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

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

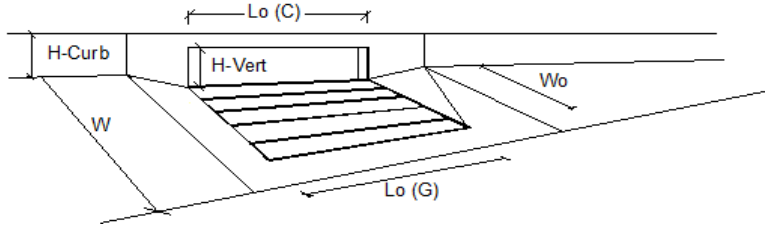
Project: COTTAGES AT MESA RIDGE
Inlet ID: DP5



Gutter Geometry:					
Maximum Allowable Width for Spread Behind Curb	T _{BACK} = 5.5 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} = 18.0 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 = 0.043 ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n _{STREET} = 0.016				
Max. Allowable Spread for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> </tr> <tr> <td style="text-align: center; padding: 2px;">18.0</td> <td style="text-align: center; padding: 2px;">18.0</td> </tr> </table> ft	Minor Storm	Major Storm	18.0	18.0
Minor Storm	Major Storm				
18.0	18.0				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> </tr> <tr> <td style="text-align: center; padding: 2px;">5.8</td> <td style="text-align: center; padding: 2px;">7.3</td> </tr> </table> inches	Minor Storm	Major Storm	5.8	7.3
Minor Storm	Major Storm				
5.8	7.3				
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	<input type="checkbox"/> <input checked="" type="checkbox"/>				
MINOR STORM Allowable Capacity is based on Depth Criterion	<table border="1" style="display: inline-table; border-collapse: collapse;"> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> </tr> <tr> <td style="text-align: center; padding: 2px;">15.9</td> <td style="text-align: center; padding: 2px;">24.6</td> </tr> </table> cfs	Minor Storm	Major Storm	15.9	24.6
Minor Storm	Major Storm				
15.9	24.6				
MAJOR STORM Allowable Capacity is based on Depth Criterion					
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management' Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'					

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



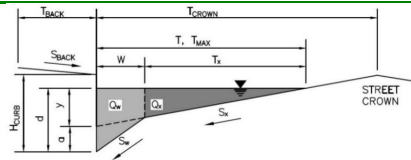
Design Information (Input)	
Type of Inlet	CDOT Type R Curb Opening
Local Depression (additional to continuous gutter depression 'a')	
Total Number of Units in the Inlet (Grate or Curb Opening)	3
Length of a Single Unit Inlet (Grate or Curb Opening)	5.00 ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10
Street Hydraulics: OK - Q < Allowable Street Capacity	
Total Inlet Interception Capacity	Q = 8.2 cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b = 0.2 cfs
Capture Percentage = Q _i /Q _o =	C% = 98 %

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a _{LOCAL} =	3.0	3.0	inches
No =	3	3	
L _o =	5.00	5.00	ft
W _o =	N/A	N/A	ft
C _{r-G} =	N/A	N/A	
C-C =	0.10	0.10	

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

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

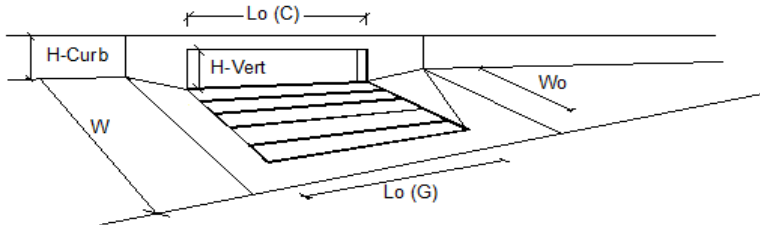
Project: COTTAGES AT MESA RIDGE
Inlet ID: DP8



Gutter Geometry:																	
Maximum Allowable Width for Spread Behind Curb	T _{BACK} = <input type="text" value="5.0"/> ft																
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S _{BACK} = <input type="text" value="0.020"/> ft/ft																
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n _{BACK} = <input type="text" value="0.016"/>																
Height of Curb at Gutter Flow Line	H _{CURB} = <input type="text" value="6.00"/> inches																
Distance from Curb Face to Street Crown	T _{CROWN} = <input type="text" value="18.0"/> ft																
Gutter Width	W = <input type="text" value="2.00"/> ft																
Street Transverse Slope	S _x = <input type="text" value="0.020"/> ft/ft																
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S _w = <input type="text" value="0.063"/> ft/ft																
Street Longitudinal Slope - Enter 0 for sump condition	S _o = <input type="text" value="0.090"/> ft/ft																
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n _{STREET} = <input type="text" value="0.016"/>																
Max. Allowable Spread for Minor & Major Storm	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <th></th> <th style="text-align: center;">Minor Storm</th> <th style="text-align: center;">Major Storm</th> <th></th> </tr> <tr> <td>T_{MAX} =</td> <td style="text-align: center;">18.0</td> <td style="text-align: center;">18.0</td> <td style="text-align: right;">ft</td> </tr> <tr> <td>d_{MAX} =</td> <td style="text-align: center;">4.6</td> <td style="text-align: center;">6.5</td> <td style="text-align: right;">inches</td> </tr> <tr> <td></td> <td style="text-align: center;"><input type="checkbox"/></td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> <td></td> </tr> </table>		Minor Storm	Major Storm		T _{MAX} =	18.0	18.0	ft	d _{MAX} =	4.6	6.5	inches		<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	Minor Storm	Major Storm															
T _{MAX} =	18.0	18.0	ft														
d _{MAX} =	4.6	6.5	inches														
	<input type="checkbox"/>	<input checked="" type="checkbox"/>															
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm																	
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)																	
<p>MINOR STORM Allowable Capacity is based on Depth Criterion</p> <p>MAJOR STORM Allowable Capacity is based on Depth Criterion</p> <p>Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'</p> <p>Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'</p>																	
<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <th></th> <th style="text-align: center;">Minor Storm</th> <th style="text-align: center;">Major Storm</th> <th></th> </tr> <tr> <td>Q_{allow} =</td> <td style="text-align: center;">16.1</td> <td style="text-align: center;">16.6</td> <td style="text-align: right;">cfs</td> </tr> </table>			Minor Storm	Major Storm		Q _{allow} =	16.1	16.6	cfs								
	Minor Storm	Major Storm															
Q _{allow} =	16.1	16.6	cfs														

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.01 (April 2021)



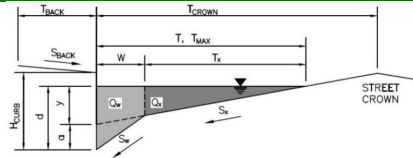
Design Information (Input)	
Type of Inlet	CDOT Type R Curb Opening
Local Depression (additional to continuous gutter depression 'a')	
Total Number of Units in the Inlet (Grate or Curb Opening)	3
Length of a Single Unit Inlet (Grate or Curb Opening)	5.00
Width of a Unit Grate (cannot be greater than W, Gutter Width)	N/A
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	N/A
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	0.10
Street Hydraulics: OK - Q < Allowable Street Capacity	
Total Inlet Interception Capacity	Q = 1.5 cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	Q _b = 0.0 cfs
Capture Percentage = Q _i /Q _o =	C% = 100 %

	MINOR	MAJOR	
Type =	CDOT Type R Curb Opening		
a _{LOCAL} =	3.0	3.0	inches
No =	3	3	
L _o =	5.00	5.00	ft
W _o =	N/A	N/A	ft
C _{r-G} =	N/A	N/A	
C-C =	0.10	0.10	

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

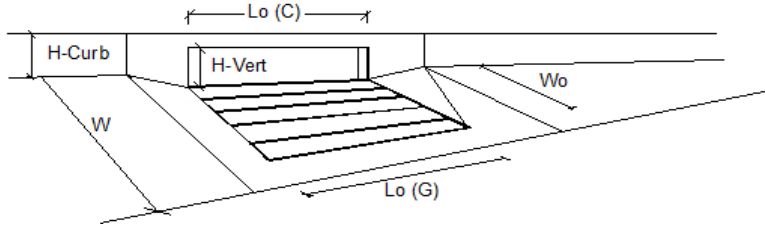
(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project: COTTAGES AT MESA RIDGE
Inlet ID: DP9



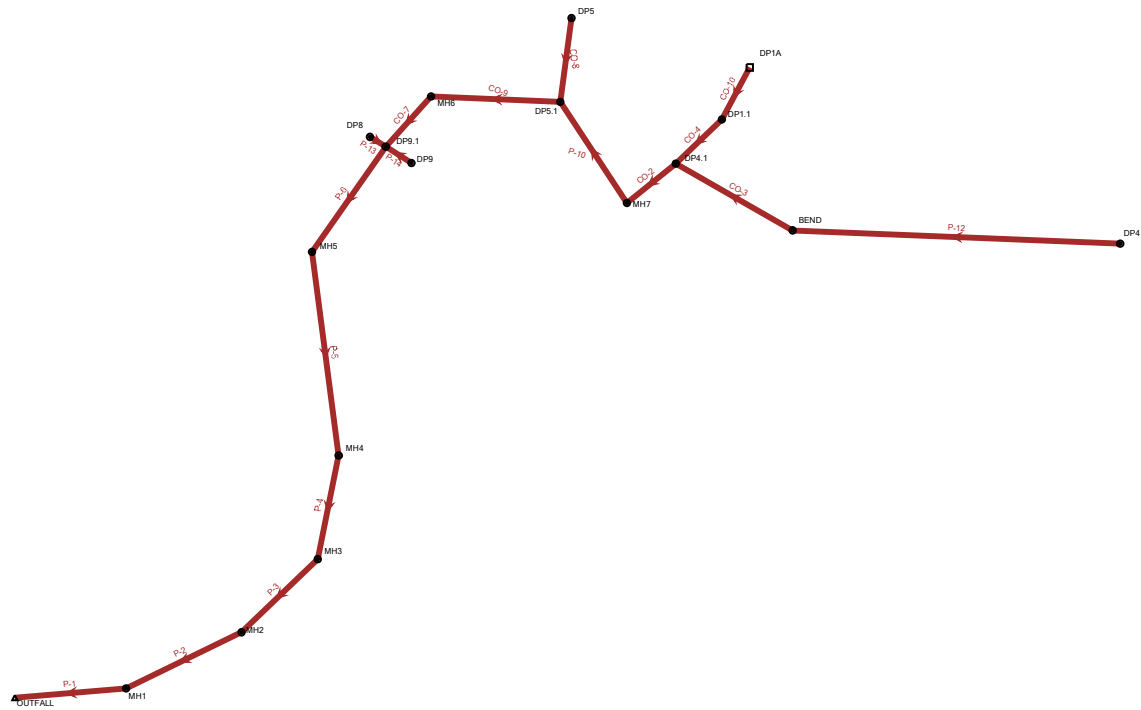
Gutter Geometry:					
Maximum Allowable Width for Spread Behind Curb	$T_{BACK} = 5.0$ ft				
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	$S_{BACK} = 0.020$ ft/ft				
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	$n_{BACK} = 0.016$				
Height of Curb at Gutter Flow Line	$H_{CURB} = 6.00$ inches				
Distance from Curb Face to Street Crown	$T_{CROWN} = 18.0$ 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)	$S_w = 0.063$ ft/ft				
Street Longitudinal Slope - Enter 0 for sump condition	$S_o = 0.046$ ft/ft				
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	$n_{STREET} = 0.016$				
Max. Allowable Spread for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 2px;">18.0</td> <td style="text-align: center; padding: 2px;">18.0</td> </tr> </tbody> </table> ft	Minor Storm	Major Storm	18.0	18.0
Minor Storm	Major Storm				
18.0	18.0				
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	<table border="1" style="display: inline-table; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 2px;">4.6</td> <td style="text-align: center; padding: 2px;">6.5</td> </tr> </tbody> </table> inches	Minor Storm	Major Storm	4.6	6.5
Minor Storm	Major Storm				
4.6	6.5				
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)	<table border="1" style="display: inline-table; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 2px;"><input type="checkbox"/></td> <td style="text-align: center; padding: 2px;"><input checked="" type="checkbox"/></td> </tr> </tbody> </table>	Minor Storm	Major Storm	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Minor Storm	Major Storm				
<input type="checkbox"/>	<input checked="" type="checkbox"/>				
MINOR STORM Allowable Capacity is based on Depth Criterion					
MAJOR STORM Allowable Capacity is based on Depth Criterion					
Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'					
Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'					
Q_{allow}	<table border="1" style="display: inline-table; border-collapse: collapse;"> <thead> <tr> <th style="padding: 2px;">Minor Storm</th> <th style="padding: 2px;">Major Storm</th> </tr> </thead> <tbody> <tr> <td style="text-align: center; padding: 2px;">16.1</td> <td style="text-align: center; padding: 2px;">20.2</td> </tr> </tbody> </table> cfs	Minor Storm	Major Storm	16.1	20.2
Minor Storm	Major Storm				
16.1	20.2				

INLET ON A CONTINUOUS GRADE



Design Information (Input)	MINOR	MAJOR	
Type of Inlet	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	$a_{LOCAL} = 3.0$	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	$N_o = 2$	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)	$C_r-G = N/A$	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	$C-C = 0.10$	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity			
Total Inlet Interception Capacity	$Q = 1.5$	4.2	cfs
Total Inlet Carry-Over Flow (flow bypassing inlet)	$Q_b = 0.0$	0.2	cfs
Capture Percentage = $Q_b/Q_o =$	$C\% = 100$	95	%

STORMCAD PLAN



5-YEAR SCENARIO

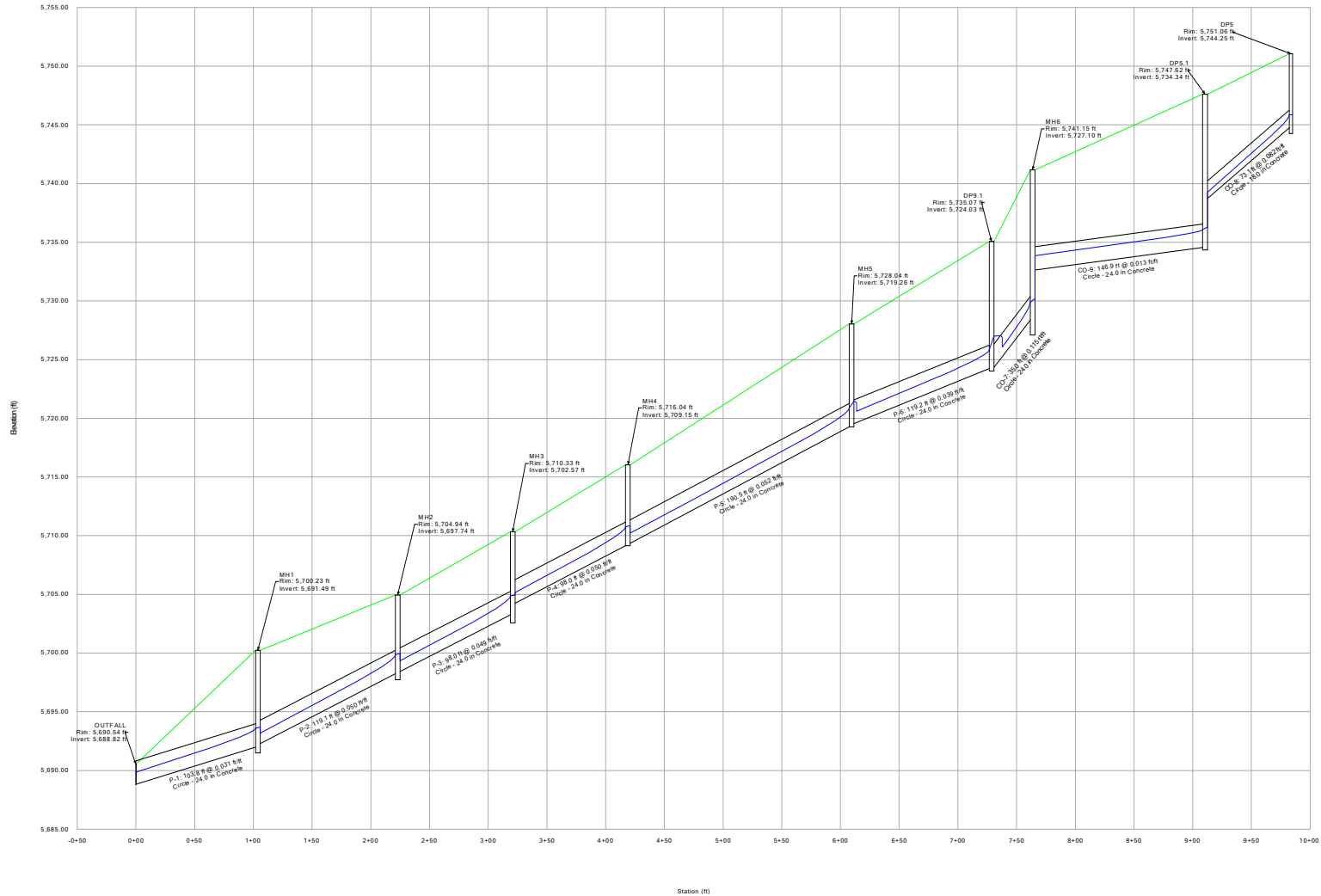
Conduit FlexTable: Combined Pipe/Node Report

Label	Upstream Structure	Diameter (in)	Length (Unified) (ft)	Flow (cfs)	Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
P-14	DP9	12.0	28.3	1.10	4.87	5,731.80	5,731.51	0.010	5,732.24	5,731.85
P-13	DP8	18.0	7.7	1.30	7.31	5,726.00	5,725.59	0.053	5,726.99	5,727.00
P-12	DP4	12.0	304.5	2.60	6.66	5,743.85	5,740.70	0.010	5,744.54	5,741.20
P-10	MH7	24.0	97.3	10.40	6.96	5,735.91	5,734.97	0.010	5,737.06	5,736.28
P-6	DP9.1	24.0	119.2	20.40	13.92	5,724.23	5,719.56	0.039	5,725.85	5,721.44
P-5	MH5	24.0	190.5	20.40	15.46	5,719.26	5,709.35	0.052	5,720.88	5,710.22
P-4	MH4	24.0	98.0	20.40	15.23	5,709.15	5,704.25	0.050	5,710.77	5,705.16
P-3	MH3	24.0	98.0	20.40	15.13	5,703.25	5,698.44	0.049	5,704.87	5,699.35
P-2	MH2	24.0	119.1	20.40	15.23	5,698.24	5,692.29	0.050	5,699.86	5,693.18
P-1	MH1	24.0	103.8	20.40	12.69	5,691.99	5,688.82	0.031	5,693.61	5,689.86
CO-10	DP1A	10.0	82.8	0.60	8.65	5,748.00	5,741.38	0.080	5,748.34	5,741.91
CO-9	DP5.1	24.0	146.9	18.00	8.89	5,734.55	5,732.63	0.013	5,736.08	5,733.86
CO-8	DP5	18.0	73.1	7.90	14.36	5,744.75	5,738.73	0.082	5,745.84	5,739.25
CO-7	MH6	24.0	35.0	18.00	19.98	5,728.37	5,724.33	0.115	5,729.90	5,727.00
CO-4	DP1.1	18.0	58.2	9.70	13.53	5,740.71	5,737.22	0.060	5,741.91	5,737.88
CO-3	BEND	18.0	117.8	2.60	8.29	5,740.20	5,737.22	0.025	5,740.81	5,738.36
CO-2	DP4.1	24.0	39.5	10.40	7.75	5,736.72	5,736.21	0.013	5,737.88	5,737.69

5-YEAR SCENARIO

Profile Report

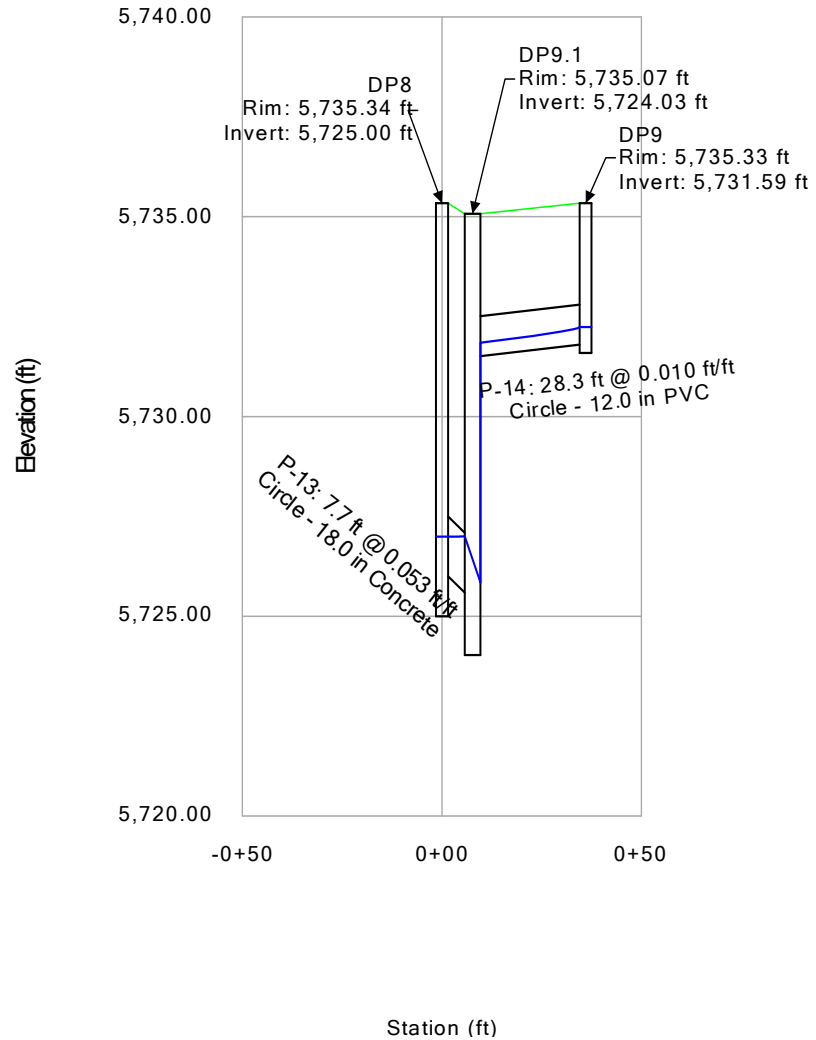
Engineering Profile - 02-Storm (Cottages_Mesa_Ridge.stsw)



5-YEAR SCENARIO

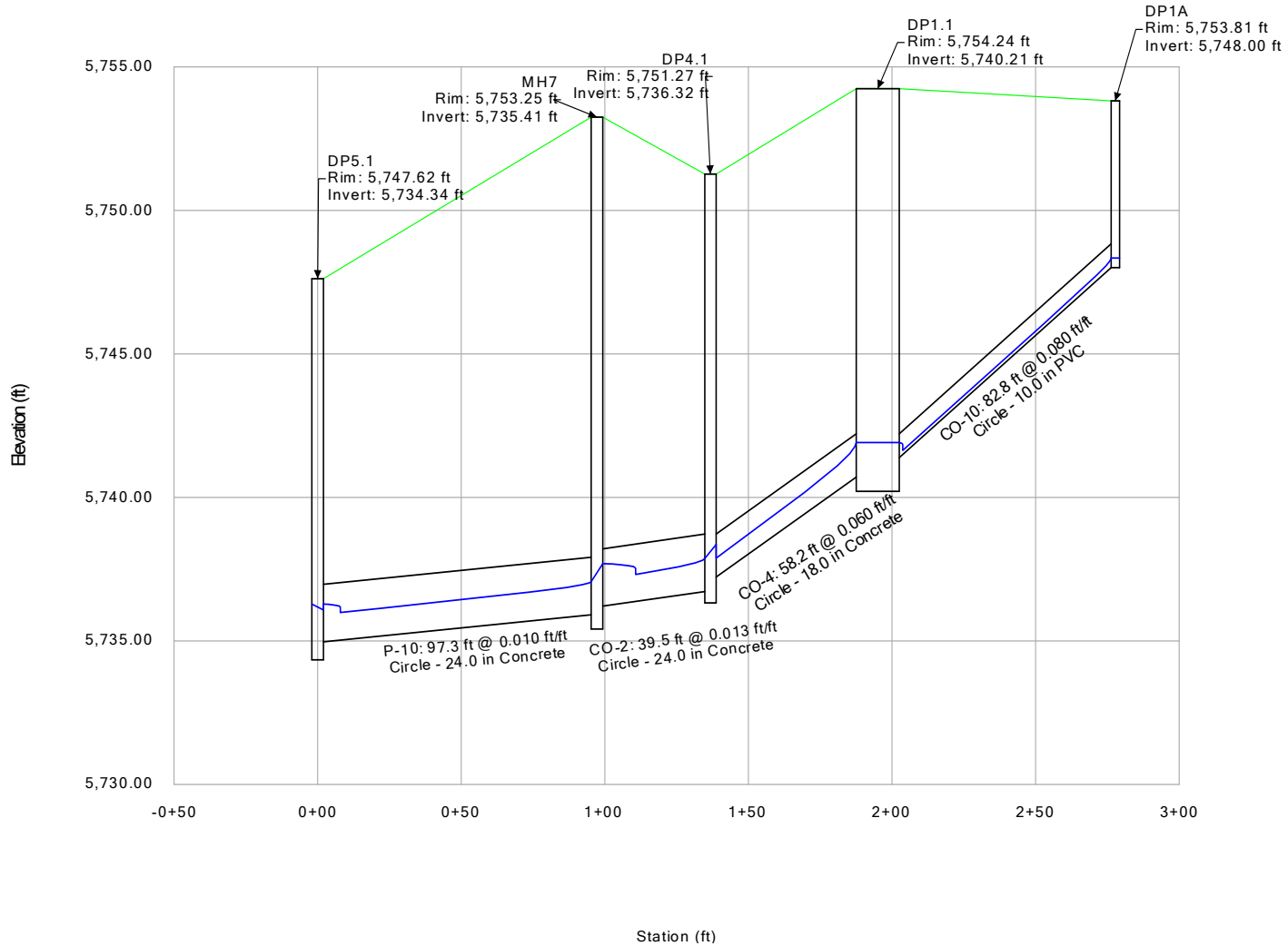
Profile Report

Engineering Profile - 03-Storm (Cottages_Mesa_Ridge.stsw)



5-YEAR SCENARIO

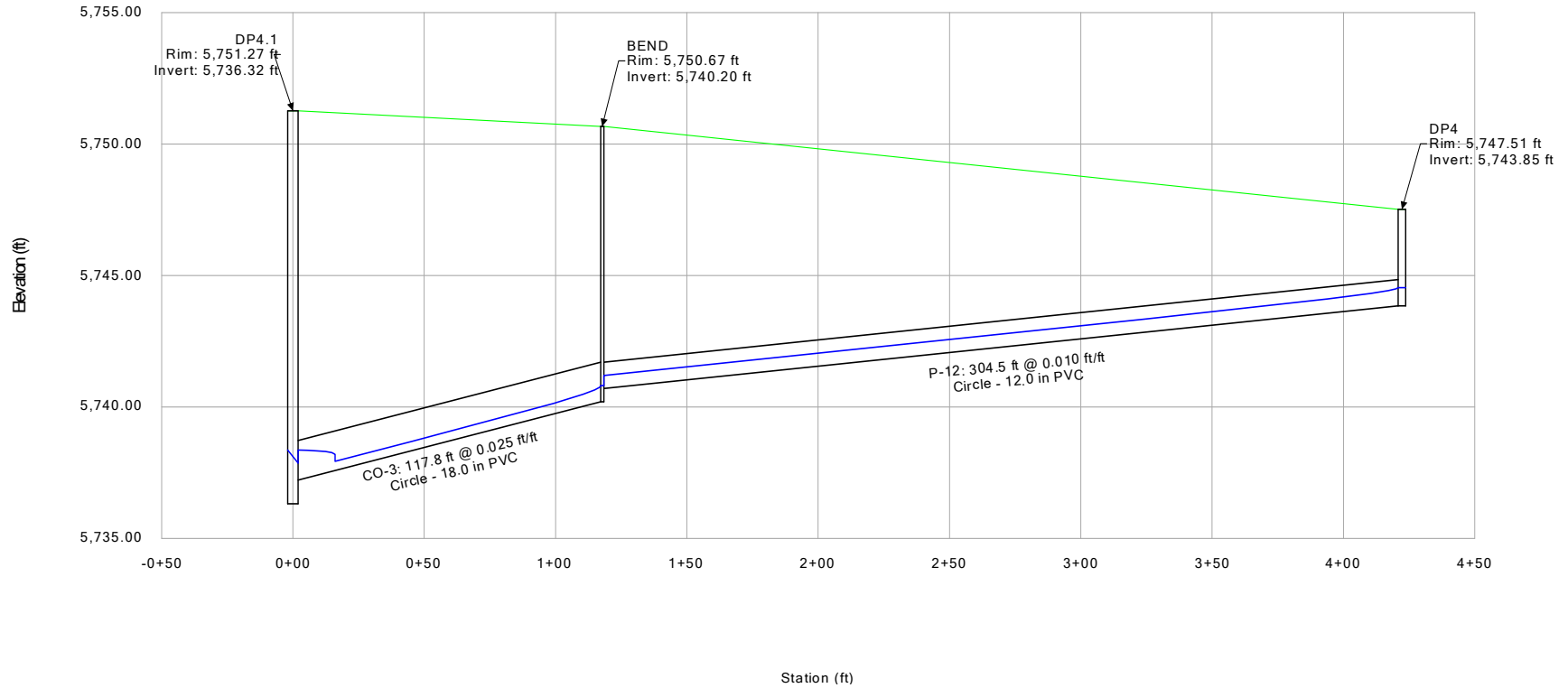
Profile Report
Engineering Profile - 04-Storm (Cottages_Mesa_Ridge.stsw)



5-YEAR SCENARIO

Profile Report

Engineering Profile - 05-Storm (Cottages_Mesa_Ridge.stsw)



100-YEAR SCENARIO

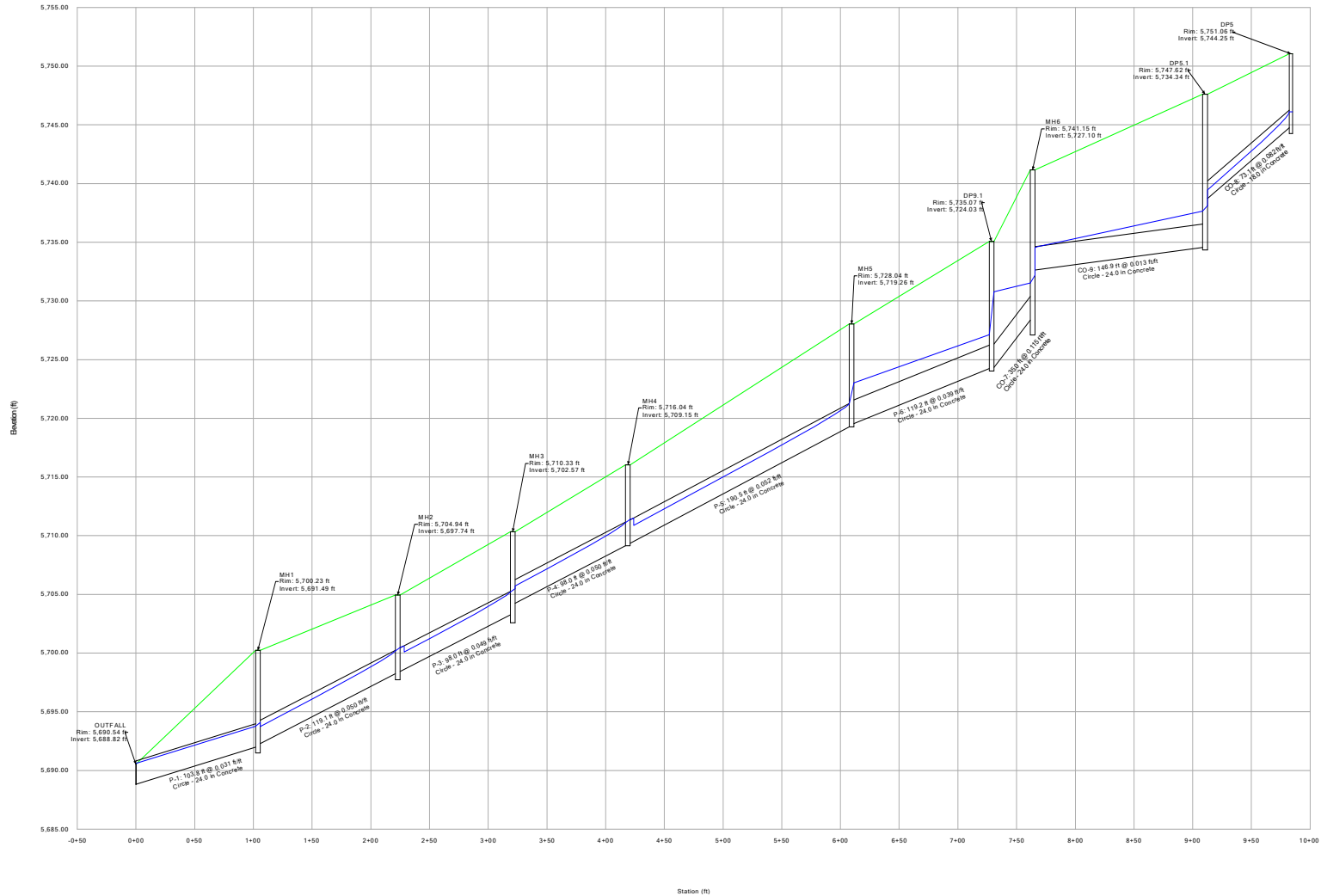
Conduit FlexTable: Combined Pipe/Node Report

Label	Upstream Structure	Diameter (in)	Length (Unified) (ft)	Flow (cfs)	Velocity (ft/s)	Invert (Start) (ft)	Invert (Stop) (ft)	Slope (Calculated) (ft/ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)
P-14	DP9	12.0	28.3	4.40	6.78	5,731.80	5,731.51	0.010	5,732.68	5,732.30
P-13	DP8	18.0	7.7	5.90	3.34	5,726.00	5,725.59	0.053	5,730.81	5,730.79
P-12	DP4	12.0	304.5	6.70	8.53	5,743.85	5,740.70	0.010	5,746.85	5,741.67
P-10	MH7	24.0	97.3	19.80	6.30	5,735.91	5,734.97	0.010	5,738.85	5,738.11
P-6	DP9.1	24.0	119.2	42.00	13.37	5,724.23	5,719.56	0.039	5,727.12	5,723.01
P-5	MH5	24.0	190.5	42.00	18.30	5,719.26	5,709.35	0.052	5,721.22	5,711.39
P-4	MH4	24.0	98.0	42.00	18.00	5,709.15	5,704.25	0.050	5,711.11	5,705.71
P-3	MH3	24.0	98.0	42.00	17.86	5,703.25	5,698.44	0.049	5,705.21	5,700.48
P-2	MH2	24.0	119.1	42.00	18.00	5,698.24	5,692.29	0.050	5,700.20	5,693.73
P-1	MH1	24.0	103.8	42.00	14.18	5,691.99	5,688.82	0.031	5,693.78	5,690.61
CO-10	DP1A	10.0	82.8	1.10	10.34	5,748.00	5,741.38	0.080	5,748.47	5,742.10
CO-9	DP5.1	24.0	146.9	32.70	10.41	5,734.55	5,732.63	0.013	5,737.65	5,734.53
CO-8	DP5	18.0	73.1	13.50	16.59	5,744.75	5,738.73	0.082	5,746.12	5,739.46
CO-7	MH6	24.0	35.0	32.70	10.41	5,728.37	5,724.33	0.115	5,731.52	5,730.79
CO-4	DP1.1	18.0	58.2	14.20	14.91	5,740.71	5,737.22	0.060	5,742.10	5,740.60
CO-3	BEND	18.0	117.8	6.70	10.82	5,740.20	5,737.22	0.025	5,741.20	5,740.60
CO-2	DP4.1	24.0	39.5	19.80	6.30	5,736.72	5,736.21	0.013	5,739.97	5,739.67

100-YEAR SCENARIO

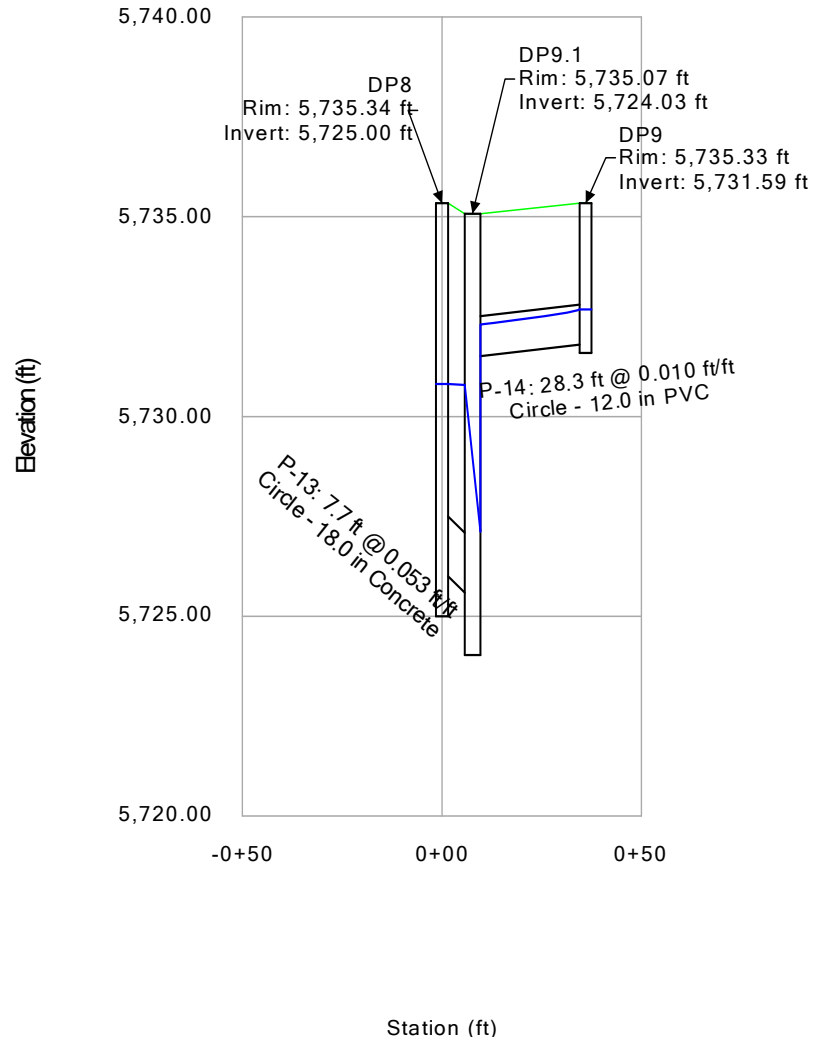
Profile Report

Engineering Profile - 02-Storm (Cottages_Mesa_Ridge.stsw)



100-YEAR SCENARIO

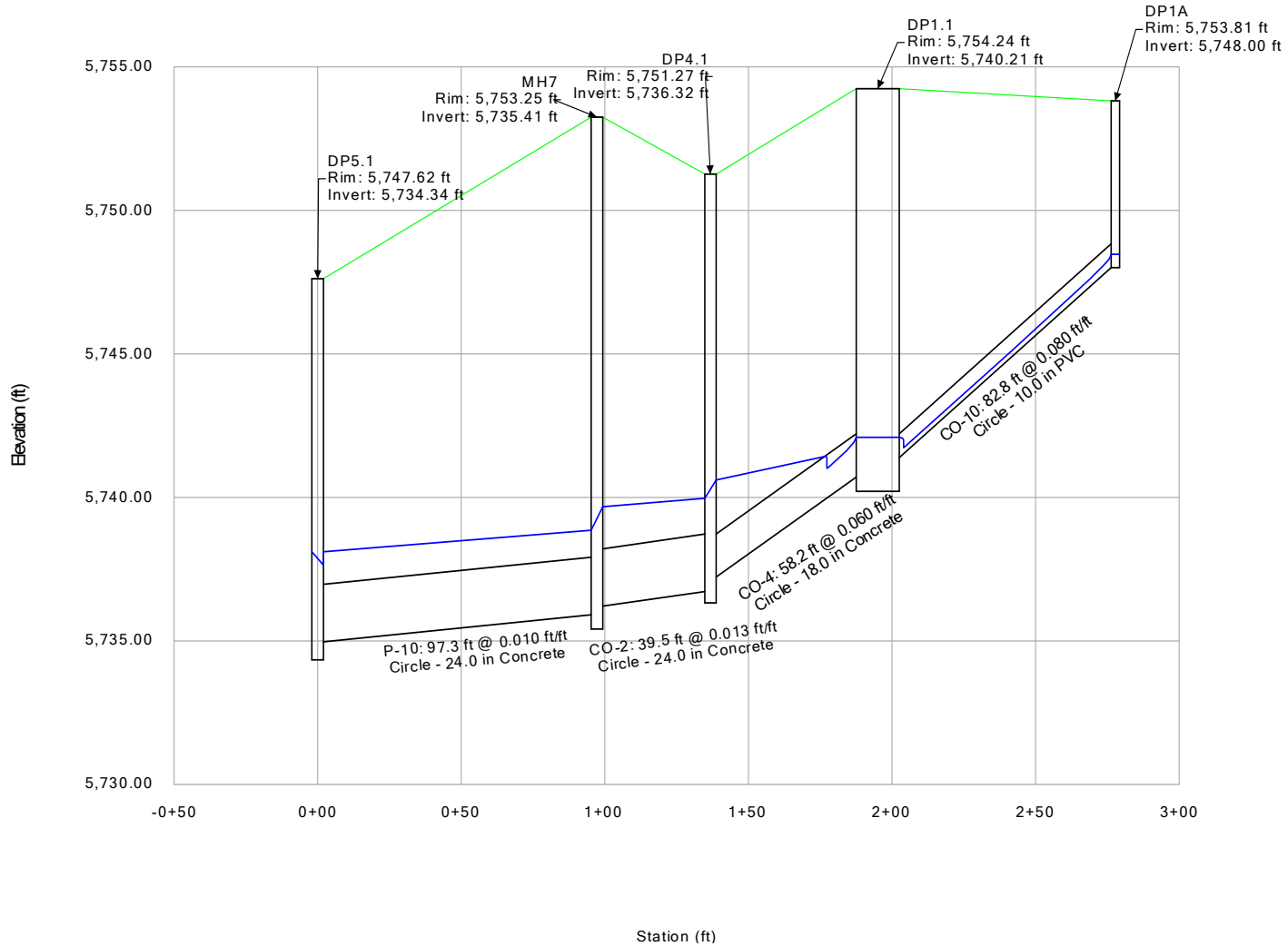
Profile Report
Engineering Profile - 03-Storm (Cottages_Mesa_Ridge.stsw)



100-YEAR SCENARIO

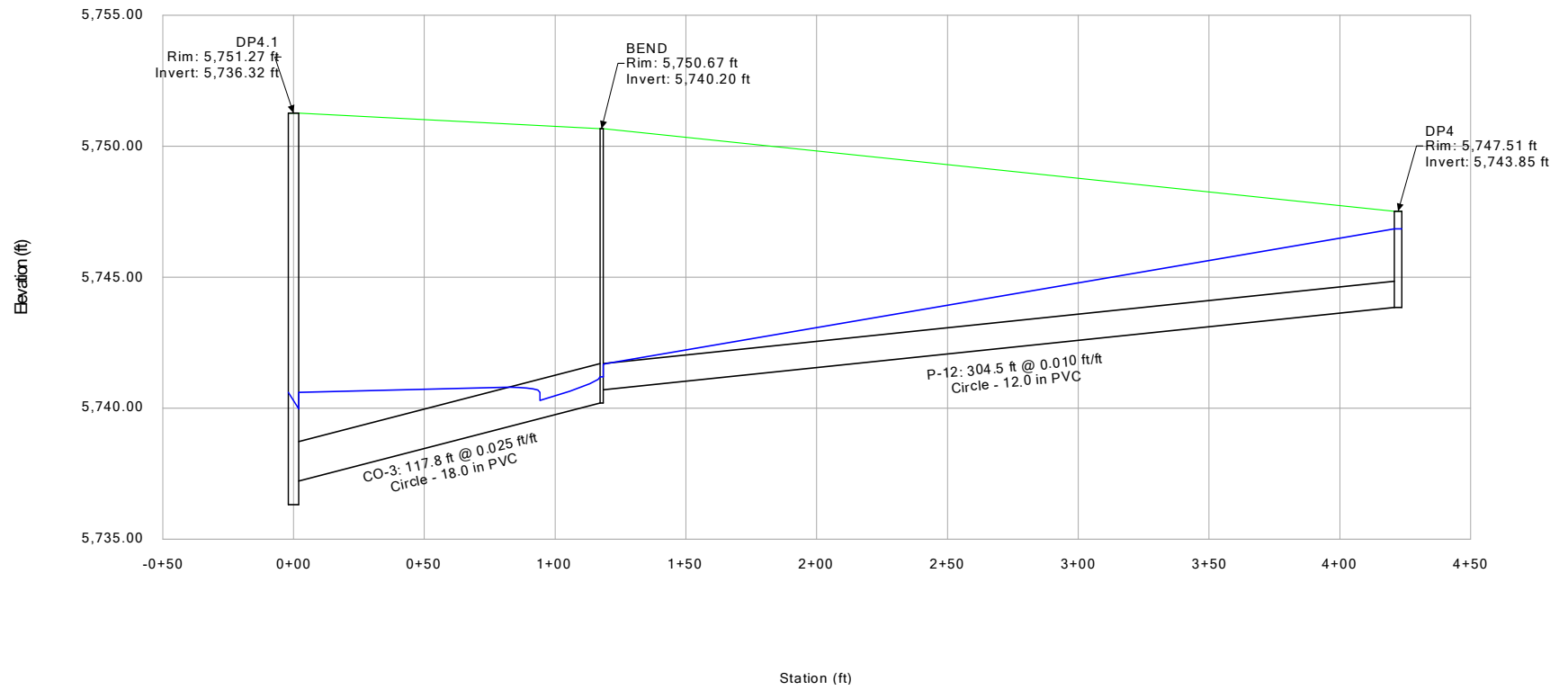
Profile Report

Engineering Profile - 04-Storm (Cottages_Mesa_Ridge.stsw)



100-YEAR SCENARIO

Profile Report
Engineering Profile - 05-Storm (Cottages_Mesa_Ridge.stsw)



24" RCP Outfall Riprap Sizing			
S (ft/ft)	C _f	q (cfs/ft)	D ₅₀ (in)
0.04	2	18.90	11.85

Type M Riprap (D ₅₀ = 12") will be utilized for the riprap energy dissipation 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

CUHP SUBCATCHMENTS - PROPOSED CONDITION

CUHP SUBCATCHMENTS

Columns with this color heading are for required user-input
 Columns with this color heading are for optional override values
 Columns with this color heading are for program-calculated values

Subcatchment Name	EPA SWMM Target Node	Raingage	Area (mi ²)	Length to Centroid (mi)	Length (mi)	Slope (ft/ft)	Percent Imperviousness	Maximum Depression Storage (Watershed inches)		Horton's Infiltration Parameters			DCIA Level 0, 1, or 2	Comment
								Pervious	Impervious	Initial Rate (in/hr)	Decay Coefficient (1/seconds)	Final Rate (in/hr)		
6001	E6001	100-YR	0.1120	0.2178	0.4356	0.012	40	0.35	0.1	4.5	0.0018	0.6	0	
6005	E6005	100-YR	0.0362	0.0786	0.2235	0.030	40	0.35	0.1	4.5	0.0018	0.6	0	
6010	E6010	100-YR	0.0433	0.1009	0.2216	0.049	50	0.35	0.1	4.5	0.0018	0.6	0	Updated imperviousness to include open space
6011	E6011	100-YR	0.0267	0.1621	0.3136	0.036	60	0.35	0.1	4.5	0.0018	0.6	0	
6020	E6020	100-YR	0.0300	0.1345	0.2083	0.050	45	0.35	0.1	4.5	0.0018	0.6	0	Updated to single-family imperviousness
1040	E1040	100-YR	0.0174	0.0758	0.1894	0.022	55.5	0.35	0.1	4.5	0.0018	0.6	0	Updated for new size and imperviousness

Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

5-Year Event

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
6,001		0.094	0.175	23.6	3.47	12.3	2.45	5.8	142	260,198	0.56	145,367	34.0	45	145,362	0.62
6,005		0.094	0.105	14.0	1.43	7.3	1.01	2.4	77	84,100	0.56	46,985	31.0	21	46,984	0.89
6,010	Updated imperviousness to include open space	0.089	0.130	10.7	1.37	5.6	0.97	2.3	121	100,595	0.68	68,520	30.0	33	68,523	1.21
6,011		0.085	0.114	18.5	1.92	9.6	1.35	3.2	43	62,029	0.81	49,990	31.0	17	49,984	0.99
6,020	Updated to single-family imperviousness	0.092	0.104	15.2	1.52	7.9	1.07	2.5	59	69,696	0.62	43,184	31.0	17	43,176	0.91
1,040	Updated for new size and imperviousness	0.087	0.091	14.6	1.32	7.6	0.93	2.2	36	40,424	0.75	30,292	31.0	12	30,298	1.08

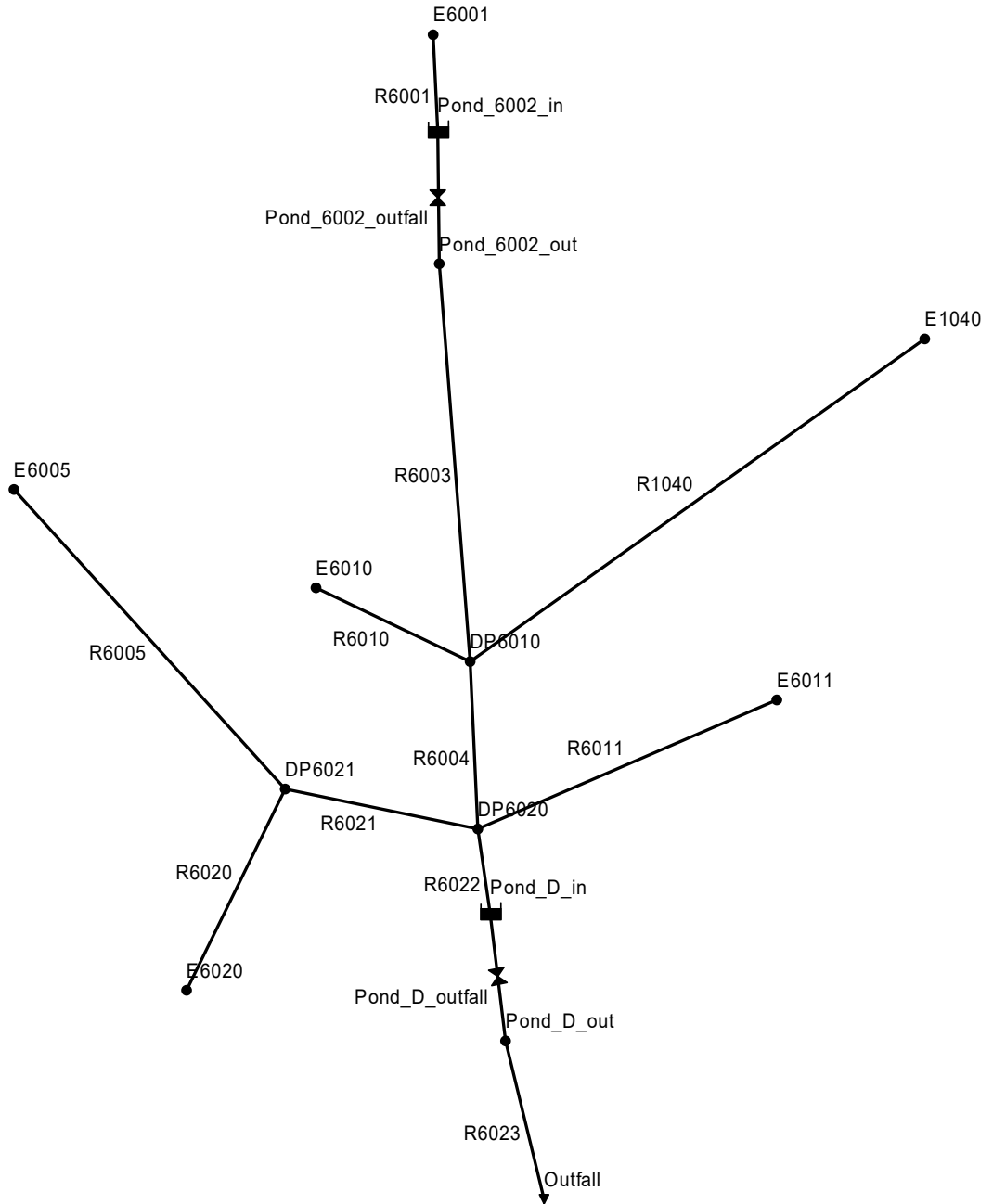
Summary of Unit Hydrograph Parameters Used By Program and Calculated Results (Version 2.0.1)

100-Year Event

Catchment Name/ID	User Comment for Catchment	Unit Hydrograph Parameters and Results									Excess Precip.		Storm Hydrograph			
		CT	Cp	W50 (min.)	W50 Before Peak	W75 (min.)	W75 Before Peak	Time to Peak (min.)	Peak (cfs)	Volume (c.f)	Excess (inches)	Excess (c.f.)	Time to Peak (min.)	Peak Flow (cfs)	Total Volume (c.f.)	Runoff per Unit Area (cfs/acre)
6,001		0.094	0.178	23.1	3.45	12.0	2.44	5.7	146	260,198	2.09	542,819	40.0	173	542,806	2.41
6,005		0.094	0.107	13.7	1.42	7.1	1.01	2.4	79	84,100	2.09	175,447	36.0	77	175,455	3.32
6,010	Updated imperviousness to include open space	0.089	0.131	10.5	1.36	5.5	0.96	2.3	123	100,595	2.22	223,481	35.0	110	223,473	3.96
6,011		0.084	0.115	18.3	1.91	9.5	1.35	3.2	44	62,029	2.36	146,231	37.0	51	146,214	2.99
6,020	Updated to single-family imperviousness	0.091	0.105	15.0	1.51	7.8	1.07	2.5	60	69,696	2.15	150,108	36.0	62	150,075	3.21
1,040	Updated for new size and imperviousness	0.086	0.091	14.4	1.31	7.5	0.93	2.2	36	40,424	2.30	92,819	35.0	38	92,844	3.39

The Cottages at Mesa Ridge

01/01/2005 00:05:00



The Cottages at Mesa Ridge
Final Drainage Report
EPA SWMM Input Parameters

[TITLE]
;;Project Title/Notes

[OPTIONS]
;;Option Value
FLOW_UNITS CFS
INFILTRATION HORTON
FLOW_ROUTING KINWAVE
LINK_OFFSETS DEPTH
MIN_SLOPE 0
ALLOW_PONDING NO
SKIP_STEADY_STATE NO

START_DATE 01/01/2005
START_TIME 00:00:00
REPORT_START_DATE 01/01/2005
REPORT_START_TIME 00:00:00
END_DATE 01/01/2005
END_TIME 12:00:00
SWEEP_START 01/01
SWEEP_END 12/31
DRY_DAYS 0
REPORT_STEP 00:05:00
WET_STEP 00:05:00
DRY_STEP 01:00:00
ROUTING_STEP 0:01:00

INERTIAL_DAMPING PARTIAL
NORMAL_FLOW_LIMITED BOTH
FORCE_MAIN_EQUATION H-W
VARIABLE_STEP 0.75
LENGTHENING_STEP 0
MIN_SURFAREA 12.557
MAX_TRIALS 8
HEAD_TOLERANCE 0.005
SYS_FLOW_TOL 5
LAT_FLOW_TOL 5
MINIMUM_STEP 0.5
THREADS 1

[FILES]
;;Interfacing Files
USE INFLOWS "SWMM_Interface_100.txt"

[EVAPORATION]
;;Data Source Parameters
;;-----
CONSTANT 0.0
DRY_ONLY NO

[JUNCTIONS] ;;Name	Elevation	MaxDepth	InitDepth	SurDepth	Aponded
E6005	5713.69	0	0	0	0
E6010	5693.19	0	0	0	0
E6001	5750.46	0	0	0	0
E1040	5732.27	0	0	0	0
E6011	5688.69	0	0	0	0
E6020	5691.39	0	0	0	0
DP6010	5688.19	0	0	0	0
DP6021	5691.19	0	0	0	0
DP6020	5683.69	0	0	0	0
Pond_D_out	5682.59	0	0	0	0
Pond_6002_out	5748.46	0	0	0	0

[OUTFALLS] ;;Name	Elevation	Type	Stage Data	Gated	Route To
Outfall	5672.84	FREE		NO	

[STORAGE] ;;Name	Elev.	MaxDepth	InitDepth	Shape	Curve Name/Params	N/A	Fevap	Psi
Ksat IMD								
Pond_6002_in	5749.46	15	0	TABULAR	Pond_6002_Storage	0	0	
Pond_D_in	5683.69	12	0	TABULAR	Pond_D_Storage	0	0	

The Cottages at Mesa Ridge
Final Drainage Report
EPA SWMM Input Parameters

```
[CONDUITS]
;;Name          From Node      To Node      Length      Roughness    InOffset    OutOffset    InitFlow
MaxFlow
;-----
;ROUTE E1040 TO DP6010
R1040          E1040          DP6010      1025        .03          0           0           0           0
R6003          Pond_6002_out  DP6010      1230        .040         0           0           0           0
R6004          DP6010         DP6020      225         .013         0           0           0           0
R6005          E6005          DP6021      750         .013         0           0           0           0
R6011          E6011          DP6020      100         0.01         0           0           0           0
R6010          E6010          DP6010      100         0.01         0           0           0           0
R6021          DP6021         DP6020      250         .013         0           0           0           0
R6020          E6020          DP6021      100         0.01         0           0           0           0
R6001          E6001          Pond_6002_in 100         0.01         0           0           0           0
R6022          DP6020         Pond_D_in    100         0.01         0           0           0           0
R6023          Pond_D_out     Outfall     325         .013         0           0           0           0

[OUTLETS]
;;Name          From Node      To Node      Offset      Type          QTable/Qcoeff  Qexpon
Gated
;-----
Pond_6002_outfall Pond_6002_in  Pond_6002_out  0           TABULAR/DEPTH  Pond_6002_Release
NO
Pond_D_outfall    Pond_D_in     Pond_D_out     0           TABULAR/DEPTH  Pond_D_Release_Proposed
NO

[XSECTIONS]
;;Link          Shape          Geom1         Geom2         Geom3         Geom4         Barrels      Culvert
;-----
R1040          TRAPEZOIDAL   5             10            4             4             1
R6003          TRAPEZOIDAL   5             10            3             3             1
R6004          CIRCULAR      4.5          0             0             0             1
R6005          CIRCULAR      3            0             0             0             1
R6011          DUMMY         0            0             0             0             1
R6010          DUMMY         0            0             0             0             1
R6021          CIRCULAR      4            0             0             0             1
R6020          DUMMY         0            0             0             0             1
R6001          DUMMY         0            0             0             0             1
R6022          DUMMY         0            0             0             0             1
R6023          RECT_CLOSED   6            12            0             0             1

[CURVES]
;;Name          Type          X-Value      Y-Value
;-----
Pond_6002_Release Rating      0.0          0.0
Pond_6002_Release      4.0          1.0
Pond_6002_Release      5.8          1.0
Pond_6002_Release      6.0          45.0
Pond_6002_Release      6.5          78.0
Pond_6002_Release      7.0          101.0
Pond_6002_Release      7.5          104.0
Pond_6002_Release      8.0          105.0
Pond_6002_Release      9.0          108.0
Pond_6002_Release      10.0         155.0
;
Pond_D_Release Rating      0.0          0.0
Pond_D_Release      4.0          1.0
Pond_D_Release      5.8          1.0
Pond_D_Release      6.0          45.0
Pond_D_Release      6.5          78.0
Pond_D_Release      7.0          101.0
Pond_D_Release      7.5          104.0
Pond_D_Release      8.0          105.0
Pond_D_Release      9.0          108.0
Pond_D_Release      10.0         155.0
;
Pond_D_Release_Proposed Rating      0           0
Pond_D_Release_Proposed      0.5         0.18
Pond_D_Release_Proposed      1           0.33
Pond_D_Release_Proposed      1.5         0.58
Pond_D_Release_Proposed      2           0.85
Pond_D_Release_Proposed      2.23        0.94
Pond_D_Release_Proposed      2.5         1.04
Pond_D_Release_Proposed      3           1.2
Pond_D_Release_Proposed      3.5         1.33
Pond_D_Release_Proposed      4           1.45
Pond_D_Release_Proposed      4.5         1.57
Pond_D_Release_Proposed      4.86        1.64
Pond_D_Release_Proposed      5           1.67
```

The Cottages at Mesa Ridge
Final Drainage Report
EPA SWMM Input Parameters

Pond_D_Release_Proposed		5.5	3.41
Pond_D_Release_Proposed		5.91	9.14
Pond_D_Release_Proposed		6	10.82
Pond_D_Release_Proposed		6.75	30.33
Pond_D_Release_Proposed		7	39.06
Pond_D_Release_Proposed		7.5	58.97
Pond_D_Release_Proposed		8	83.01
Pond_D_Release_Proposed		8.5	110.04
Pond_D_Release_Proposed		9	139.71
Pond_D_Release_Proposed		9.5	171.79
Pond_D_Release_Proposed		10	206.11
Pond_D_Release_Proposed		10.32	229.19
Pond_D_Release_Proposed		10.5	242.53
Pond_D_Release_Proposed		11	280.92
Pond_D_Release_Proposed		11.5	488.1
Pond_D_Release_Proposed		11.6	552.09

```

;
Pond_D_Storage Storage 0 0
Pond_D_Storage 0.5 11012.5
Pond_D_Storage 1 28227
Pond_D_Storage 1.5 46992
Pond_D_Storage 2 52539.4
Pond_D_Storage 2.23 53571.2
Pond_D_Storage 2.5 54782.4
Pond_D_Storage 3 56603.4
Pond_D_Storage 3.5 58318.9
Pond_D_Storage 4 60873.6
Pond_D_Storage 4.5 63638.1
Pond_D_Storage 4.89 65067.4
Pond_D_Storage 5 65399.8
Pond_D_Storage 5.5 66910.8
Pond_D_Storage 5.8 67828.8
Pond_D_Storage 6 68444.6
Pond_D_Storage 6.5 69984.1
Pond_D_Storage 7 71558.4
Pond_D_Storage 7.5 73141.4
Pond_D_Storage 8 73607.2
Pond_D_Storage 8.5 73793.7
Pond_D_Storage 9 76336.2
Pond_D_Storage 9.5 79467.7
Pond_D_Storage 10 81579.6
Pond_D_Storage 10.43 83176.6
Pond_D_Storage 10.5 83436.6
Pond_D_Storage 11 85250
Pond_D_Storage 11.5 87052.5
Pond_D_Storage 11.6 87413
;

```

```

Pond_6002_Storage Storage 0 5301
Pond_6002_Storage 1 6600
Pond_6002_Storage 2 8028
Pond_6002_Storage 3 9583
Pond_6002_Storage 4 11267
Pond_6002_Storage 5 13078
Pond_6002_Storage 6 15018
Pond_6002_Storage 7 17086
Pond_6002_Storage 7.37 17883
Pond_6002_Storage 8 19281
Pond_6002_Storage 9 21557
;

```

```

[REPORT]
;;Reporting Options
INPUT NO
CONTROLS NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

```

[TAGS]

```

[MAP]
DIMENSIONS -2634.831 0.000 12634.831 10000.000
Units None

```

```

[COORDINATES]
;;Node X-Coord Y-Coord
;-----
E6005 1343.714 6170.704
E6010 3662.053 5409.458
E6001 4561.707 9665.513
E1040 8321.799 7324.106
E6011 7191.465 4555.940

```

The Cottages at Mesa Ridge
Final Drainage Report
EPA SWMM Input Parameters

E6020	2670.127	2318.339
DP6010	4846.323	4851.811
DP6021	3430.296	3874.863
DP6020	4896.194	3564.014
Pond_D_out	5109.769	1931.943
Pond_6002_out	4607.843	7900.807
Outfall	5403.691	715.110
Pond_6002_in	4596.309	8915.802
Pond_D_in	5000.000	2908.891

[VERTICES]
;;Link X-Coord Y-Coord
;;-----

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

WARNING 04: minimum elevation drop used for Conduit R6022

 NOTE: The summary statistics displayed in this report are based on results found at every computational time step, not just on results from each reporting time step.

 Analysis Options

 Flow Units CFS
 Process Models:
 Rainfall/Runoff NO
 RDII NO
 Snowmelt NO
 Groundwater NO
 Flow Routing YES
 Ponding Allowed NO
 Water Quality NO
 Flow Routing Method KINWAVE
 Starting Date 01/01/2005 00:00:00
 Ending Date 01/01/2005 12:00:00
 Antecedent Dry Days 0.0
 Report Time Step 00:05:00
 Routing Time Step 60.00 sec

	Volume acre-feet	Volume 10 ⁶ gal
Flow Routing Continuity	-----	-----
Dry Weather Inflow	0.000	0.000
Wet Weather Inflow	0.000	0.000
Groundwater Inflow	0.000	0.000
RDII Inflow	0.000	0.000
External Inflow	30.551	9.956
External Outflow	24.620	8.023
Flooding Loss	0.000	0.000
Evaporation Loss	0.000	0.000
Exfiltration Loss	0.000	0.000
Initial Stored Volume	0.000	0.000
Final Stored Volume	5.917	1.928
Continuity Error (%)	0.048	

 Highest Flow Instability Indexes

 All links are stable.

 Routing Time Step Summary

 Minimum Time Step : 60.00 sec
 Average Time Step : 60.00 sec
 Maximum Time Step : 60.00 sec
 Percent in Steady State : 0.00
 Average Iterations per Step : 1.14
 Percent Not Converging : 0.00

 Node Depth Summary

Node	Type	Average Depth Feet	Maximum Depth Feet	Maximum HGL Feet	Time of Max Occurrence days hr:min	Reported Max Depth Feet
E6005	JUNCTION	0.14	1.79	5715.48	0 00:37	1.76
E6010	JUNCTION	0.00	0.00	5693.19	0 00:00	0.00
E6001	JUNCTION	0.00	0.00	5750.46	0 00:00	0.00
E1040	JUNCTION	0.04	0.52	5732.79	0 00:36	0.52
E6011	JUNCTION	0.00	0.00	5688.69	0 00:00	0.00
E6020	JUNCTION	0.00	0.00	5691.39	0 00:00	0.00

The Cottages at Mesa Ridge
 Final Drainage Report
 EPA SWMM Results – 100-year with pond modifications

DP6010	JUNCTION	0.48	3.13	5691.32	0	00:42	3.06
DP6021	JUNCTION	0.18	2.13	5693.32	0	00:37	2.09
DP6020	JUNCTION	0.48	3.13	5686.82	0	00:42	3.05
Pond_D_out	JUNCTION	0.18	1.04	5683.63	0	01:13	1.04
Pond_6002_out	JUNCTION	0.18	1.25	5749.71	0	00:59	1.24
Outfall	OUTFALL	0.18	1.04	5673.88	0	01:13	1.04
Pond_6002_in	STORAGE	4.90	9.61	5759.07	0	00:59	9.61
Pond_D_in	STORAGE	5.72	10.33	5694.02	0	01:13	10.32

 Node Inflow Summary

Node	Type	Maximum Lateral Inflow CFS	Maximum Total Inflow CFS	Time of Max Occurrence days hr:min	Lateral Inflow Volume 10^6 gal	Total Inflow Volume 10^6 gal	Flow Balance Error Percent
E6005	JUNCTION	76.91	76.91	0 00:37	1.31	1.31	0.000
E6010	JUNCTION	109.76	109.76	0 00:36	1.67	1.67	0.000
E6001	JUNCTION	172.95	172.95	0 00:41	4.06	4.06	0.000
E1040	JUNCTION	37.80	37.80	0 00:36	0.694	0.694	0.000
E6011	JUNCTION	51.06	51.06	0 00:38	1.09	1.09	0.000
E6020	JUNCTION	61.62	61.62	0 00:37	1.12	1.12	0.000
DP6010	JUNCTION	0.00	230.53	0 00:42	0	6.24	0.000
DP6021	JUNCTION	0.00	138.54	0 00:37	0	2.43	0.000
DP6020	JUNCTION	0.00	410.85	0 00:41	0	9.77	0.000
Pond_D_out	JUNCTION	0.00	229.63	0 01:13	0	8.02	0.000
Pond_6002_out	JUNCTION	0.00	136.68	0 00:59	0	3.87	0.000
Outfall	OUTFALL	0.00	229.63	0 01:13	0	8.02	0.000
Pond_6002_in	STORAGE	0.00	172.95	0 00:41	0	4.06	0.152
Pond_D_in	STORAGE	0.00	410.85	0 00:41	0	9.77	0.050

 Node Flooding Summary

No nodes were flooded.

 Storage Volume Summary

Storage Unit	Average Volume 1000 ft3	Avg Pcnt Full	Evap Pcnt Loss	Exfil Pcnt Loss	Maximum Volume 1000 ft3	Max Pcnt Full	Time of Max Occurrence days hr:min	Maximum Outflow CFS
Pond_6002_in	45.849	16	0	0	126.976	45	0 00:59	136.68
Pond_D_in	286.568	37	0	0	623.205	81	0 01:13	229.63

 Outfall Loading Summary

Outfall Node	Flow Freq Pcnt	Avg Flow CFS	Max Flow CFS	Total Volume 10^6 gal
Outfall	98.06	25.32	229.63	8.022
System	98.06	25.32	229.63	8.022

 Link Flow Summary

Link	Type	Maximum Flow CFS	Time of Max Occurrence days hr:min	Maximum Veloc ft/sec	Max/ Full Flow	Max/ Full Depth
R1040	CONDUIT	37.50	0 00:38	5.98	0.01	0.10
R6003	CONDUIT	136.55	0 01:01	8.00	0.06	0.25

The Cottages at Mesa Ridge
Final Drainage Report
EPA SWMM Results – 100-year with pond modifications

R6004	CONDUIT	230.69	0	00:42	19.55	0.83	0.70
R6005	CONDUIT	76.92	0	00:37	17.52	0.67	0.60
R6011	DUMMY	51.06	0	00:38			
R6010	DUMMY	109.76	0	00:36			
R6021	CONDUIT	138.54	0	00:37	20.33	0.56	0.53
R6020	DUMMY	61.62	0	00:37			
R6001	DUMMY	172.95	0	00:41			
R6022	DUMMY	410.85	0	00:41			
R6023	CONDUIT	229.63	0	01:13	18.32	0.10	0.17
Pond_6002_outfall	DUMMY	136.68	0	00:59			
Pond_D_outfall	DUMMY	229.63	0	01:13			

Conduit Surcharge Summary

No conduits were surcharged.

Analysis begun on: Wed Oct 05 13:18:56 2022
Analysis ended on: Wed Oct 05 13:18:56 2022
Total elapsed time: < 1 sec

Table - Node Total Inflow

Days	Hours	Node DP6020
0	00:05:00	0.00
0	00:10:00	0.00
0	00:15:00	3.68
0	00:20:00	22.20
0	00:25:00	57.77
0	00:30:00	91.60
0	00:35:00	93.99
0	00:40:00	80.35
0	00:45:00	66.57
0	00:50:00	57.98
0	00:55:00	75.96
0	01:00:00	67.76
0	01:05:00	59.44
0	01:10:00	52.51
0	01:15:00	46.43
0	01:20:00	40.52
0	01:25:00	35.86
0	01:30:00	32.59
0	01:35:00	29.91
0	01:40:00	27.25
0	01:45:00	24.14
0	01:50:00	21.44
0	01:55:00	19.09
0	02:00:00	17.45
0	02:05:00	14.98
0	02:10:00	11.89
0	02:15:00	9.04
0	02:20:00	7.01
0	02:25:00	5.27
0	02:30:00	4.08

Days	Hours	Node DP6020
0	02:35:00	3.12
0	02:40:00	2.39
0	02:45:00	1.78
0	02:50:00	1.41
0	02:55:00	1.22
0	03:00:00	1.11
0	03:05:00	1.06
0	03:10:00	1.03
0	03:15:00	1.02
0	03:20:00	1.02
0	03:25:00	1.01
0	03:30:00	1.01
0	03:35:00	1.01
0	03:40:00	1.01
0	03:45:00	1.01
0	03:50:00	1.01
0	03:55:00	1.00
0	04:00:00	1.00
0	04:05:00	1.00
0	04:10:00	1.00
0	04:15:00	1.00
0	04:20:00	1.00
0	04:25:00	1.00
0	04:30:00	1.00
0	04:35:00	1.00
0	04:40:00	1.00
0	04:45:00	1.00
0	04:50:00	1.00
0	04:55:00	1.00
0	05:00:00	1.00
0	05:05:00	1.00

Days	Hours	Node DP6020
0	05:10:00	1.00
0	05:15:00	1.00
0	05:20:00	1.00
0	05:25:00	1.00
0	05:30:00	1.00
0	05:35:00	1.00
0	05:40:00	1.00
0	05:45:00	1.00
0	05:50:00	1.00
0	05:55:00	1.00
0	06:00:00	1.00
0	06:05:00	1.00
0	06:10:00	1.00
0	06:15:00	1.00
0	06:20:00	1.00
0	06:25:00	1.00
0	06:30:00	1.00
0	06:35:00	1.00
0	06:40:00	1.00
0	06:45:00	1.00
0	06:50:00	1.00
0	06:55:00	1.00
0	07:00:00	1.00
0	07:05:00	1.00
0	07:10:00	1.00
0	07:15:00	1.00
0	07:20:00	1.00
0	07:25:00	1.00
0	07:30:00	1.00
0	07:35:00	1.00
0	07:40:00	1.00

Days	Hours	Node DP6020
0	07:45:00	1.00
0	07:50:00	1.00
0	07:55:00	1.00
0	08:00:00	1.00
0	08:05:00	1.00
0	08:10:00	1.00
0	08:15:00	1.00
0	08:20:00	1.00
0	08:25:00	1.00
0	08:30:00	1.00
0	08:35:00	1.00
0	08:40:00	1.00
0	08:45:00	1.00
0	08:50:00	1.00
0	08:55:00	1.00
0	09:00:00	1.00
0	09:05:00	1.00
0	09:10:00	1.00
0	09:15:00	1.00
0	09:20:00	1.00
0	09:25:00	1.00
0	09:30:00	1.00
0	09:35:00	1.00
0	09:40:00	0.99
0	09:45:00	0.99
0	09:50:00	0.98
0	09:55:00	0.97
0	10:00:00	0.97
0	10:05:00	0.96
0	10:10:00	0.95
0	10:15:00	0.95

Days	Hours	Node DP6020
0	10:20:00	0.94
0	10:25:00	0.93
0	10:30:00	0.93
0	10:35:00	0.92
0	10:40:00	0.91
0	10:45:00	0.91
0	10:50:00	0.90
0	10:55:00	0.90
0	11:00:00	0.89
0	11:05:00	0.88
0	11:10:00	0.88
0	11:15:00	0.87
0	11:20:00	0.86
0	11:25:00	0.86
0	11:30:00	0.85
0	11:35:00	0.85
0	11:40:00	0.84
0	11:45:00	0.83
0	11:50:00	0.83
0	11:55:00	0.82
0	12:00:00	0.82

Table - Node DP6020

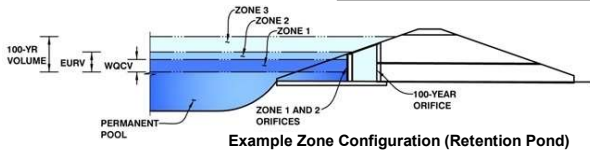
Days	Hours	Total Inflow (CFS)
0	00:05:00	0.00
0	00:10:00	0.00
0	00:15:00	9.15
0	00:20:00	29.86
0	00:25:00	75.86
0	00:30:00	224.30
0	00:35:00	325.58
0	00:40:00	406.85
0	00:45:00	390.58
0	00:50:00	355.85
0	00:55:00	338.34
0	01:00:00	312.73
0	01:05:00	287.31
0	01:10:00	252.73
0	01:15:00	214.47
0	01:20:00	180.60
0	01:25:00	159.97
0	01:30:00	144.87
0	01:35:00	132.09
0	01:40:00	96.60
0	01:45:00	70.38
0	01:50:00	50.94
0	01:55:00	42.18
0	02:00:00	36.02
0	02:05:00	29.75
0	02:10:00	22.55
0	02:15:00	16.89
0	02:20:00	12.59
0	02:25:00	9.33
0	02:30:00	6.83

Days	Hours	Total Inflow (CFS)
0	02:35:00	4.98
0	02:40:00	3.71
0	02:45:00	2.77
0	02:50:00	2.08
0	02:55:00	1.53
0	03:00:00	1.24
0	03:05:00	1.11
0	03:10:00	1.05
0	03:15:00	1.03
0	03:20:00	1.02
0	03:25:00	1.02
0	03:30:00	1.01
0	03:35:00	1.01
0	03:40:00	1.01
0	03:45:00	1.01
0	03:50:00	1.01
0	03:55:00	1.00
0	04:00:00	1.00
0	04:05:00	1.00
0	04:10:00	1.00
0	04:15:00	1.00
0	04:20:00	1.00
0	04:25:00	1.00
0	04:30:00	1.00
0	04:35:00	1.00
0	04:40:00	1.00
0	04:45:00	1.00
0	04:50:00	1.00
0	04:55:00	1.00
0	05:00:00	1.00
0	05:05:00	1.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Mesa Ridge Cottages
Basin ID: Existing Pond D Sizing Confirmation



	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (User)	4.79	5.144	Orifice Plate
Zone 2 (User)	5.00	0.316	Orifice Plate
Zone 3 (User)	8.77	6.110	Weir&Pipe (Rect.)
Total (all zones)		11.570	

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

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

Calculated Parameters for Underdrain

Underdrain Orifice Area = ft²
 Underdrain Orifice Centroid = feet

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

Invert of Lowest Orifice = 0.00 ft (relative to basin bottom at Stage = 0 ft)
 Depth at top of Zone using Orifice Plate = 4.46 ft (relative to basin bottom at Stage = 0 ft)
 Orifice Plate: Orifice Vertical Spacing = N/A inches
 Orifice Plate: Orifice Area per Row = N/A inches

Calculated Parameters for Plate

WQ Orifice Area per Row = N/A ft²
 Elliptical Half-Width = N/A feet
 Elliptical Slot Centroid = N/A feet
 Elliptical Slot Area = N/A ft²

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)	0.85	1.19	1.52	1.85	2.19	2.52	2.85	3.19
Orifice Area (sq. inches)	3.93	3.93	3.93	3.93	3.93	3.93	3.93	3.93

	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)		0.00	0.00	0.00	0.00	0.00	0.00	0.00
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

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

Calculated Parameters for Vertical Orifice

Vertical Orifice Area = Not Selected / Not Selected ft²
 Vertical Orifice Centroid = Not Selected / Not Selected feet

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.46	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	12.00	N/A	feet
Overflow Weir Grate Slope =	3.00	N/A	H:V
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Type =	Close Mesh Grate	N/A	
Debris Clogging % =	0%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H ₁ =	6.46	N/A	feet
Overflow Weir Slope Length =	6.32	N/A	feet
Grate Open Area / 100-yr Orifice Area =	3.34	N/A	
Overflow Grate Open Area w/o Debris =	60.03	N/A	ft ²
Overflow Grate Open Area w/ Debris =	60.03	N/A	ft ²

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

	Zone 3 Rectangular	Not Selected	
Depth to Invert of Outlet Pipe =	1.21	N/A	ft (distance below basin bottom at Stage = 0 ft)
Rectangular Orifice Width =	72.00	N/A	inches
Rectangular Orifice Height =	36.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Rectangular	Not Selected	
Outlet Orifice Area =	18.00	N/A	ft ²
Outlet Orifice Centroid =	1.50	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage = 11.00 ft (relative to basin bottom at Stage = 0 ft)
 Spillway Crest Length = 185.00 feet
 Spillway End Slopes = 4.00 H:V
 Freeboard above Max Water Surface = 0.40 feet

Calculated Parameters for Spillway

Spillway Design Flow Depth = 0.59 feet
 Stage at Top of Freeboard = 11.99 feet
 Basin Area at Top of Freeboard = 2.00 acres
 Basin Volume at Top of Freeboard = 16.89 acre-ft

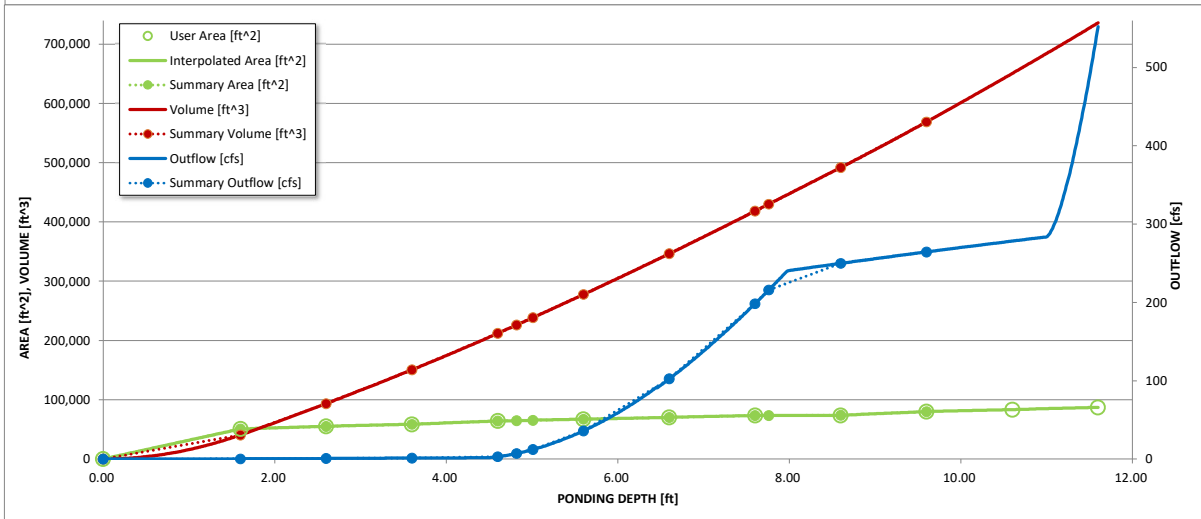
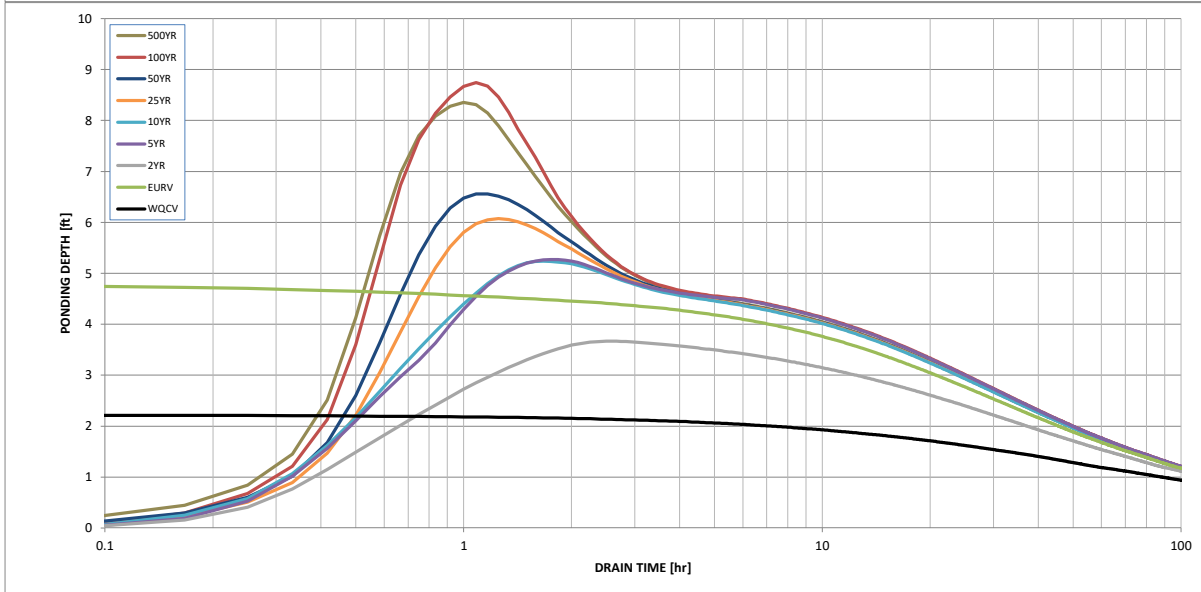
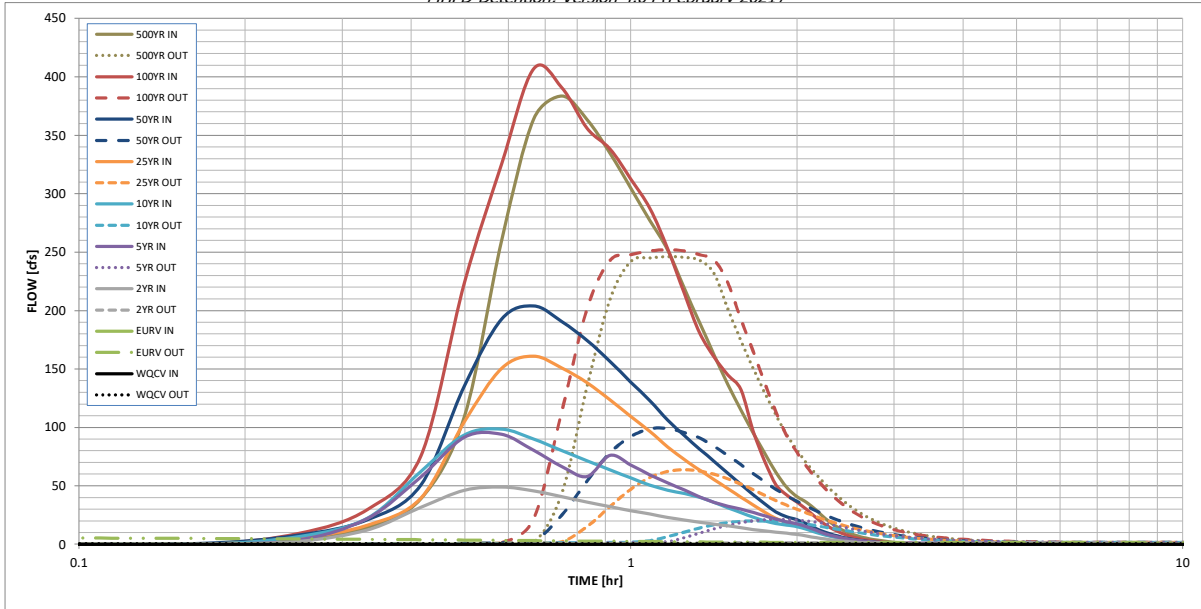
Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period =			1.00	1.28	1.55	1.97	2.34	2.74	3.84
One-Hour Rainfall Depth (in) =	N/A	N/A							
CUHP Runoff Volume (acre-ft) =	1.668	5.144	3.741	5.457	7.346	11.262	14.320	18.048	27.556
User Override Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	3.741	7.741	7.346	11.262	14.320	29.530	27.556
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	1.1	11.3	25.4	67.3	93.5	127.0	207.8
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.11	0.26	0.68	0.95	1.29	2.11
Peak Inflow Q (cfs) =	N/A	N/A	48.9	94.0	98.5	160.9	204.0	406.9	383.6
Peak Outflow Q (cfs) =	0.5	6.0	1.3	21.2	19.9	63.7	99.0	252.0	246.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.9	0.8	0.9	1.1	2.0	1.2
Structure Controlling Flow =	Plate	Overflow Weir 1	Plate	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	0.08	N/A	0.3	0.3	1.0	1.6	4.2	4.1
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) =	>120	>120	>120	>120	>120	>120	116	71	74
Time to Drain 99% of Inflow Volume (hours) =	>120	>120	>120	>120	>120	>120	>120	>120	>120
Maximum Ponding Depth (ft) =	2.22	4.79	3.67	5.27	5.24	6.07	6.56	8.75	8.35
Area at Maximum Ponding Depth (acres) =	1.23	1.49	1.35	1.52	1.52	1.58	1.61	1.72	1.69
Maximum Volume Stored (acre-ft) =	1.674	5.147	3.537	5.869	5.808	7.107	7.888	11.532	10.870
Equivalent Elevation (ft) =		5687.19	5686.07	5687.67	5687.64	5688.47	5688.96	5691.15	
Pond Bottom (ft) =		5682.400							

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHED-Detention, Version 4.04 (February 2021)



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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

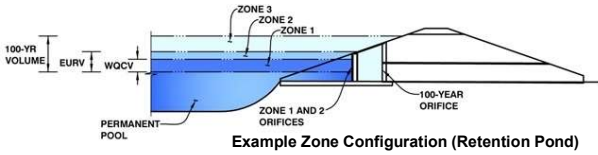
Time Interval	SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.00	3.10
	0:15:00	0.00	0.00	2.44	3.68	6.55	5.32	7.70	9.15	14.53
	0:20:00	0.00	0.00	12.33	22.20	22.34	16.41	20.93	29.86	39.05
	0:25:00	0.00	0.00	31.58	57.77	62.41	39.62	50.94	75.86	109.58
	0:30:00	0.00	0.00	46.22	91.60	93.69	104.96	135.84	224.30	260.19
	0:35:00	0.00	0.00	48.91	93.99	98.50	150.44	192.56	325.58	363.94
	0:40:00	0.00	0.00	45.62	80.35	89.94	160.90	203.99	406.85	383.58
	0:45:00	0.00	0.00	40.60	66.57	80.09	150.83	190.53	390.58	363.39
	0:50:00	0.00	0.00	35.99	57.98	71.32	138.19	174.41	355.85	334.71
	0:55:00	0.00	0.00	32.15	75.96	63.65	123.67	156.45	338.34	304.85
	1:00:00	0.00	0.00	28.76	67.76	56.73	109.40	138.82	312.73	277.04
	1:05:00	0.00	0.00	25.77	59.44	50.57	96.49	122.76	287.31	251.64
	1:10:00	0.00	0.00	23.01	52.51	46.21	83.22	106.15	252.73	219.04
	1:15:00	0.00	0.00	20.73	46.43	43.34	72.54	92.97	214.47	189.42
	1:20:00	0.00	0.00	18.86	40.52	40.02	63.39	81.32	180.60	161.73
	1:25:00	0.00	0.00	17.21	35.86	35.68	55.33	70.84	159.97	136.62
	1:30:00	0.00	0.00	15.65	32.59	31.19	47.55	60.66	144.87	114.69
	1:35:00	0.00	0.00	14.10	29.91	26.98	40.25	51.11	132.09	95.18
	1:40:00	0.00	0.00	12.60	27.25	23.19	33.50	42.33	96.60	77.40
	1:45:00	0.00	0.00	11.29	24.14	19.93	27.36	34.35	70.38	61.40
	1:50:00	0.00	0.00	10.39	21.44	17.77	22.10	27.59	50.94	48.63
	1:55:00	0.00	0.00	9.39	19.09	16.39	18.79	23.48	42.18	40.83
	2:00:00	0.00	0.00	8.39	17.45	15.05	16.78	20.94	36.02	35.83
	2:05:00	0.00	0.00	7.01	14.98	12.68	13.91	17.33	29.75	29.12
	2:10:00	0.00	0.00	5.61	11.89	10.10	10.82	13.44	22.55	22.17
	2:15:00	0.00	0.00	4.43	9.04	7.92	8.32	10.32	16.89	16.55
	2:20:00	0.00	0.00	3.50	7.01	6.19	6.42	7.92	12.59	12.30
	2:25:00	0.00	0.00	2.74	5.27	4.80	4.93	6.05	9.33	9.17
	2:30:00	0.00	0.00	2.14	4.08	3.67	3.77	4.61	6.83	6.96
	2:35:00	0.00	0.00	1.66	3.12	2.77	2.85	3.47	4.98	5.24
	2:40:00	0.00	0.00	1.28	2.39	2.09	2.15	2.61	3.71	4.00
	2:45:00	0.00	0.00	0.97	1.78	1.60	1.64	1.99	2.77	3.09
	2:50:00	0.00	0.00	0.72	1.41	1.20	1.24	1.50	2.08	2.32
	2:55:00	0.00	0.00	0.51	1.22	0.86	0.90	1.08	1.53	1.66
	3:00:00	0.00	0.00	0.33	1.11	0.57	0.61	0.73	1.24	1.11
	3:05:00	0.00	0.00	0.20	1.06	0.34	0.38	0.45	1.11	0.67
	3:10:00	0.00	0.00	0.10	1.03	0.18	0.20	0.23	1.05	0.34
	3:15:00	0.00	0.00	0.04	1.02	0.07	0.08	0.09	1.03	0.11
	3:20:00	0.00	0.00	0.01	1.02	0.01	0.01	0.01	1.02	0.00
	3:25:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.02	0.00
	3:30:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.01	0.00
	3:35:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.01	0.00
	3:40:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.01	0.00
	3:45:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.01	0.00
	3:50:00	0.00	0.00	0.00	1.01	0.00	0.00	0.00	1.01	0.00
	3:55:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:00:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:05:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:10:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:15:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:20:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:25:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:30:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:35:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:40:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:45:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:50:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:55:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:00:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:05:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:10:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:15:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:20:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:25:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:30:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:35:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:40:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:45:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:50:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:55:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	6:00:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Mesa Ridge Cottages

Basin ID: Existing Pond D Sizing Confirmation - with Structure Modifications



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (User)	4.86	5.14	Orifice Plate
Zone 2 (User)	5.92	1.61	Orifice Plate
Zone 3 (User)	10.31	7.53	Weir&Pipe (Rect.)
Total (all zones)		14.28	

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

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

Calculated Parameters for Underdrain

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

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	5.80	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	N/A	inches

Calculated Parameters for Plate

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

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

	Row 1 (required)	Row 2 (optional)	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	0.81	1.14	1.47	1.80			
Orifice Area (sq. inches)	7.60	5.00	5.00	5.00	2.00			

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

User Input: Vertical Orifice (Circular or Rectangular)

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

SEE CONSTRUCTION DOCUMENTS FOR MODIFICATIONS TO EX ORIFICE PLATE

Calculated Parameters for Vertical Orifice

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

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

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.24	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	12.00	N/A	feet
Overflow Weir Grate Slope =	3.00	N/A	H:V
Horiz. Length of Weir Sides =	6.00	N/A	feet
Overflow Grate Type =	Type C Grate	N/A	
Debris Clogging % =	0%	N/A	%

SEE CONSTRUCTION DOCUMENTS FOR MODIFICATIONS TO EX OUTLET STRUCT.

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H _g =	7.24	N/A	feet
Overflow Weir Slope Length =	6.32	N/A	feet
Grate Open Area / 100-yr Orifice Area =	2.93	N/A	
Grate Area w/o Debris =	52.82	N/A	ft ²
Grate Area w/ Debris =	52.82	N/A	ft ²

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

	Zone 3 Rectangular	Not Selected	
Depth to Invert of Outlet Pipe =	1.21	N/A	ft (distance below basin bottom at Stage = 0 ft)
Rectangular Orifice Width =	72.00	N/A	inches
Rectangular Orifice Height =	36.00	N/A	inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Rectangular	Not Selected	
Outlet Orifice Area =	18.00	N/A	ft ²
Outlet Orifice Centroid =	1.50	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage =	11.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	185.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	0.40	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth =	0.80	feet
Stage at Top of Freeboard =	12.20	feet
Basin Area at Top of Freeboard =	2.09	acres
Basin Volume at Top of Freeboard =	18.03	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).

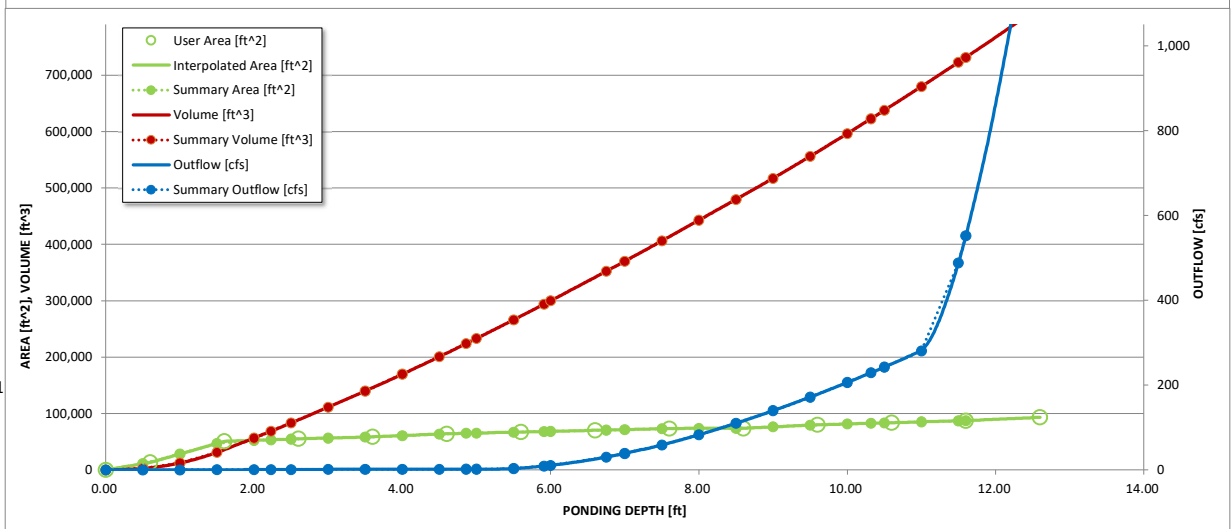
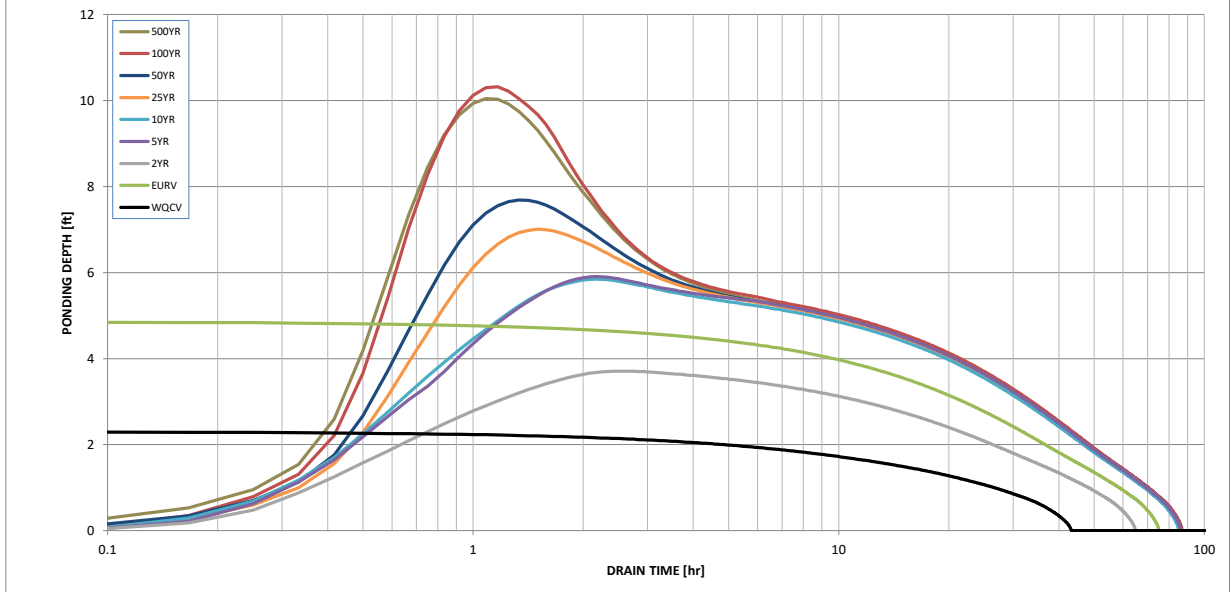
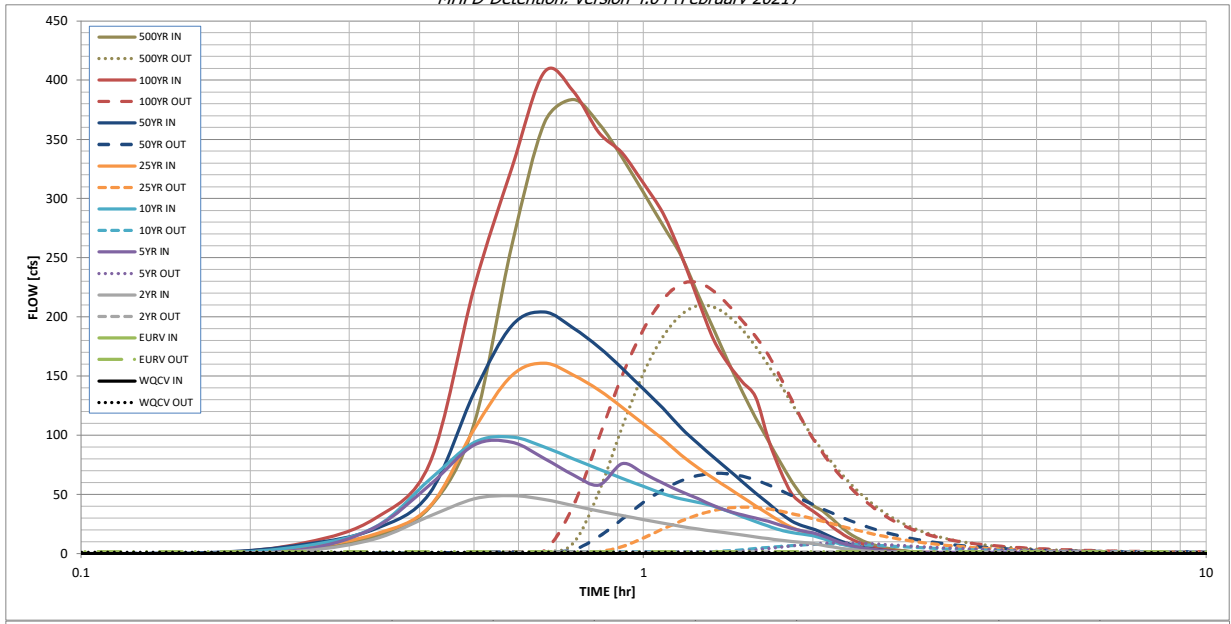
	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period	N/A	N/A	1.00	1.28	1.55	1.97	2.34	2.74	3.84
One-Hour Rainfall Depth (in)	1.668	5.144	3.741	5.457	7.346	11.262	14.320	18.048	27.556
CUHP Runoff Volume (acre-ft)	N/A	N/A	3.741	7.741	7.345	11.262	14.320	29.530	27.556
User Override Inflow Hydrograph Volume (acre-ft)	N/A	N/A	1.1	11.3	25.4	67.3	93.5	127.0	207.8
CUHP Predevelopment Peak Q (cfs)	N/A	N/A	0.01	0.11	0.26	0.68	0.95	2.37	2.11
OPTIONAL Override Predevelopment Peak Q (cfs)	N/A	N/A	48.9	94.0	98.5	160.9	204.0	406.9	333.3
Predevelopment Unit Peak Flow, q (cfs/acre)	N/A	N/A	1.4	9.1	8.1	39.3	67.7	229.1	209.4
Peak Inflow Q (cfs)	1.0	1.6	N/A	0.8	0.3	0.5	0.7	1.0	1.0
Peak Outflow Q (cfs)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ratio Peak Outflow to Predevelopment Q	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Structure Controlling Flow	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1
Max Velocity through Grate 1 (fps)	N/A	N/A	N/A	0.1	0.1	0.7	1.2	4.3	8.9
Max Velocity through Grate 2 (fps)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours)	39	64	56	72	71	67	65	55	56
Time to Drain 99% of Inflow Volume (hours)	41	70	61	80	79	77	76	70	70
Maximum Ponding Depth (ft)	2.31	4.86	3.71	5.91	5.85	7.01	7.69	10.32	10.05
Area at Maximum Ponding Depth (acres)	1.24	1.49	1.36	1.56	2.56	1.64	1.69	1.90	1.88
Maximum Volume Stored (acre-ft)	1.68	5.14	3.48	6.75	6.64	8.50	9.63	14.28	13.77
Equivalent Elevation (ft)		5687.26	5686.11	5688.31				5692.72	
Pond Bottom (ft)	5682.400								

RESULTS FROM CROSSED OUT STORM EVENTS ARE NOT VALID, ONLY THE 5-YR & 100-YR HYDROGRAPHS WERE REPLACED (FROM SWMM) IN THIS WORKSHEET

100 YR PEAK RELEASE SET BELOW VALUE PERSCRIBED IN 2013 MDDP (233 CFS)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)



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

DETENTION BASIN OUTLET STRUCTURE DESIGN

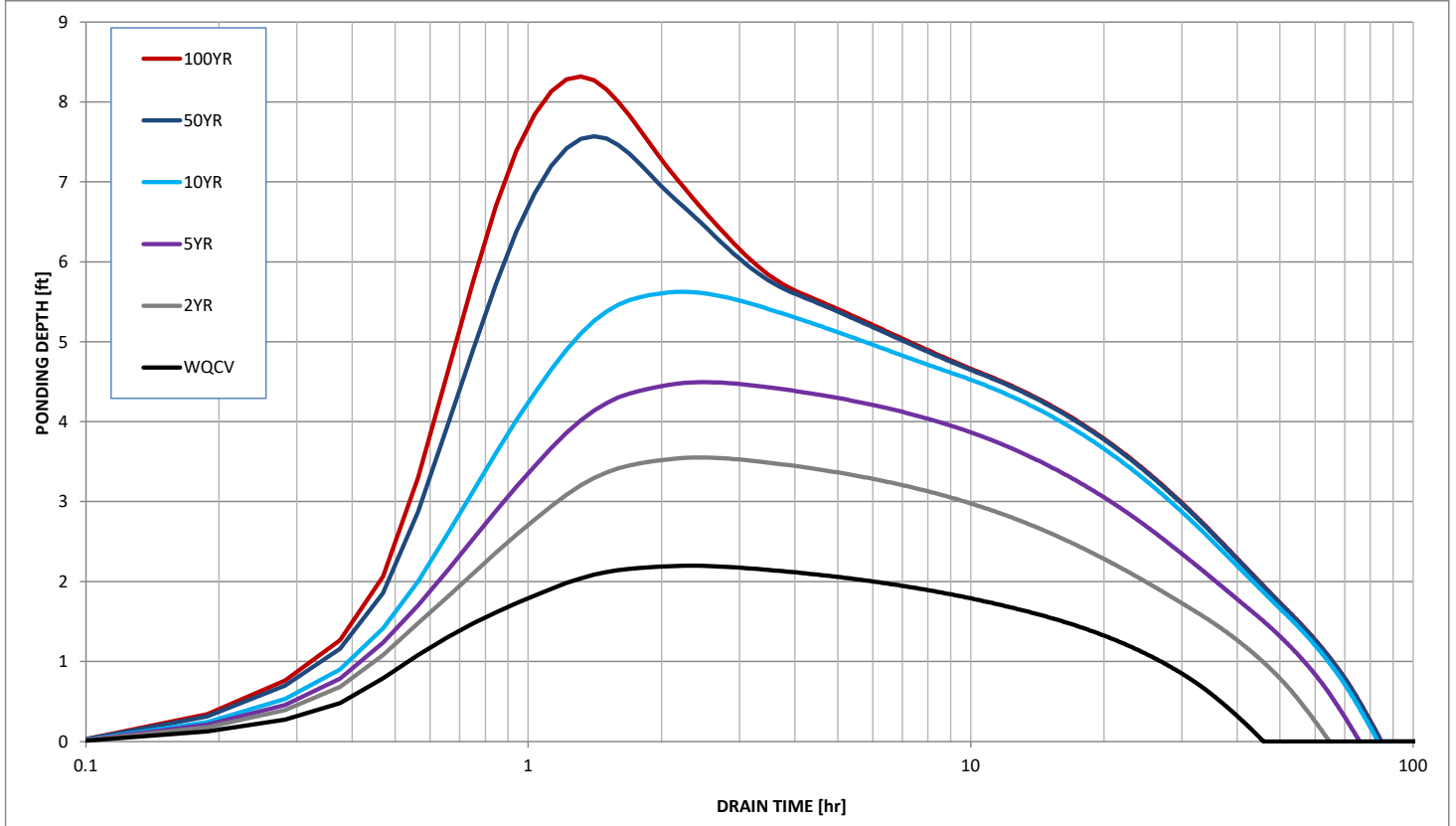
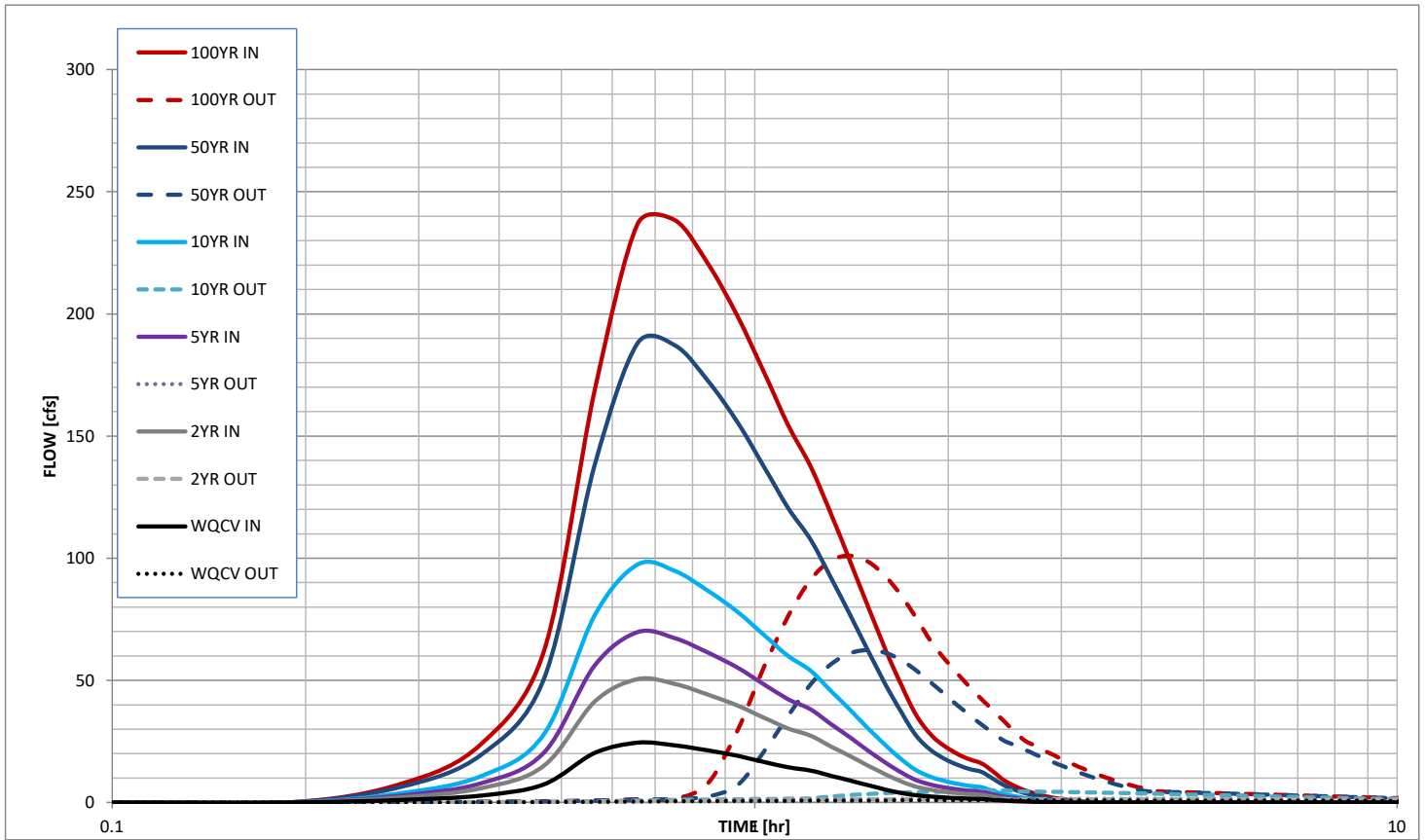
Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

Time Interval	SOURCE	CUHP	CUHP	CUHP	USER	CUHP	CUHP	CUHP	USER	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	0.71	0.00	3.10
	0:15:00	0.00	0.00	2.44	3.68	6.55	5.32	7.70	9.15	14.53
	0:20:00	0.00	0.00	12.33	22.20	22.34	16.41	20.93	29.86	39.05
	0:25:00	0.00	0.00	31.58	57.77	62.41	39.62	50.94	75.86	109.58
	0:30:00	0.00	0.00	46.22	91.60	93.69	104.96	135.84	224.30	260.19
	0:35:00	0.00	0.00	48.91	93.99	98.50	150.44	192.56	325.58	363.94
	0:40:00	0.00	0.00	45.62	80.35	89.94	160.90	203.99	406.85	383.58
	0:45:00	0.00	0.00	40.60	66.57	80.09	150.83	190.53	390.58	363.39
	0:50:00	0.00	0.00	35.99	57.98	71.32	138.19	174.41	355.85	334.71
	0:55:00	0.00	0.00	32.15	75.96	63.65	123.67	156.45	338.34	304.85
	1:00:00	0.00	0.00	28.76	67.76	56.73	109.40	138.82	312.73	277.04
	1:05:00	0.00	0.00	25.77	59.44	50.57	96.49	122.76	287.31	251.64
	1:10:00	0.00	0.00	23.01	52.51	46.21	83.22	106.15	252.73	219.04
	1:15:00	0.00	0.00	20.73	46.43	43.34	72.54	92.97	214.47	189.42
	1:20:00	0.00	0.00	18.86	40.52	40.02	63.39	81.32	180.60	161.73
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	1:30:00	0.00	0.00	15.65	32.59	31.19	47.55	60.66	144.87	114.69
	1:35:00	0.00	0.00	14.10	29.91	26.98	40.25	51.11	132.09	95.18
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	4:00:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
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	4:10:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:15:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:20:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	4:25:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
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	5:10:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:15:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:20:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:25:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
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	5:35:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:40:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:45:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:50:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	5:55:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
	6:00:00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00

Stormwater Detention and Infiltration Design Data Sheet



APPENDIX E – REFERENCE MATERIAL

**Mesa Ridge Development
Master Development Drainage Plan Update**

Fountain, Colorado

Prepared for:
Nor'wood Development
111 South Tejon Suite 222
Colorado Springs, Colorado 80903

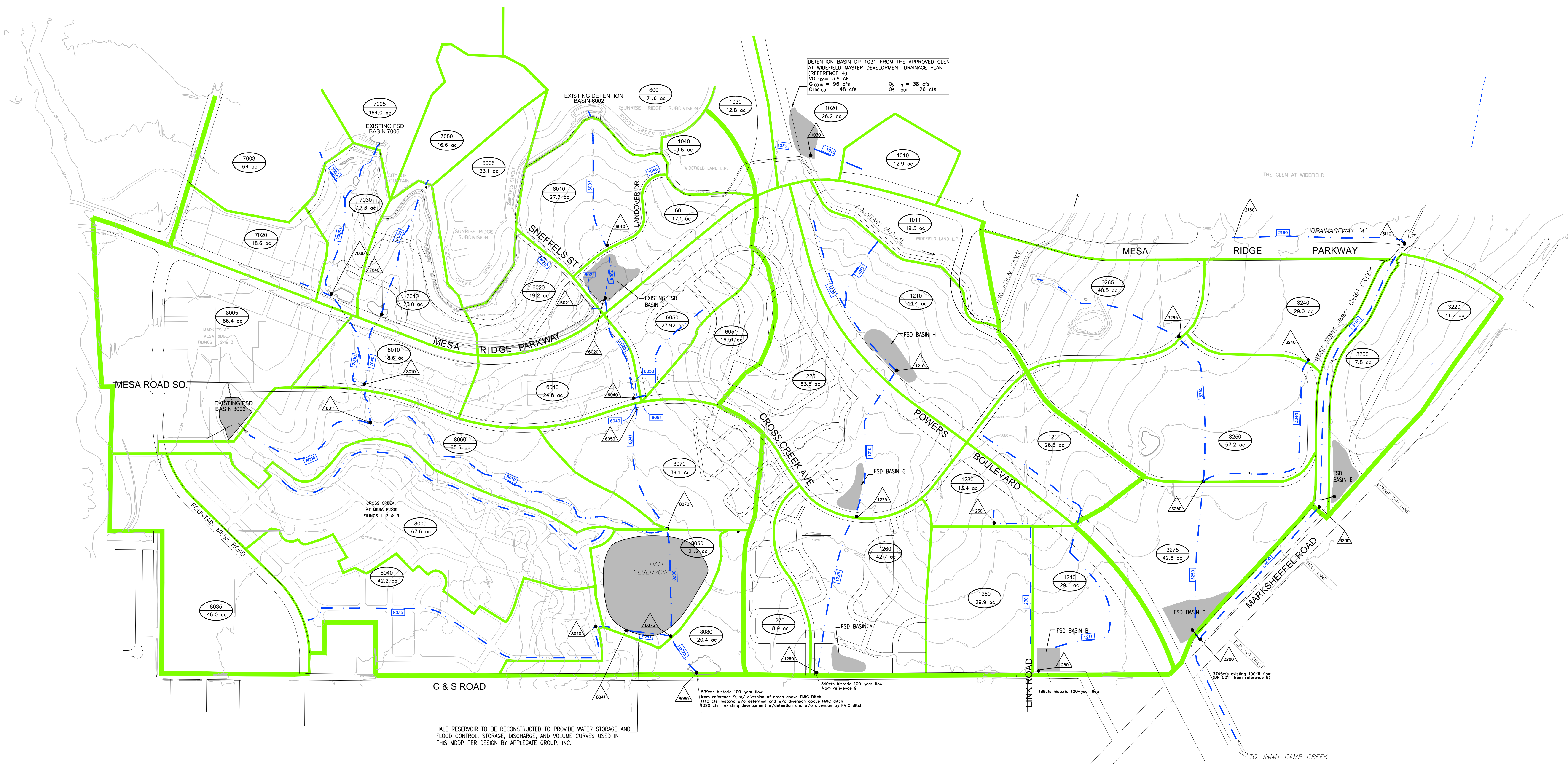
Prepared by:

Kiowa
Engineering Corporation

1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

Kiowa Project No. 11045

January 15, 2013



DETENTION BASIN DP 1031 FROM THE APPROVED GLEN AT WIDEFIELD MASTER DEVELOPMENT DRAINAGE PLAN (REFERENCE A)
 VOLUME = 3.9 ac-ft
 Q₁₀₀ = 96 cfs
 Q₅ = 38 cfs
 Q₁₀₀ = 48 cfs

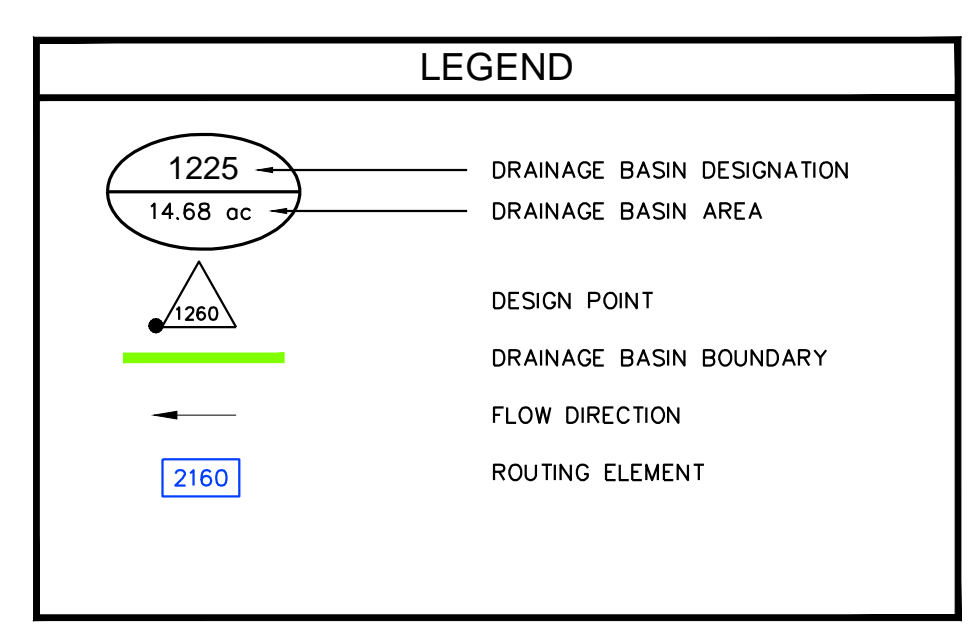
HALE RESERVOIR TO BE RECONSTRUCTED TO PROVIDE WATER STORAGE AND FLOOD CONTROL. STORAGE, DISCHARGE, AND VOLUME CURVES USED IN THIS MDDP PER DESIGN BY APPLICABLE GROUP, INC.

53% historic 100-year flow from reference #, w/ diversion of cross above FMC ditch
 110% historic w/o diversion and w/o diversion above FMC ditch
 130% cfs = existing development w/ diversion and w/o diversion by FMC ditch

18% historic 100-year flow from reference #
 24% historic 100-year flow (DP 3201 from reference #)

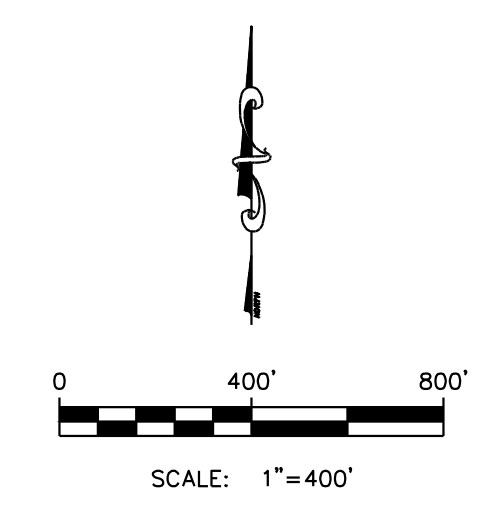
SUMMARY OF PROPOSED FSD BASIN DATA (24-HOUR STORM)			
PROPOSED FS DETENTION BASIN A		PROPOSED FS DETENTION BASIN B	
Q ₅	Q ₁₀₀	Q ₅	Q ₁₀₀
IN 69 cfs	187 cfs	IN 102 cfs	297 cfs
OUT 9 cfs	52 cfs	OUT 13 cfs	91 cfs
100 yr VOLUME = 6.8 ac-ft EURV VOLUME = 3.1 ac-ft		100 yr VOLUME = 8.4 ac-ft EURV VOLUME = 3.1 ac-ft	
PROPOSED FS DETENTION BASIN C		AS-BUILT FS DETENTION BASIN D	
Q ₅	Q ₁₀₀	Q ₅	Q ₁₀₀
IN 158 cfs	490 cfs	IN 109 cfs	375 cfs
OUT 9 cfs	145 cfs	OUT 24 cfs	233 cfs
100 yr VOLUME = 14.8 ac-ft EURV VOLUME = 8.3 ac-ft		100 yr VOLUME = 8.0 ac-ft 5 yr VOLUME = 4.1 ac-ft	
PROPOSED FS DETENTION BASIN E		RECONSTRUCTED DAM & RESERVOIR BASIN F	
Q ₅	Q ₁₀₀	Q ₅	Q ₁₀₀
IN 41 cfs	120 cfs	IN 540 cfs	1540 cfs
OUT 5 cfs	24 cfs	OUT 7 cfs	255 cfs
100 yr VOLUME = 3.9 ac-ft EURV VOLUME = 1.3 ac-ft		100 yr VOLUME = 95.9 ac-ft 5 yr VOLUME = 50.0 ac-ft	
PROPOSED FS DETENTION BASIN G		PROPOSED FS DETENTION BASIN H	
Q ₅	Q ₁₀₀	Q ₅	Q ₁₀₀
IN 74 cfs	216 cfs	IN 161 cfs	323 cfs
OUT 10 cfs	51 cfs	OUT 23 cfs	56 cfs
100 yr VOLUME = 6.6 ac-ft EURV VOLUME = 2.2 ac-ft		100 yr VOLUME = 13.2 ac-ft EURV VOLUME = 2.5 ac-ft	

SUMMARY OF DESIGN POINT DISCHARGES (24-HOUR STORM WITH FSD)					
DESIGN POINT	LOCATION	DRAINAGE AREA	5 Year	100 Year	
DP 6010	AT LANDOVER	108.9 ac	0.18 sm	43 cfs	196 cfs
DP 6020	INFLOW TO DETENTION BASIN D	168.3 ac	0.27 sm	109 cfs	375 cfs
DB 6030	OUTFLOW FROM DETENTION BASIN D	168.3 ac	0.27 sm	24 cfs	233 cfs
DP 6040	U/S CROSS CREEK	217.0 ac	0.35 sm	74 cfs	334 cfs
DP 6050	DS CROSS CREEK AVE	233.5 ac	0.37 sm	92 cfs	358 cfs
DP 7030	AT OUTLET OF BASIN 7030	283.9 ac	0.41 sm	183 cfs	420 cfs
DP 7040	AT OUTLET OF BASIN 7040	39.6 ac	0.06 sm	30 cfs	110 cfs
DP 8010	AT OUTLET OF BASIN 8010	322.1 ac	0.50 sm	241 cfs	603 cfs
DP 8070	U/S OF HALE RESERVOIR	726.7 ac	1.15 sm	446 cfs	1259 cfs
DP 8075	INFLOW TO HALE RESERVOIR	908.9 ac	1.42 sm	540 cfs	1540 cfs
DB 8075	OUTFLOW FROM HALE RESERVOIR	908.8 ac	1.42 sm	7 cfs	255 cfs
DP 8080	C&S ROAD	928 ac	1.45 sm	13 cfs	257 cfs
DP 1031	D/S POWERS BOULEVARD	51.0 ac	0.08 sm	28 cfs	55 cfs
DP 1211	INFLOW TO DET. BASIN H	108.8 ac	0.17 sm	161 cfs	323 cfs
DB 1210	OUTFLOW FROM DET. BASIN H	108.8 ac	0.17 sm	23 cfs	36 cfs
SB 1225	INFLOW TO DETENTION BASIN G	70.4 ac	0.11 sm	74 cfs	216 cfs
DP 1225	AT CROSS CREEK AVENUE	185.6 ac	0.29 sm	33 cfs	104 cfs
DP 1250	INFLOW TO DETENTION BASIN B	96.0 ac	0.15 sm	102 cfs	297 cfs
DB 1250	OUTFLOW FROM DETENTION BASIN B	96.0 ac	0.15 sm	13 cfs	91 cfs
DP 1265	INFLOW TO DETENTION BASIN A	64 ac	0.10 sm	69 cfs	187 cfs
DP 1260	AT C & S ROAD	243 ac	0.38 sm	41 cfs	156 cfs
DP 2160	DESIGN POINT 2160	448 ac	0.70 sm	188 cfs	640 cfs
DP 3110	AT MESA RIDGE PARKWAY	2163.2 ac	3.38 sm	766 cfs	3095 cfs
DP 3200	DESIGN POINT 3200	2208 ac	3.44 sm	764 cfs	3089 cfs
DP 3250	AT COLLECTOR ROAD	126.7 ac	0.20 sm	130 cfs	380 cfs
DP 3265	AT OUTLET OF BASIN 3265	40.5 ac	0.06 sm	52 cfs	135 cfs
DP 3275	INFLOW TO DET. BASIN C	172.8 ac	0.27 sm	158 cfs	490 cfs
DB 3280	OUTFLOW FROM DETENTION BASIN C	172.8 ac	0.27 sm	9 cfs	145 cfs
DP 3280	AT MARKSHEFFEL ROAD	2381.0 ac	3.72 sm	772 cfs	3215 cfs



SUMMARY OF HISTORIC DISCHARGES			
DESIGN POINT	LOCATION	5 Year	100 Year
3280	HF JIMMY CAMP CREEK @ MARKSHEFFEL ROAD	992 cfs	3745 cfs
1250	@ C & S ROAD	35 cfs	186 cfs
1260	@ C & S ROAD	48 cfs	340 cfs
8080 (1)	@ C & S ROAD	152 cfs	1110 cfs

(1) AREA ABOVE FOUNTAIN MUTUAL IRRIGATION CANAL ASSUMED TRIBUTARY TO THIS DESIGN POINT. FMC CANAL ASSUMED TO CONVEY IRRIGATION FLOW ONLY.



NOTE: TOPOGRAPHY USED IN THIS MDDP MAY NOT REFLECT THE EXISTING CONDITIONS FOR ALL AREAS OF THE DRAINAGE BASINS.

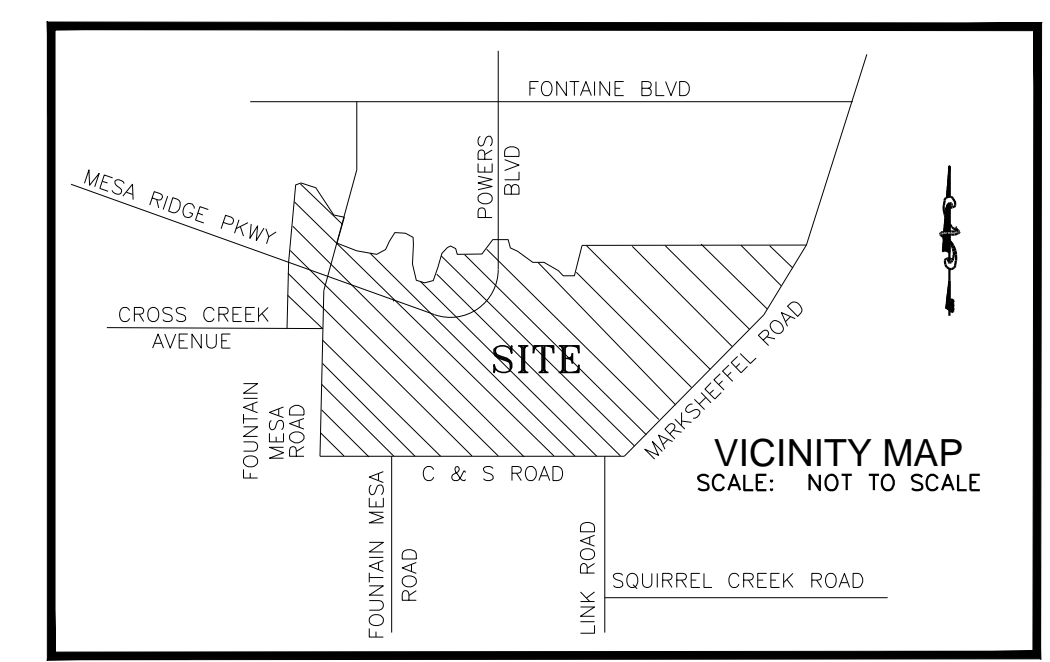
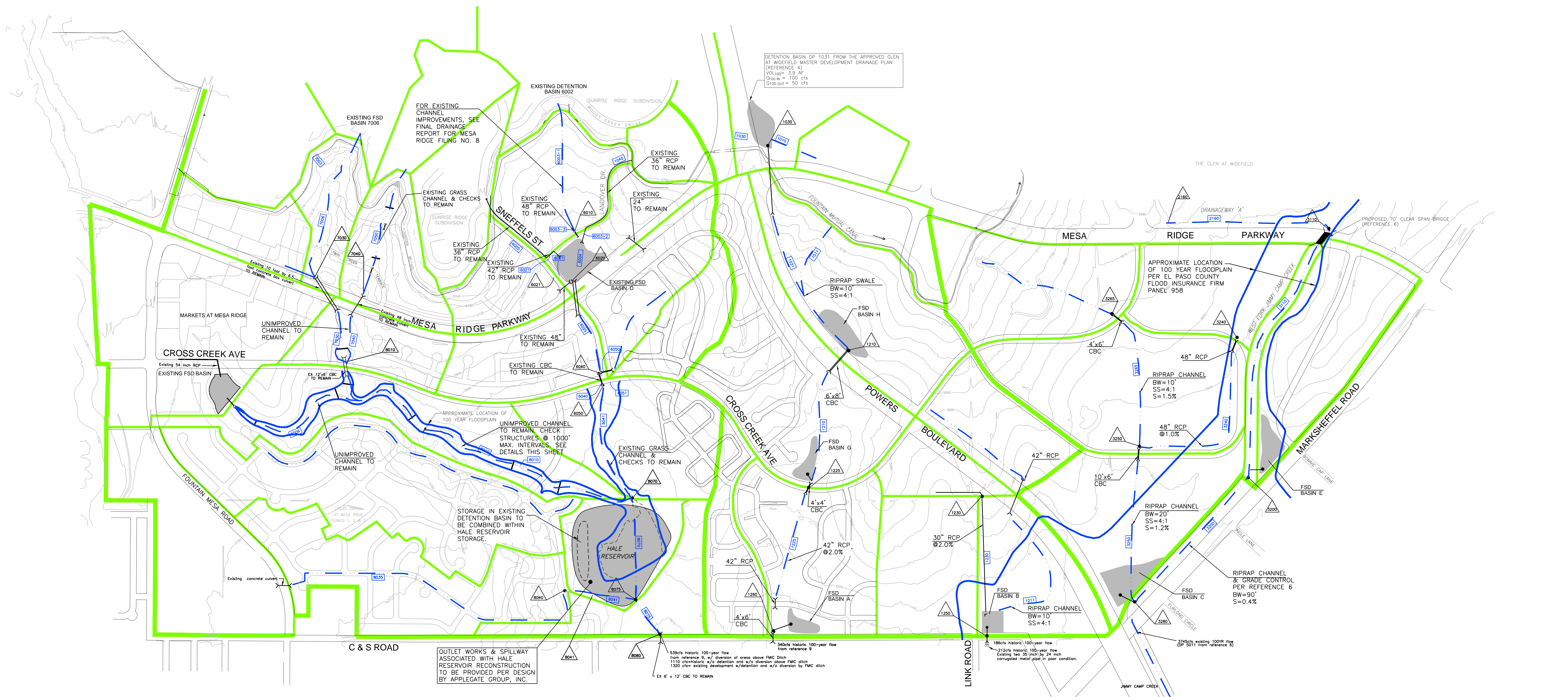


EXHIBIT 1
MESA RIDGE DEVELOPMENT
MASTER DEVELOPMENT DRAINAGE PLAN UPDATE
HYDROLOGIC SUB-BASIN MAP
 DEVELOPED WITH EXISTING & PROPOSED DETENTION
 FOUNTAIN, COLORADO

Kiowa Engineering Corporation
 1604 South 21st Street
 Colorado Springs, Colorado
 80904 - 4208
 (719) 630-7342

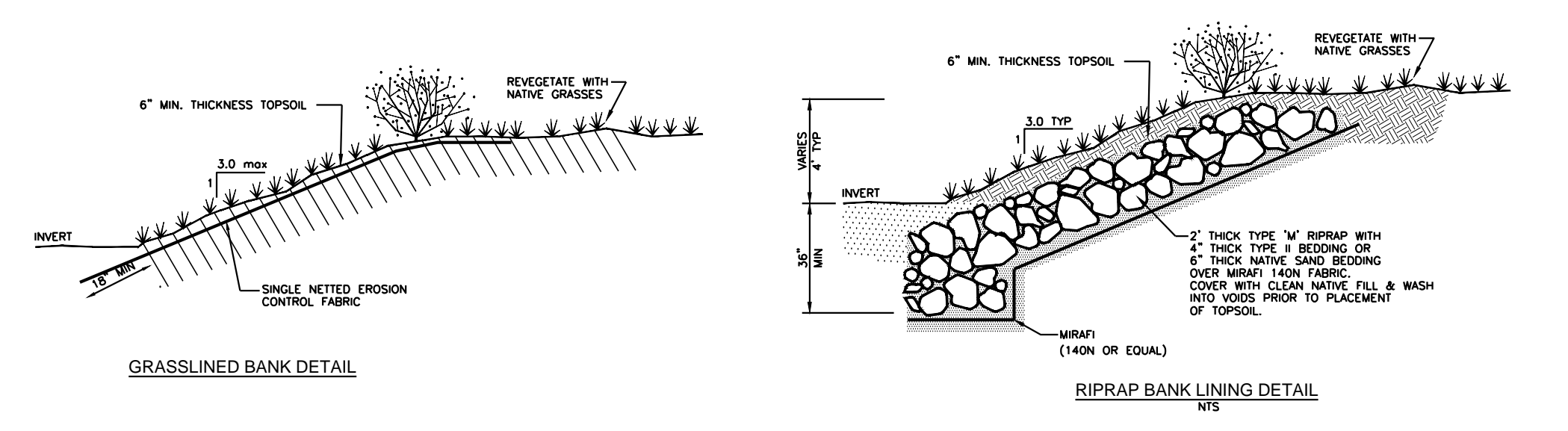


SUMMARY OF PROPOSED FSD BASIN DATA (24-HOUR STORM)

PROPOSED FS DETENTION BASIN A		PROPOSED FS DETENTION BASIN B	
Q ₅	Q ₁₀₀	Q ₅	Q ₁₀₀
IN 69 cfs	187 cfs	IN 102 cfs	297 cfs
OUT 9 cfs	52 cfs	OUT 13 cfs	91 cfs
100 yr VOLUME= 6.8 ac-ft EURV VOLUME= 3.1 ac-ft		100 yr VOLUME= 8.4 ac-ft EURV VOLUME= 3.1 ac-ft	
PROPOSED FS DETENTION BASIN C		AS-BUILT FS DETENTION BASIN D	
Q ₅	Q ₁₀₀	Q ₅	Q ₁₀₀
IN 158 cfs	490 cfs	IN 109 cfs	375 cfs
OUT 9 cfs	145 cfs	OUT 24 cfs	233 cfs
100 yr VOLUME= 14.8 ac-ft EURV VOLUME= 8.3 ac-ft		100 yr VOLUME= 8.0 ac-ft 5 yr VOLUME= 4.1 ac-ft	
PROPOSED FS DETENTION BASIN E		RECONSTRUCTED DAM & RESERVOIR BASIN F	
Q ₅	Q ₁₀₀	Q ₅	Q ₁₀₀
IN 41 cfs	120 cfs	IN 540 cfs	1540 cfs
OUT 5 cfs	24 cfs	OUT 7 cfs	255 cfs
100 yr VOLUME= 3.9 ac-ft EURV VOLUME= 1.3 ac-ft		100 yr VOLUME= 95.9 ac-ft 5 yr VOLUME= 50.0 ac-ft	
PROPOSED FS DETENTION BASIN G		PROPOSED FS DETENTION BASIN H	
Q ₅	Q ₁₀₀	Q ₅	Q ₁₀₀
IN 74 cfs	216 cfs	IN 161 cfs	323 cfs
OUT 10 cfs	51 cfs	OUT 23 cfs	58 cfs
100 yr VOLUME= 6.6 ac-ft EURV VOLUME= 2.2 ac-ft		100 yr VOLUME= 13.2 ac-ft EURV VOLUME= 2.5 ac-ft	

SUMMARY OF DESIGN POINT DISCHARGES (24-HOUR STORM WITH FSD)

DESIGN POINT	LOCATION	DRAINAGE AREA	5 Year	100 Year
DP 6010	AT LANDOVER	108.9 ac	0.18 sm	43 cfs
DP 6020	INFLOW TO DETENTION BASIN D	168.3 ac	0.27 sm	109 cfs
DB 6020	OUTFLOW FROM DETENTION BASIN D	168.3 ac	0.27 sm	24 cfs
DP 6040	U/S CROSS CREEK	217.0 ac	0.35 sm	74 cfs
DP 6050	D/S CROSS CREEK AVE	233.5 ac	0.37 sm	92 cfs
DP 7030	AT OUTLET OF BASIN 7030	263.9 ac	0.41 sm	183 cfs
DP 7040	AT OUTLET OF BASIN 7040	39.6 ac	0.06 sm	30 cfs
DP 8010	AT OUTLET OF BASIN 8010	322.1 ac	0.50 sm	241 cfs
DP 8070	U/S OF HALE RESERVOIR	726.7 ac	1.15 sm	446 cfs
DP 8075	INFLOW TO HALE RESERVOIR	908.8 ac	1.42 sm	540 cfs
DB 8075	OUTFLOW FROM HALE RESERVOIR	908.8 ac	1.42 sm	7 cfs
DP 8080	C&S ROAD	928 ac	1.45 sm	13 cfs
DP 1031	D/S POWERS BOULEVARD	51.0 ac	0.08 sm	28 cfs
DP 1211	INFLOW TO DET. BASIN H 1210, POWERS BLVD	108.8 ac	0.17 sm	161 cfs
DP 1210	OUTFLOW FROM DET. BASIN H	108.8 ac	0.17 sm	23 cfs
SB 1225	INFLOW TO DETENTION BASIN G	70.4 ac	0.11 sm	74 cfs
DP 1225	AT CROSS CREEK AVENUE	185.6 ac	0.29 sm	33 cfs
DP 1250	INFLOW TO DETENTION BASIN B	96.0 ac	0.15 sm	102 cfs
DB 1250	OUTFLOW FROM DETENTION BASIN B	96.0 ac	0.15 sm	13 cfs
DP 1265	INFLOW TO DETENTION BASIN A	64 ac	0.10 sm	69 cfs
DP 1260	AT C & S ROAD	243 ac	0.38 sm	41 cfs
DP 2160	DESIGN POINT 2160	448 ac	0.70 sm	188 cfs
DP 3110	AT MESA RIDGE PARKWAY	2163.2 ac	3.38 sm	766 cfs
DP 3200	DESIGN POINT 3200	2208 ac	3.44 sm	764 cfs
DP 3250	AT COLLECTOR ROAD	126.7 ac	0.20 sm	130 cfs
DP 3265	AT OUTLET OF BASIN 3265	40.5 ac	0.06 sm	52 cfs
DP 3281	INFLOW TO DET. BASIN C	172.8 ac	0.27 sm	158 cfs
DB 3281	OUTFLOW FROM DETENTION BASIN C	172.8 ac	0.27 sm	9 cfs
DP 3280	AT MARKSHEFFEL ROAD	2381.0 ac	3.72 sm	772 cfs



RIPRAP GRADATIONS

TYPE	INTERMEDIATE ROCK DIMENSION IN INCHES	% SMALLER THAN GIVEN SIZE BY WEIGHT	D ₅₀ INCHES
TYPE M RIPRAP	30	100	18
	24	50-70	13
	18	35-50	9
TYPE M RIPRAP	21	100	12
	18	50-70	9
	12	35-50	6

SEED MIX

AREAS DISTURBED BY THE EARTHWORK SHALL BE PERMANENTLY REVEGETATED WITH NATIVE GRASSES. NATIVE SEED MIX FOR THIS PROJECT SHALL BE AS FOLLOWS:

NATIVE SEED MIX	pl/acre
BLUE GRAMA	2.0
SIDONIA'S GRAMA	3.0
SLENDER WHEATGRASS	2.0
WESTERN WHEATGRASS	4.0
<i>Chlorodermis hirsuta</i>	2.0
<i>Bouteloua curtipendula</i>	3.0
<i>Agropyron trachycalium trachycalium</i>	2.0
<i>Agropyron smithii</i>	4.0
TOTAL	11.0 lbs

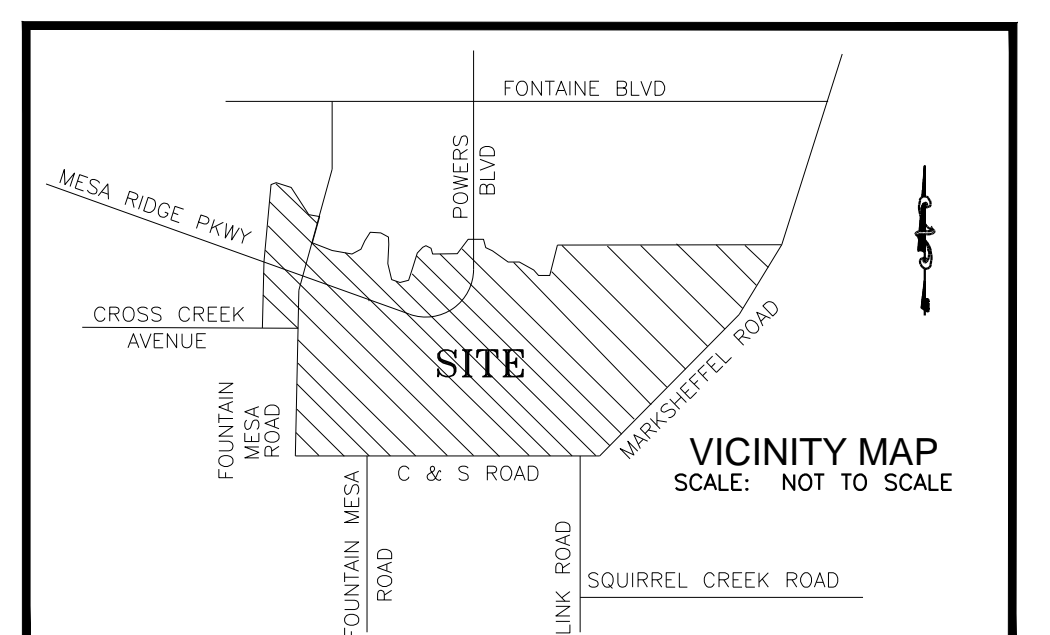
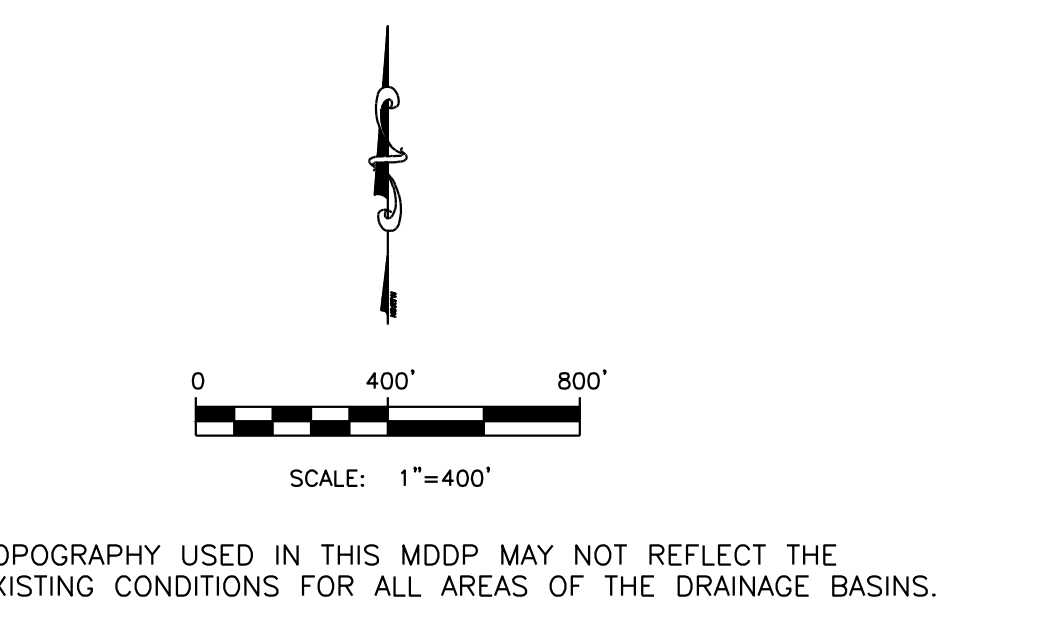
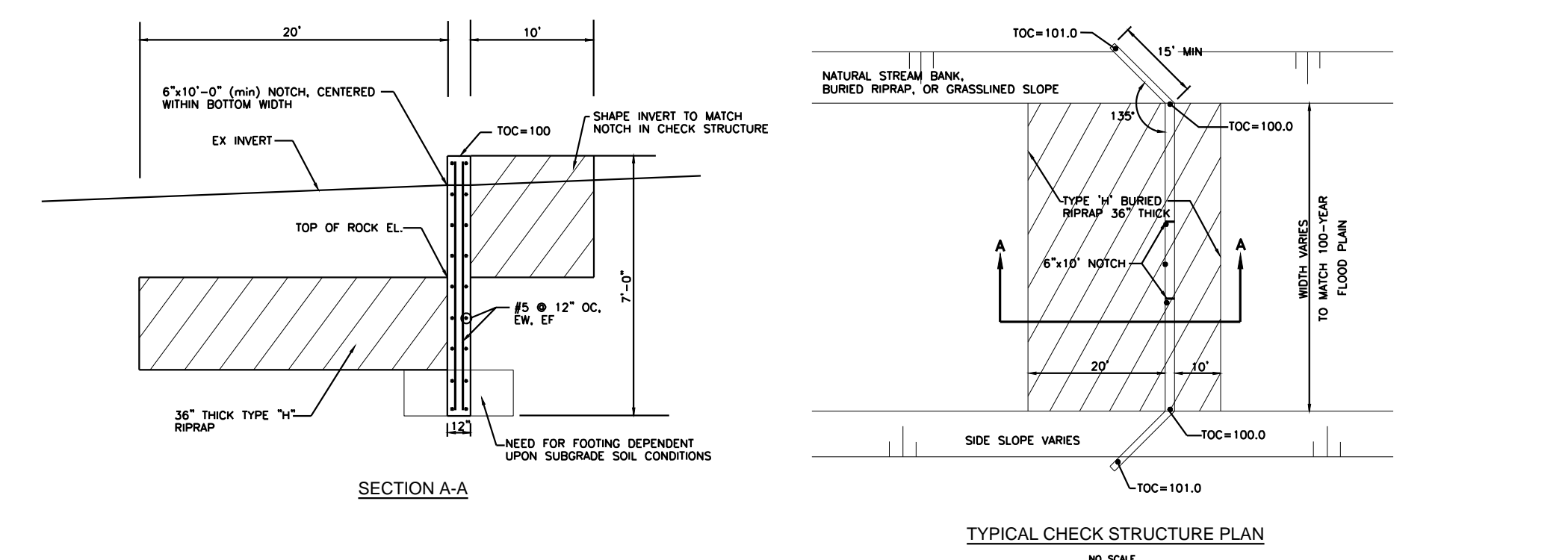


EXHIBIT 2
MESA RIDGE DEVELOPMENT
MASTER DEVELOPMENT DRAINAGE PLAN UPDATE
PROPOSED FACILITIES PLAN
DEVELOPED WITH REGIONAL DETENTION
FOUNTAIN, COLORADO

Kiowa Engineering Corporation
 1604 South 21st Street
 Colorado Springs, Colorado
 80904 - 4208
 (719) 630-7342

Master Development Drainage Plan
Mesa Ridge Development

City of Fountain, Colorado

Prepared For:

Norwood Development
111 South Tejon #222
Colorado Springs, CO 80903

Prepared By:

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904

Project Number 05011
December 17, 2006



NEW DOC

Kiowa Records 10/25/11

PROJECT SPECIFIC GRADING AND EROSION CONTROL NOTES

- All earthwork required of this construction shall be completed in accordance with all applicable sections of the Project Specifications and Soil Investigation Report (Geotechnical Report).
- Rubbish including timber, concrete rubble, trees, brush, and asphalt shall not be backfilled adjacent to any of the structures or be in the placement of any unclassified fill. The Contractor shall be responsible for the removal and hauling of such materials to a suitable spoil area. Costs associated with the removal of such materials shall be paid for as documented in the Project Specifications.
- Excess excavation shall become the property of the Contractor and shall be disposed of at the Contractor's expense. The cost of haulage and spilling of excess excavated materials shall be paid for as documented in the Project Specifications.
- Water shall be used as a dust palliative as required and shall be included in the cost for earthwork item(s). No separate payment will be made for dust control associated with the site construction.
- The road grades shall be cleared of vegetation and the topsoil stockpiled for later use.
- All grading shall be in conformance with the Geotechnical Report for the area.
- Placement of fill for roadway embankments shall be completed in conformance with the Geotechnical Report.
- Grading contours shown on this plan are to final grade.
- Compaction under filled areas, including roadway and detention basin embankments, shall be 95 percent of the maximum Standard Proctor Density (ASTM D698) at two (2) percent of optimum moisture content.
- No rubble or debris shall be placed in the backfill under any of the proposed buildings, streets, curb & gutter, sidewalk and drainage structures or within five (5) feet of a building footprint. Properly graded rubble may be used in some locations as specified and verified by the Geotechnical Engineer.
- Contractor is responsible for reviewing the site prior to bidding to verify site conditions.
- Contractor is responsible for providing erosion control measures as approved by the City of Fountain Dept. of Public Works Division and as may be required by the El Paso County Inspector.
- All slopes equal to or greater than 3:1 shall require erosion control blanket, single netted fabric, American Excelsior or equal.
- The Developer is responsible for maintaining erosion control measures until a mature stage of vegetation is established.
- All soils used for fill must be approved by a representative of the Geotechnical Engineer.
- All natural ground to receive fill must be properly scarified, watered and compacted prior to placing fill.
- The Contractor is solely responsible for the design, maintenance and operation of any required dewatering system. The Contractor shall perform such independent investigation as he deems necessary to satisfy himself as to the subsurface groundwater conditions and unstable soil conditions to be encountered throughout the construction.
- No fill shall be placed, spread or rolled while it is frozen, thawing or during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until a representative of the Geotechnical Engineer indicates that the moisture content and density of the previously placed fill are as specified. Fill surfaces may be scarified and recompacted after rainfall if necessary, to obtain proper moisture density relation.
- Additional erosion control structures and/or grading may be required at the time of construction.
- Sediment removal for erosion control facilities shall be performed continuously for proper function.
- Base mapping was provided by Rockwell Consulting. The date of the survey was January 2008.
- Proposed Construction Schedule:
Begin Construction: FEBRUARY 25, 2011
End Construction: FEBRUARY 28, 2012
Total Site Area = 3.8 Acres
- Area to be disturbed = 3.8 Acres (est.)
Existing 100-year runoff coefficient = 0.40
Proposed 100-year runoff coefficient = 0.40
Existing Hydrological Soil Groups: B & C
- Site is currently undeveloped and covered with native grasses on mild slopes (2%-7%).
- Site is located in the Jimmy Camp Creek Drainage Basin.
- All grading and erosion control shall be completed in accordance with the City of Fountain Municipal Code Sections 12.04.160 and 12.10.

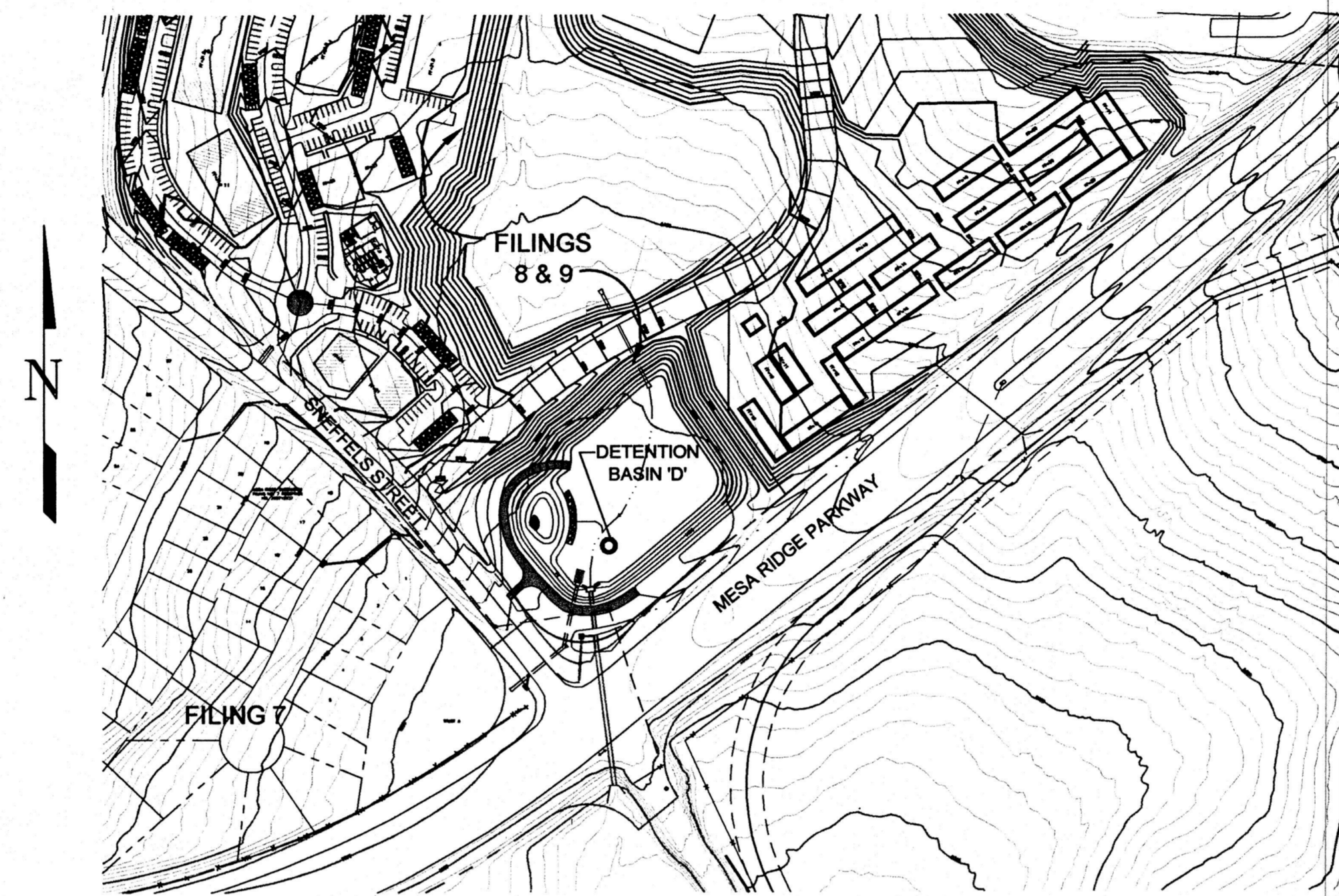
MESA RIDGE FILINGS 8 & 9

DETENTION BASIN 'D'

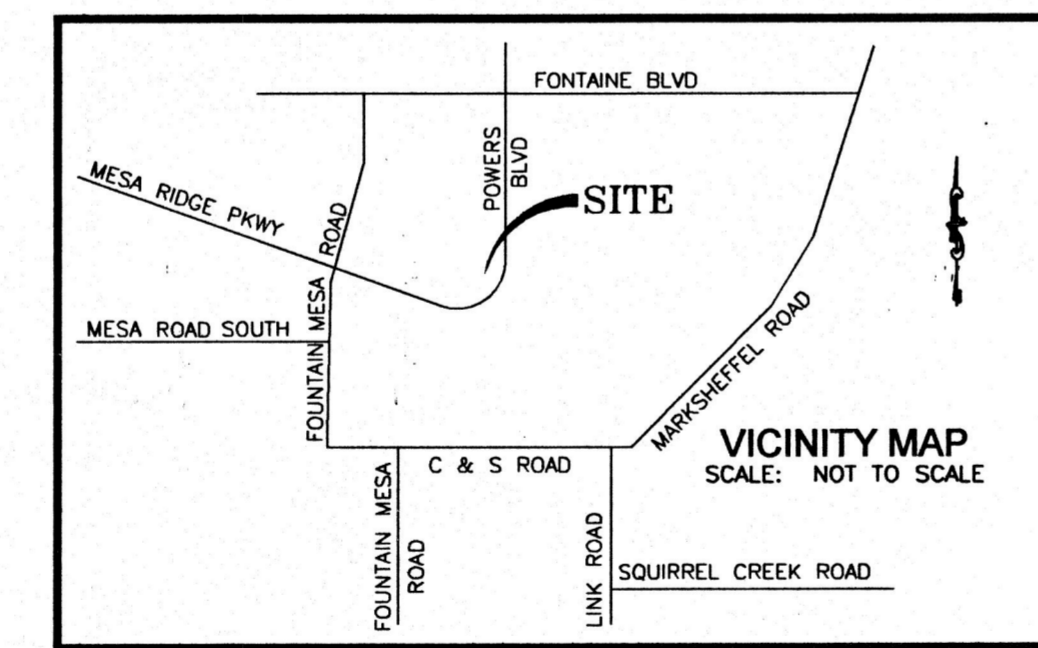
FULL SPECTRUM DETENTION MODIFICATIONS

FINAL DESIGN DRAWINGS

FOUNTAIN, COLORADO



SITE MAP
SCALE: 1"=200'



GENERAL NOTES

- ALL WORK REQUIRED OF THESE PLANS SHALL BE COMPLETED IN ACCORDANCE WITH CITY OF COLORADO SPRINGS, ENGINEERING DIVISION, STANDARD SPECIFICATIONS, AND WITH THE APPLICABLE SECTIONS OF THE COLORADO DEPARTMENT OF TRANSPORTATION, STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION.
- THE CONTRACTOR IS RESPONSIBLE FOR THE FIELD VERIFICATION OF ALL PUBLIC AND PRIVATE UTILITIES PRIOR TO THE COMMENCEMENT OF WORK. THE UTILITIES SHOWN ON THESE PLANS HAVE BEEN LOCATED USING THE BEST AVAILABLE INFORMATION. SHOULD A UTILITY BE DAMAGED AS A RESULT OF THIS CONSTRUCTION, IT SHALL BE REPAIRED IMMEDIATELY BY EITHER THE CONTRACTOR OR THE AFFECTED UTILITY OWNER. THE FULL COST OF SUCH A REPAIR SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
- SURFACE AND GROUNDWATER AT THE SITE MAY CREATE A NEED FOR DEWATERING DURING THE CONSTRUCTION OF THE DRAINAGEWAY FACILITIES. CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF TEMPORARY DEWATERING STRUCTURES, AND PROVIDE FOR THE SAFE AND STABLE DISCHARGE OF WATER FROM THE CONSTRUCTION SITE. THE COST OF DEWATERING IS CONSIDERED INCIDENTAL TO THE CONSTRUCTION AND WILL NOT BE PAID FOR UNDER A SPECIFIC ITEM IN THE BID DOCUMENTS.
- CLASS III RCP SHALL BE USED FOR ALL STORM SEWERS UNLESS OTHERWISE SPECIFIED.
- THE CONTRACTOR SHALL NOTIFY THE CITY OF FOUNTAIN DEPARTMENT OF PUBLIC WORKS 48 HOURS PRIOR TO THE START OF CONSTRUCTION TO OUTLINE METHODS OF CONSTRUCTION, SCHEDULING, AND ISSUING OF INSPECTION PERMITS.

STRUCTURAL CONCRETE NOTES

- ALL CONSTRUCTION INVOLVING THE PLACEMENT OF STRUCTURAL CONCRETE SHALL BE COMPLETED IN ACCORDANCE WITH SECTION 600 OF THE CITY OF COLORADO SPRINGS ENGINEERING DIVISION STANDARD SPECIFICATIONS.
- STEEL REINFORCING SHALL BE GRADE 60 FOR ALL REINFORCING STEEL GREATER THAN #4. A TABLE SPECIFYING MINIMUM SPLICE LENGTHS HAS BEEN PROVIDED ON THE STRUCTURAL DETAIL SHEETS. ALL REINFORCING SHALL HAVE A 2-INCH MINIMUM COVER UNLESS OTHERWISE SPECIFIED. REBAR SHOP DRAWINGS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW PRIOR TO FABRICATION.
- CAST-IN-PLACE CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH (F'C) OF 4,000 PSI AT 28 DAYS. ALL CONCRETE PLACED AGAINST SOIL SHALL BE TYPE II/V PORTLAND CEMENT. ALL EXPOSED CORNERS SHALL BE FORMED WITH A 3/4" CHAMFER UNLESS OTHERWISE SPECIFIED.
- EXPANSION JOINT MATERIAL SHALL MEET AASHTO SPECIFICATION M-213.
- BACKFILL AGAINST STRUCTURES SHALL NOT COMMENCE UNTIL ALL SUPPORTING DIAPHRAGMS ARE IN PLACE AND CONCRETE HAS OBTAINED ITS FULL SEVEN DAY STRENGTH. BACKFILL SHALL BE PLACED EQUALLY ON EACH SIDE OF CHECK STRUCTURES AND CUTOFF WALLS UNTIL THE FINAL GRADE IS REACHED.
- FOOTING EXCAVATIONS SHALL BE EXAMINED BY THE GEOTECHNICAL ENGINEER PRIOR TO THE FORMING AND PLACING OF CONCRETE.
- CONTRACTOR IS RESPONSIBLE FOR PROVIDING THE ENGINEER AND GEOTECHNICAL ENGINEER WITH A 24-HOUR MINIMUM NOTIFICATION FOR REBAR OBSERVATION, SOIL AND/OR CONCRETE TESTING. PLACEMENT OF CONCRETE IN THE ABSENCE OF TESTING SHALL BE COMPLETED AT THE SOLE RISK OF THE CONTRACTOR.

8. CONCRETE:

- NO ADMIXTURES PERMITTED WITHOUT THE REVIEW OF ENGINEER. SUBMIT DESIGN MIX FOR ENGINEER APPROVAL.
- CONTRACTOR IS RESPONSIBLE FOR THE ADEQUACY OF FORMS AND SHORING AND FOR SAFE PRACTICE IN THEIR USE AND REMOVAL.
- COMPRESSIVE STRENGTH SHALL BE 4,000 psi, MIN.

9. REINFORCING STEEL:

- TO BE BILLET STEEL CONFORMING TO THE LATEST A.S.T.M./ A615 GRADE 60 SPECIFICATION, FABRICATED IN ACCORDANCE WITH MANUAL OF STANDARD PRACTICE OF THE C.R.S.I. AND PLACED IN ACCORDANCE WITH A.C.I. 315 AND A.C.I. MANUAL OF PRACTICE.
- MINIMUM OF CONCRETE COVER UNLESS OTHERWISE DETAILED ON DRAWINGS: FOOTINGS 3 INCHES, WALLS 3 INCHES, SLABS EXPOSED TO WEATHER 1-1/2 INCHES, SLABS ON GRADE 1-1/2 INCHES MEASURED FROM TOP OF SLAB.
- SLAB REINFORCEMENT: LAPPED 36 BAR DIAMETER OR MINIMUM 18 INCHES. BOTTOM BARS SPLICED ONLY AT SUPPORTS, TOP BARS SPLICED ONLY AT MID-SPAN. ALL TOP BARS HOOKED AT NON-CONTINUOUS EDGES (U.O.N.) ALL HOOKS TO BE STANDARD 90 DEGREE OR 180 DEGREE HOOKS AS REQUIRED (U.O.N.), DOWELS IN FOUNDATION TO MATCH REINFORCING ABOVE.
- SUBMIT SHOP DRAWINGS FOR REINFORCING PRIOR TO FABRICATION.

10. FOUNDATIONS:

- STRUCTURES SHALL BEAR ON SOIL HAVING A MINIMUM BEARING CAPACITY OF 2,000 P.S.F. COMPACTION FOR SUBGRADE PREPARATION SHALL BE IN ACCORDANCE WITH REQUIREMENTS OF THE SOILS REPORT. SUBGRADE PREPARATION SHALL BE MONITORED BY THE SOILS ENGINEER.

11. BACKFILL AND STABILIZATION MATERIAL:

- BACKFILL MATERIAL CONSISTING OF SELECT, GRANULAR, NON-SWELLING MATERIAL TO BE PLACED ALONG THE SIDES OF THE VAULTS EXTENDING 3 FEET OUTSIDE THE VAULT WALLS.
- 3/4-INCH ROCK, 12-INCHES DEEP, TO BE PLACED UNDER ALL VAULTS.
- 2-INCH TO 4-INCH STABILIZATION MATERIAL SHALL BE PLACED UNDER THE 3/4" ROCK IF SUBGRADE STABILIZATION IS REQUIRED.

12. ABBREVIATIONS

- | | | |
|---------------------------|------------------------------|-------------------|
| E.C. -- EPOXY COATED | O.F. -- OUTSIDE FACE | E.F. -- EACH FACE |
| E.W. -- EACH WAY | I.F. -- INSIDE FACE | N.F. -- NEAR FACE |
| T.O.C. -- TOP OF CONCRETE | B.O.C. -- BOTTOM OF CONCRETE | |
| CONT. -- CONTINUOUS | | |

INDEX OF SHEETS

- COVER SHEET
- GRADING AND EROSION CONTROL PLAN & STORM PROFILE
- OUTLET STRUCTURE DETAILS

ABBREVIATIONS

ASSY = ASSEMBLY	HORIZ = HORIZONTAL	PVC = POINT OF VERTICAL CURVATURE
BNDY = BOUNDARY	HYD = HYDRANT	PMI = POINT OF VERTICAL INTERSECTION
B.O.P. = BOTTOM OF PIPE	I.D. = INSIDE DIAMETER	PVT = POINT OF VERTICAL TANGENCY
CL = CENTERLINE	LT = LEFT	RCB = REINFORCED CONCRETE BOX
CRA = CONCRETE REVERSE ANCHOR	LF = LINEAR FEET	RCP = REINFORCED CONCRETE PIPE
CTR = CONCRETE THRUST BLOCK	LP = LOW POINT	RT = RIGHT OF WAY
CR = POINT OF CURB RETURN	MAX. = MAXIMUM	RT = RIGHT
DIP = DUCTILE IRON PIPE	M.H. = MANHOLE	SHT = SHEET
EL = ELEVATION	MIN. = MINIMUM	SS = SANITARY SEWER
ESMT = EASEMENT	NTS = NOT TO SCALE	STA. = STATION
EX. = EXISTING	O.D. = OUTSIDE DIAMETER	STD. = STANDARD
FG = FACE OF CURB	P.C. = POINT OF CURVATURE	T.O.P. = TOP OF PIPE
FES = FLARED END SECTION	PCHC = POINT OF CURVATURE ON HORIZ. CURVE	TYP. = TYPICAL
FG = FLANGE	PP = PROPOSED	VC = VERTICAL CURVE
FL = FLOWLINE	PT = POINT OF HORIZONTAL TANGENCY	VERT. = VERTICAL
FB = GRADE BREAK	PTHC = POINT OF TANGENCY ON HORIZ. CURVE	
HP = HIGH POINT	PVC = POLY VINYL CHLORIDE PIPE	

*A.G.A./A.P.W.A. STANDARD UTILITY MARKING COLOR CODE

NATURAL GAS	YELLOW
ELECTRIC	RED
WATER	BLUE
WASTEWATER	GREEN

CALL BEFORE YOU DIG... 1-800-922-1987

48 HOURS BEFORE YOU DIG, CALL UTILITY LOCATIONS FOR LOCATING AND MARKING GAS, ELECTRIC, WATER AND WASTEWATER

STATEMENTS

CITY OF FOUNTAIN ACCEPTANCE:
THE PLANS OR REPORT SUBMITTED APPEAR TO BE IN CONFORMANCE WITH THE CITY OF FOUNTAIN SUBMITTAL REQUIREMENTS AND STANDARD ENGINEERING PRINCIPALS AND PRACTICES APPEAR TO HAVE BEEN FOLLOWED. THE PROFESSIONAL ENGINEER SUBMITTING AND SEALING THE PLANS OR REPORT IS SOLELY RESPONSIBLE FOR THEIR ACCURACY AND VALIDITY. THIS REVIEW IS ONLY VALID FOR ONE (1) YEAR FROM THE DATE BELOW.

Duane Greenwood
DUANE GREENWOOD, PUBLIC WORKS DIR./CITY ENGINEER
DATE: 10/25/2011

DETAILED DRAINAGE CONSTRUCTION PLANS & SPECIFICATIONS ENGINEER'S STATEMENT:
THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID DETAILED PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE CRITERIA ESTABLISHED BY THE CITY FOR DETAILED DRAINAGE PLANS AND SPECIFICATIONS. SAID DETAILED DRAINAGE PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR DRAINAGE FACILITY(S) IS DESIGNED. I ACCEPT RESPONSIBILITY FOR LIABILITY CAUSED BY NEGLIGENT ACTS, ERRORS OR OMISSIONS, ON MY PART IN PREPARATION OF THE DETAILED DRAINAGE PLANS AND SPECIFICATIONS.

Richard N. Wray
RICHARD N. WRAY, P.E. #19310
DATE: 10/25/11

DEVELOPER:
NORWOOD DEVELOPMENT
PLAZA OF THE ROCKIES
11 S. TEJON STREET, SUITE 222
COLORADO SPRINGS, COLORADO 80903

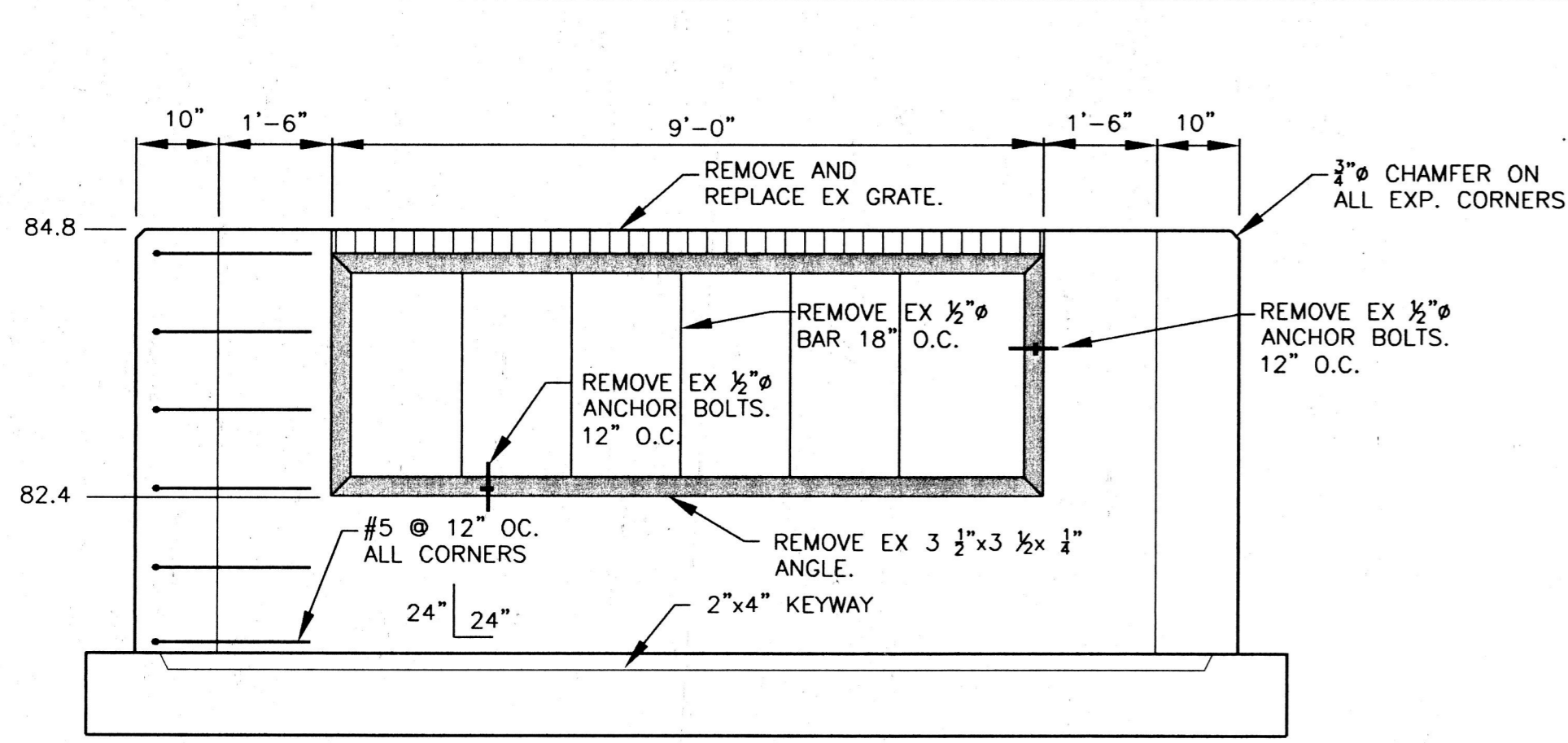
GRADING AND EROSION CONTROL NOTES

- ALL GRADING AND EROSION CONTROL SHALL BE COMPLETED IN ACCORDANCE WITH THE CITY OF FOUNTAIN MUNICIPAL CODE SECTIONS 12.04.160 AND 12.10.
- ALL FILL AREAS SHALL BE COMPACTED IN ACCORDANCE WITH THE GEOTECHNICAL ENGINEER'S RECOMMENDATIONS.
- SOIL EROSION CONTROL MEASURES FOR ALL SLOPES, CHANNELS, DITCHES, OR ANY DISTURBED LAND AREA SHALL BE COMPLETED WITHIN TWENTY ONE (21) CALENDAR DAYS AFTER FINAL GRADING, OR FINAL EARTH DISTURBANCE HAS BEEN COMPLETED. AN AREA THAT IS GOING TO REMAIN IN AN OPEN STATE FOR MORE THAN 60 DAYS SHALL ALSO BE SEEDED. ALL TEMPORARY SOIL EROSION CONTROL MEASURES AND BMPs SHALL BE MAINTAINED UNTIL PERMANENT SOIL EROSION CONTROL MEASURES ARE IMPLEMENTED.
- EROSION CONTROL SHALL CONSIST OF SILT FENCES AND HAY BALES AS SHOWN ON THE DRAWING, AND TOPSOIL WITH GRASS SEED WHICH WILL BE WATERED UNTIL VEGETATION HAS BEEN REESTABLISHED.
- EROSION CONTROL BALES OR SILT FENCE SHALL BE PLACED AT THE TOE AND DRAINAGE OUTFALL POINTS OF ALL SLOPES 4:1 OR STEEPER TO PREVENT SILTATION ON STREETS. REFER TO STORM WATER MANAGEMENT PLAN FOR DETAIL AND LOCATION OF EROSION CONTROL MEASURES.
- CONTRACTOR SHALL COMPLY WITH ALL LOCAL, COUNTY AND STATE REGULATIONS PERTAINING TO GRADING, DUST AND EROSION.
- NATURAL VEGETATION SHALL BE RETAINED AND PROTECTED WHEREVER POSSIBLE. EXPOSURE OF SOIL TO EROSION BY REMOVAL OR DISTURBANCE OF VEGETATION SHALL BE LIMITED TO THE AREA REQUIRED FOR IMMEDIATE CONSTRUCTION OPERATIONS AND FOR THE SHORTEST PRACTICAL PERIOD OF TIME.
- TOPSOIL SHALL BE STOCKPILED TO THE EXTENT PRACTICABLE ON THE SITE FOR USE ON AREAS TO BE REVEGETATED. ANY AND ALL STOCKPILES SHALL BE LOCATED AND PROTECTED FROM EROSION ELEMENTS.
- AT ALL TIMES, THE PROPERTY SHALL BE MAINTAINED AND/OR WATERED TO PREVENT WIND-CAUSED EROSION. EARTHWORK OPERATIONS SHALL BE DISCONTINUED WHEN FUGITIVE DUST SIGNIFICANTLY IMPACTS ADJACENT PROPERTY. IF EARTHWORK IS COMPLETE OR DISCONTINUED AND DUST FROM THE SITE CONTINUES TO CREATE PROBLEMS, THE OWNER/DEVELOPER SHALL IMMEDIATELY INSTITUTE MITIGATIVE MEASURES AND SHALL CORRECT DAMAGE TO ADJACENT PROPERTY.
- ALL PERSONS ENGAGED IN EARTH DISTURBANCE SHALL IMPLEMENT AND MAINTAIN ACCEPTABLE SOIL EROSION AND SEDIMENT CONTROL MEASURES INCLUDING BMPs IN CONFORMANCE WITH THE EROSION CONTROL TECHNICAL STANDARDS OF THE MANUAL AND IN ACCORDANCE WITH THE EROSION AND STORMWATER QUALITY CONTROL PLAN APPROVED BY THE CITY OF FOUNTAIN, IF REQUIRED.
- ALL EARTH DISTURBANCE SHALL BE CONDUCTED IN SUCH A MANNER SO AS TO EFFECTIVELY REDUCE ACCELERATED SOIL EROSION.
- ALL EARTH DISTURBANCE SHALL BE DESIGNED, CONSTRUCTED, AND COMPLETED IN SUCH A MANNER SO THAT THE EXPOSED AREA OF ANY DISTURBED LAND SHALL BE LIMITED TO THE SHORTEST PRACTICAL PERIOD OF TIME.
- ALL EARTH DISTURBANCE SHALL BE DONE IN A MANNER THAT MINIMIZES POLLUTION OF ANY ON-SITE OR OFF-SITE WATERS.
- SUSPENDED SEDIMENT CAUSED BY ACCELERATED SOIL EROSION SHALL BE MINIMIZED IN RUNOFF WATER BEFORE IT LEAVES THE SITE.
- TEMPORARY SOIL EROSION CONTROL FACILITIES SHALL BE REMOVED AND EARTH DISTURBANCE AREAS GRADED AND STABILIZED WITH PERMANENT SOIL EROSION CONTROL MEASURES PURSUANT TO THE STANDARDS AND SPECIFICATIONS PRESCRIBED IN THE MANUAL, AND IN ACCORDANCE WITH THE PERMANENT EROSION CONTROL FEATURES SHOWN ON THE EROSION AND STORMWATER CONTROL PLANS APPROVED BY THE CITY OF FOUNTAIN, IF REQUIRED.
- ANY STREET OR DRAINAGE FACILITY WHICH HAS HAD EROSION SEDIMENT DEPOSITED IN IT DUE TO CONSTRUCTION, GRADING, OR OTHER DEVELOPMENT ACTIVITY, MUST BE CLEANED IMMEDIATELY AT THE EXPENSE OF THE CONTRACTOR, DEVELOPER, HOMEOWNER, OR WHOEVER IS RESPONSIBLE FOR THE CONSTRUCTION, GRADING, OR LAND DEVELOPMENT ACTIVITY. IF THE FACILITY IS NOT CLEANED IMMEDIATELY OR WITHIN A RESPONSIBLE PERIOD OF TIME AFTER NOTIFICATION BY THE CITY, THE CITY MAY PERFORM THE WORK OR HAVE THE WORK DONE AND BILL THE RESPONSIBLE PARTY.
- IT IS THE RESPONSIBILITY OF THE OWNER TO ENSURE THAT VEHICLE TRACKING CONTROL IS IN PLACE, FUNCTIONAL, AND MAINTAINED THROUGHOUT THE CONSTRUCTION PHASE OF THIS PROJECT.
- INDIVIDUALS SHALL COMPLY WITH THE "COLORADO WATER QUALITY CONTROL ACT" (TITLE 25, ARTICLE 8, CRS), AND THE "CLEAN WATER ACT" (33USC 1344), REGULATIONS PROMULGATED, CERTIFICATIONS OR PERMITS ISSUED, IN ADDITION TO CITY OF FOUNTAIN REQUIREMENTS. IN THE EVENT OF CONFLICTS BETWEEN THESE REQUIREMENTS, THE MORE RESTRICTIVE LAWS, RULES, OR REGULATIONS SHALL APPLY.

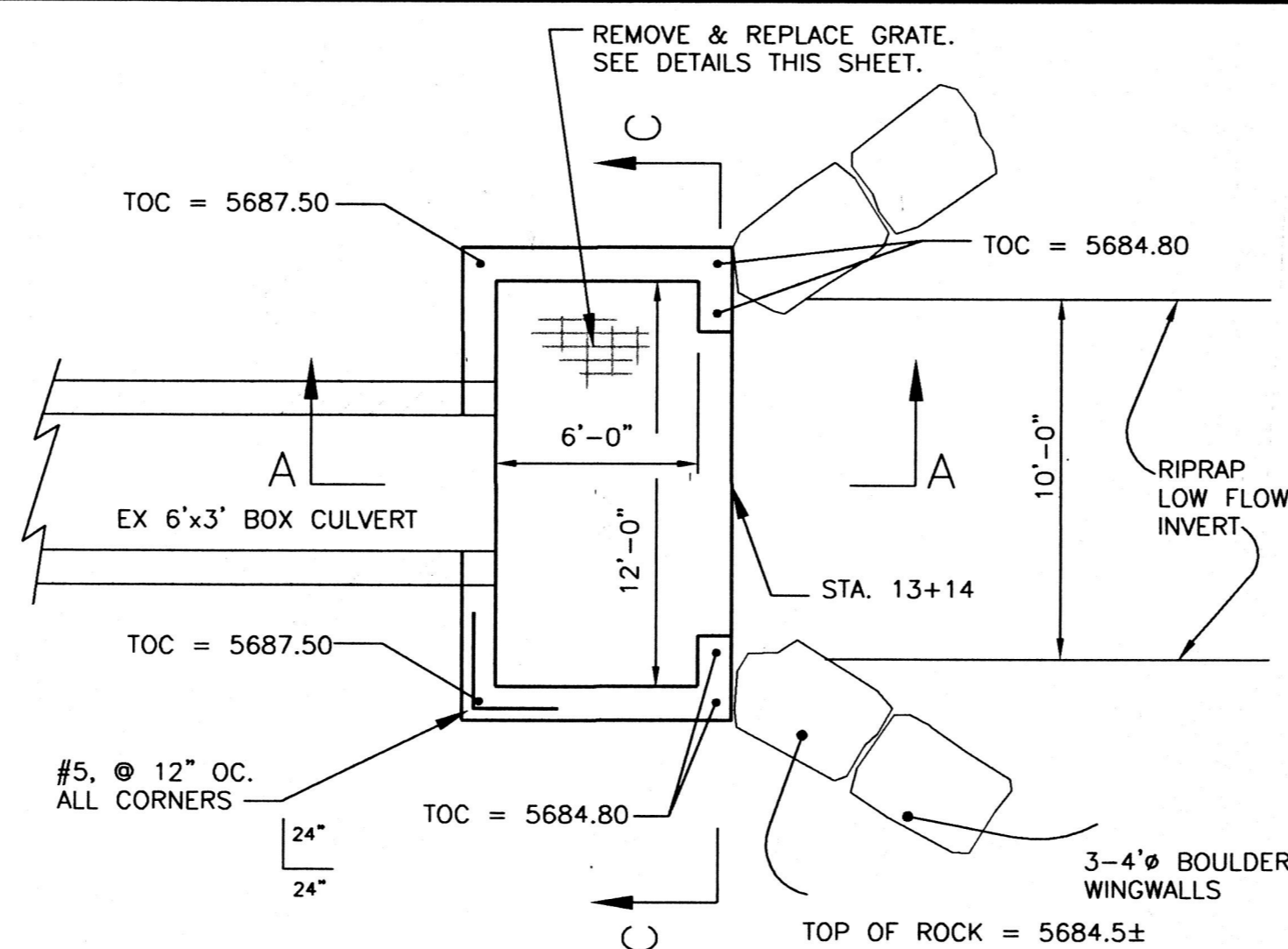
DEVELOPER:
NORWOOD DEVELOPMENT
PLAZA OF THE ROCKIES
11 S. TEJON STREET, SUITE 222
COLORADO SPRINGS, COLORADO 80903

PREPARED BY:
Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904-4208
(719) 630-7342

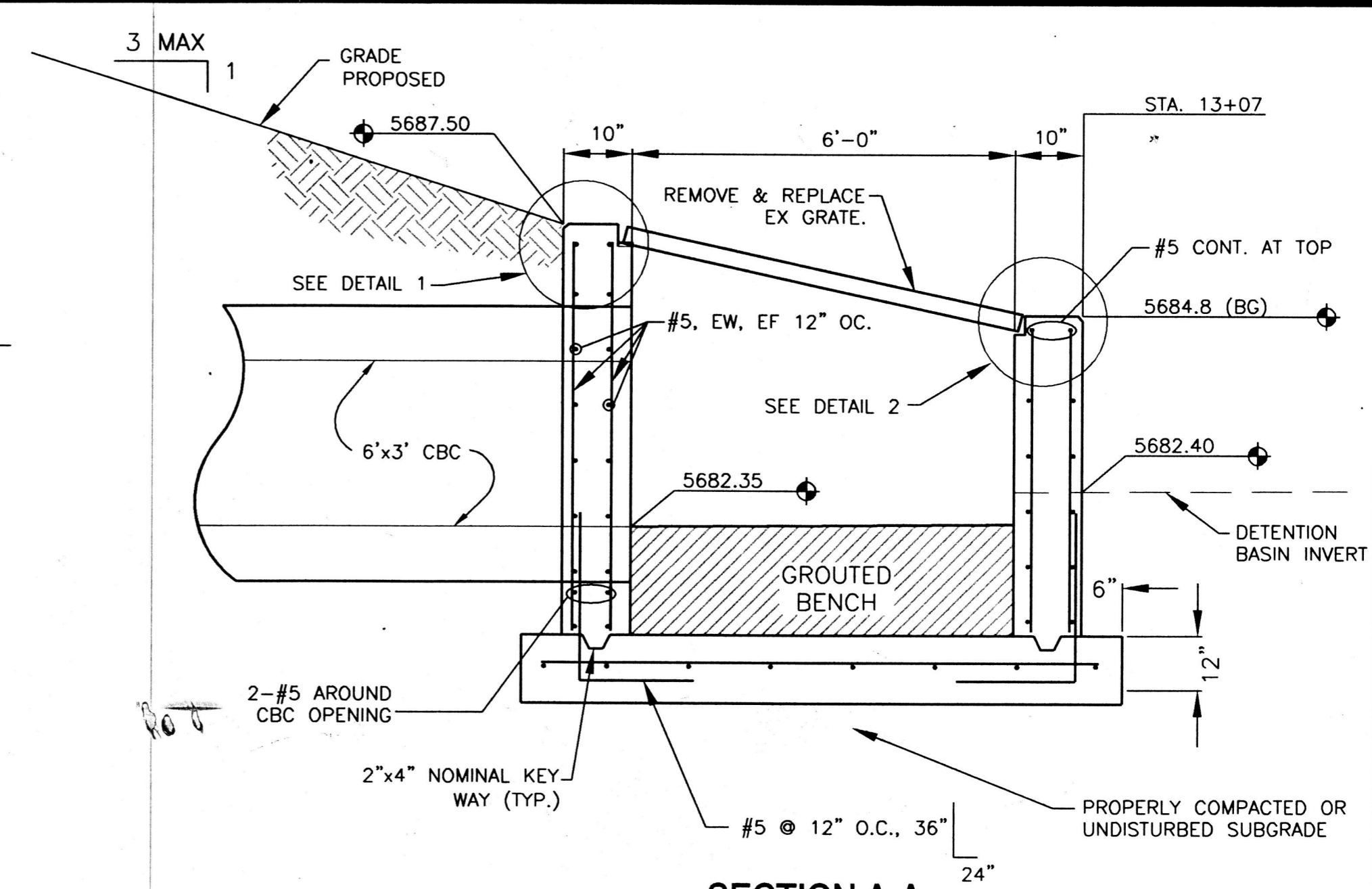
Kiowa Project No. 09061
October 25, 2011



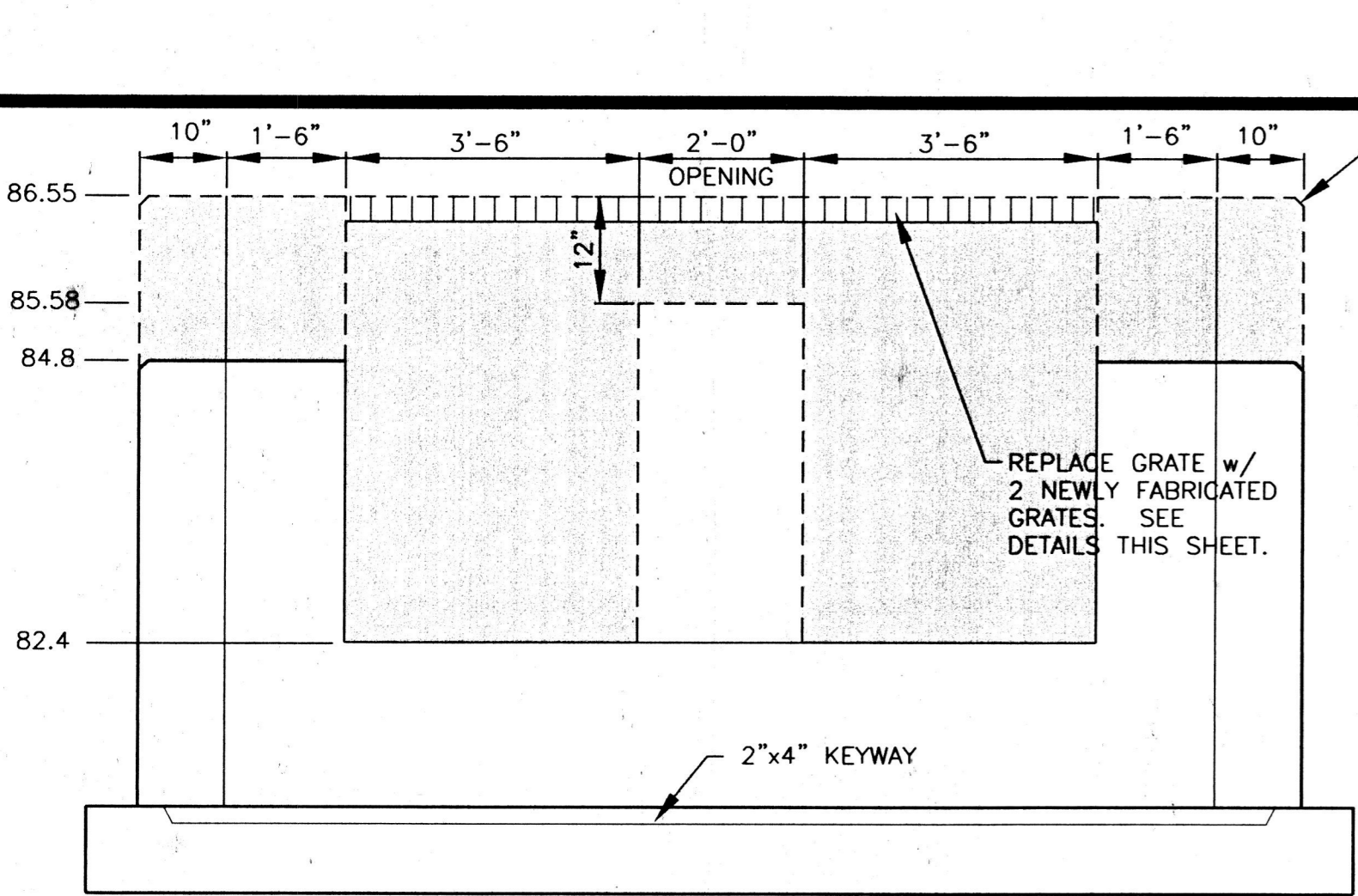
SECTION C-C
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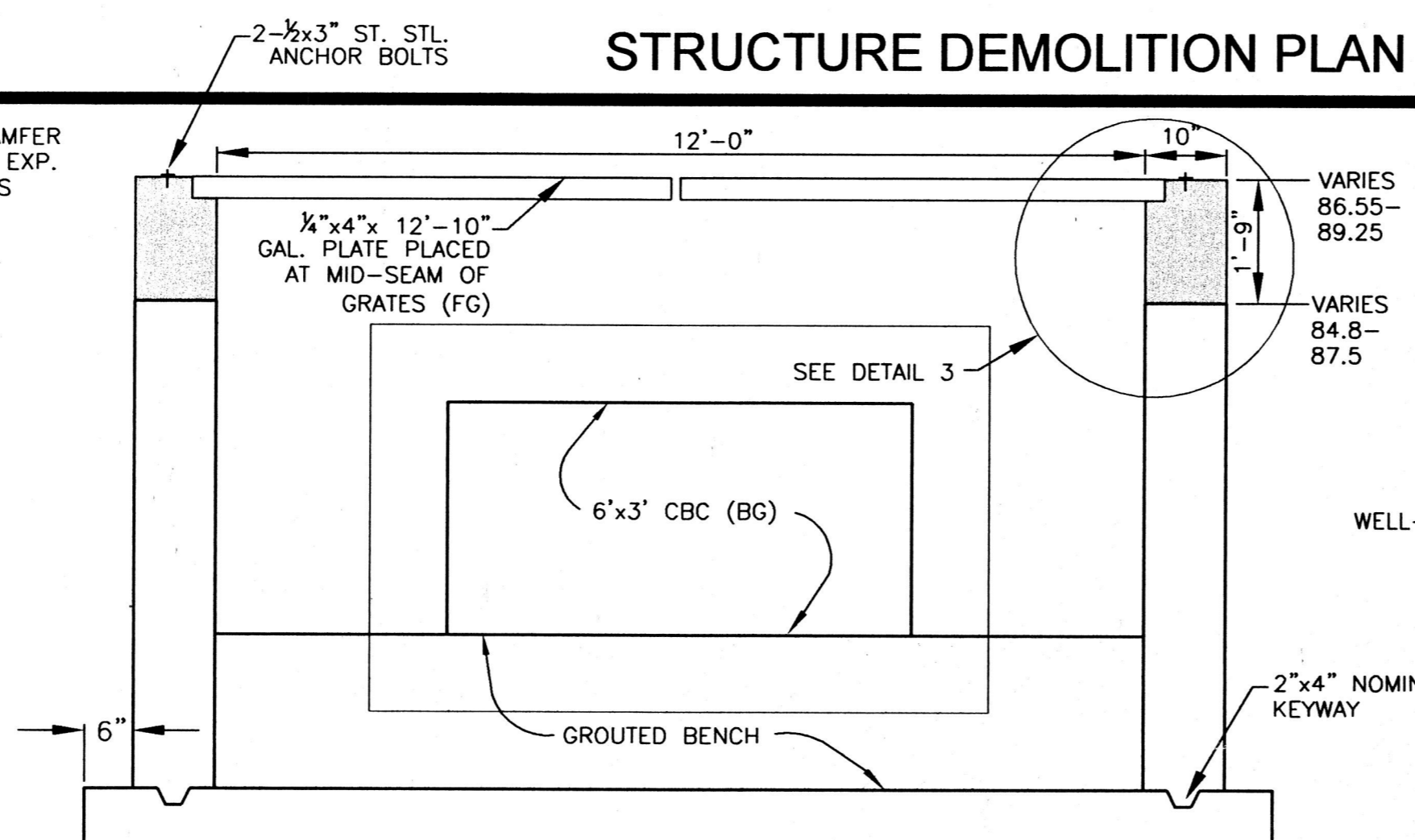
EX. OUTLET STRUCTURE PLAN
SCALE: N.T.S.



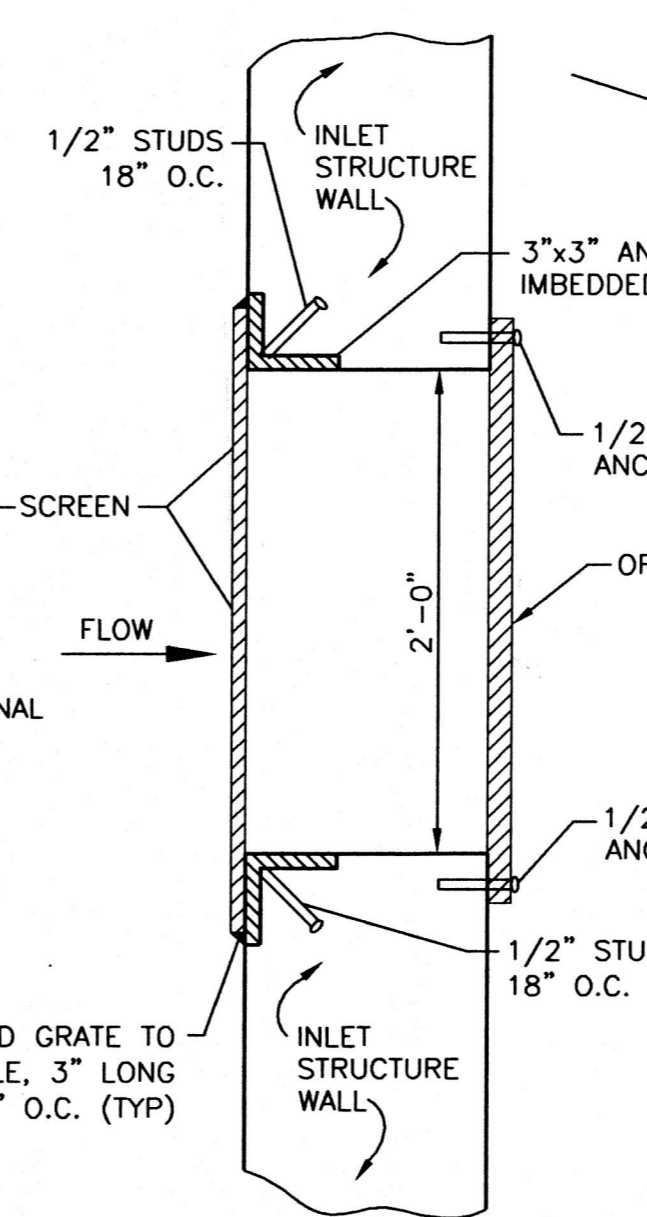
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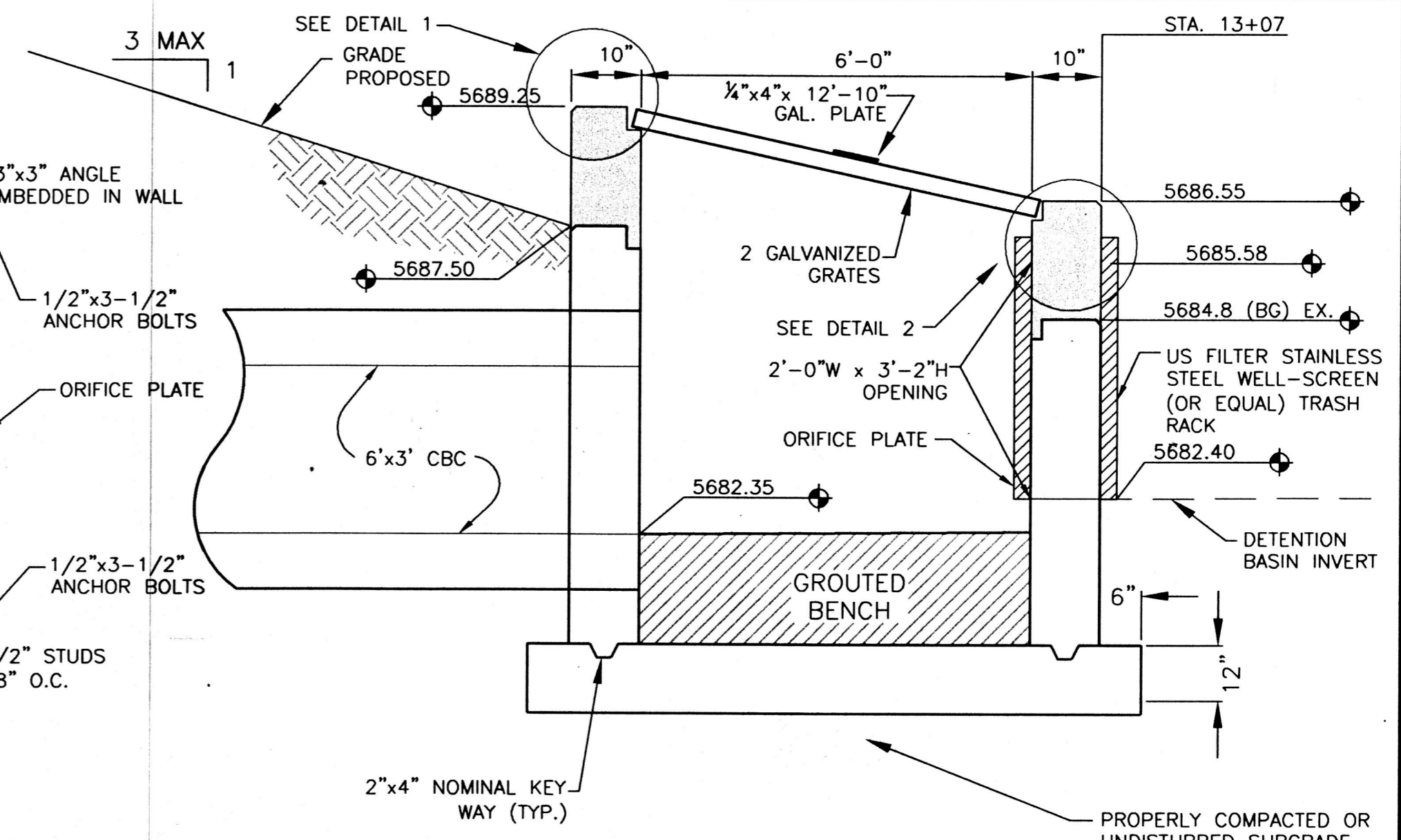
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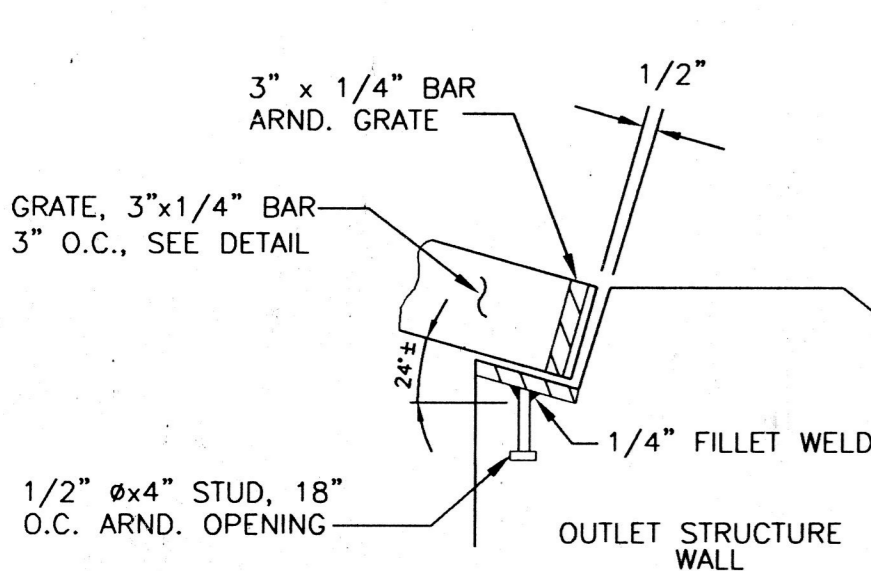
STRUCTURE DEMOLITION PLAN



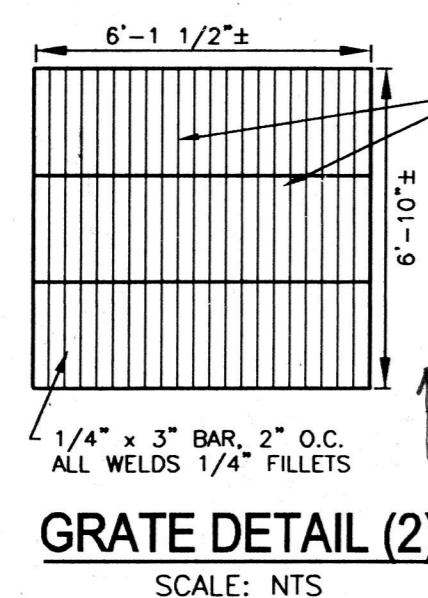
TRASH RACK DETAIL
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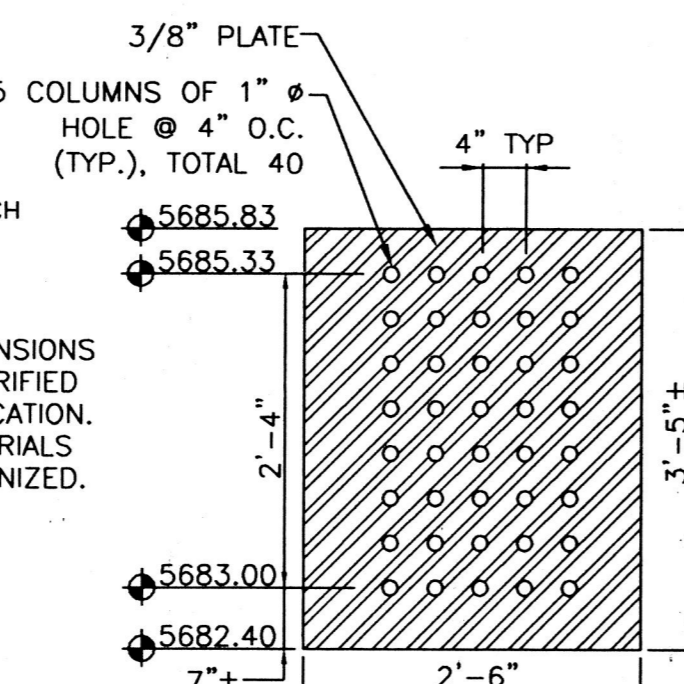
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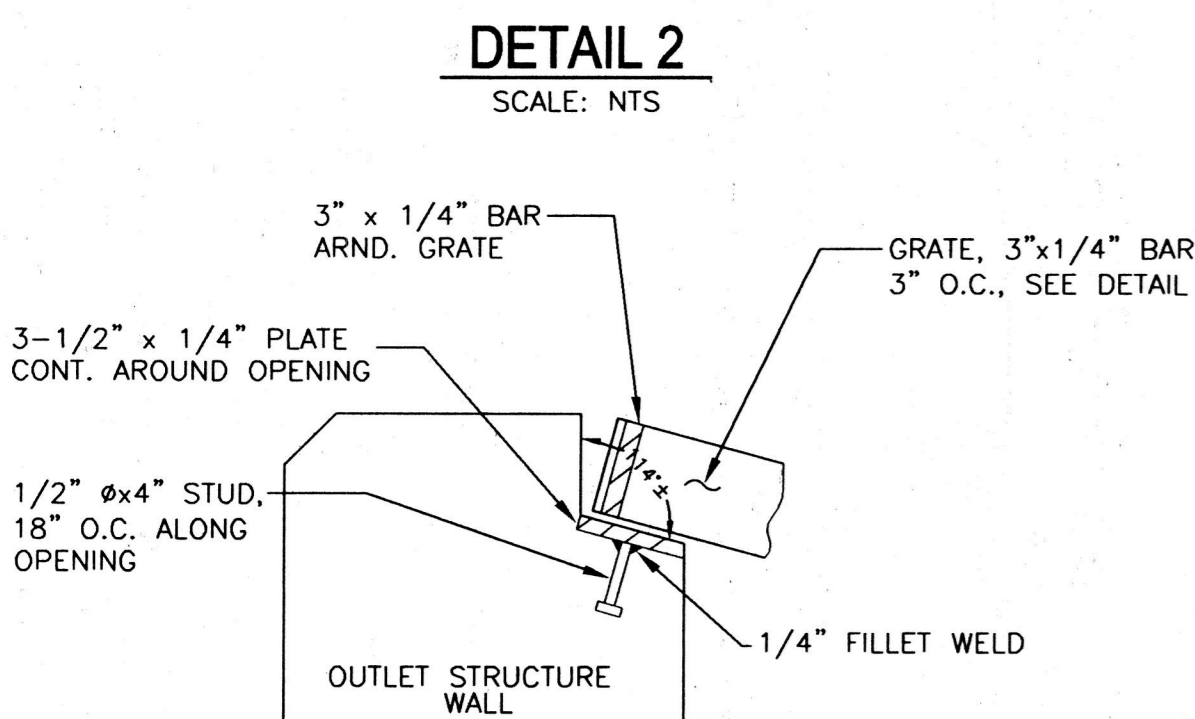
DETAIL 2
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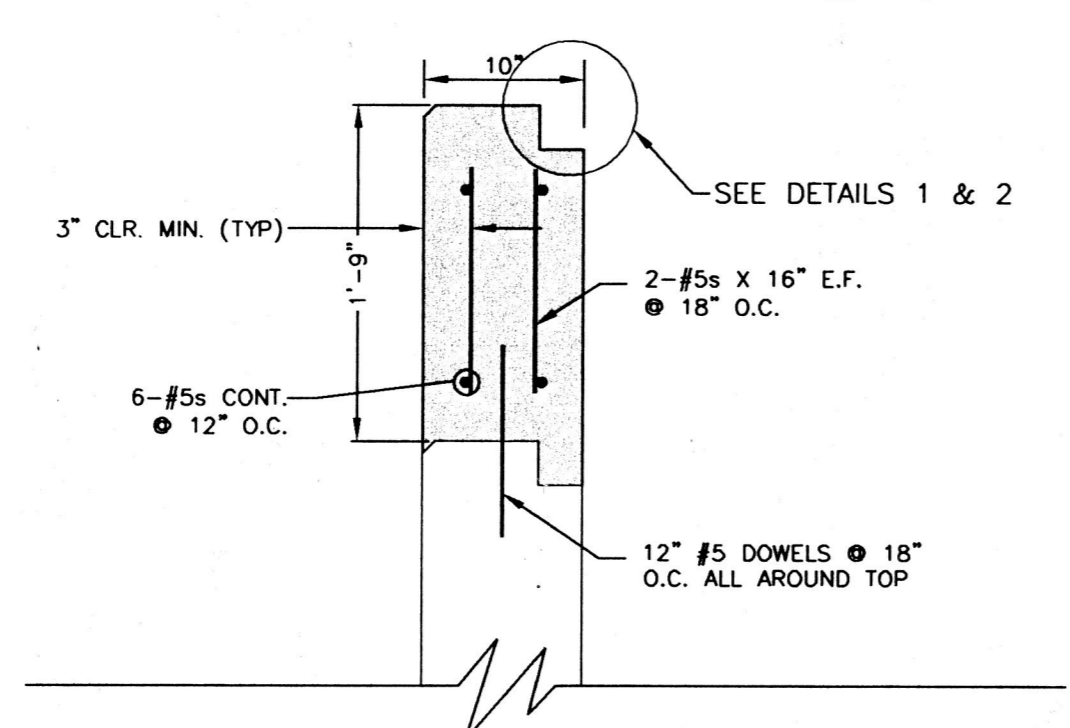
GRATE DETAIL (2)
SCALE: N.T.S.



ORIFICE PLATE HOLE DETAIL
SCALE: N.T.S.

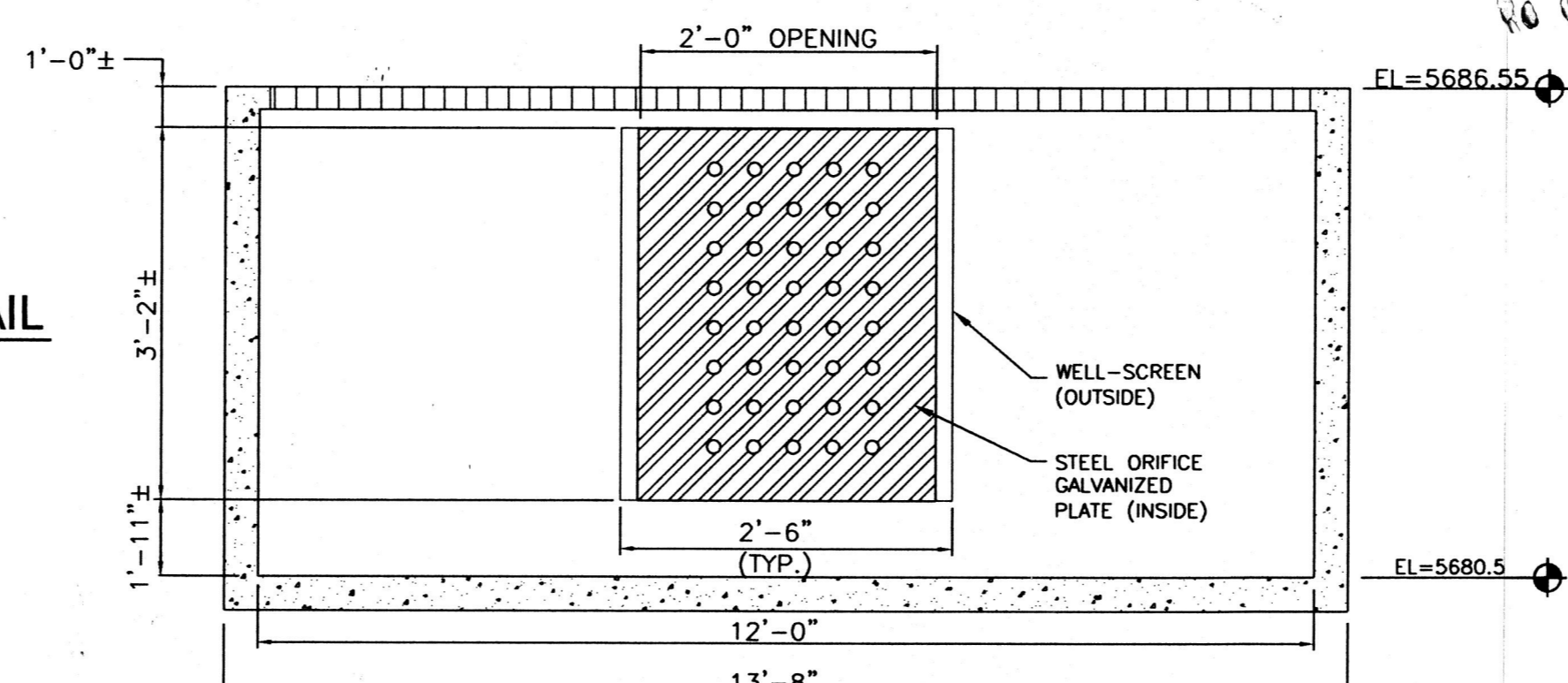


DETAIL 1
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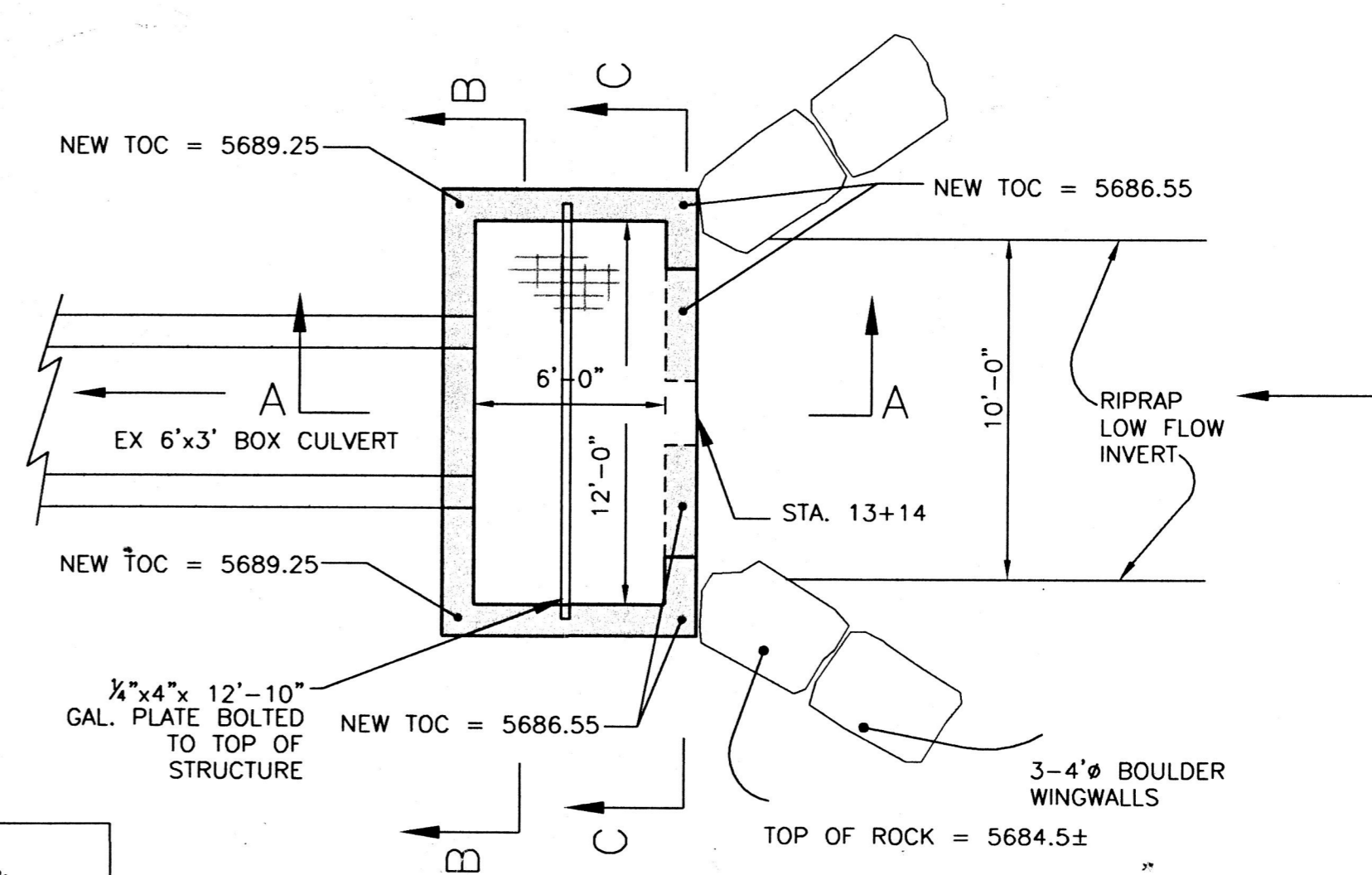


DETAIL 3
SCALE: 1/2"=1'-0"

SECTION B-B
SCALE: 1"=2"



**FULL SPECTRUM STORAGE BASIN
OUTLET STRUCTURE
ELEVATION DETAIL**
SCALE: N.T.S.



OUTLET STRUCTURE PLAN
SCALE: N.T.S.

STRUCTURE MODIFICATION PLAN

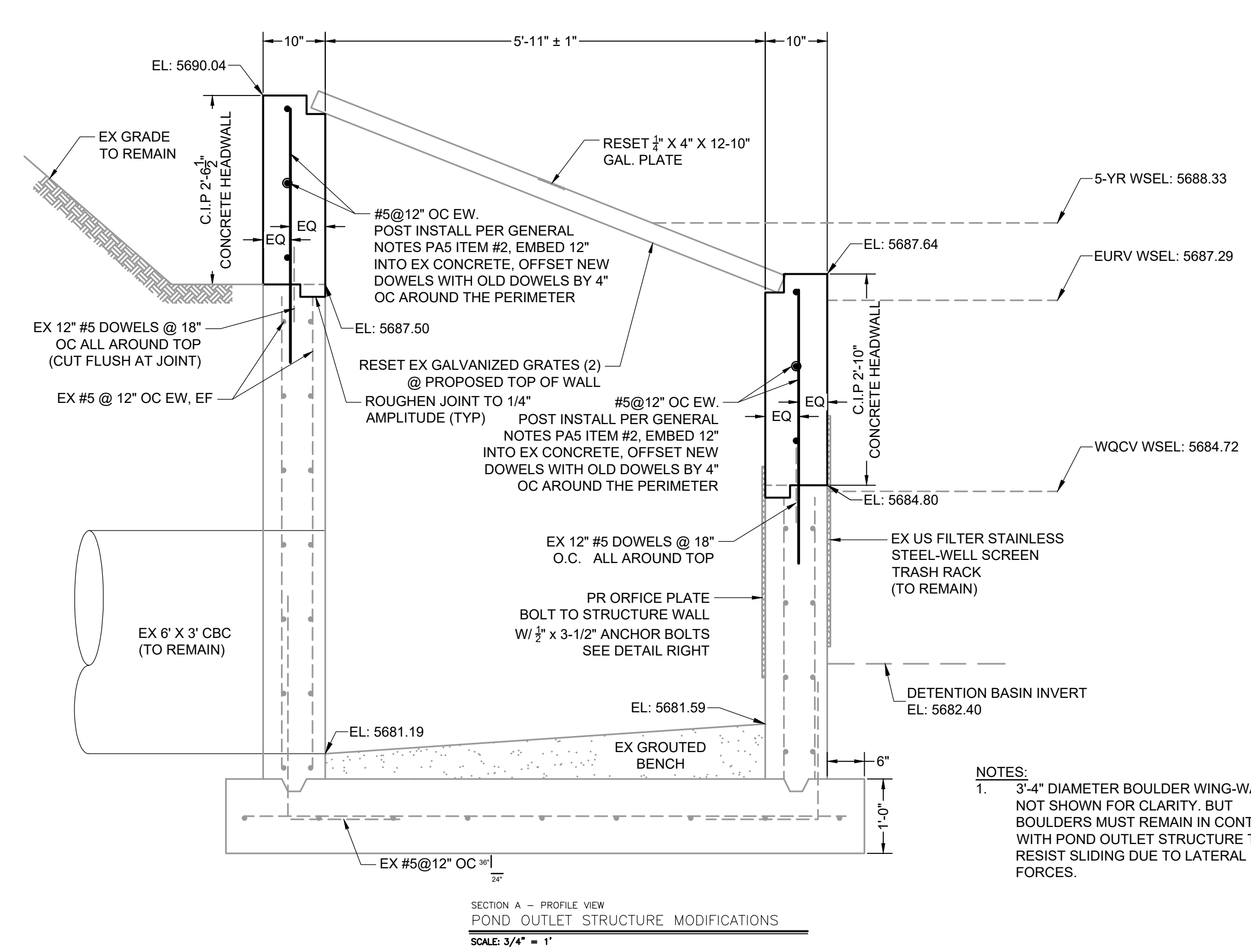
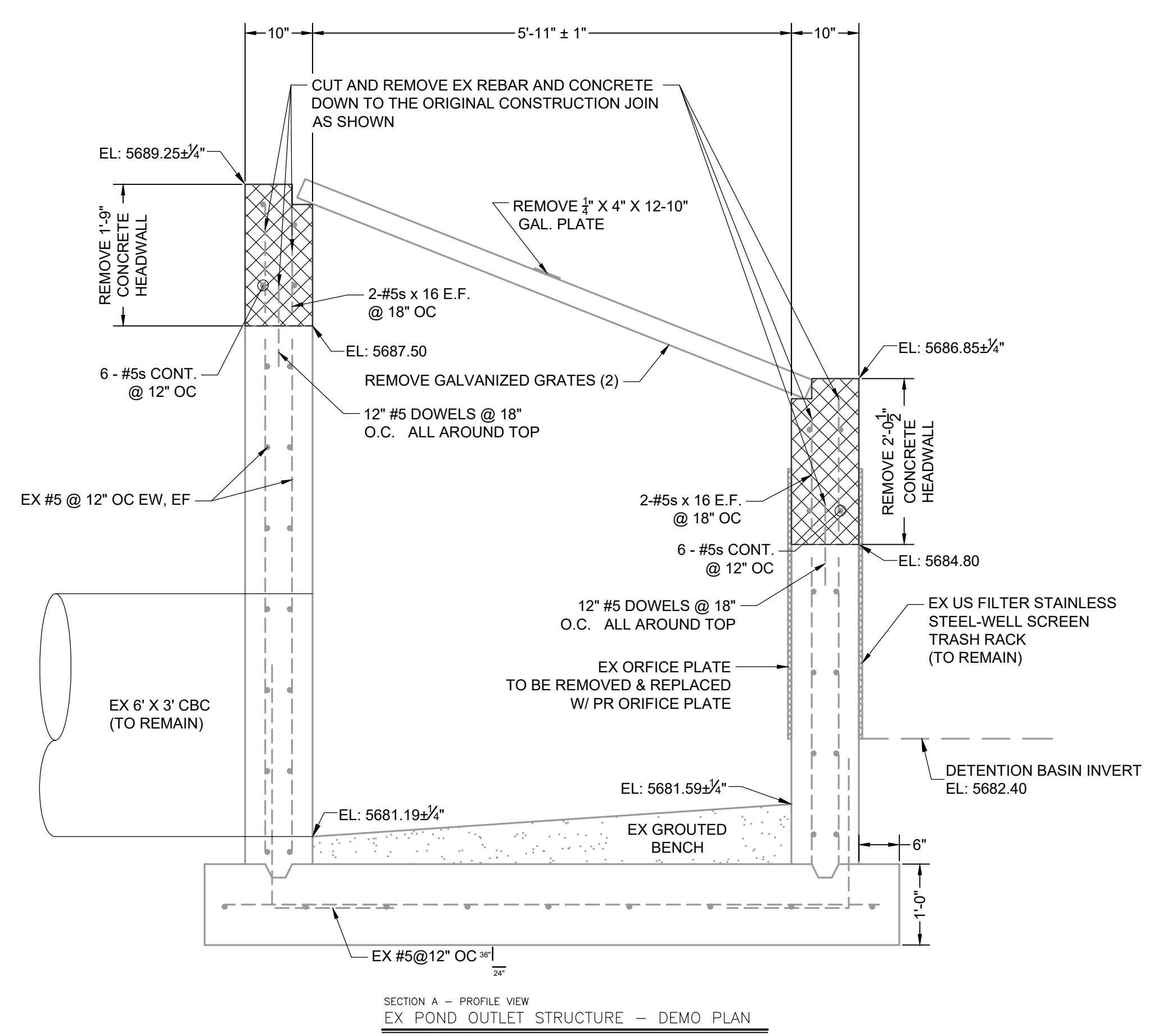
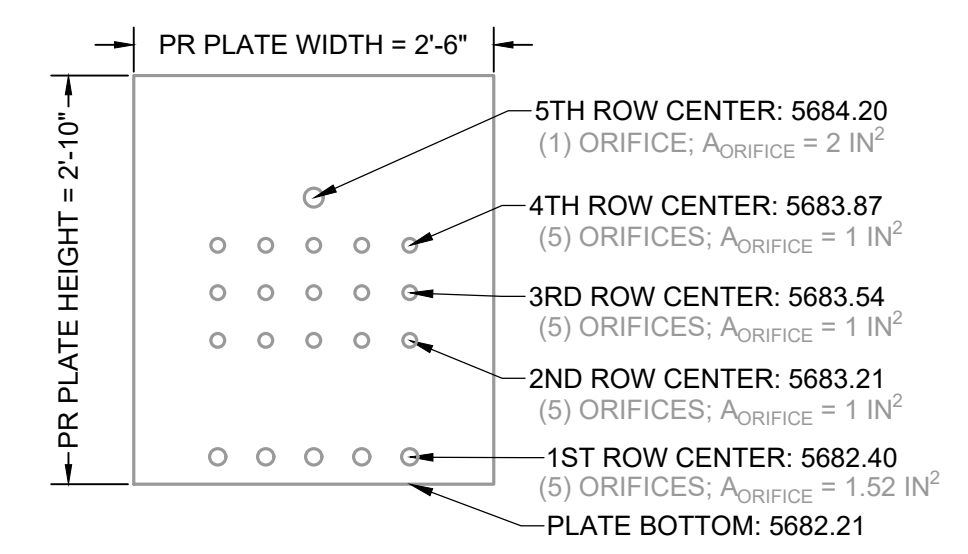
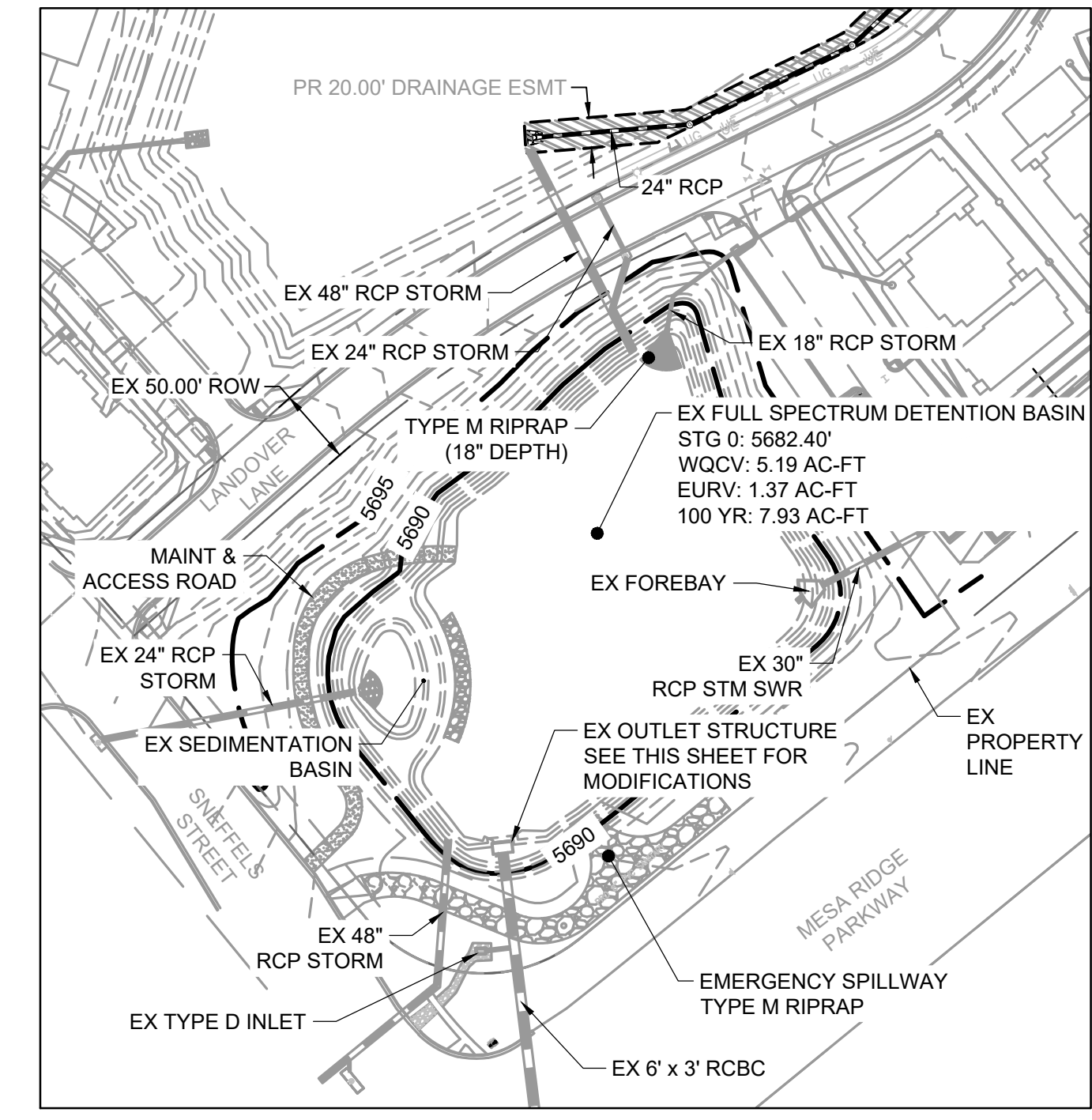
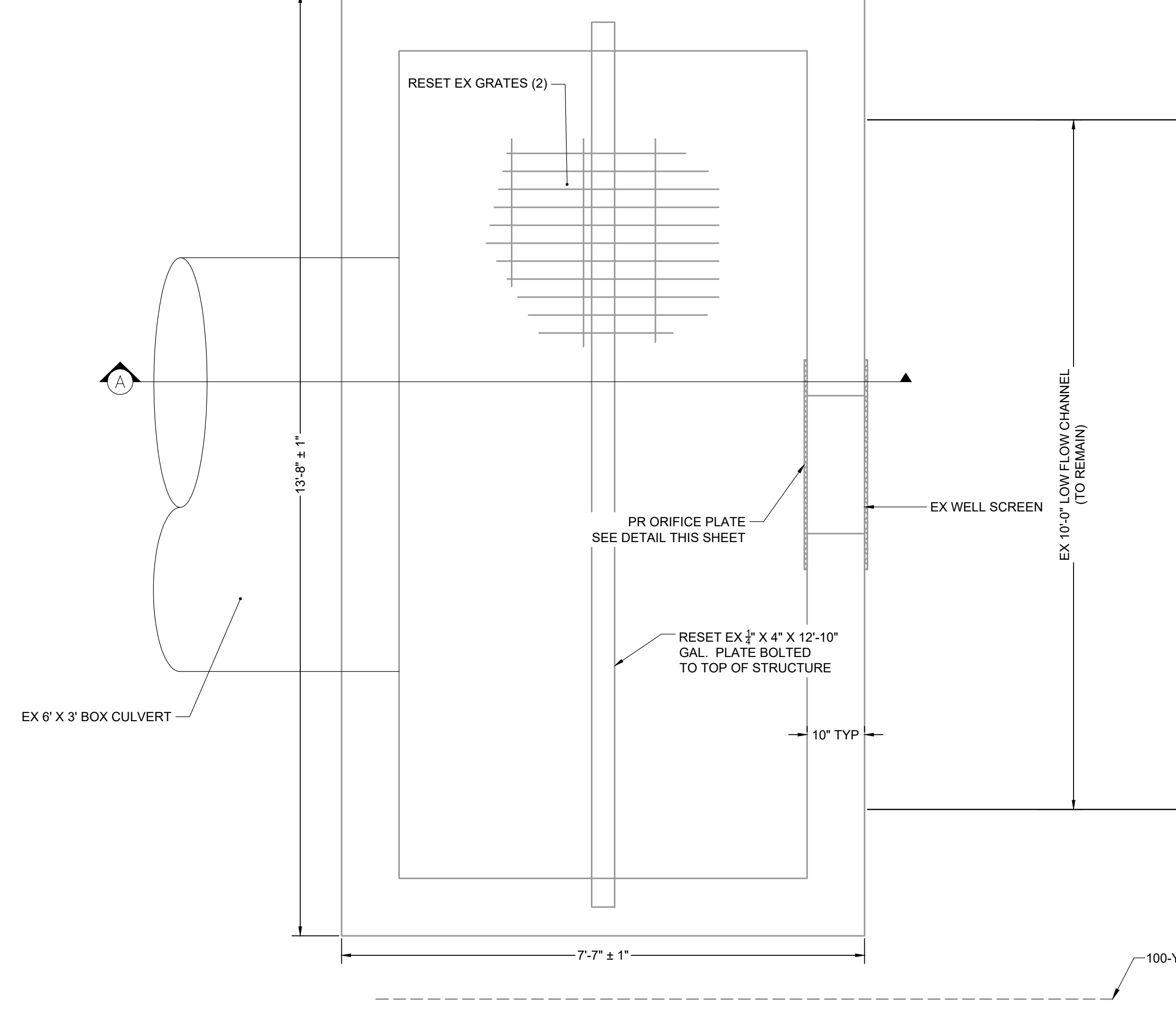
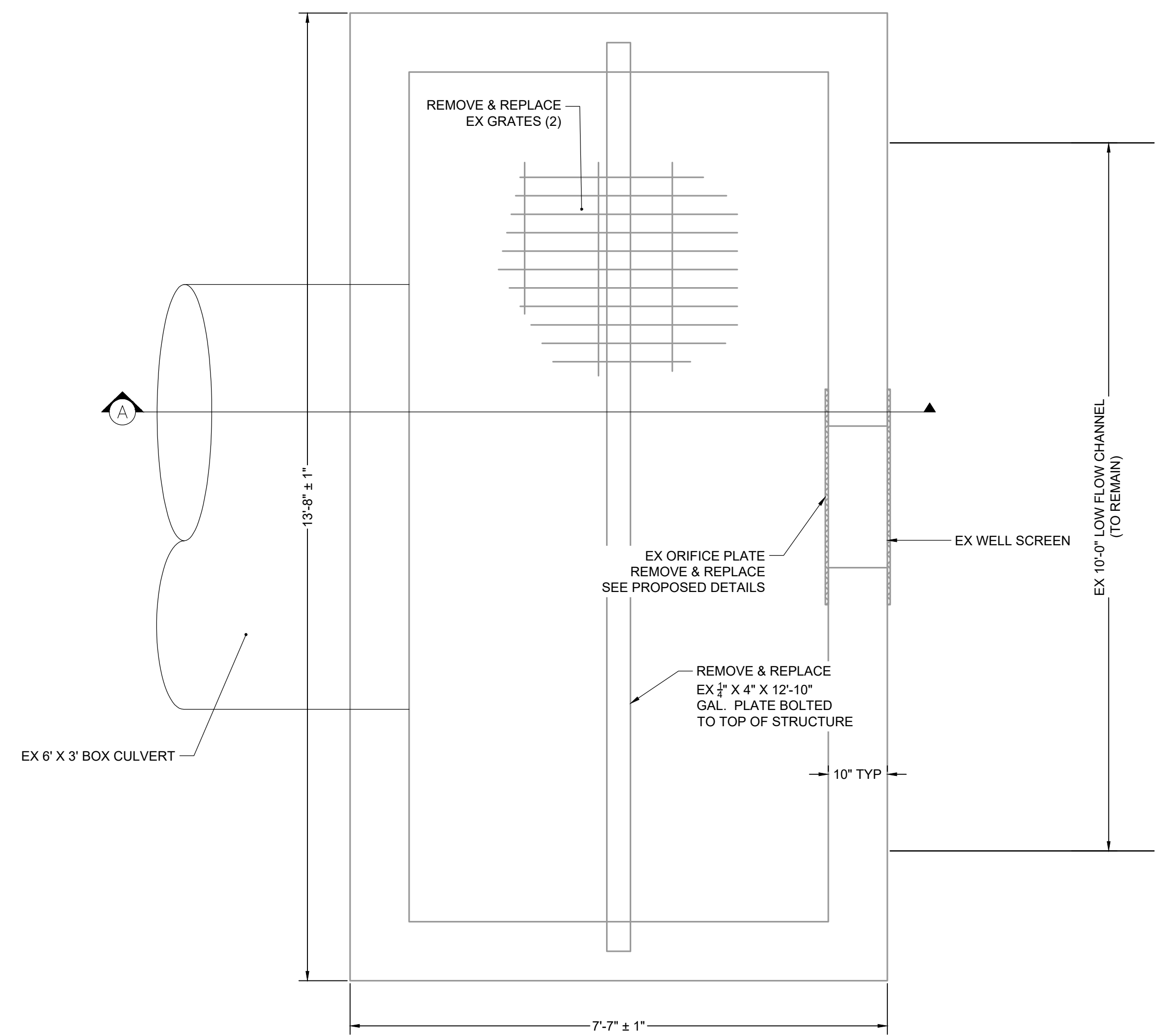
NOTE:
ALL METAL PLATE &
EMBEDMENTS SHALL BE
GALVANIZED STEEL.
ALL BOLTS & NUTS SHALL
BE STAINLESS STEEL.

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado
80904-4208
(719) 630-7342

MESA RIDGE FILINGS 8 & 9 - DETENTION BASIN 'D'
FULL SPECTRUM DETENTION MODIFICATIONS
OUTLET STRUCTURE DETAILS
FOUNTAIN, COLORADO

Project No.:	09061
Date:	October 24, 2011
Design:	RNW
Drawn:	JGD
Check:	RNW
Revisions:	

SHEET
3
OF 3 SHEETS



NOTES:
1. 3'-4" DIAMETER BOULDER WING-WALLS NOT SHOWN FOR CLARITY, BUT BOULDERS MUST REMAIN IN CONTACT WITH POND OUTLET STRUCTURE TO RESIST SLIDING DUE TO LATERAL FORCES.

SCALE:
3/4" = 1'

NOT FOR CONSTRUCTION

DRAWN BY: NQJ	JOB DATE: 7/22/2022	BAR IS ONE INCH ON OFFICIAL DRAWINGS.
APPROVED: KMH	JOB NUMBER: 200541	0
CAD DATE: 8/19/2022		IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.
CAD FILE: J:\2020\200541\CAD\DWG\CICDCI.O.FIOutlet_Structure_Details		

NO.	DATE	BY	REVISION DESCRIPTION

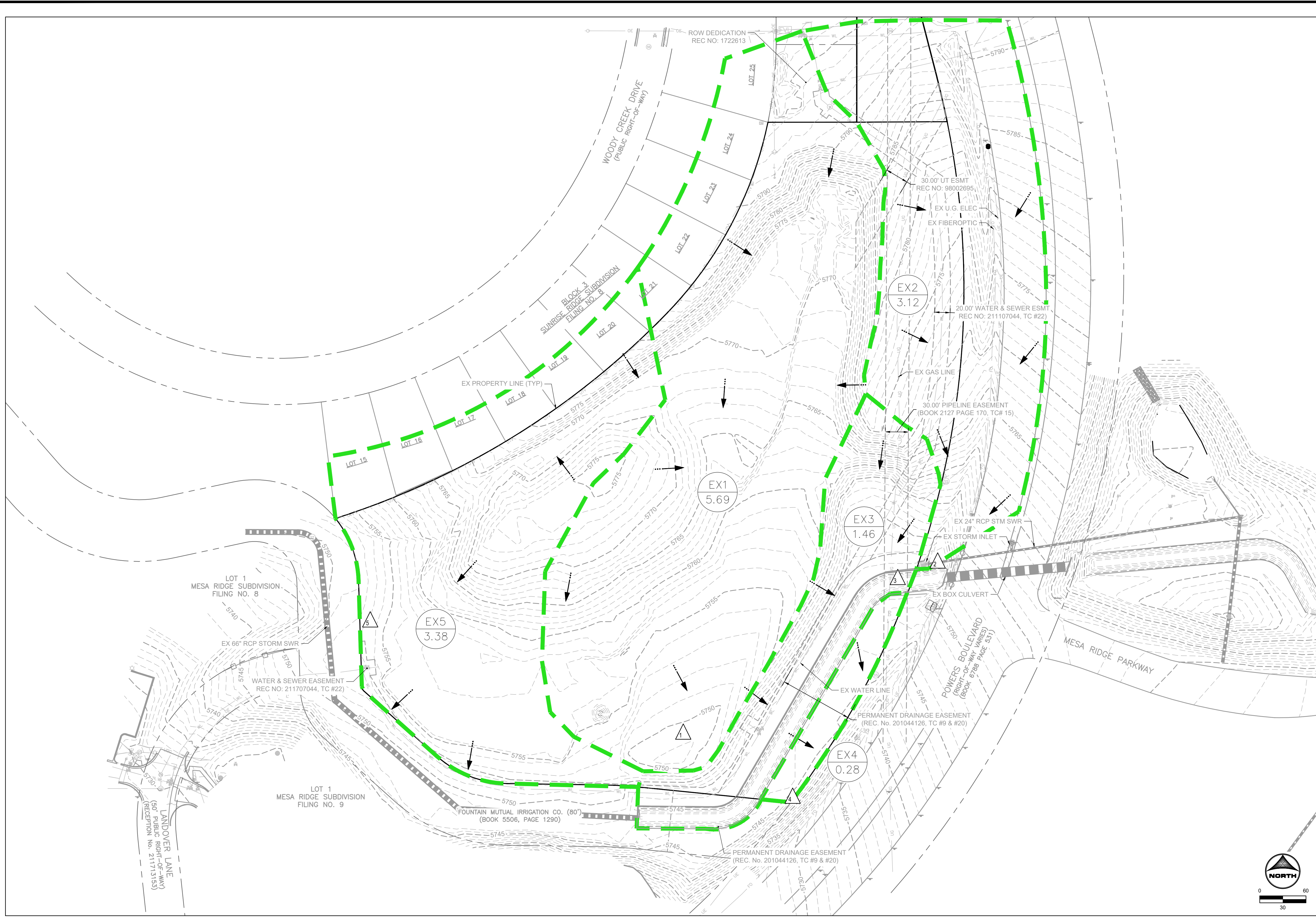
HR GREEN - COLORADO SPRINGS
7222 COMMERCE CENTER DR SUITE 220
COLORADO SPRINGS CO 80919
PHONE: 719.300.4140 TOLL FREE: 800.728.7805
FAX: 844.273.1057 | HRGreen.com

THE COTTAGES AT MESA RIDGE
GOODWIN KNIGHT
FOUNTAIN, COLORADO

CITY OF FOUNTAIN CONSTRUCTION DOCUMENTS
OUTLET STRUCTURE MODIFICATION PLAN

SHEET
DT
10

APPENDIX F – DRAINAGE MAPS

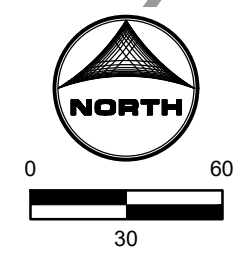


LEGEND:

- PROPOSED MAJOR CONTOUR — 5250 —
- PROPOSED MINOR CONTOUR — 5250 —
- EXISTING MAJOR CONTOUR - - - 5250 - - -
- EXISTING MINOR CONTOUR - - - - -
- PROPOSED STORM DRAIN PIPE ———
- EXISTING STORM DRAIN PIPE - - - - -
- PROPOSED DRAINAGE SWALE ———
- PROPERTY LINE ———
- EXISTING FLOW DIRECTION ———
- SUB BASIN LINE ———
- DESIGN POINT
- PROPOSED BASIN LABEL

11
1.25

 BASIN DESIGNATION
- AREA (AC.)



BASIN	AREA (ac)	% IMPERVIOUS	Q ₅ (cfs)	Q ₁₀₀ (cfs)
EX1	5.69	7	2.5	13.4
EX2	3.12	28	3.5	10.0
EX3	1.46	24	1.4	4.1
EX4	0.28	2	0.1	0.5
EX5	3.38	15	2.1	8.7

DESIGN POINT	UPSTREAM BASIN	ΣQ ₅ (cfs)	ΣQ ₁₀₀ (cfs)
1	EX1	2.5	13.4
2	EX2	3.5	10.0
3	EX3	1.4	4.1
4	EX4	0.1	0.5
5	EX5	2.1	8.7

DRAWN BY: YOU JOB DATE: 8/10/2021
 APPROVED: KEN JOB NUMBER: 200541
 CAD DATE: 12/6/2021
 CAD FILE: J:\2020\200541\CAD\Drawings\C\Drainage\Ex_Drn_Map

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

NO.	DATE	BY	REVISION DESCRIPTION

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THE COTTAGES AT MESA RIDGE
GOODWIN KNIGHT
 EL PASO COUNTY, COLORADO

PRELIMINARY DRAINAGE REPORT
 EXISTING DRAINAGE MAP

