FINAL DRAINAGE REPORT for

Legacy Church
10460 W Hwy 24,
Green Mountain Falls, CO

Prepared for:

Pearson Ministries International
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Prepared by:

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PCD File No. PPR1933

Project #: 096856000

Prepared: July 19, 2019
Resubmitted: September 17, 2019
Resubmitted: October 18, 2019
Resubmitted: November 22, 2019

Please address the CDOT comments.

Kimley»Horn

CERTIFICATION

ENGINEERS STATEMENT

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

SIGNATURE (Affix Seal): ____
Colorado P.E. No. 49487 Date

DEVELOPER'S STATEMENT

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

____
Business Name

____
By:

____
Title:

____
Address:

EL PASO COUNTY STATEMENT

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

____________________________________ ____________________
Jennifer Irving, P.E. Date
County Engineer/ECM Administrator

Conditions:

TABLE OF CONTENTS

INTRODUCTION

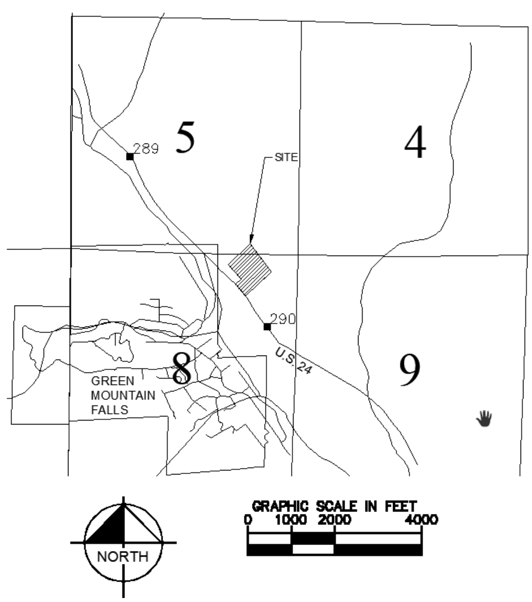
PURPOSE AND SCOPE OF STUDY

The purpose of this report is to outline the Final Drainage Report for Legacy Church – Green Mountain Falls, located in on U.S. Highway 24 between mile marker 289 and 290 (the "Property"), City of Green Mountain Falls, Colorado (the "City"). This Final Drainage Report identifies on-site and offsite drainage patterns, storm sewer and inlet locations, areas tributary to the site and proposes to safely route developed storm water to adequate outfalls. The Property approximately 148 acres in size; however, the limits of project area are approximately 3.66 acres.

GENERAL PROJECT DESCRIPTION

The proposed improvements consist of the paving of approximately 1.7 acres of an existing gravel parking lot, as well as the construction of 2 detention ponds and associated storm infrastructure (the "Project") within the Property (the "Site"). The Project will be processed through El Paso County.

The Project is located within the Southeast Quarter of the Southeast Quarter of Section 5 and the East half of the Northeast Quarter of Section 8, Township 13 South, Range 68 West of the Sixth Principal Meridian, City of Colorado Springs, County of El Paso, State of Colorado (see Vicinity Map). The Property is bounded by U.S. Highway 24 to the South, dispersed residential homes to the East and West, and undeveloped forest to the North. The Property is currently developed and consists of a +/- 19,000 SF building that will be repurposed for the church's use, as well as several small cabins. The Property generally slopes from northeast to southwest with the anticipated stormwater outfall being the existing outfall near U.S. 24 and conveyed via existing drainage ditch to the south side of the highway (herein the "ultimate outfall"). In its current existence, the Site has a large church building with surrounding areas predominately covered in gravel/dirt roads and parking lots intermixed with undeveloped grassy landscape.



A topographic field survey was completed for the Project by Barron Land, LLC. dated June 27,

Kimley»Horn

2019 and is the basis for design for the drainage improvements.

PROJECT CHARACTERISTICS

Along the project frontage, US Highway 24 slopes from east to west at approximately 1.5%, the western and eastern project boundaries slope from north to south at approximately 10%, and the northern project boundary slopes from east to west at approximately 3%, This historic runoff pattern will be maintained and unaffected with the proposed Project.

The proposed building, parking lot, paved drives, and other impervious surfaces comprise 77.1 percent (102,938 square feet) of the overall Project. Landscape areas internal to the site consist of landscape islands within the parking lot, and landscape zones within the building and landscape setback areas. The proposed internal landscaping areas make up 22.9 percent (30,646 square feet) of the Project. Landscape improvements (grass, tree lawns, shrubs, trees etc.) are proposed along the project perimeter.

There are no major irrigation facilities within the Site. The Site does not currently provide on-site water quality or detention for the Project area. The existing land use is mixed with residential and commercial buildings with several cabins. The proposed land use is a church with several cabins.

SOILS CONDITIONS

NRCS soil data is available for this Site and it has been noted that soils onsite are generally USCS Type D. The NRSC Soils map is provided in the Appendix.

DRAINAGE DESIGN CRITERIA

please revise to just indicate "CRITERIA as the subsequent paragraphs only identify "CRITERIA"

REGULATIONS

There are no provisions selected or deviations from the El Paso County Drainage Criteria Manual for the proposed development.

DEVELOPMENT DESIGN CRITERIA REFERENCE AND CONSTRAINTS

The proposed storm facilities follow the El Paso County Drainage Criteria Manual (the "COUNTY CRITERIA"), the City of Colorado Springs Drainage Criteria Manual (the "CITY CRITERIA"), and the Urban Storm Drainage Criteria Manual (the "MANUAL"). Site drainage is not significantly impacted by such constraints as utilities or existing development. Further detail regarding onsite drainage patterns is provided in the Proposed Drainage Conditions Section.

HYDROLOGIC CRITERIA

The 5-year and 100-year design storm events were used in determining rainfall and runoff for the proposed drainage system per chapter 6 of the CRITERIA. Table 6-2 of the CRITERIA is the source for rainfall data for the 5-year and 100-year design storm events. Design runoff was calculated using the Rational Method for developed conditions as established in the CRITERIA and MANUAL. Runoff coefficients for the proposed development were determined using Table 6-6 of the CRITERIA by calculating weighted impervious values for each specific site basin. The detention storage requirement was calculated using Full Spectrum Detention methods as specified in the CRITERIA and MANUAL. The detention basin's outlet structure was designed to release the Water Quality Capture Volume (WQCV) in 40 hours. Based upon this approach, we feel that the drainage design provided for the Site is conservative and in keeping with the zoning and historic drainage concept for the area.

HYDRAULIC CRITERIA

The proposed drainage facilities are designed in accordance with the CRITERIA and MANUAL. Floodplain identification was determined using FIRM panels by FEMA and information provided in the CRITERIA. Hydraulic calculations were computed using StormCAD for the proposed storm sewer system and existing 24" PVC culvert. Results of the hydraulic calculations are summarized in the Appendix.

Please update this last sentence so that it does not indicate that the site is in a FEMA floodplain.

VARIANCES FROM CRITERIA

There are no proposed variances from the El Paso County Drainage Criteria Manual for the proposed development.

MAJOR DRAINAGE BASIN CHARACTERISTICS

The Property lies in the Fountain Creek Headwaters Watershed within the major drainage basin that is the Fountain Creek Watershed. Major drainageways in this area include Fountain Creek and Cascade Creek to the south, and West Monument Creek to the north. The Property lies in the FEMA flood plain 08041C0467G, eff 12/7/2018 indicating this parcel of land is in Zone D (area determined to be out of the 100-year and 500-year flood plain).

EXISTING DRAINAGE CONDITIONS

EXISTING CONDITIONS SUB-BASIN DESCRIPTION

The existing runoff from the building on the Site is generally collected via existing 24" PVC storm sewer pipe that outfalls to a drainage ditch along the western most property line. The drainage ditch then flows south to the CDOT ROW along US Hwy 24. The surrounding areas flow from a northeast to southwestern direction and are collected from two different drainage ditches that need cleaning. Both drainage ditches flow to the same CDOT ROW ditch along US Hwy 24.

The Property has been divided into 8 sub-basins, 1-8. The runoff generated on the eastern portion of the Site (sub-basins 1 and 8) are collected via drainage ditch and flow to the CDOT ROW ditch. An existing sediment-plugged culvert (18" CMP) borders basins 1 and 8 on their eastern edge and conveys flow beneath the existing gravel road to the eventual ROW ditch.

Sub-basins 2, 3, 4, and 5 flow over gravel parking areas as well as grassy landscape areas toward a drainage ditch along the western most property line. Sub-basins 2, 3, and 4 partially flow through two different plugged culverts (18" CMP) that are a part of the drainage ditch which eventually outfalls to the CDOT ROW.

The building roof and parking lot (sub-basin 7) flows to design point 7 and then via existing 24" PVC storm sewer pipe to the same drainage ditch that outfalls into the CDOT ROW. Sub-basin

6 flows south along the existing gravel road and landscape areas to the CDOT ROW along Hwy 24.

Currently, off-site flow flows to the same drainage ditches that the onsite flow outfalls to and does not impact the development.

The weighted imperviousness of the Site with existing conditions is 14%. Cumulative runoff for the 5-year and 100-year storm events are 6.37 cfs and 19.94 cfs respectively.

PROPOSED DRAINAGE CONDITIONS

PROPOSED CONDITIONS SUB-BASIN DESCRIPTION

The developed runoff from the Project will generally be collected by means of private roof drains and storm sewer inlets located in the paved driveways within each delineated basin area. The runoff collected from each basin and the roof system of the proposed building will be conveyed to either of the two-proposed private water quality and detention basins at the western edge of the Site. The controlled stormwater release from the outlet structures within the ponds will be conveyed through the existing private 24" PVC storm sewer pipe, which will be rerouted via a proposed manhole and 24" PVC pipe. The proposed line outfalls into a concrete forebay structure, which will dissipate the incoming flows, and convey to the existing CDOT right of way.

The Property has been divided into six sub-basins, A1-A5 and R1. The runoff generated on the building roof area, sub-basins R1, is collected and conveyed via a private roof drain system which outfalls to the proposed water quality detention basins. Sub-basins A1-A5 are all internal areas within the parking lot and driveway. Each of the sub-basins drains to an inlet or curb cut within the parking lot and is routed to the two water quality detention basins (west and east ponds). A proposed conditions map is provided in the Appendix.

The weighted imperviousness of the Site with proposed conditions is 74.4%. Cumulative runoff for the 5-year and 100-year storm events are 0.7 cfs and 3.8 cfs respectively.

Sub-Basin R1

Sub-basin R1 consists of the rooftop of the proposed building. The runoff developed within this sub-basin is collected via private building roof drains. These roof drains discharge to the proposed east EDB via proposed 4" PVC. Developed runoff during the 5-year and 100-year events are 1.66 cfs and 3.09 cfs respectively.

Sub-Basin A1

Sub-basin A1 is located at the southeast corner of the Site and consists of 0.27 acres of the drive aisle at the southeast corner of the building with a basin impervious value of 80.8%. Developed runoff for the 5-year and 100-year storm events are 1.04 and 2.02 cfs respectively and flows southwest to a proposed curb cut and directly to the east pond at design point 1. Flows are conveyed from the pond via a private storm sewer outfall to the ultimate outfall. On the outside of the southernmost corner of the sub-basin, a culvert directs off-Site flow underneath an existing driveway along the drainage ditch on the eastern boundary of development. This culvert has been plugged with sediment and will need to be cleaned in order to keep flow from entering the Site.

The drainage plan shows proposed grading in this area to divert the offsite flow away from the pond. Also the drainage plan indicates that the existing culvert will be relocated and there appears to be protection provided downstream. Please include a description of this in the narrative.

Sub-Basin A2

Sub-basin A2 is located along the north east portion of the site and consists of 0.75 acres of mostly pavement area with a basin impervious value of 95.4%. Developed runoff for the 5-year and 100-year storm events are 3.29 and 5.99 cfs respectively and flows from the south to the north to a 5' Type R inlet located at design point 2. Flows are conveyed via a private storm line to the east pond. The flow exits the pond via private outlet structure and flows to the existing 24" PVC pipe via 18" RCP. On the outside of the northwest corner of the sub-basin, 2 culverts direct off-Site flow underneath a pair of existing driveways along the drainage ditch on the northwestern boundary of development. Both of these culverts have been plugged with sediment and will need to be cleaned in order to keep flow from entering the Site.

Sub-Basin A3

Sub-basin A3 is located along the northern and western portions of the site and consists of 1.18 acres of mostly pavement area with some landscape area, with a basin impervious value of 85.0%. Developed runoff for the 5-year and 100-year storm events are 4.71 and 8.94 cfs respectively and flows from the north and the south to a curb cut located at design point 3 which outfalls to the west pond. On the outside of the northwest corner of the sub-basin, 2 culverts direct off-Site flow underneath a pair of existing driveways along the drainage ditch on the northwestern boundary of development. Both of these culverts have been plugged with sediment and will need to be cleaned in order to keep flow from entering the Site.

Sub-Basin A4

Sub-basin A4 is located southeast of the building and consists of 0.26 acres of landscape area with a basin impervious value of 2.0%. Developed runoff for the 5-year and 100-year storm events are 0.17 and 0.93 cfs respectively and flows into the east pond outlet structure at design point 4. The outlet structure intercepts the 5-year and 100-year storm event. Flows are conveyed via a private storm line to the ultimate outfall.

Sub-Basin A5

Sub-basin A5 is located at the southern portion of the site and consists of 0.265 acres of landscape area and .045 acres of pavement, totaling 0.31 acres with a basin impervious value of 16.6%. Developed runoff for the 5-year and 100-year storm events are 0.41 and 1.47 cfs respectively and flows into the west pond outlet structure at design point 5. The outlet structure intercepts the 5-year and 100-year storm event. Flows are conveyed via a private storm line to ultimate outfall.

Please update this paragraph to reflect the new design

Ultimate Outfall

The ultimate outfall point will now be directly on the property line bordering the CDOT ROW. Approximately 43' from the existing outlet a 45º bend will be added to the existing 24" PVC pipe directing flow south toward the CDOT ROW. A small concrete rundown will direct flow to the bottom of the existing ditch at the end of the proposed 24" PVC addition. The pipe redirection will avoid the existing sump condition that currently sits at the original outfall of the existing pipe.

In existing conditions, sub-basins 2, 3, 4, 5, and 7 total 2.94 acres and all flow to outfall 1 (design point O1) and produce 13.39cfs of on-site cumulative flow. Sub-basins 1 and 8 combine for 0.47 acres and drain to the existing drainage ditch and flow along the entry road to outfall 2 (design point O2) which produces 1.61cfs for the site. Sub basin 6 (0.44 acres) flows down the entry road and produces 1.30cfs on on-site flow which outfalls into the CDOT ROW.

Under proposed conditions the area of the entire site with the exception of the driveway (see section below) is directed to outfall 1 and a cumulative on-site flow of 3.80cfs is produced from the 3.20 acres. Outfall 2 will receive no on-site flow and will only convey off-site flow toward the CDOT ROW ditch.

Driveway Flow

The runoff from the driveway leading to the property from Hwy 24 does not need to be treated in the water quality ponds on site due to the El Paso County Drainage Criteria Manual section I.7.1.C.1 which states "100% of the applicable development site is captured, except the County may exclude up to 20 percent, not to exceed 1 acre, of the applicable development site area when the County has determined that it is not practicable to capture runoff from portions of the site that will not drain towards control measures. Of the .44 acre driveway, 0.33 acres will not be treated. In addition, the County must also determine that the implementation of a separate control measure for that portion of the site is not practicable (e.g., driveway access that drains directly to street)"

Off-Site Flow

The drainage areas within the Property but outside the area of development are independent drainage basins from the proposed ones discussed previously. The flow from these basins are diverted around the area of development via existing drainage ditches that flow to the CDOT ROW along Hwy24. The drainage ditches must be cleaned to provide the necessary capacity for runoff so that the Site will not be impacted.

EMERGENCY OVERFLOW ROUTING

Emergency overflow routing consists of flows following the proposed drainage pattern of north to south. Once the flows reach the south portion of the site, they will overtop the proposed curb and gutter and sheet flow directly south to the existing culvert under US Highway 24.

DETENTION REQUIREMENTS

The water quality capture volume and 100 year detention volume is required to be detained on-site. This is accomplished through the two proposed 100 year and water quality detention ponds located at the west side of the Site. Each of these ponds were sized per UDFCD criteria and the water quality and detention calculations are provided in the Appendix of this report. The proposed private water quality and detention basins will be maintained by the Owner.

Four-Step Process

The four-step process per the County Criteria provides guidance and requirements for the selection of siting of structural Best Management Practices (BMPs) for new development and significant redevelopment.

Step 1: Employ Runoff Reduction Practices

Currently the site is developed land with surrounding vacant land. Development of the site will increase current runoff conditions due to increased imperviousness values. However, implementation of landscaping throughout the site, the proposed storm sewer infrastructure, and the two proposed private water quality and detention basins will help slow runoff and encourage infiltration.

Step 2: Provide Water Quality Capture Volume (WQCV)
The water quality capture volume will be detained using two proposed private water quality detention basins with water quality outlet structures located in the south portion of the property. The outfall pipes from the water quality outlet structures will control the release of stormwater to less than historic rates.

Step 3: Stabilize Drainageways
There are no current drainageways conveyed through the portion of the property which will be developed. No changes in stabilization are anticipated.

Step 4: Consider need for Industrial and Commercial BMPs
Erosion control features for the final stages of the Project will be designed to reduce contamination. Source control BMPs will include the use of, inlet protection, silt fences, concrete washout areas, stockpile management, and stabilized staging areas. The Grading and Erosion Control Plans will be submitted as a separate construction document set.

Detention and Water Quality Design

Each extended detention basin is designed with an outlet structure that is fitted with a restrictor plate to release the WQCV in a 40-hour time period per the MANUAL.

Calculations included in the Appendix provide details regarding the private water quality and detention basins design. The calculations include determination of the storage volumes required for full spectrum detention for the WQCV and 100 year detention and allowable release rates.

Overall, 0.214 acre-feet of water quality and detention storage volume is required for the east detention pond and the proposed basin provides 0.443 acre-feet of storage. Sub-basins A1, A2, A4, and R1 have a total area of 1.72 acres (77.7% imperviousness) contributing flow to the east water quality and detention basin.

Overall, 0.163 acre-feet of water quality and detention storage volume is required for the west detention pond and the proposed basin provides 0.312 acre-feet of storage. Sub-basins A3 and A5 have a total area of 1.49 acres (74.1% imperviousness) contributing flow to the west detention pond.

The required 5-year and 100-year detention volumes are 0.172 acre-feet and 0.214 acre-feet respectively for the east pond and 0.122 acre-feet and 0.163 acre-feet respectively for the west pond.

Outlet Requirements

The water quality standards established by Vol 2 of the MANUAL in chapter 12 section 5.5 are met by the proposed water quality detention basins. The water quality outlet structures were designed per the specifications in chapter 12 section 5.5 of Vol 2 of the MANUAL. The structures meet the micro-pool requirement that it be integrated into the design of the structure with an additional initial surcharge volume. The orifice plates of the structures were designed based on section 13.4.2.2 of the CITY CRITERIA. The orifice plates will allow the Water Quality Capture Volume to be drained from the structure in 40 hours. The calculations for the design of the water quality outlet structure are presented in the Appendix.

Channel Design and Soil Erodibility

A proposed concrete lined trickle channel within the basin was designed per the MANUAL. A forebay structure is located at the upstream entrance to the basin. This forebay structure was designed per the MANUAL. The surrounding protection is designed as Type L riprap. Calculations detailing the design and dimensions of the trickle channel and forebay structure are included in the Appendix.

Emergency Spillway Path

Two private water quality detention basins are proposed on the west side of the property. Both of these basins have been designed with an emergency spillway/overflow path with Type L riprap that would direct flow to the south portion of the site to the culvert under US Highway 24. The design for each pond also includes an outfall pipe that directs flow from the ponds to an existing drainage ditch and ultimately to the culvert running under US Highway 24.

directs flow from the ponds to the CDOT ROW and ultimately....

EROSION CONTROL PLAN

Erosion Control Plans will be submitted separately as a standalone construction document.

FLOODPLAIN STATEMENT

The Flood Insurance Rate Maps (FIRM) 08041C0459G effective date December 7, 2018, by FEMA, indicates that the Site is located in Zone D (Area of Undetermined Flood Hazard). This panel is included in the Appendix.

MAINTENANCE AND OPERATIONS

It is our recommendation that the detention basins maintenance cycles consist of twice per year inspections (spring and fall), evaluation of sedimentation within the basins, and removal of sediment if levels exceed two inches deep or if discharge is otherwise deemed insufficient. This satisfies the maintenance and access requirement set by the County CRITERIA.

SUMMARY

COMPLIANCE WITH STANDARDS

The drainage design presented within this report for Legacy Church – Green Mountain Falls, conforms to the El Paso County Drainage Criteria Manual and the Urban Drainage and Flood Control District Manual. Additionally, the Site runoff and storm drain facilities will not adversely affect the downstream and surrounding developments. There are no drainage fees associated with the Site as the basin is an unstudied basin and for a site development plan application which also requires no fees. The proposed developed flows entering the water quality ponds are greater than the existing ultimate outfall of the site due to the greater imperviousness of the site, however the implementation of the extended detention basins will disperse the flow over an extended period of time therefore decreasing the flow at the ultimate outfall.

REFERENCES

1. City of Colorado Springs Drainage Criteria Manual, May 2014.
2. El Paso County Drainage Criteria Manual, Vol. 1 and 2, October 1994.

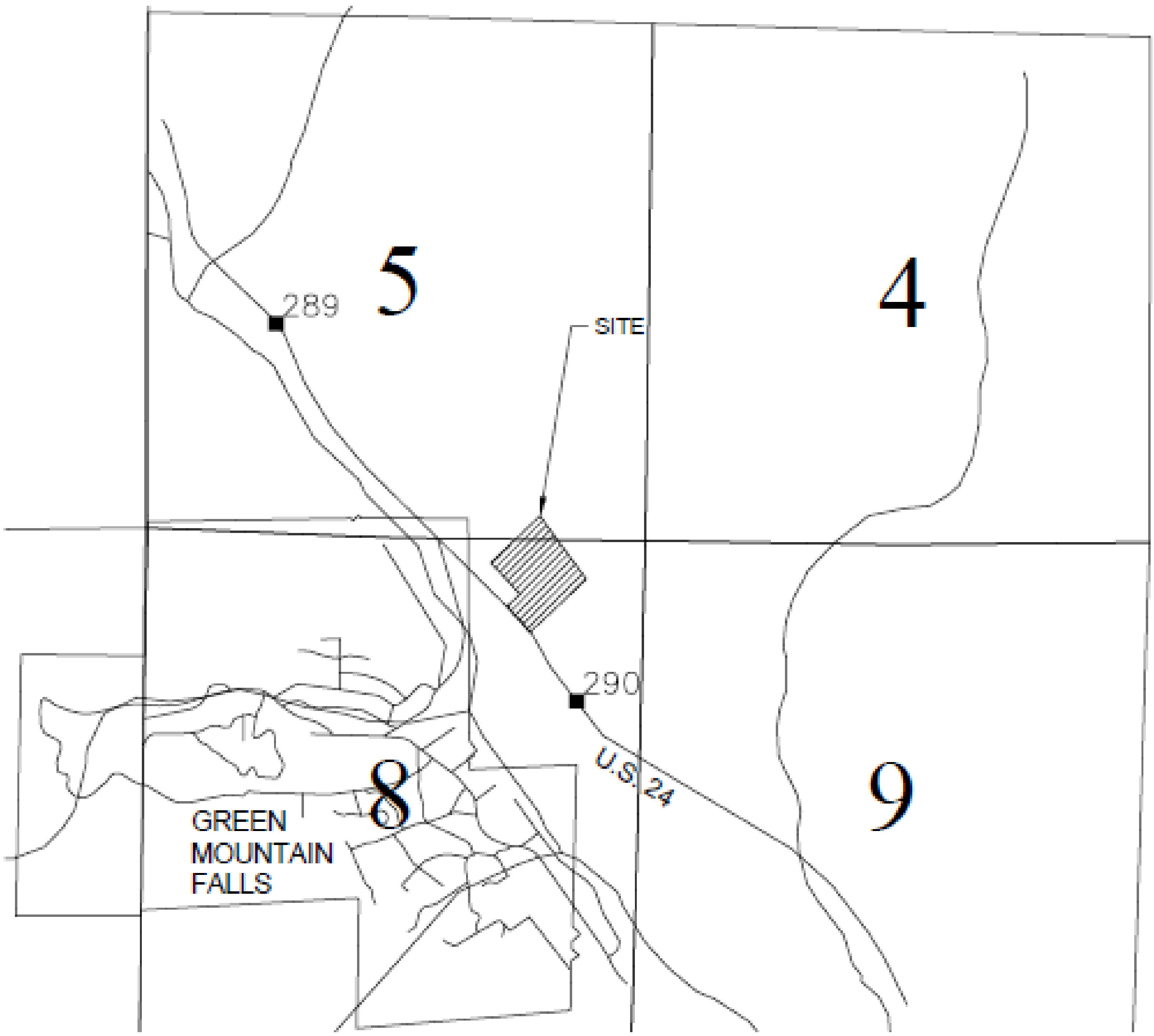
3. Urban Drainage and Flood Control District Drainage Criteria Manual (UDFCDCM), Vol. 1 & 2, prepared by Wright-McLaughlin Engineers, June 2001, with latest revisions.

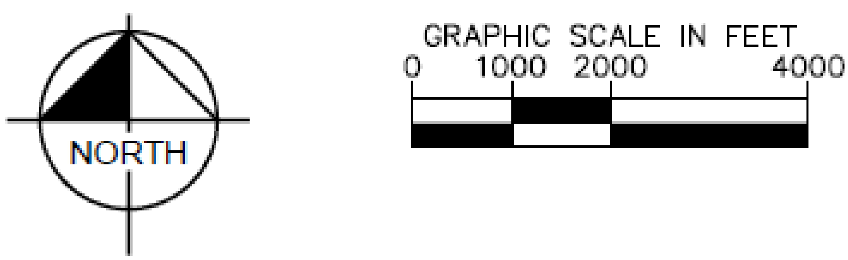
4. Flood Insurance Rate Map, El Paso County, Colorado and Incorporated Areas, Map Number 08041C0459G, Effective Date December 7, 2018, prepared by the Federal Emergency Management Agency (FEMA).

APPENDIX

VICINITY MAP

VICINITY MAP





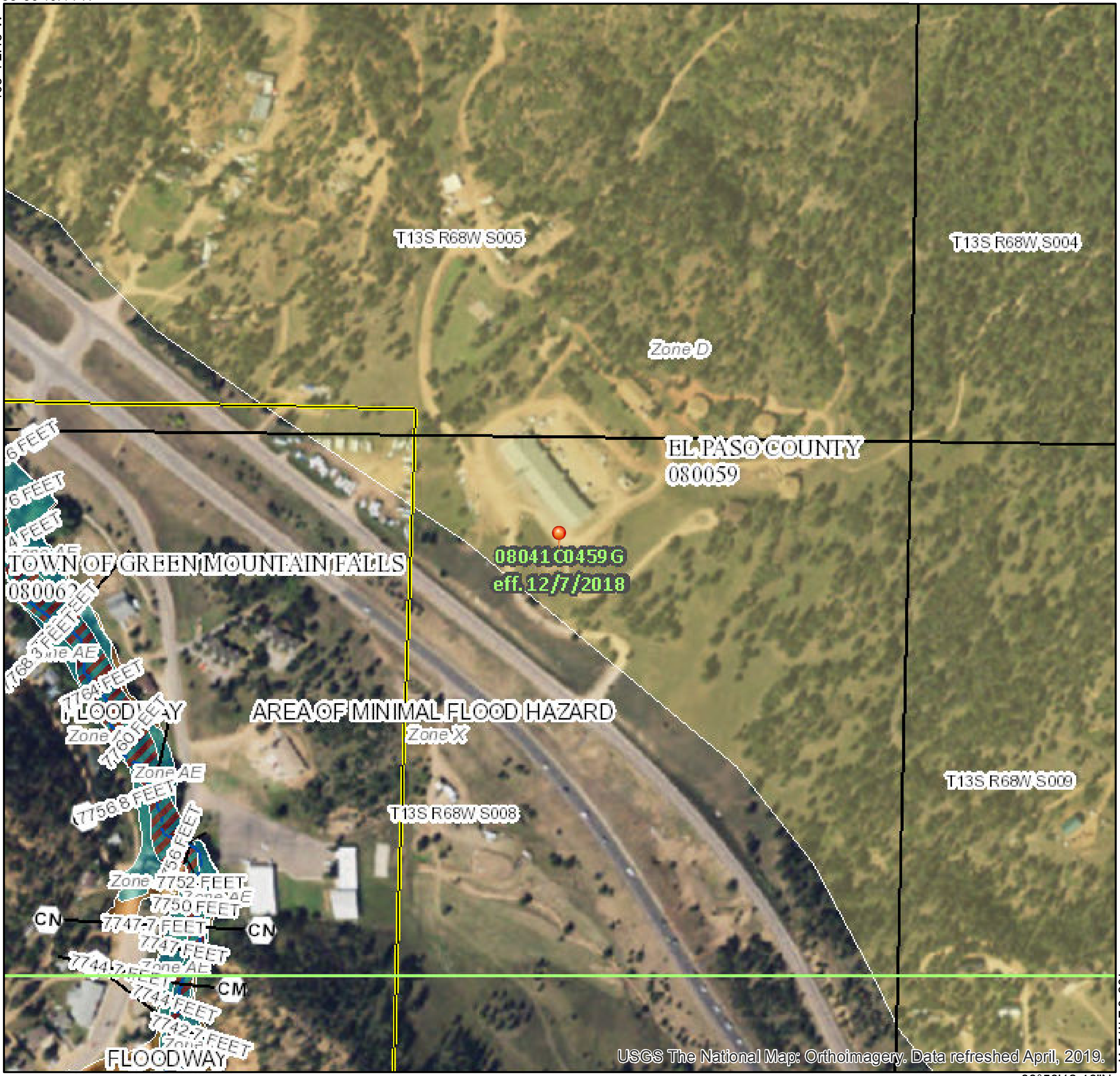
SOILS MAP AND FEMA FIRM PANEL

National Flood Hazard Layer FIRMette

FEMA

38°56'40.44"N

105°1'2.18"W



105°0'24.72"W

38°56'12.46"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X*
	Effective LOMRs
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	Coastal Transect
	513 Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
MAP PANELS	Digital Data Available
	No Digital Data Available
	Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/18/2019 at 4:06:34 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Pike National Forest, Eastern Part, Colorado, Parts of Douglas, El Paso, Jefferson, and Teller Counties

July 18, 2019

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map


105° 0' 50" W
105° 0' 28" W
498820
498900
498980
499060
499140
499220
499300
38° 56' 40" N
38° 56' 17" N
4310590
4310510
4310430
4310350
4310270
4310190
4310110
4310030
4309950
47
24
Us Hwy 24
Soil Map may not be valid at this scale.
Map Scale: 1:3,390 if printed on A portrait (8.5" x 11") sheet.
Meters
0 50 100 200 300
Feet
0 150 300 600 900
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
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: Pike National Forest, Eastern Part, Colorado, Parts of Douglas, El Paso, Jefferson, and Teller Counties
Survey Area Data: Version 5, Sep 10, 2018

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

Date(s) aerial images were photographed: Jul 4, 2010—Oct 16, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND	MAP INFORMATION
	imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
47	Sphinx, warm-Rock outcrop complex, 15 to 80 percent slopes	47.6	100.0%
Totals for Area of Interest		**47.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Pike National Forest, Eastern Part, Colorado, Parts of Douglas, El Paso, Jefferson, and Teller Counties

47—Sphinx, warm-Rock outcrop complex, 15 to 80 percent slopes

Map Unit Setting

National map unit symbol: jpjz
Elevation: 6,500 to 9,200 feet
Mean annual precipitation: 15 to 24 inches
Mean annual air temperature: 43 to 48 degrees F
Frost-free period: 70 to 125 days
Farmland classification: Not prime farmland

Map Unit Composition

Sphinx, warm, and similar soils: 60 percent
Rock outcrop: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sphinx, Warm

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountaintop, mountainflank
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Parent material: Weathered from granite

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
A - 1 to 5 inches: gravelly coarse sandy loam
AC - 5 to 13 inches: very gravelly loamy coarse sand
Cr - 13 to 61 inches: weathered bedrock

Properties and qualities

Slope: 15 to 70 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Natural drainage class: Somewhat excessively drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Very low (about 0.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Other vegetative classification: Ponderosa pine/kinnikinnick (PIPO/ARUV) (C1140)
Hydric soil rating: No

Description of Rock Outcrop

Setting

Landform: Mountain slopes
Landform position (three-dimensional): Mountaintop, mountainflank
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex

Typical profile

R - 0 to 61 inches: bedrock

Properties and qualities

Slope: 15 to 80 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Available water storage in profile: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Sphinx, dark surface

Percent of map unit: 10 percent
Landform: Mountain slopes
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Other vegetative classification: Ponderosa pine/kinnikinnick (PIPO/ARUV) (C1140)
Hydric soil rating: No

Garber

Percent of map unit: 5 percent
Landform: Drainageways, mountain slopes
Landform position (three-dimensional): Mountainbase
Down-slope shape: Linear, convex, concave
Across-slope shape: Linear, convex, concave
Hydric soil rating: No

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PROPOSED HYDROLOGIC CALCULATIONS

$$I = \frac{28.5\ P_1}{(10+T_D)^{0.786}}$$

Where:

I = rainfall intensity (inches per hour)

P_1 = one-hour rainfall depth (inches) from Table 6-2 One-hour Point Rainfall D
City of Colorado Springs Drainage Design

T_C = storm duration (minutes)

	2-yr	5-yr	10-yr	100-yr
P_1 =	1.19	1.50	1.75	2.52

Time Intensity Frequency Tabulation

TIME	2 YR	5 YR	10 YR	100 YR
5	4.04	5.09	5.94	8.55
10	3.22	4.06	4.73	6.82
15	2.70	3.41	3.97	5.72
30	1.87	2.35	2.75	3.95
60	1.20	1.52	1.77	2.55
120	0.74	0.93	1.09	1.57

Weighted Imperviousness Calculations

SUB-BASIN	AREA (SF)	AREA (Acres)	ROOF AREA	ROOF IMPERVIOUSNESS	ROOF C2	ROOF C5	ROOF C10	ROOF C100	LANDSCAPE AREA	LANDSCAPE IMPERVIOUSNESS	LANDSCAPE C2	LANDSCAPE C5	LANDSCAPE C10	LANDSCAPE C100	PAVEMENT AREA	PAVEMENT IMPERVIOUSNESS	PAVEMENT C2	PAVEMENT C5	PAVEMENT C10	PAVEMENT C100	WEIGHTED IMPERVIOUSNESS	WEIGHTED COEFFICIENTS C2	C5	C10	C100
A1	11,853	0.27	0	90%	0.73	0.75	0.77	0.83	2,326	2%	0.05	0.16	0.26	0.51	9,527	100%	0.89	0.90	0.92	0.96	80.8%	0.73	0.75	0.79	0.87
A2	32,590	0.75	0	90%	0.73	0.75	0.77	0.83	1,536	2%	0.05	0.16	0.26	0.51	31,054	100%	0.89	0.90	0.92	0.96	95.4%	0.85	0.87	0.89	0.94
A3	51,202	1.18	0	90%	0.73	0.75	0.77	0.83	7,814	2%	0.05	0.16	0.26	0.51	43,388	100%	0.89	0.90	0.92	0.96	85.0%	0.76	0.79	0.82	0.89
R1	18,969	0.44	18,969	90%	0.73	0.75	0.77	0.83	0	2%	0.05	0.16	0.26	0.51	0	100%	0.89	0.90	0.92	0.96	90.0%	0.73	0.75	0.77	0.83
A4	13,569	0.31	0	90%	0.73	0.75	0.77	0.83	11,161	2%	0.05	0.16	0.26	0.51	2,408	100%	0.89	0.90	0.92	0.96	19.4%	0.20	0.29	0.38	0.59
A5	13,625	0.31	0	90%	0.73	0.75	0.77	0.83	11,600	2%	0.05	0.16	0.26	0.51	2,025	100%	0.89	0.90	0.92	0.96	16.6%	0.17	0.27	0.36	0.58
TOTAL	141,808	3.26	18,969	90%	0.73	0.75	0.77	0.83	34,437	2%	0.05	0.16	0.26	0.51	88,402	100%	0.89	0.90	0.92	0.96	74.9%	0.66	0.70	0.74	0.83
EAST POND (A1, A2, A4, R1)	76,981	1.77	18,969	90%	0.73	0.75	0.77	0.83	15,023	2%	0.05	0.16	0.26	0.51	42,989	100%	0.89	0.90	0.92	0.96	78.4%	0.69	0.72	0.75	0.84
WEST (A3 & A5)	64,827	1.49	0	90%	0.73	0.75	0.77	0.83	19,414	2%	0.05	0.16	0.26	0.51	45,413	100%	0.89	0.90	0.92	0.96	70.7%	0.64	0.68	0.72	0.82

Green Mountain Falls Church - Drainage Report
Proposed Runoff Calculations
Time of Concentration

Watercourse Coefficient

Forest & Meadow	2.50	Short Grass Pasture & Lawns	7.00	Grassed Waterway	15.00
Fallow or Cultivation	5.00	Nearly Bare Ground	10.00	Paved Area & Shallow Gutter	20.00

	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)					T(c) CHECK (URBANIZED BASINS)			FINAL T(c)
DESIGN POINT	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	TOTAL LENGTH	L/180+10	min.
1	A1	11,853	0.27	0.75	10	10.0%	0.9	313	6.4%	20.00	5.1	1.0	5.0	323	11.8	5.0
2	A2	32,590	0.75	0.87	10	10.0%	0.6	440	4.3%	20.00	4.2	1.8	5.0	450	12.5	5.0
3	A3	51,202	1.18	0.79	10	10.0%	0.8	482	6.1%	20.00	4.9	1.6	5.0	492	12.7	5.0
R1	R1	18,969	0.44	0.75	10	26.0%	0.7	35	5.3%	20.00	4.6	0.1	5.0	45	10.3	5.0
4	A4	13,569	0.31	0.29	102	7.4%	7.7	0	1.0%	15.00	1.5	0.0	7.7	102	10.6	7.7
5	A5	13,625	0.31	0.27	70	10.0%	5.9	0	1.0%	15.00	1.5	0.0	5.9	70	10.4	5.9

Green Mountain Falls Church - Drainage Report
Proposed Runoff Calculations ***Design Storm 5 Year***
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
1	A1	0.27	0.75	5.0	0.21	5.09	1.04					A portion of the east drive aisle and pavement draining to a riprap swale.
2	A2	0.75	0.87	5.0	0.65	5.09	3.29					A portion of the east drive aisle and the north parking lot draining to a Type R inlet
3	A3	1.18	0.79	5.0	0.93	5.09	4.71					The majority of the west and south sides of the building draining to a curb cut and riprap swale.
R1	R1	0.44	0.75	5.0	0.33	5.09	1.66					This basin is for the roof flows, draining to roof drains and to Basin A4
4	A4	0.31	0.29	7.7	0.09	4.47	0.41					Landscaping and the East Detention Pond
5	A5	0.31	0.27	5.9	0.08	4.86	0.41					Landscaping and the West Detention Pond
7	Total	3.26						5.0	2.28	5.09	11.60	Total Site Area

Green Mountain Falls Church - Drainage Report

Proposed Runoff Calculations ***Design Storm 100 Year***

(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	NOTES
1	A1	0.27	0.87	5.0	0.24	8.55	2.02					A portion of the east drive aisle and pavement draining to a riprap swale.
2	A2	0.75	0.94	5.0	0.70	8.55	5.99					A portion of the east drive aisle and the north parking lot draining to a Type R inlet
3	A3	1.18	0.89	5.0	1.05	8.55	8.94					The majority of the west and south sides of the building draining to a curb cut and riprap swale.
R1	R1	0.44	0.83	5.0	0.36	8.55	3.09					This basin is for the roof flows, draining to roof drains and to Basin A4
4	A4	0.31	0.59	7.7	0.18	7.50	1.38					Landscaping and the East Detention Pond
5	A5	0.31	0.58	5.9	0.18	8.16	1.47					Landscaping and the West Detention Pond
7	Total							5.0	2.71	8.55	23.15	Total Site Area

SUMMARY - PROPOSED RUNOFF TABLE						
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
1	A1	0.27	1.04	2.02	1.04	2.02
2	A2	0.75	3.29	5.99	3.29	5.99
3	A3	1.18	4.71	8.94	4.71	8.94
R1	R1	0.44	1.66	3.09	1.66	3.09
4	A4	0.31	0.41	1.38	0.41	1.38
5	A5	0.31	0.41	1.47	0.41	1.47

EXISTING HYDROLOGIC CALCULATIONS

$$I = \frac{28.5\ P_1}{(10+T_D)^{0.786}}$$

Where:

I = rainfall intensity (inches per hour)

P_1 = one-hour rainfall depth (inches) from Table 6-2 One-hour Point Rainfall D
City of Colorado Springs Drainage Design

T_C = storm duration (minutes)

	2-yr	5-yr	10-yr	100-yr
P_1 =	1.19	1.50	1.75	2.52

Time Intensity Frequency Tabulation

TIME	2 YR	5 YR	10 YR	100 YR
5	4.04	5.09	5.94	8.55
10	3.22	4.06	4.73	6.82
15	2.70	3.41	3.97	5.72
30	1.87	2.35	2.75	3.95
60	1.20	1.52	1.77	2.55
120	0.74	0.93	1.09	1.57

Weighted Imperviousness Calculations

SUB-BASIN	AREA (SF)	AREA (Acres)	ROOF AREA	ROOF IMPERVIOUSNESS	ROOF				LANDSCAPE AREA	LANDSCAPE IMPERVIOUSNESS	LANDSCAPE				PAVEMENT AREA	PAVEMENT IMPERVIOUSNESS	PAVEMENT				WEIGHTED IMPERVIOUSNESS	WEIGHTED COEFFICIENTS			
					C2	C5	C10	C100			C2	C5	C10	C100			C2	C5	C10	C100		C2	C5	C10	C100
1	5,308	0.12	0	90%	0.73	0.75	0.77	0.83	5,308	2%	0.05	0.16	0.26	0.51	0	100%	0.89	0.90	0.92	0.96	2.0%	0.05	0.16	0.26	0.51
2	5,649	0.13	0	90%	0.73	0.75	0.77	0.83	5,649	2%	0.05	0.16	0.26	0.51	0	100%	0.89	0.90	0.92	0.96	2.0%	0.05	0.16	0.26	0.51
3	42,118	0.97	0	90%	0.73	0.75	0.77	0.83	39,273	2%	0.05	0.16	0.26	0.51	2,845	100%	0.89	0.90	0.92	0.96	8.6%	0.11	0.21	0.30	0.54
4	13,513	0.31	0	90%	0.73	0.75	0.77	0.83	9,909	2%	0.05	0.16	0.26	0.51	3,604	100%	0.89	0.90	0.92	0.96	28.1%	0.27	0.36	0.44	0.63
5	34,333	0.79	0	90%	0.73	0.75	0.77	0.83	26,068	2%	0.05	0.16	0.26	0.51	8,265	100%	0.89	0.90	0.92	0.96	25.6%	0.25	0.34	0.42	0.62
6	18,959	0.44	0	90%	0.73	0.75	0.77	0.83	18,959	2%	0.05	0.16	0.26	0.51	0	100%	0.89	0.90	0.92	0.96	2.0%	0.05	0.16	0.26	0.51
7	32,663	0.75	19,102	90%	0.73	0.75	0.77	0.83	6,081	2%	0.05	0.16	0.26	0.51	7,480	100%	0.89	0.90	0.92	0.96	75.9%	0.64	0.67	0.71	0.80
8	15,262	0.35	0	90%	0.73	0.75	0.77	0.83	15,262	2%	0.05	0.16	0.26	0.51	0	100%	0.89	0.90	0.92	0.96	2.0%	0.05	0.16	0.26	0.51
TOTAL	119,880	2.75	0	90%	0.73	0.75	0.77	0.83	105,166	2%	0.05	0.16	0.26	0.51	14,714	100%	0.89	0.90	0.92	0.96	14.0%	0.15	0.25	0.34	0.56

Per DCM Vol. 1 Ch 6 section 3.2.1(City criteria adopted by County) length of overland flow shall be a max. 300 ft. This comment is consistent with the comment provided by CDOT.

Green Mountain Falls Church - Drainage Report

Existing Runoff Calculations

Time of Concentration

Watercourse Coefficient

Forest & Meadow 2.50	Short Grass Pasture & Lawns 7.00	Grassed Waterway 15.00
Fallow or Cultivation 5.00	Nearly Bare Ground 10.00	Paved Area & Shallow Gutter 20.00

	SUB-BASIN DATA				INITIAL / OVERLAND TIME			TRAVEL TIME T(t)					T(c) CHECK (URBANIZED BASINS)			FINAL T(c)
DESIGN POINT	DRAIN BASIN	AREA sq. ft.	AREA ac.	C(5)	Length ft.	Slope %	T(i) min	Length ft.	Slope %	Coeff.	Velocity fps	T(t) min.	COMP. T(c)	TOTAL LENGTH	L/180+10	min.
1	1	5,308	0.12	0.16	365	9.3%	15.6	0	1.0%	20.00	2.0	0.0	15.6	365	12.0	12.0
2	2	5,649	0.13	0.16	409	5.9%	19.3	0	1.0%	20.00	2.0	0.0	19.3	409	12.3	12.3
3	3	42,118	0.97	0.21	320	4.7%	17.4	0	1.0%	20.00	2.0	0.0	17.4	320	11.8	11.8
4	4	13,513	0.31	0.36	246	9.8%	10.0	0	1.0%	20.00	2.0	0.0	10.0	246	11.4	10.0
5	5	34,333	0.79	0.34	228	7.0%	11.0	0	1.0%	15.00	1.5	0.0	11.0	228	11.3	11.0
6	6	18,959	0.44	0.16	765	3.4%	31.7	0	1.0%	16.00	1.6	0.0	31.7	765	14.3	14.3
7	7	32,663	0.75	0.67	134	9.7%	4.2	0	0.0%	17.00	0.0	0.0	5.0	134	10.7	5.0
8	8	15,262	0.35	0.16	152	9.2%	10.1	0	0.0%	18.00	0.0	0.0	10.1	152	10.8	10.1

Green Mountain Falls Church - Drainage Report
Existing Runoff Calculations
(Rational Method Procedure)

Design Storm 5 Year

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	NOTES
1	1	0.12	0.16	12.0	0.019	3.77	0.07					A portion of the east drive aisle landscape on either side.
2	2	0.13	0.16	12.3	0.021	3.73	0.08					The northern most gravel road leading to the northern parking lot.
3	3	0.97	0.21	11.8	0.20	3.79	0.77					The parking lot on the northern side of the building as well as the landscape area and trash enclosure.
4	4	0.31	0.36	10.0	0.11	4.06	0.45					The drive aisle and parking lot on the northwest corner of the building. A small channel runs along the
5	5	0.79	0.34	11.0	0.27	3.91	1.04					The parking lot on the southern side of the building. Also includes the landscape berm area and the drive aisle through the parking lot.
6	6	0.44	0.16	14.3	0.07	3.48	0.24					The driveway from the highway to the building.
7	7	0.75	0.67	5.0	0.51	5.09	2.57					The building rooftop and the parking pad outside of the southern most corner of the building. Also includes a small landscape area leading toward an existing inlet.
8	8	0.35	0.16	10.1	0.06	4.04	0.23					The landscape area to the south of the building. It is enclosed by area 6 to the east and area 7 to the north.
9	Total Area	3.85						5	1.2521	5.0878	6.3705	

Green Mountain Falls Church - Drainage Report

Existing Runoff Calculations

Design Storm **10 Year**

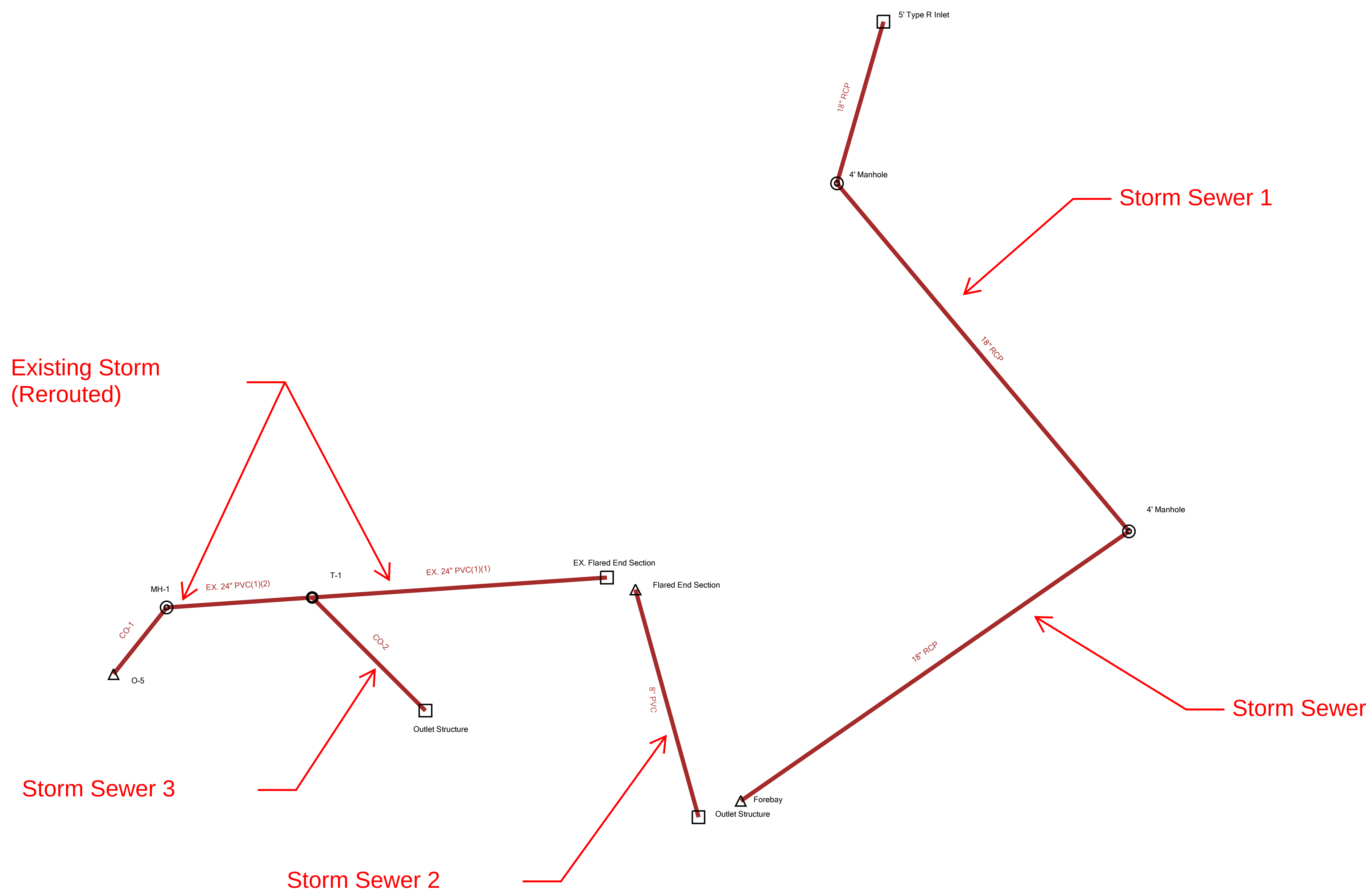
(Rational Method Procedure)

BASIN INFORMATION				DIRECT RUNOFF				CUMULATIVE RUNOFF				NOTES
DESIGN POINT	DRAIN BASIN	AREA ac.	RUNOFF COEFF	T(c) min	C x A	I in/hr	Q cfs	T(c) min	C x A	I in/hr	Q cfs	
1	1	0.122	0.26	12.0	0.03	4.39	0.14					A portion of the east drive aisle landscape on either side.
2	2	0.13	0.26	12.3	0.03	4.35	0.15					The northern most gravel road leading to the northern parking lot.
3	3	0.967	0.30	11.8	0.29	4.42	1.30					The parking lot on the northern side of the building as well as the landscape area and trash enclosure.
4	4	0.31	0.44	10.0	0.14	4.73	0.64					The drive aisle and parking lot on the northwest corner of the building. A small channel runs along the aisle.
5	5	0.788	0.42	11.0	0.33	4.56	1.50					The parking lot on the southern side of the building. Also includes the landscape berm area and the drive aisle through the parking lot.
												The driveway from the highway to the building.
												The building rooftop and the parking pad outside of the southern most corner of the building. Also includes a small landscape area leading toward an existing inlet.
8	8	0.35	0.26	10.1	0.09	4.72	0.43					The landscape area to the south of the building. It is enclosed by area 6 to the east and area 7 to the north.

SUMMARY - EXISTING RUNOFF TABLE						
DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
1	1	0.12	0.07	0.39	0.07	0.39
2	2	0.13	0.08	0.41	0.08	0.41
3	3	0.97	0.77	3.33	0.77	3.33
4	4	0.31	0.45	1.33	0.45	1.33
5	5	0.79	1.04	3.20	1.04	3.20
6	6	0.44	0.24	1.30	0.24	1.30
7	7	0.75	2.57	5.13	2.57	5.13
8	8	0.35	0.23	1.21	0.23	1.21

HYDRAULIC CALCULATIONS

Scenario: Base



5-Year FlexTable: Catch Basin Table

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Additional Subsurface) (cfs)	Flow (Total Out) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)
5' Type R Inlet	7,907.73	7,903.73	3.29	3.29	7,904.42	7,904.42	Standard	0.000
EX. Flared End Section	7,881.28	7,879.12	0.19	0.19	7,879.27	7,879.27	Standard	0.000
Outlet Structure	7,885.93	7,882.17	0.19	0.19	7,882.37	7,882.37	Standard	0.000
Outlet Structure	7,872.42	7,871.17	0.17	0.17	7,871.36	7,871.36	Standard	0.000

5-Year FlexTable: Conduit Table

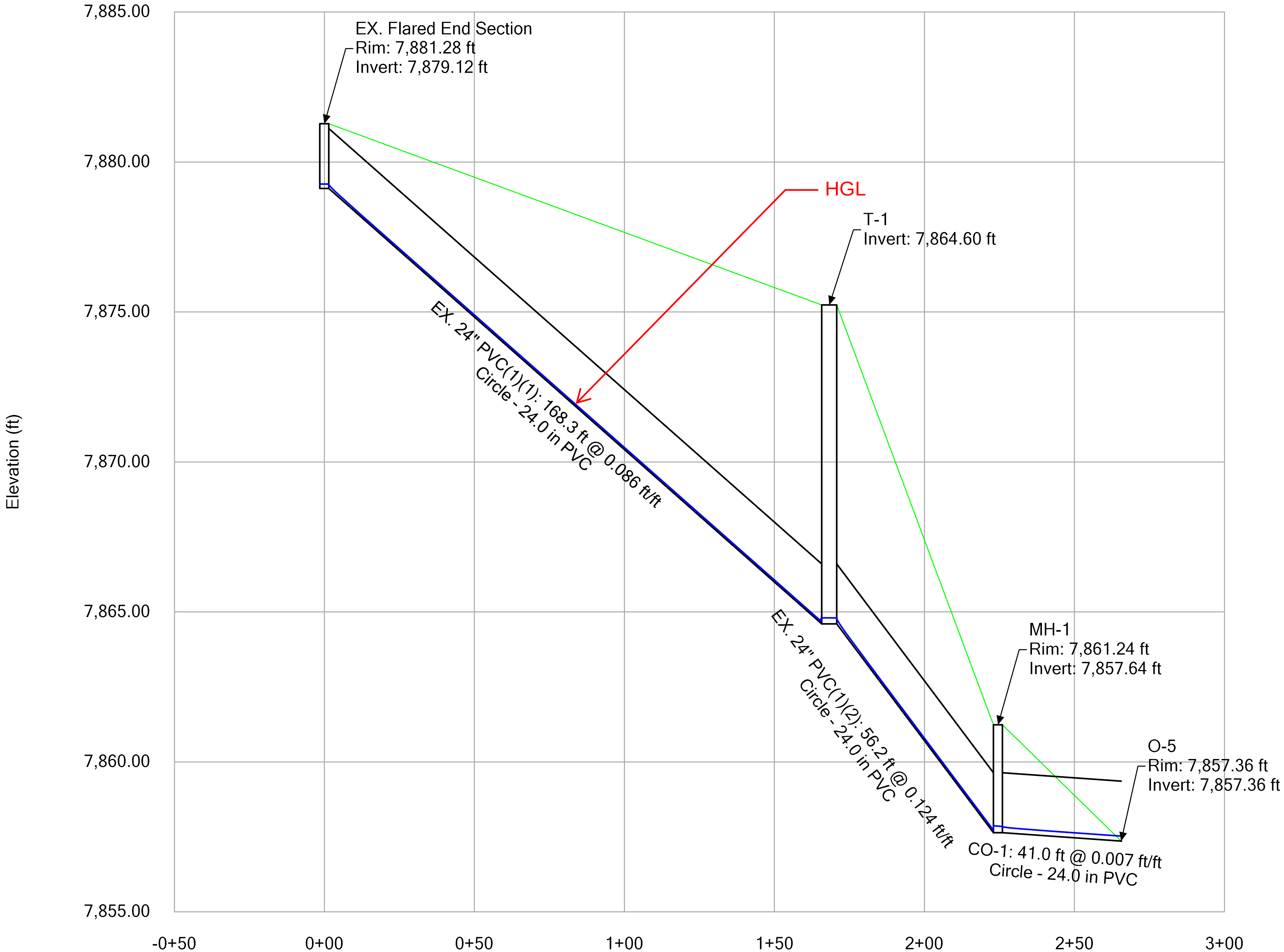
Label	Start Node	Diameter (in)	Invert (Start) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Capacity (Full Flow) (cfs)	Flow (cfs)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (ft/s)
18" RCP	4' Manhole	18.0	7,901.86	7,897.49	218.7	0.020	14.85	3.29	7,907.90	7,909.20	7,902.55	7,898.33	6.75
18" RCP	4' Manhole	18.0	7,897.28	7,883.00	227.6	0.066	26.99	3.29	7,909.20	7,883.00	7,897.98	7,883.35	10.35
18" RCP	5' Type R Inlet	18.0	7,903.73	7,902.06	81.1	0.020	14.85	3.29	7,907.73	7,907.90	7,904.42	7,902.54	6.75
8" PVC	Outlet Structure	8.0	7,882.17	7,881.38	113.7	0.014	1.44	0.19	7,885.93	7,881.38	7,882.37	7,881.54	2.84
CO-1	MH-1	24.0	7,857.64	7,857.36	41.0	0.007	24.29	0.36	7,861.24	7,857.36	7,857.84	7,857.53	2.78
EX. 24" PVC(1) (1)	EX. Flared End Section	24.0	7,879.12	7,864.60	142.2	0.086	86.38	0.19	7,881.28	7,875.24	7,879.27	7,864.80	5.57
EX. 24" PVC(1) (2)	T-1	24.0	7,864.60	7,857.64	70.3	0.124	103.46	0.36	7,875.24	7,861.24	7,864.80	7,857.87	7.64
CO-2	Outlet Structure	8.0	7,871.17	7,864.60	77.1	0.085	4.59	0.17	7,872.42	7,875.24	7,871.36	7,864.80	6.27

5-Year FlexTable: Manhole Table

ID	Label	Elevation (Ground) (ft)	Set Rim to Ground Elevation?	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Depth (Out) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)	Hydraulic Grade Line (In) (ft)	Notes
30	4' Manhole	7,909.20	True	7,909.20	7,897.49	3.29	0.70	7,897.98	Standard	1.320	7,898.33	MH
31	4' Manhole	7,907.90	True	7,907.90	7,902.06	3.29	0.69	7,902.55	Standard	0.400	7,902.66	MH
63	MH-1	7,861.24	True	7,861.24	7,857.64	0.36	0.20	7,857.84	Standard	0.400	7,857.87	

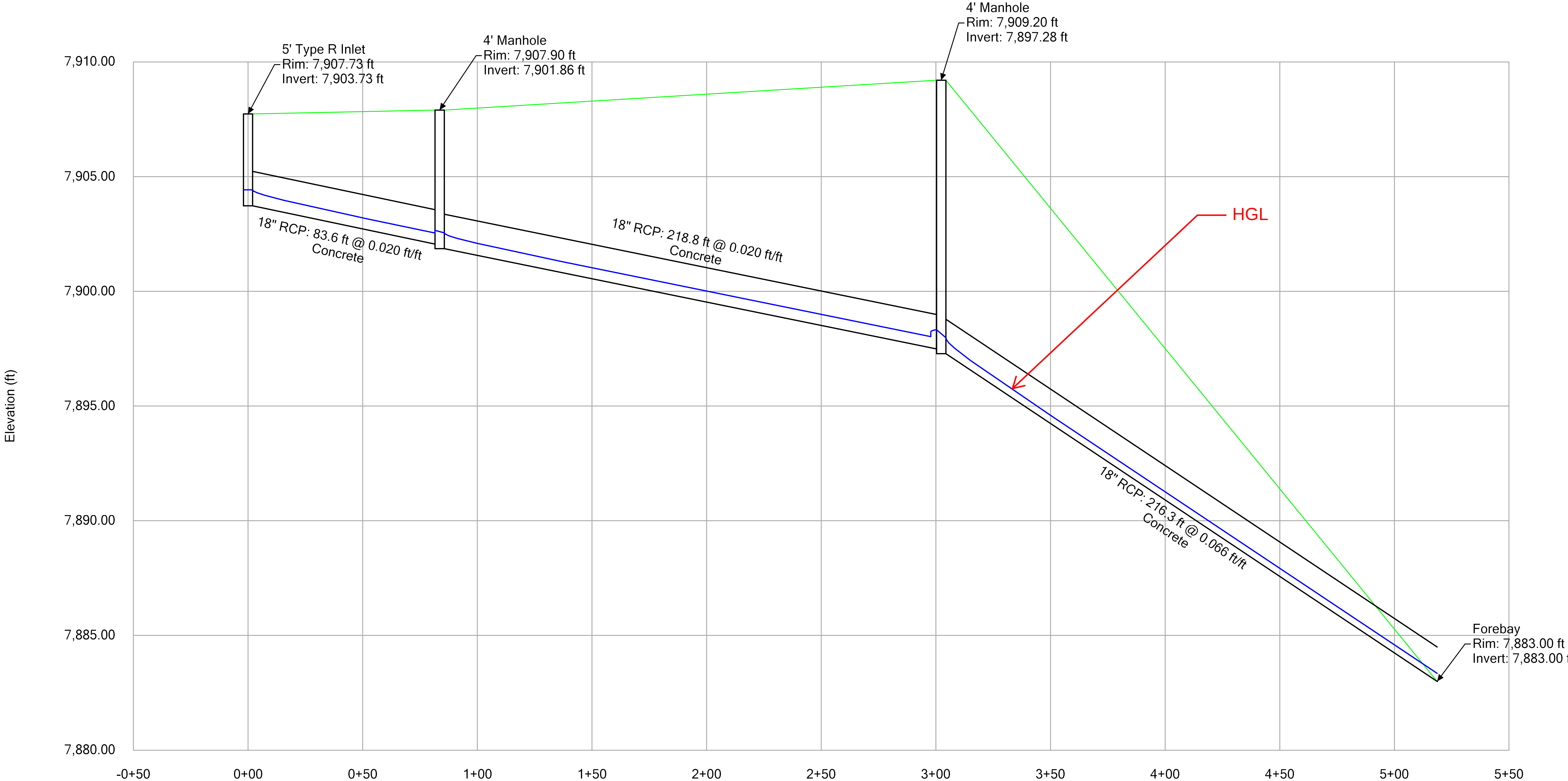
Profile Report

5-Year Engineering Profile - EXISTING STORM (REROUTED) (Green Mountain Falls Church_StormCAD.stsw)

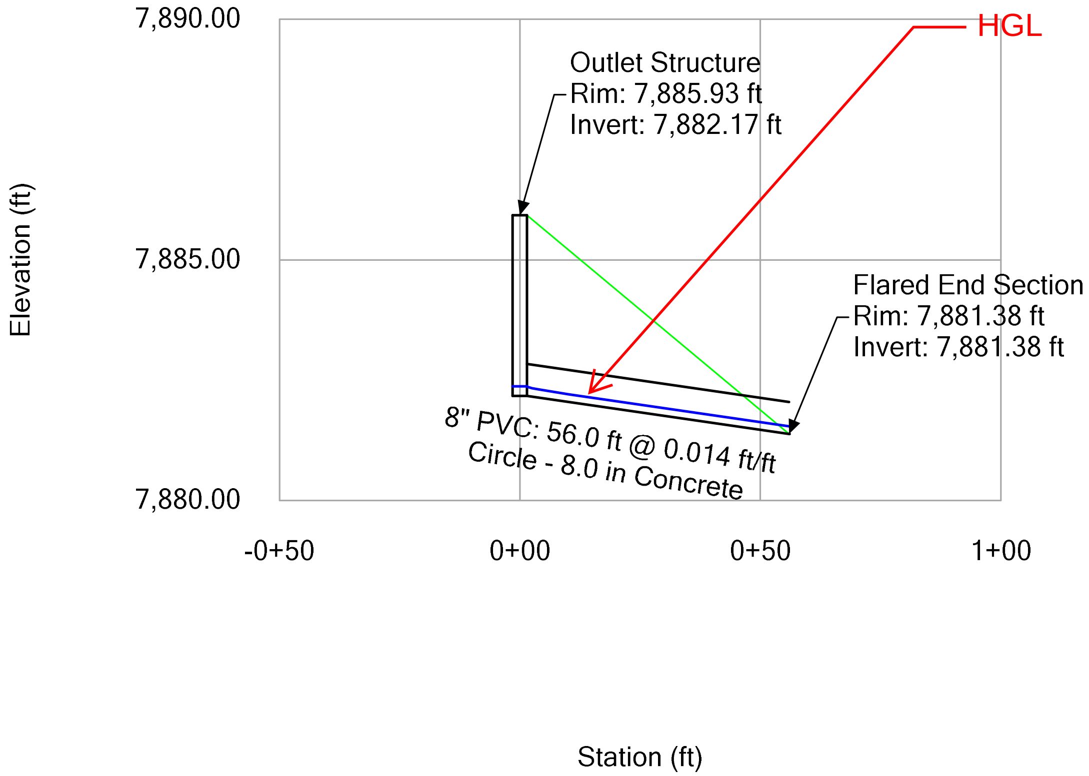


Profile Report

5-Year Engineering Profile - STORM SEWER 1 (Green Mountain Falls Church_StormCAD.stsw)

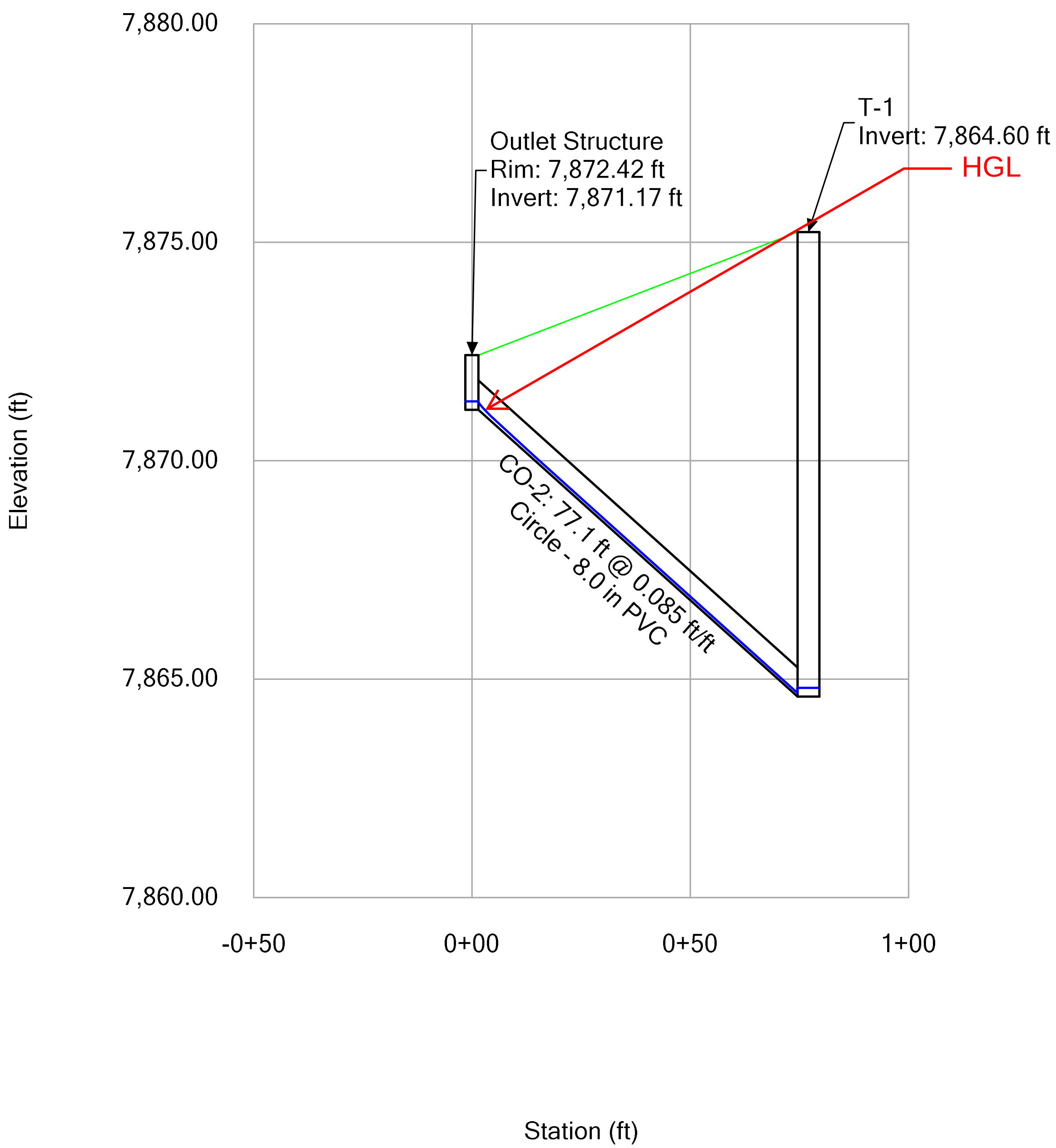


Profile Report
5-Year Engineering Profile - STORM SEWER 2 (Green Mountain Falls Church_StormCAD.stsw)



Profile Report

5-Year Engineering Profile - STORM SEWER 3 (Green Mountain Falls Church_StormCAD.stsw)



100-Year FlexTable: Catch Basin Table

Label	Elevation (Rim) (ft)	Elevation (Invert) (ft)	Flow (Additional Subsurface) (cfs)	Flow (Total Out) (cfs)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)
5' Type R Inlet	7,907.73	7,903.73	5.99	5.99	7,904.68	7,904.68	Standard	0.000
EX. Flared End Section	7,881.28	7,879.12	0.22	0.22	7,879.28	7,879.28	Standard	0.000
Outlet Structure	7,885.93	7,882.17	0.22	0.22	7,882.38	7,882.38	Standard	0.000
Outlet Structure	7,872.42	7,871.17	1.83	1.83	7,871.78	7,871.78	Standard	0.000

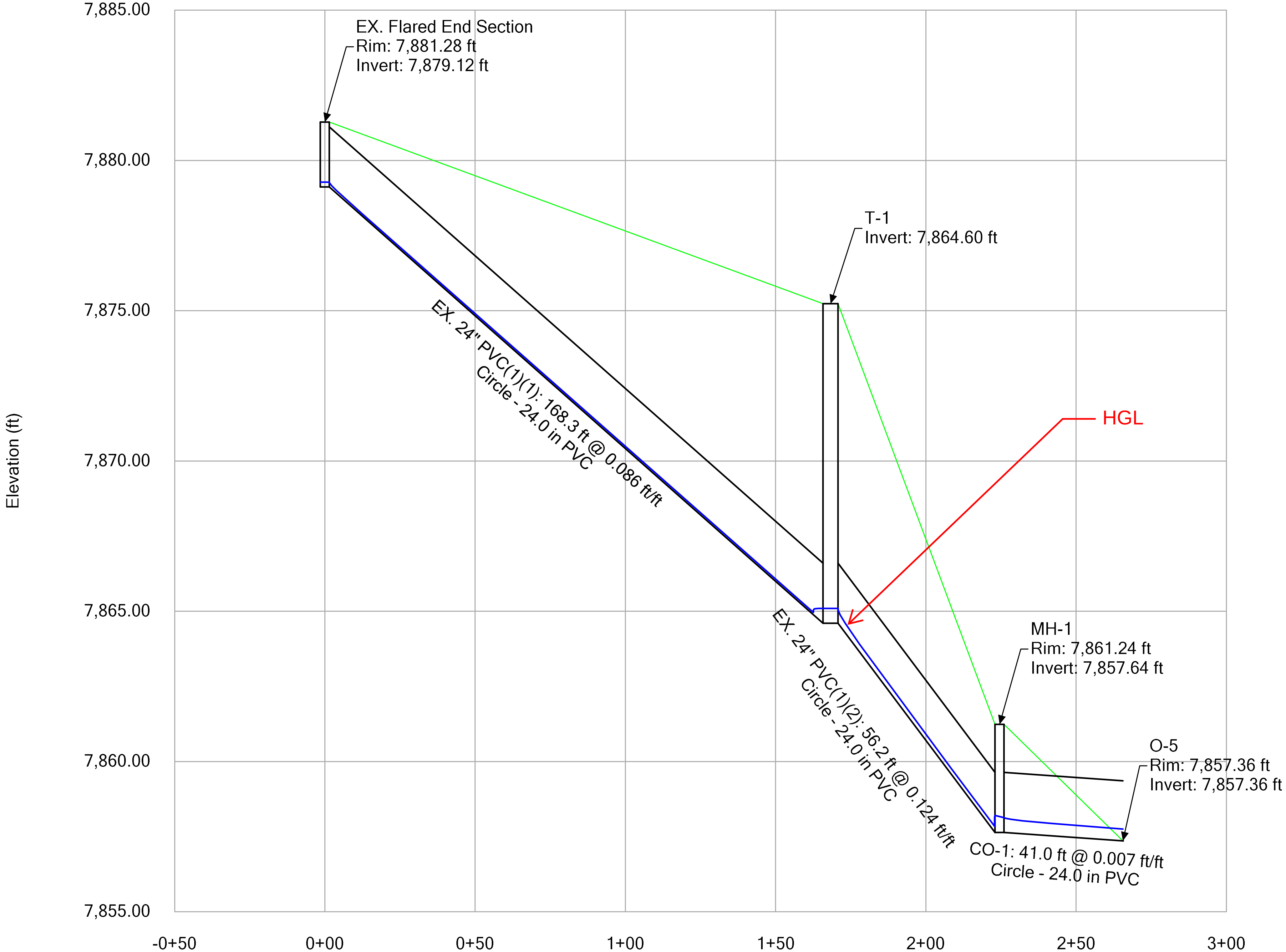
100-Year FlexTable: Conduit Table

Label	Start Node	Diameter (in)	Invert (Start) (ft)	Invert (Stop) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Capacity (Full Flow) (cfs)	Flow (cfs)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Velocity (ft/s)
18" RCP	4' Manhole	18.0	7,901.86	7,897.49	218.7	0.020	14.85	5.99	7,907.90	7,909.20	7,902.81	7,898.76	7.95
18" RCP	4' Manhole	18.0	7,897.28	7,883.00	227.6	0.066	26.99	5.99	7,909.20	7,883.00	7,898.23	7,883.48	12.28
18" RCP	5' Type R Inlet	18.0	7,903.73	7,902.06	81.1	0.020	14.85	5.99	7,907.73	7,907.90	7,904.68	7,902.72	7.95
8" PVC	Outlet Structure	8.0	7,882.17	7,881.38	113.7	0.014	1.44	0.22	7,885.93	7,881.38	7,882.38	7,881.56	2.97
CO-1	MH-1	24.0	7,857.64	7,857.36	41.0	0.007	24.29	2.04	7,861.24	7,857.36	7,858.14	7,857.76	4.70
EX. 24" PVC(1) (1)	EX. Flared End Section	24.0	7,879.12	7,864.60	142.2	0.086	86.38	0.22	7,881.28	7,875.24	7,879.28	7,865.10	5.79
EX. 24" PVC(1) (2)	T-1	24.0	7,864.60	7,857.64	70.3	0.124	103.46	2.04	7,875.24	7,861.24	7,865.10	7,858.21	12.99
CO-2	Outlet Structure	8.0	7,871.17	7,864.60	77.1	0.085	4.59	1.83	7,872.42	7,875.24	7,871.78	7,864.89	12.40

100-Year FlexTable: Manhole Table

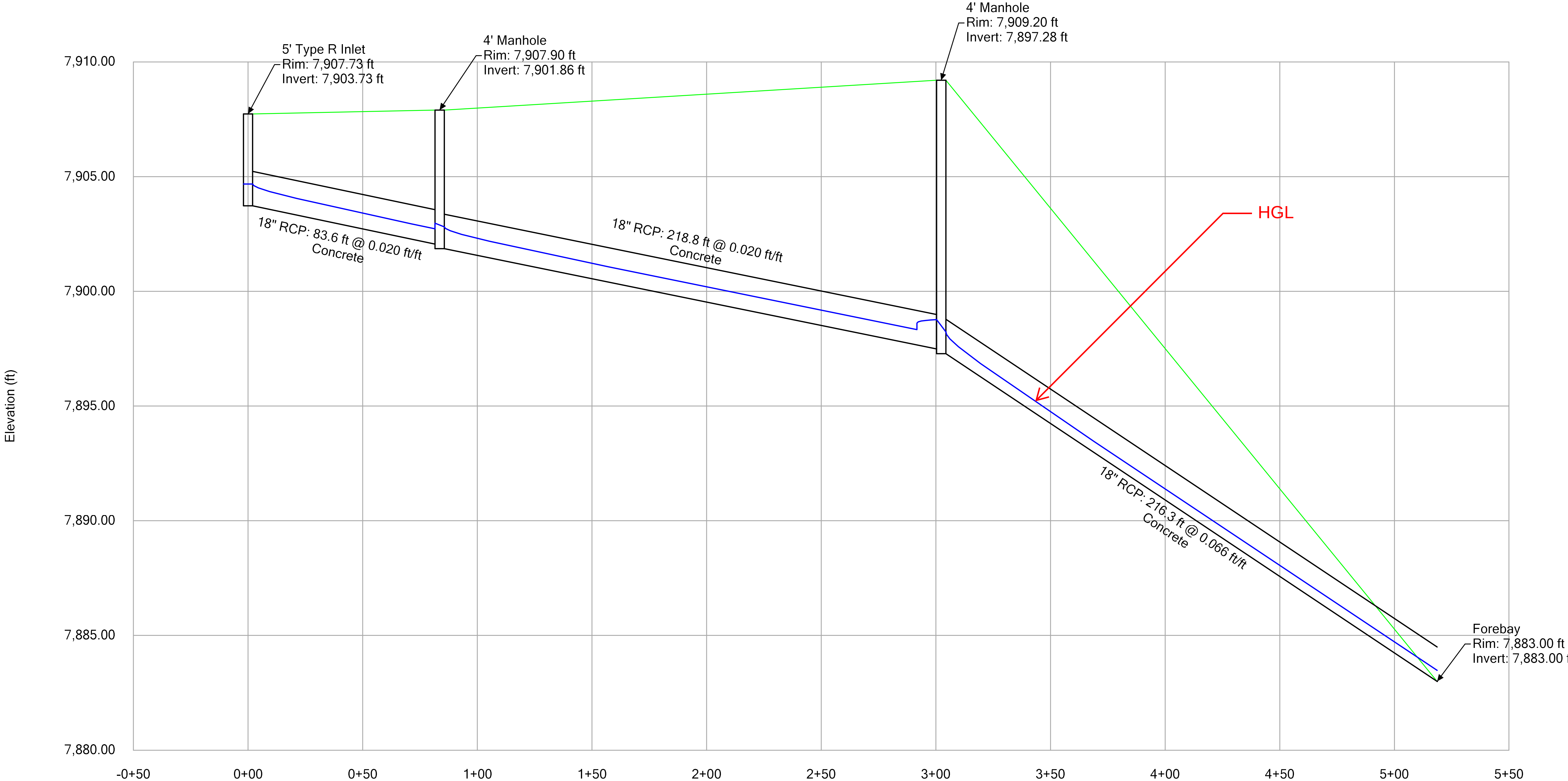
ID	Label	Elevation (Ground) (ft)	Set Rim to Ground Elevation?	Elevation (Rim) (ft)	Elevation (Invert in 1) (ft)	Flow (Total Out) (cfs)	Depth (Out) (ft)	Hydraulic Grade Line (Out) (ft)	Headloss Method	Headloss Coefficient (Standard)	Hydraulic Grade Line (In) (ft)	Notes
30	4' Manhole	7,909.20	True	7,909.20	7,897.49	5.99	0.95	7,898.23	Standard	1.320	7,898.76	MH
31	4' Manhole	7,907.90	True	7,907.90	7,902.06	5.99	0.95	7,902.81	Standard	0.400	7,902.97	MH
63	MH-1	7,861.24	True	7,861.24	7,857.64	2.04	0.50	7,858.14	Standard	0.400	7,858.21	

Profile Report
100-Year Engineering Profile - EXISTING STORM (REROUTED) (Green Mountain Falls Church_StormCAD.stsw)



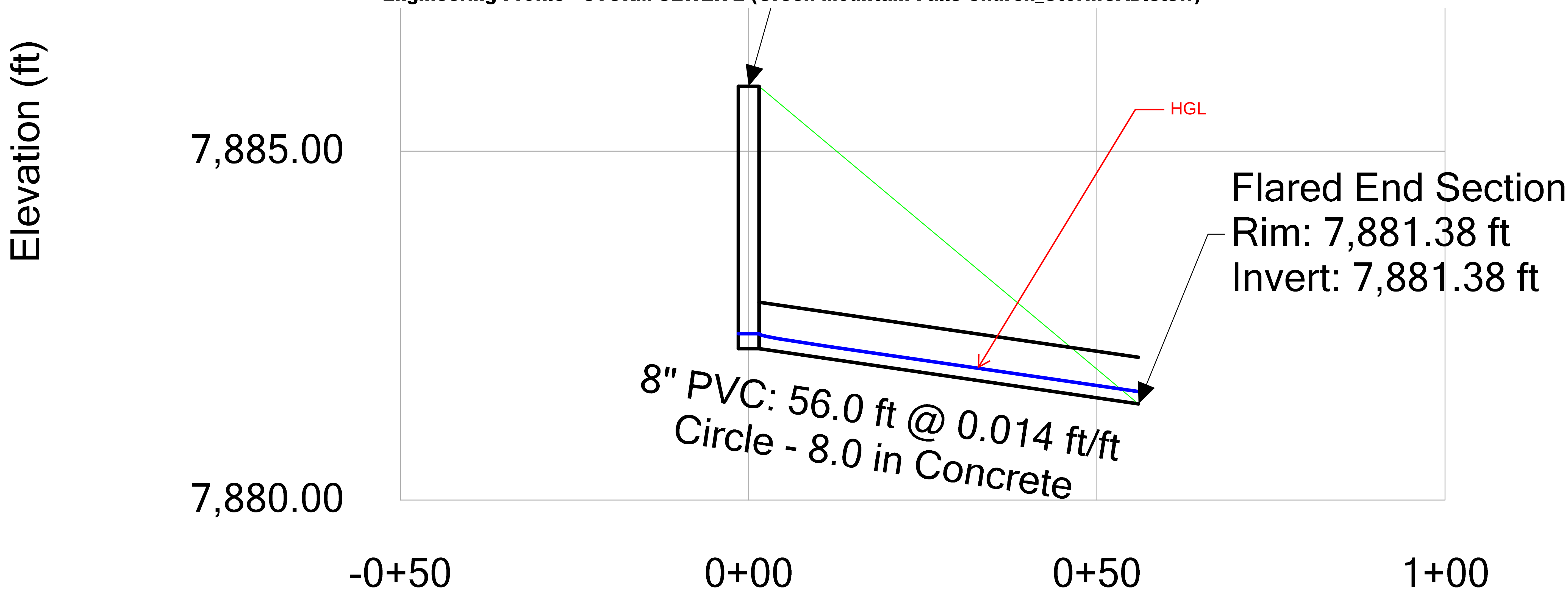
Profile Report

100-Year Engineering Profile - STORM SEWER 1 (Green Mountain Falls Church_StormCAD.stsw)



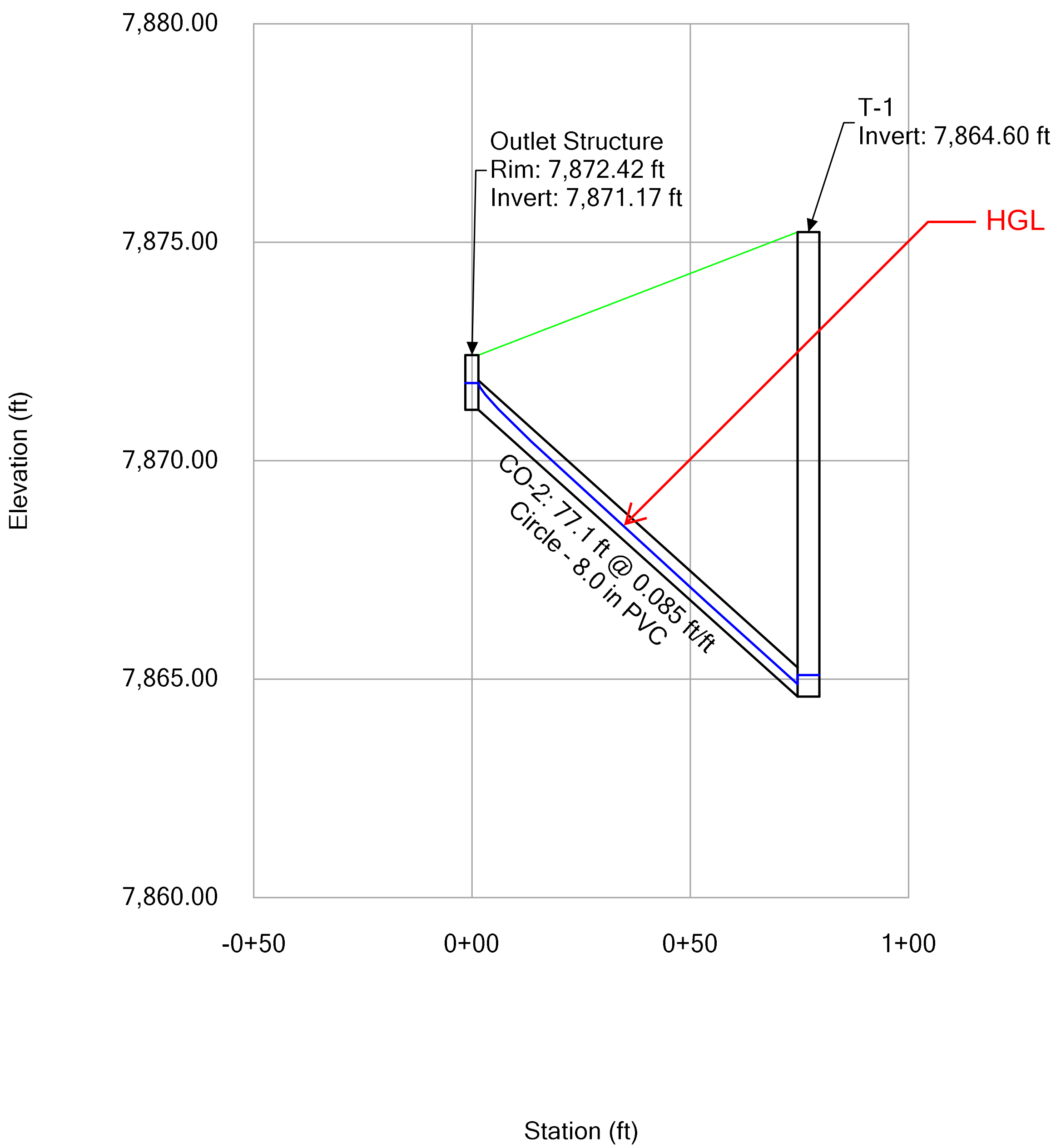
Profile Report

100-Year Engineering Profile - STORM SEWER 2 (Green Mountain Falls Church_StormCAD.stsw)



Profile Report

100-Year Engineering Profile - STORM SEWER 3 (Green Mountain Falls Church_StormCAD.stsw)



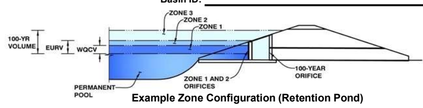
WATER QUALITY CALCULATIONS

0.4

UD-Detention, Version 3.07 (February 2017)

Project: Legacy Church - Green Mountain Falls - East Pond

Basin ID:



Example Zone Configuration (Retention Pond)

Required Volume Calculation

Selected BMP Type =	**EDB**			
Watershed Area =	1.77	acres		
Watershed Length =	454	ft		
Watershed Slope =	0.060	ft/ft		
Watershed Imperviousness =	77.70%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	0.0%	percent		
Percentage Hydrologic Soil Groups C/D =	100.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	0.046	acre-feet	Optional User Override 1-hr Precipitation	
Excess Urban Runoff Volume (EURV) =	0.135	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.130	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.51 in.) =	0.178	acre-feet	1.51	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.213	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.260	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.300	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.348	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	0.122	acre-feet		
Approximate 5-yr Detention Volume =	0.168	acre-feet		
Approximate 10-yr Detention Volume =	0.192	acre-feet		
Approximate 25-yr Detention Volume =	0.203	acre-feet		
Approximate 50-yr Detention Volume =	0.208	acre-feet		
Approximate 100-yr Detention Volume =	0.221	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.046	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.088	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.087	acre-feet
Total Detention Basin Volume =	0.221	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	610	0.014		
	--	1.00	--	--	--	1,183	0.027	885	0.020
	--	2.00	--	--	--	1,856	0.043	2,397	0.055
	--	3.00	--	--	--	2,634	0.060	4,661	0.107
	--	4.00	--	--	--	3,514	0.081	7,735	0.178
	--	5.00	--	--	--	4,507	0.103	11,745	0.270
	--	6.00	--	--	--	5,602	0.129	16,800	0.386
	--	7.00	--	--	--	6,797	0.156	22,999	0.528
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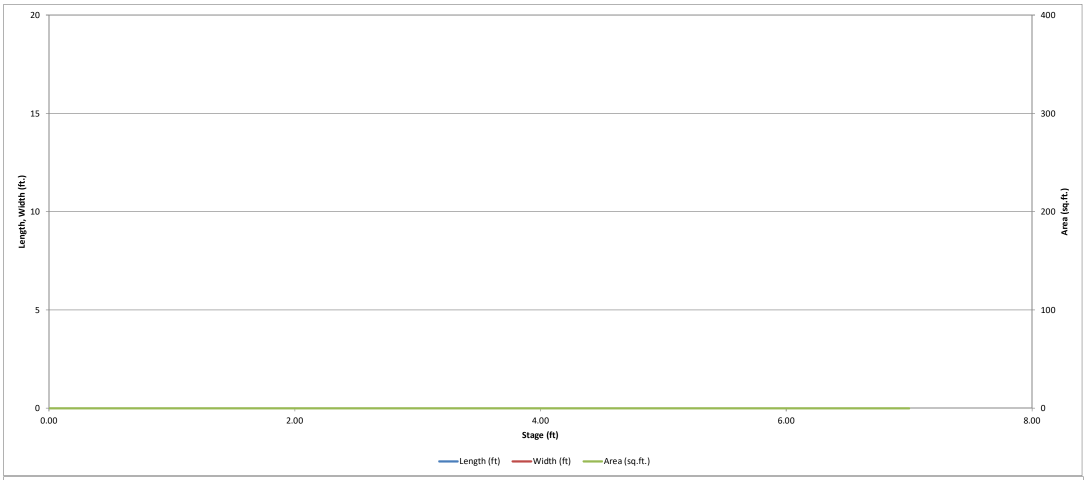
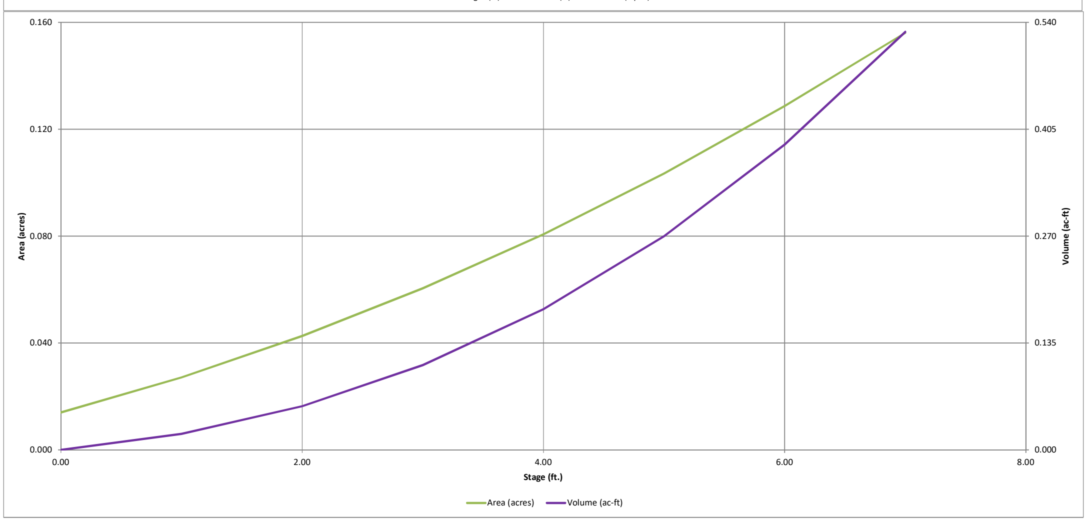
0.4

UD-Detention, Version 3.07 (February 2017)



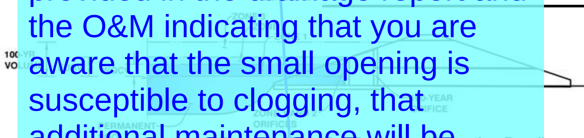


Having such a small opening will be susceptible to clogging. Consider revising the outlet designs. If you decide to keep this design, additional text shall be provided in the drainage report and the O&M indicating that you are aware that the small opening is susceptible to clogging, that additional maintenance will be required and that the pond should be closely monitored.

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Legacy Church - Green Mountain Falls - East Pond



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.78	0.046	Orifice Plate
Zone 2 (EURV)	3.43	0.088	Circular Orifice
Zone 3 (100-year)	4.51	0.087	Weir&Pipe (Restrict)
		0.221	Total

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 =	1.78	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	0.75	1.50					
Orifice Area (sq. inches)	0.30	0.30	0.30					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	1.78	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	3.43	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	0.75	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.00	N/A	ft^2
Vertical Orifice Centroid =	0.03	N/A	feet

The pond details indicate 4 ft. Please revise so that they match.

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	3.43	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	3.43	N/A	feet
Over Flow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	346.79	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	6.30	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.15	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.83	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	8.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	0.80		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.02	N/A	ft^2
Outlet Orifice Centroid =	0.04	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	0.64	N/A	radians

the pond detail shows the invert at 0.33" below the basin bottom. Revise so that they match.

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	6.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	18.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

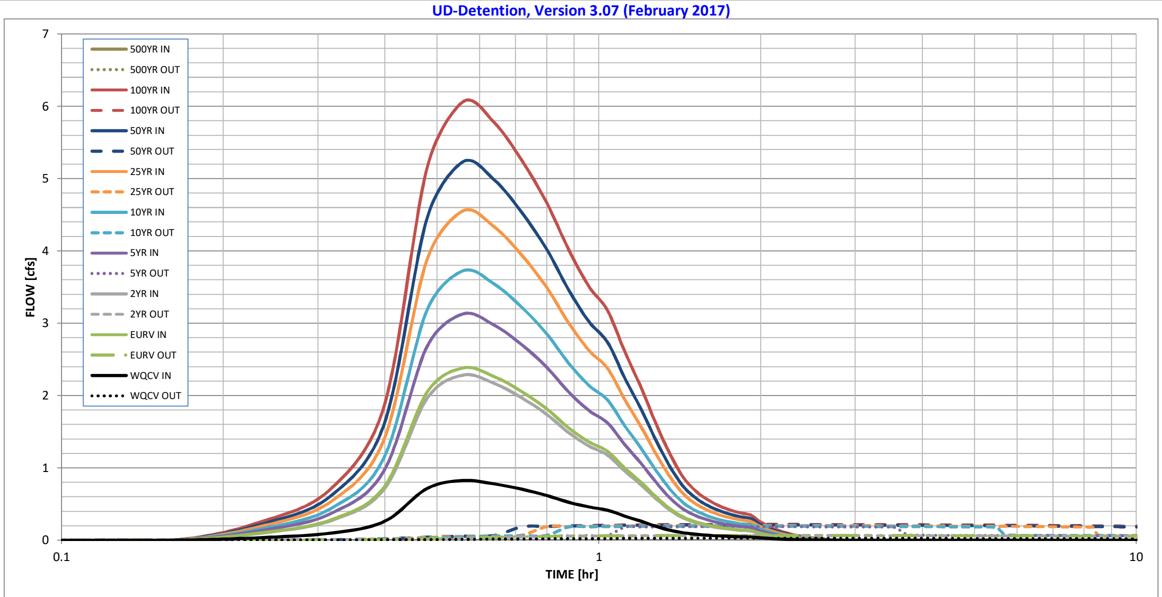
Spillway Design Flow Depth=	0.22	feet
Stage at Top of Freeboard =	7.22	feet
Basin Area at Top of Freeboard =	0.16	acres

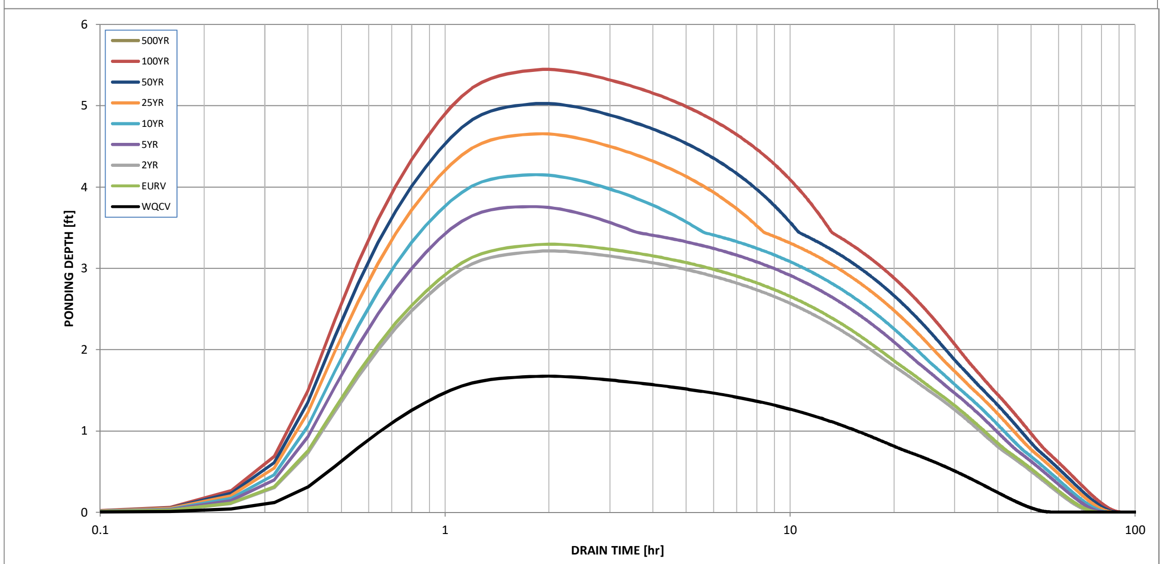
Routed Hydrograph Results

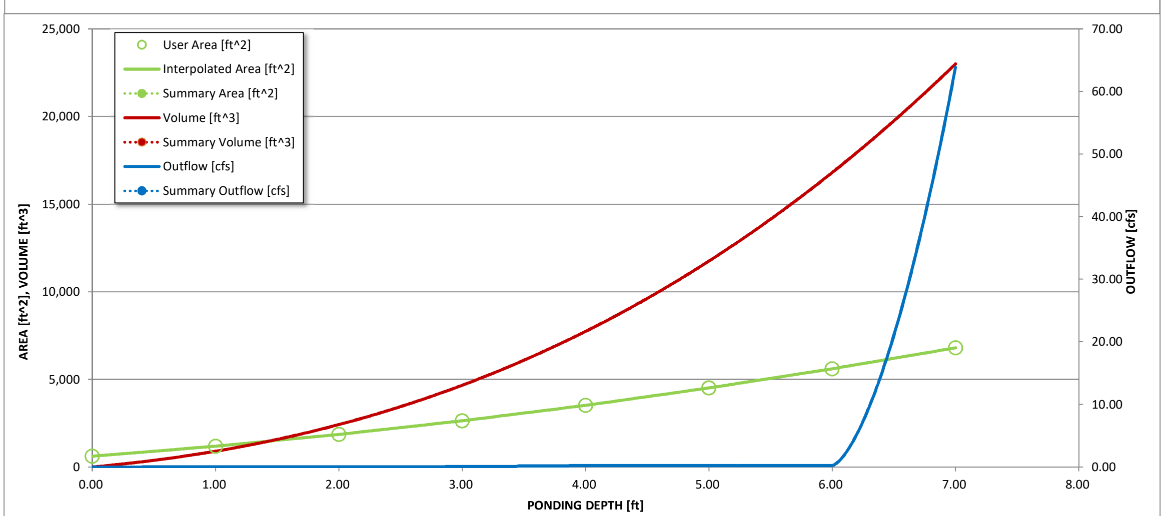
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.51	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.046	0.135	0.130	0.178	0.213	0.260	0.300	0.348	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.046	0.135	0.129	0.177	0.212	0.260	0.299	0.347	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.13	0.34	0.80	1.05	1.37	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.2	0.6	1.4	1.9	2.4	0.0
Peak Inflow Q (cfs) =	0.8	2.4	2.3	3.1	3.7	4.6	5.2	6.1	#N/A
Peak Outflow Q (cfs) =	0.027	0.1	0.1	0.187	0.2	0.2	0.2	0.218	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	0.8	0.3	0.1	0.1	0.1	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.0	0.0	0.0	0.0	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	47	60	60	61	61	61	61	61	#N/A
Time to Drain 99% of Inflow Volume (hours) =	52	68	68	70	71	72	73	74	#N/A
Maximum Ponding Depth (ft) =	1.67	3.30	3.21	3.76	4.15	4.66	5.03	5.45	#N/A
Area at Maximum Ponding Depth (acres) =	0.04	0.07	0.06	0.08	0.08	0.10	0.10	0.11	#N/A
Maximum Volume Stored (acre-ft) =	0.042	0.125	0.120	0.158	0.190	0.235	0.272	0.318	#N/A

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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:

Storm Inflow Hydrographs **UD-Detention, Version 3.07 (February 2017)**

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

Time Interval	4.79 min
Hydrograph Constant	1.043

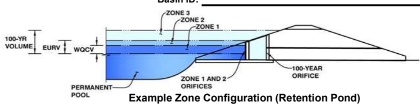
SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
0:04:47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
0:09:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
0:14:22	0.04	0.11	0.10	0.14	0.17	0.21	0.24	0.27	#N/A
0:19:10	0.10	0.29	0.28	0.38	0.45	0.55	0.63	0.73	#N/A
0:23:57	0.26	0.74	0.71	0.97	1.16	1.41	1.62	1.87	#N/A
0:28:44	0.71	2.05	1.96	2.68	3.18	3.88	4.45	5.15	#N/A
0:33:32	0.82	2.38	2.28	3.13	3.72	4.55	5.23	6.06	#N/A
0:38:19	0.78	2.26	2.17	2.97	3.54	4.33	4.98	5.77	#N/A
0:43:07	0.71	2.06	1.97	2.70	3.22	3.94	4.53	5.25	#N/A
0:47:54	0.62	1.82	1.74	2.40	2.86	3.50	4.03	4.68	#N/A
0:52:41	0.52	1.55	1.49	2.05	2.45	3.01	3.46	4.02	#N/A
0:57:29	0.46	1.36	1.30	1.79	2.14	2.63	3.02	3.51	#N/A
1:02:16	0.41	1.23	1.18	1.62	1.94	2.38	2.74	3.18	#N/A
1:07:04	0.33	1.00	0.95	1.32	1.58	1.94	2.24	2.61	#N/A
1:11:51	0.26	0.80	0.77	1.06	1.28	1.57	1.82	2.12	#N/A
1:16:38	0.19	0.60	0.57	0.80	0.96	1.19	1.38	1.61	#N/A
1:21:26	0.14	0.43	0.41	0.58	0.70	0.87	1.01	1.19	#N/A
1:26:13	0.10	0.32	0.31	0.43	0.52	0.64	0.74	0.87	#N/A
1:31:01	0.08	0.25	0.24	0.34	0.40	0.50	0.58	0.68	#N/A
1:35:48	0.07	0.21	0.20	0.28	0.33	0.41	0.48	0.56	#N/A
1:40:35	0.06	0.18	0.17	0.24	0.28	0.35	0.41	0.47	#N/A
1:45:23	0.05	0.16	0.15	0.21	0.25	0.31	0.36	0.42	#N/A
1:50:10	0.05	0.14	0.14	0.19	0.23	0.28	0.32	0.38	#N/A
1:54:58	0.04	0.13	0.13	0.18	0.21	0.26	0.30	0.35	#N/A
1:59:45	0.03	0.10	0.09	0.13	0.15	0.19	0.22	0.26	#N/A
2:04:32	0.02	0.07	0.07	0.09	0.11	0.14	0.16	0.19	#N/A
2:09:20	0.02	0.05	0.05	0.07	0.08	0.10	0.12	0.14	#N/A
2:14:07	0.01	0.04	0.04	0.05	0.06	0.07	0.09	0.10	#N/A
2:18:55	0.01	0.03	0.03	0.04	0.04	0.05	0.06	0.07	#N/A
2:23:42	0.01	0.02	0.02	0.02	0.03	0.04	0.04	0.05	#N/A
2:28:29	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	#N/A
2:33:17	0.00	0.01	0.01	0.01	0.01	0.02	0.02	0.02	#N/A
2:38:04	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	#N/A
2:42:52	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	#N/A
2:47:39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
2:52:26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
2:57:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:02:01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:06:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:11:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:16:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:21:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:25:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:30:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:35:33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:40:20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:45:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:49:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:54:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:59:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:04:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:09:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:13:52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:18:40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:23:27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:28:14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:33:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:37:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:42:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:47:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:52:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:56:59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:01:46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:06:34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:11:21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:16:08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:20:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:25:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:30:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:35:18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:40:05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:44:53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)

Project: Legacy Church - Green Mountain Falls- West Pond

Basin ID:



Example Zone Configuration (Retention Pond)

Required Volume Calculation

			Optional User Override 1-hr Precipitation	
Selected BMP Type =	EDB			
Watershed Area =	1.49	acres		
Watershed Length =	445	ft		
Watershed Slope =	0.080	ft/ft		
Watershed Imperviousness =	74.10%	percent		
Percentage Hydrologic Soil Group A =	0.0%	percent		
Percentage Hydrologic Soil Group B =	0.0%	percent		
Percentage Hydrologic Soil Groups C/D =	100.0%	percent		
Desired WQCV Drain Time =	40.0	hours		
Location for 1-hr Rainfall Depths =	User Input			
Water Quality Capture Volume (WQCV) =	0.037	acre-feet		
Excess Urban Runoff Volume (EURV) =	0.108	acre-feet		
2-yr Runoff Volume (P1 = 1.19 in.) =	0.104	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.143	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.172	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.213	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.247	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.288	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 0 in.) =	0.000	acre-feet		inches
Approximate 2-yr Detention Volume =	0.097	acre-feet		
Approximate 5-yr Detention Volume =	0.134	acre-feet		
Approximate 10-yr Detention Volume =	0.154	acre-feet		
Approximate 25-yr Detention Volume =	0.164	acre-feet		
Approximate 50-yr Detention Volume =	0.168	acre-feet		
Approximate 100-yr Detention Volume =	0.180	acre-feet		

Stage-Storage Calculation

Zone 1 Volume (WQCV) =	0.037	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.071	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.072	acre-feet
Total Detention Basin Volume =	0.180	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 1 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	832	0.019		
	--	1.00	--	--	--	1,422	0.033	1,113	0.026
	--	2.00	--	--	--	2,159	0.050	2,896	0.066
	--	3.00	--	--	--	3,022	0.069	5,508	0.126
	--	4.00	--	--	--	4,004	0.092	9,021	0.207
	--	5.00	--	--	--	5,093	0.117	13,569	0.312
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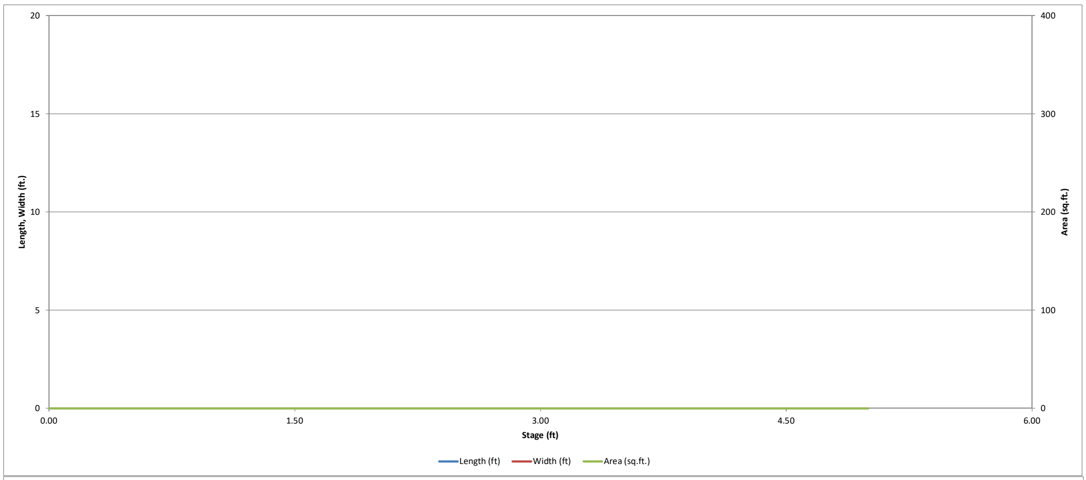
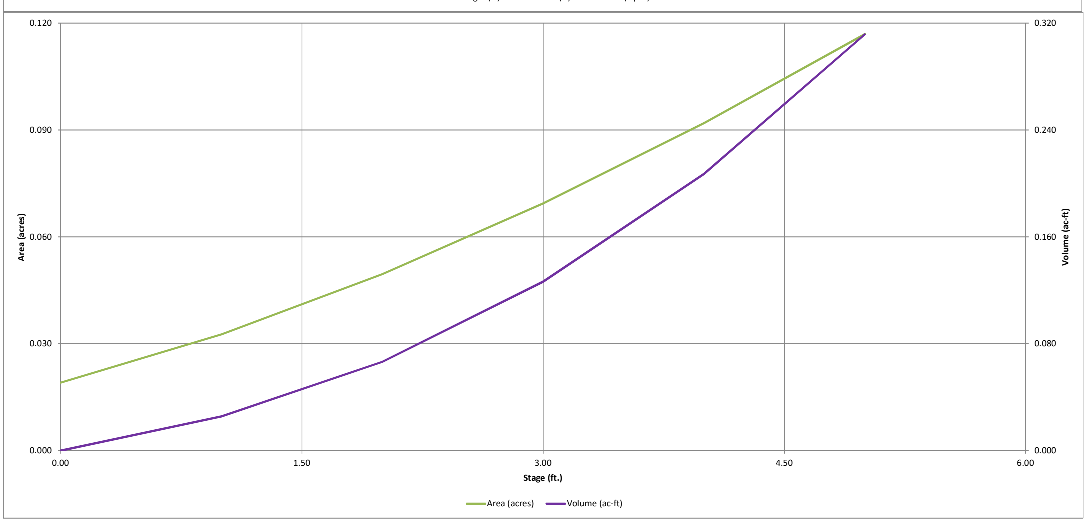
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

UD-Detention, Version 3.07 (February 2017)



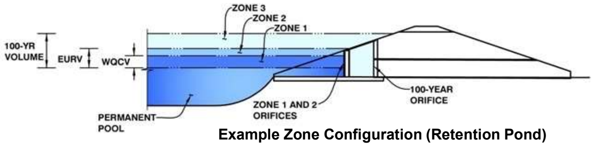


Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)

Project: Legacy Church - Green Mountain Falls - West Pond

Basin ID:



Example Zone Configuration (Retention Pond)

	Stage (ft)	Zone Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	1.31	0.037	Orifice Plate
Zone 2 (EURV)	2.72	0.071	Circular Orifice
Zone 3 (100-year)	3.69	0.072	Weir&Pipe (Restrict)
		0.180	Total

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 =	1.31	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	0.60	1.20					
Orifice Area (sq. inches)	0.30	0.30	0.30					

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

User Input: Vertical Orifice (Circular or Rectangular)

	Zone 2 Circular	Not Selected	
Invert of Vertical Orifice =	1.31	N/A	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =	2.72	N/A	ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =	0.73	N/A	inches

Calculated Parameters for Vertical Orifice

	Zone 2 Circular	Not Selected	
Vertical Orifice Area =	0.00	N/A	ft^2
Vertical Orifice Centroid =	0.03	N/A	feet

The pond details indicate 4 ft. Please revise so that they match.

User Input: Overflow Weir (Dropbox) and Grate (Flat or Sloped)

	Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	2.72	N/A	ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	3.00	N/A	feet
Overflow Weir Slope =	0.00	N/A	H:V (enter zero for flat grate)
Horiz. Length of Weir Sides =	3.00	N/A	feet
Overflow Grate Open Area % =	70%	N/A	%, grate open area/total area
Debris Clogging % =	50%	N/A	%

Calculated Parameters for Overflow Weir

	Zone 3 Weir	Not Selected	
Height of Grate Upper Edge, H_t =	2.72	N/A	feet
Over Flow Weir Slope Length =	3.00	N/A	feet
Grate Open Area / 100-yr Orifice Area =	346.79	N/A	should be ≥ 4
Overflow Grate Open Area w/o Debris =	6.30	N/A	ft^2
Overflow Grate Open Area w/ Debris =	3.15	N/A	ft^2

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

	Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.83	N/A	ft (distance below basin bottom at Stage = 0 ft)
Outlet Pipe Diameter =	8.00	N/A	inches
Restrictor Plate Height Above Pipe Invert =	0.80		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Zone 3 Restrictor	Not Selected	
Outlet Orifice Area =	0.02	N/A	ft^2
Outlet Orifice Centroid =	0.04	N/A	feet
Half-Central Angle of Restrictor Plate on Pipe =	0.64	N/A	radians

the pond detail shows the invert at 0.33" below the basin bottom. Revise so that they match.

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	4.00	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	18.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.19	feet
Stage at Top of Freeboard =	5.19	feet
Basin Area at Top of Freeboard =	0.12	acres

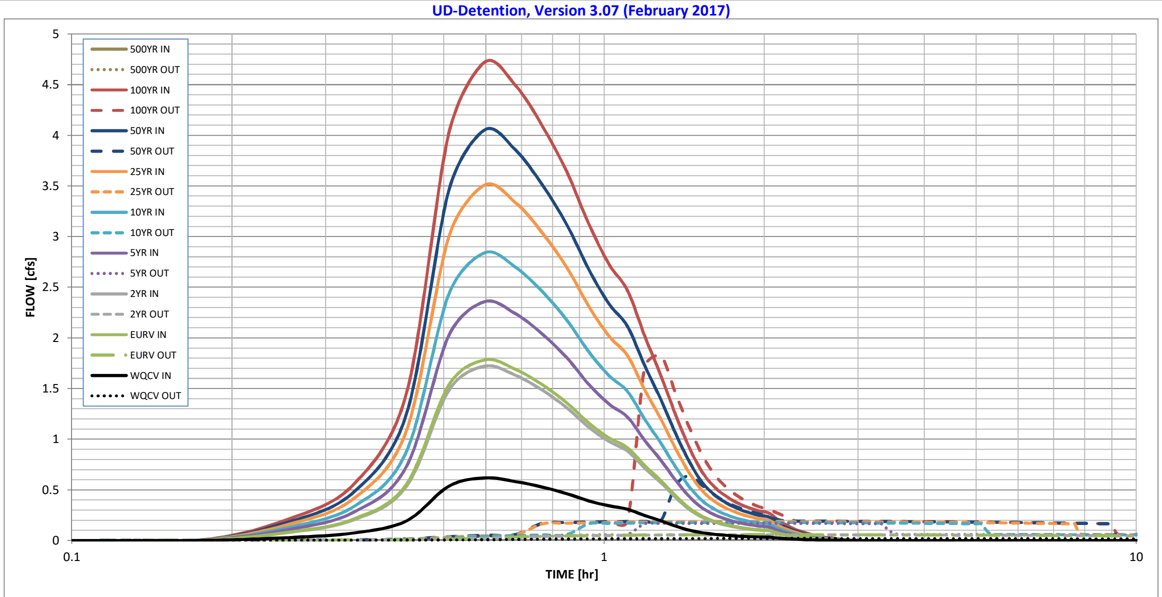
Routed Hydrograph Results

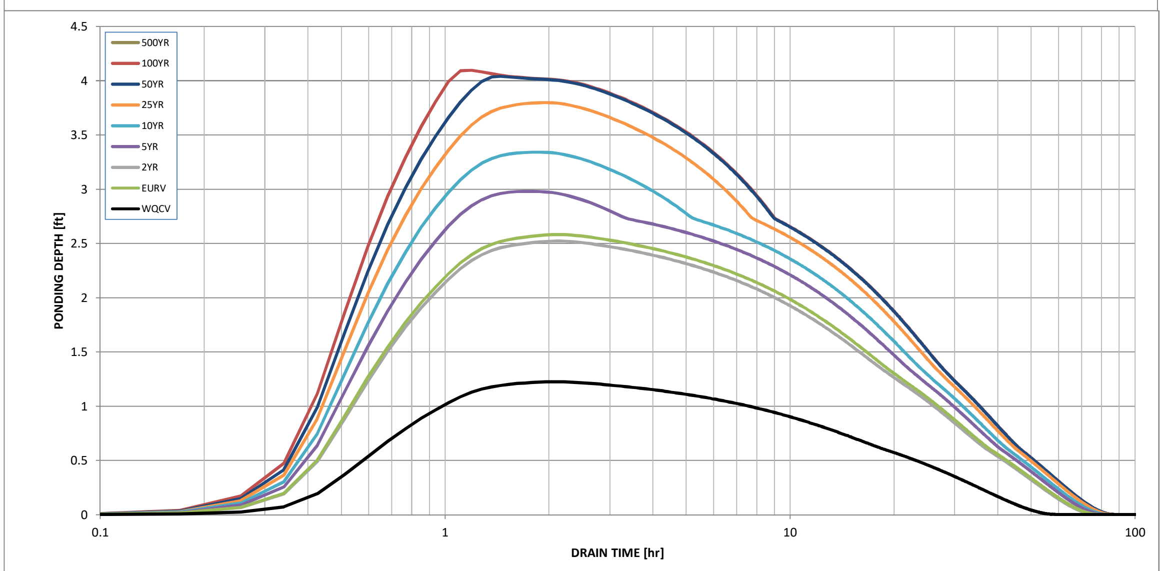
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	0.53	1.07	1.19	1.50	1.75	2.00	2.25	2.52	0.00
Calculated Runoff Volume (acre-ft) =	0.037	0.108	0.104	0.143	0.172	0.213	0.247	0.288	0.000
OPTIONAL Override Runoff Volume (acre-ft) =									
Inflow Hydrograph Volume (acre-ft) =	0.036	0.107	0.103	0.142	0.172	0.213	0.246	0.288	#N/A
Predevelopment Unit Peak Flow, q (cfs/acre) =	0.00	0.00	0.01	0.12	0.32	0.76	1.00	1.31	0.00
Predevelopment Peak Q (cfs) =	0.0	0.0	0.0	0.2	0.5	1.1	1.5	2.0	0.0
Peak Inflow Q (cfs) =	0.6	1.8	1.7	2.4	2.8	3.5	4.1	4.7	#N/A
Peak Outflow Q (cfs) =	0.021	0.058	0.057	0.170	0.178	0.187	0.637	1.826	#N/A
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.0	0.4	0.2	0.4	0.9	#N/A
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Outlet Plate 1	Outlet Plate 1	Outlet Plate 1	Spillway	Spillway	#N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	0.0	0.0	0.0	0.0	0.0	#N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	#N/A
Time to Drain 97% of Inflow Volume (hours) =	49	60	59	60	59	59	58	56	#N/A
Time to Drain 99% of Inflow Volume (hours) =	53	68	67	69	70	71	71	70	#N/A
Maximum Ponding Depth (ft) =	1.23	2.58	2.52	2.98	3.34	3.80	4.04	4.10	#N/A
Area at Maximum Ponding Depth (acres) =	0.04	0.06	0.06	0.07	0.08	0.09	0.09	0.09	#N/A
Maximum Volume Stored (acre-ft) =	0.033	0.099	0.095	0.125	0.151	0.188	0.211	0.215	#N/A

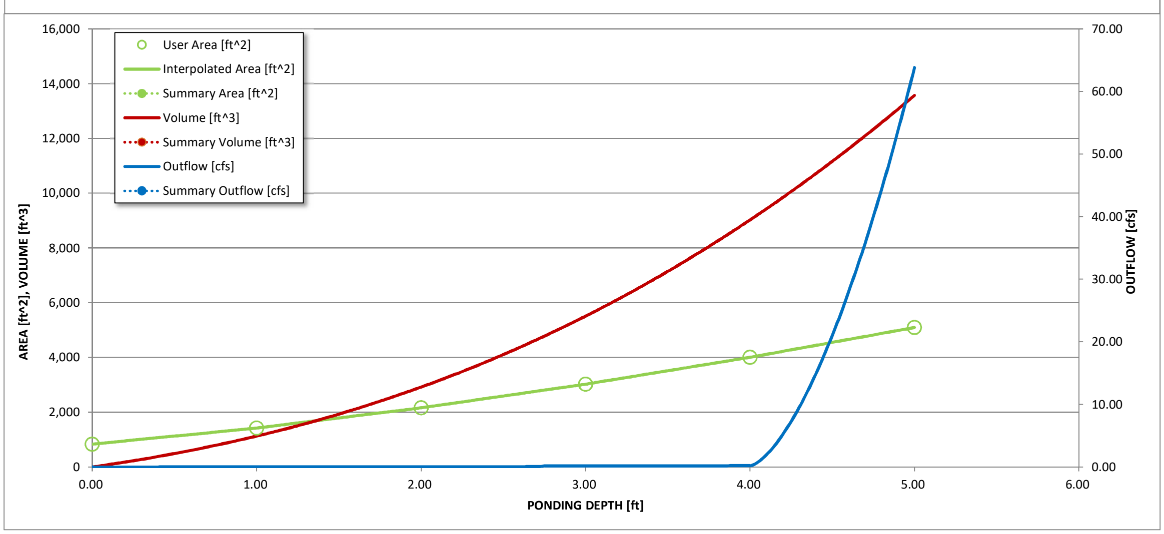
See comment on east pond calculation.

Detention Basin Outlet Structure Design

UD-Detention, Version 3.07 (February 2017)







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:

Storm Inflow Hydrographs UD-Detention, Version 3.07 (February 2017)

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

Time Interval: 5.11 min

Hydrograph Constant: 0.978

SOURCE	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	WORKBOOK	#N/A
TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
0:05:07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
0:10:13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
0:15:20	0.03	0.08	0.08	0.11	0.13	0.16	0.18	0.21	#N/A
0:20:26	0.08	0.22	0.21	0.29	0.34	0.42	0.49	0.57	#N/A
0:25:33	0.19	0.56	0.54	0.74	0.88	1.09	1.26	1.46	#N/A
0:30:40	0.54	1.53	1.48	2.02	2.43	3.00	3.46	4.02	#N/A
0:35:46	0.62	1.78	1.72	2.36	2.84	3.51	4.05	4.72	#N/A
0:40:53	0.58	1.69	1.63	2.24	2.70	3.34	3.86	4.49	#N/A
0:45:59	0.53	1.54	1.48	2.04	2.45	3.03	3.51	4.09	#N/A
0:51:06	0.46	1.36	1.31	1.80	2.18	2.69	3.12	3.64	#N/A
0:56:13	0.39	1.16	1.12	1.54	1.86	2.31	2.67	3.12	#N/A
1:01:19	0.34	1.01	0.98	1.35	1.63	2.02	2.34	2.73	#N/A
1:06:26	0.31	0.92	0.88	1.22	1.47	1.82	2.11	2.47	#N/A
1:11:32	0.25	0.74	0.71	0.99	1.20	1.49	1.73	2.02	#N/A
1:16:39	0.19	0.59	0.57	0.80	0.97	1.20	1.40	1.64	#N/A
1:21:46	0.14	0.44	0.43	0.60	0.73	0.91	1.06	1.24	#N/A
1:26:52	0.10	0.32	0.31	0.43	0.53	0.66	0.77	0.91	#N/A
1:31:59	0.08	0.24	0.23	0.32	0.39	0.49	0.57	0.67	#N/A
1:37:05	0.06	0.19	0.18	0.25	0.31	0.38	0.44	0.52	#N/A
1:42:12	0.05	0.15	0.15	0.21	0.25	0.31	0.37	0.43	#N/A
1:47:19	0.04	0.13	0.13	0.18	0.22	0.27	0.31	0.37	#N/A
1:52:25	0.04	0.12	0.11	0.16	0.19	0.24	0.27	0.32	#N/A
1:57:32	0.03	0.11	0.10	0.14	0.17	0.21	0.25	0.29	#N/A
2:02:38	0.03	0.10	0.10	0.13	0.16	0.20	0.23	0.27	#N/A
2:07:45	0.02	0.07	0.07	0.10	0.12	0.15	0.17	0.20	#N/A
2:12:52	0.02	0.05	0.05	0.07	0.09	0.11	0.12	0.14	#N/A
2:17:58	0.01	0.04	0.04	0.05	0.06	0.08	0.09	0.11	#N/A
2:23:05	0.01	0.03	0.03	0.04	0.05	0.06	0.07	0.08	#N/A
2:28:11	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.05	#N/A
2:33:18	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	#N/A
2:38:25	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.03	#N/A
2:43:31	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	#N/A
2:48:38	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	#N/A
2:53:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
2:58:51	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:03:58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:09:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:14:11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:19:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:24:24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:29:31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:34:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:39:44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:44:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:49:57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
3:55:04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:00:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:05:17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:10:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:15:30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:20:37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:25:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:30:50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:35:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:41:03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:46:10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:51:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
4:56:23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:01:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:06:36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:11:43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:16:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:21:56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:27:02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:32:09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:37:16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:42:22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:47:29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:52:35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
5:57:42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
6:02:49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A
6:07:55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	#N/A

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer: JAR, Checked by: EJG
Company: Kimley-Horn and Associates, Inc.
Date: November 22, 2019
Project: Green Mountain Falls Church
Location: Green Mountain Falls

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 77.7 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.777
C) Contributing Watershed Area	Area = 1.770 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ○ Water Quality Capture Volume (WQCV) ◉ Excess Urban Runoff Volume (EURV)
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}= 0.046 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$)	$V_{DESIGN\ OTHER}$= ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ac-ft
I) NRCS Hydrologic Soil Groups of Tributary Watershed	
i) Percentage of Watershed consisting of Type A Soils	HSG_A = 0 %
ii) Percentage of Watershed consisting of Type B Soils	HSG_B = 0 %
iii) Percentage of Watershed consisting of Type C/D Soils	$HSG_{C/D}$ = 100 %
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ = 0.135 ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$= ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	
5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 1% of the WQCV)	V_{FMIN} = 0.000 ac-ft
B) Actual Forebay Volume	V_F = 0.001 ac-ft
C) Forebay Depth (D_F = 12 inch maximum)	D_F = 6.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 5.99 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 0.12 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe ◉ Wall with Rect. Notch ○ Wall with V-Notch Weir — Flow too small for berm w/ pipe
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 2.4 in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**JAR, Checked by: EJG**
Company:	**Kimley-Horn and Associates, Inc.**
Date:	**November 22, 2019**
Project:	**Green Mountain Falls Church**
Location:	**Green Mountain Falls**

6. Trickle Channel

A) Type of Trickle Channel — Choose One: (●) Concrete ( ) Soft Bottom

F) Slope of Trickle Channel — S = 0.0040 ft / ft

7. Micropool and Outlet Structure

A) Depth of Micropool (2.5-feet minimum) — D_M = 2.5 ft

B) Surface Area of Micropool (10 ft^2 minimum) — A_M = 16 sq ft

C) Outlet Type — Choose One: (●) Orifice Plate ( ) Other (Describe):

D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention) — $D_{orifice}$ = 0.80 inches

E) Total Outlet Area — A_{ot} = 0.50 square inches

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches) — D_{IS} = 4 in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV) — V_{IS} = cu ft

C) Initial Surcharge Provided Above Micropool — V_s = 5.3 cu ft

9. Trash Rack

A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$ — A_t = 18 square inches

B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) — *S.S. Well Screen with 60% Open Area*

Other (Y/N): N

C) Ratio of Total Open Area to Total Area (only for type 'Other') — User Ratio =

D) Total Water Quality Screen Area (based on screen type) — A_{total} = 30 sq. in.

E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E) — H = 10.08 feet

F) Height of Water Quality Screen (H_{TR}) — H_{TR} = 148.96 inches

G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended) — $W_{opening}$ = 12.0 inches

VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	JAR, Checked by: EJG
Company:	Kimley-Horn and Associates, Inc.
Date:	November 22, 2019
Project:	Green Mountain Falls Church
Location:	Green Mountain Falls

10. Overflow Embankment A) Describe embankment protection for 100-year and greater overtopping: B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Ze = 4.00 ft / ft
11. Vegetation	Choose One ○ Irrigated ● Not Irrigated
12. Access A) Describe Sediment Removal Procedures	

Notes:

Design Procedure Form: Extended Detention Basin (EDB)

UD-BMP (Version 3.07, March 2018)

Designer:	**JJM, Checked by: EJG**
Company:	**Kimley-Horn and Associates, Inc.**
Date:	**November 22, 2019**
Project:	**Green Mountain Falls Church**
Location:	**Green Mountain Falls - West Pond**

1. Basin Storage Volume			
A) Effective Imperviousness of Tributary Area, I_a	I_a =	74.1	%
B) Tributary Area's Imperviousness Ratio ($i = I_a$ / 100)	i =	0.741	
C) Contributing Watershed Area	Area =	1.490	ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 =		in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ○ Water Quality Capture Volume (WQCV) ● Excess Urban Runoff Volume (EURV)		
F) Design Volume (WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area$)	V_{DESIGN}=	0.037	ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6*(V_{DESIGN}/0.43))$	$V_{DESIGN\ OTHER}$=		ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$=		ac-ft
I) NRCS Hydrologic Soil Groups of Tributary Watershed			
i) Percentage of Watershed consisting of Type A Soils	HSG_A =	0	%
ii) Percentage of Watershed consisting of Type B Soils	HSG_B =	0	%
iii) Percentage of Watershed consisting of Type C/D Soils	$HSG_{C/D}$ =	100	%
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = 1.68 * i^{1.28}$ For HSG B: $EURV_B = 1.36 * i^{1.08}$ For HSG C/D: $EURV_{C/D} = 1.20 * i^{1.08}$	$EURV_{DESIGN}$ =	0.108	ac-f t
K) User Input of Excess Urban Runoff Volume (EURV) Design Volume (Only if a different EURV Design Volume is desired)	$EURV_{DESIGN\ USER}$=		ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W =	2.0	: 1
3. Basin Side Slopes			
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z =	4.00	ft / ft
4. Inlet			
A) Describe means of providing energy dissipation at concentrated inflow locations:			
5. Forebay			
A) Minimum Forebay Volume (V_{FMIN} = 1% of the WQCV)	V_{FMIN} =	0.000	ac-ft
B) Actual Forebay Volume	V_F =	0.001	ac-ft
C) Forebay Depth (D_F = 12 inch maximum)	D_F =	6.0	in
D) Forebay Discharge			
i) Undetained 100-year Peak Discharge	Q_{100} =	4.02	cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F =	0.08	cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe ● Wall with Rect. Notch ○ Wall with V-Notch Weir	Flow too small for berm w/ pipe	
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P =		in
G) Rectangular Notch Width	Calculated W_N =	2.0	in

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**JJM, Checked by: EJG**
Company:	**Kimley-Horn and Associates, Inc.**
Date:	**November 22, 2019**
Project:	**Green Mountain Falls Church**
Location:	**Green Mountain Falls - West Pond**

6. Trickle Channel	
A) Type of Trickle Channel	Choose One ◉ Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0040 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft^2 minimum)	A_M = 16 sq ft
C) Outlet Type	Choose One ◉ Orifice Plate ○ Other (Describe):
D) Smallest Dimension of Orifice Opening Based on Hydrograph Routing (Use UD-Detention)	$D_{orifice}$ = 0.51 inches
E) Total Outlet Area	A_{ot} = 0.20 square inches
8. Initial Surcharge Volume	
A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches)	D_{IS} = 4 in
B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV)	V_{IS} = cu ft
C) Initial Surcharge Provided Above Micropool	V_s= 5.3 cu ft
9. Trash Rack	
A) Water Quality Screen Open Area: $A_t = A_{ot} * 38.5*(e^{-0.095D})$	A_t = 7 square inches
B) Type of Screen (If specifying an alternative to the materials recommended in the USDCM, indicate "other" and enter the ratio of the total open are to the total screen are for the material specified.) Other (Y/N): N	*S.S. Well Screen with 60% Open Area*
C) Ratio of Total Open Area to Total Area (only for type 'Other')	User Ratio =
D) Total Water Quality Screen Area (based on screen type)	A_{total} = 12 sq. in.
E) Depth of Design Volume (EURV or WQCV) (Based on design concept chosen under 1E)	H= 10.08 feet
F) Height of Water Quality Screen (H_{TR})	H_{TR}= 148.96 inches
G) Width of Water Quality Screen Opening ($W_{opening}$) (Minimum of 12 inches is recommended)	$W_{opening}$ = 12.0 inches **VALUE LESS THAN RECOMMENDED MIN. WIDTH. WIDTH HAS BEEN SET TO 12 INCHES.**

Design Procedure Form: Extended Detention Basin (EDB)

Designer: JJM, Checked by: EJG
Company: Kimley-Horn and Associates, Inc.
Date: November 22, 2019
Project: Green Mountain Falls Church
Location: Green Mountain Falls - West Pond

10. Overflow Embankment

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

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

Ze = 4.00 ft / ft

11. Vegetation

Choose One
- ○ Irrigated
- ● Not Irrigated

12. Access

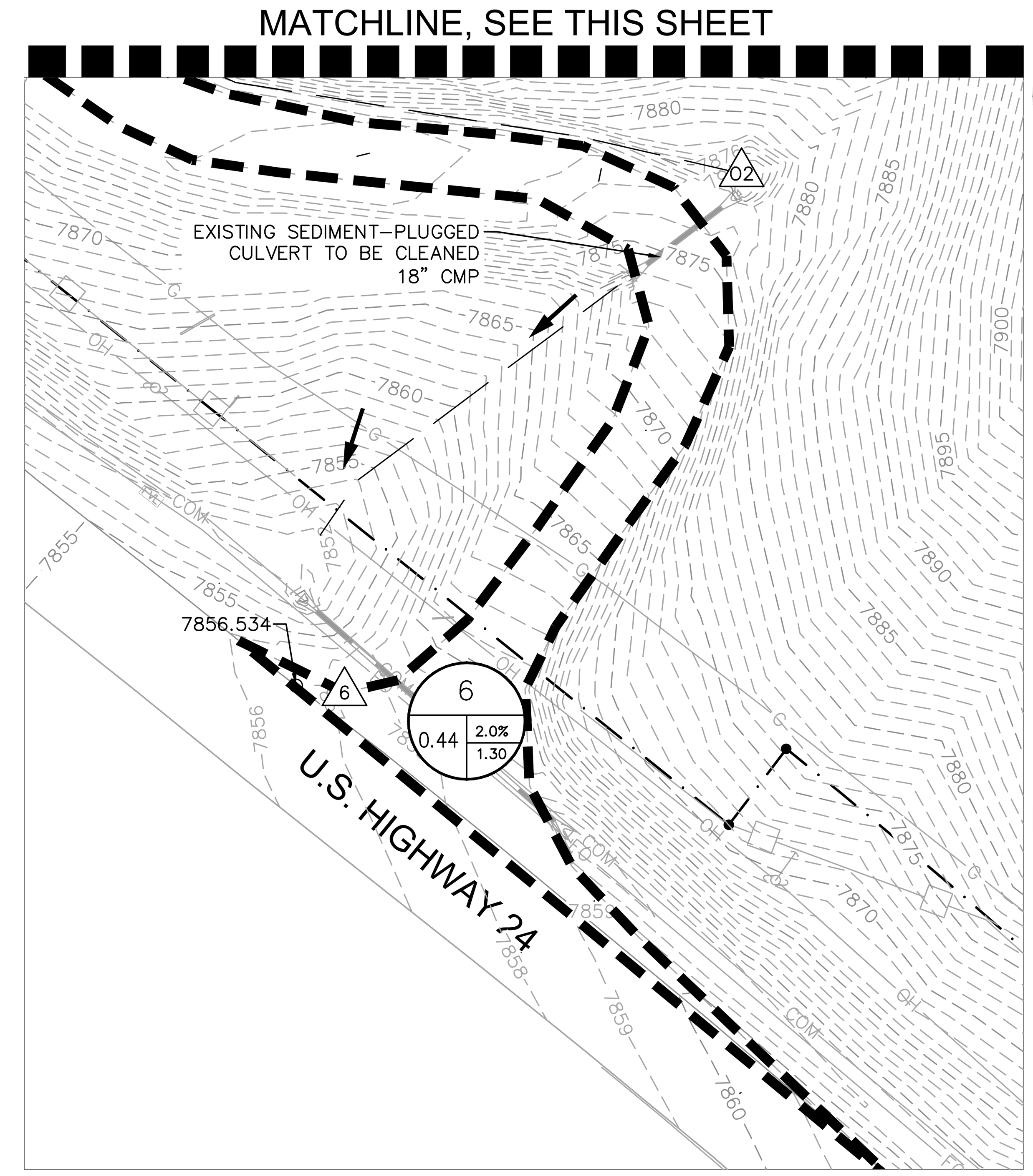
A) Describe Sediment Removal Procedures

Notes:

EXISTING AND PROPOSED DRAINAGE MAP

MATCHLINE, SEE THIS SHEET

MATCHLINE, SEE THIS SHEET



LEGEND

- A = BASIN DESIGNATION
- B = AREA (ACRES)
- C = 100-YR COMPOSITE RUNOFF COEFFICIENT
- D = 100-YR DESIGN STORM RUNOFF (CFS)

- DESIGN POINT
- FLOW DIRECTION
- EMERGENCY OVERFLOW PATH
- DRAINAGE BASIN BOUNDARY
- PROPERTY LINE
- XXXX PROPOSED MAJOR CONTOUR
- XXXX PROPOSED MINOR CONTOUR
- XXXX EXISTING MAJOR CONTOUR
- XXXX EXISTING MAJOR CONTOUR
- EXISTING DRAINAGE DITCH

NOTES

1. THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID DETAILED PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE ESTABLISHED CRITERIA FOR DETAILED DRAINAGE PLANS AND SPECIFICATIONS, AND SAID DETAILED PLANS AND SPECIFICATIONS ARE IN CONFORMITY WITH THE MASTER PLAN OF THE DRAINAGE BASIN. SAID DETAILED DRAINAGE PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR DRAINAGE FACILITY(S) IS DESIGNED. I ACCEPT RESPONSIBILITY FOR ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS OR OMISSIONS ON MY PART IN PREPARATION OF THE DETAILED DRAINAGE PLANS AND SPECIFICATIONS.
2. PLAN REVIEW BY EL PASO COUNTY IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH DESIGN CRITERIA. EL PASO COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. EL PASO COUNTY, THROUGH APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

SUMMARY - EXISTING RUNOFF TABLE

DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
1	1	0.12	0.07	0.39	0.07	0.39
2	2	0.13	0.08	0.41	0.08	0.41
3	3	0.97	0.77	3.33	0.77	3.33
4	4	0.31	0.45	1.33	0.45	1.33
5	5	0.79	1.04	3.20	1.04	3.20
6	6	0.44	0.24	1.30	0.24	1.30
7	7	0.75	2.57	5.13	2.57	5.13
8	8	0.35	0.23	1.21	0.23	1.21
O1		2.94				13.39
O2		0.47				1.61

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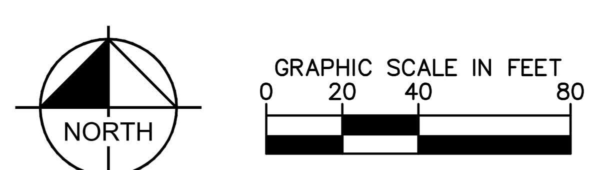
Kimley»Horn

2 NORTH NEVADA AVENUE, SUITE 300
COLORADO SPRINGS, COLORADO 80903 (719) 453-0180

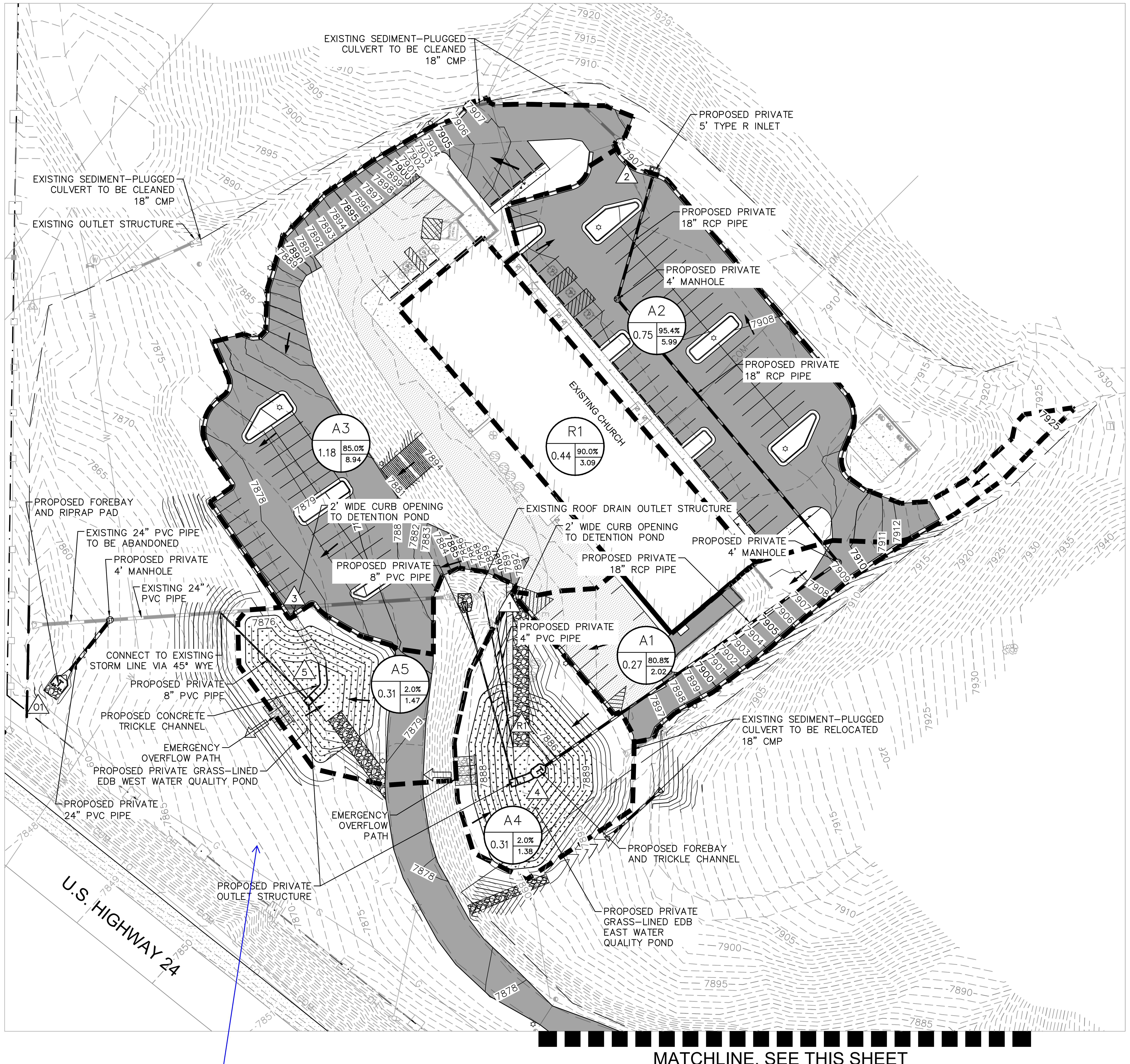


REV: 11/22/19

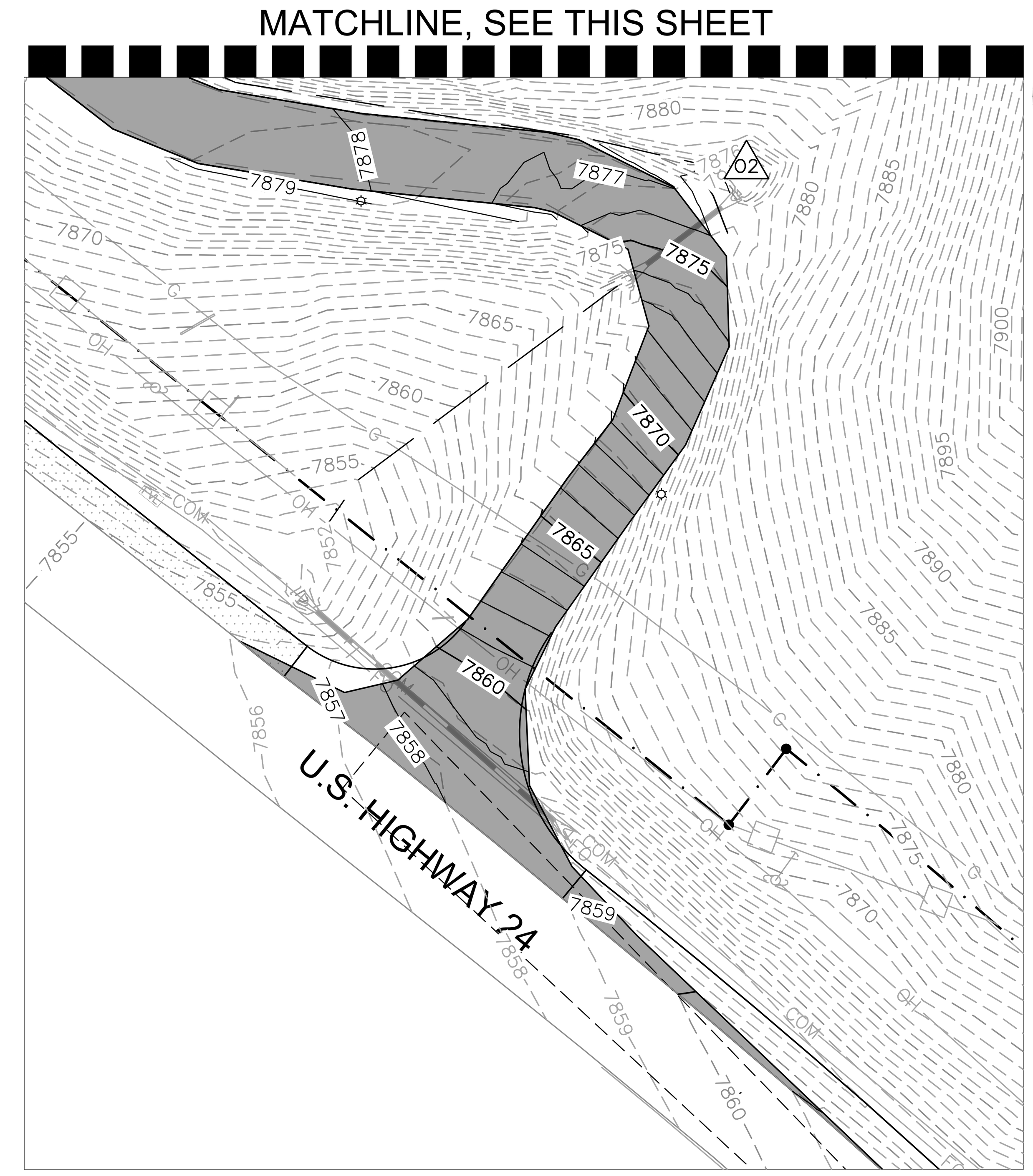
REV: 10/18/19

EXISTING DRAINAGE PLAN

SHEET 1 OF 3



per comments from CDOT please show the location of the proposed septic system.



LEGEND

A = BASIN DESIGNATION
B = AREA (ACRES)
C = 100–YR COMPOSITE RUNOFF COEFFICIENT
D = 100–YR DESIGN STORM RUNOFF (CFS)

DESIGN POINT
FLOW DIRECTION
EMERGENCY OVERFLOW PATH
DRAINAGE BASIN BOUNDARY
PROPERTY LINE
PROPOSED MAJOR CONTOUR
PROPOSED MINOR CONTOUR
EXISTING MAJOR CONTOUR
EXISTING MAJOR CONTOUR
EXISTING DRAINAGE DITCH
PROPOSED DRAINAGE DITCH

NOTES

1. THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID DETAILED PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE ESTABLISHED CRITERIA FOR DETAILED DRAINAGE PLANS AND SPECIFICATIONS, AND SAID DETAILED PLANS AND SPECIFICATIONS ARE IN CONFORMITY WITH THE MASTER PLAN OF THE DRAINAGE BASIN. SAID DETAILED DRAINAGE PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR DRAINAGE FACILITY(S) IS DESIGNED. I ACCEPT RESPONSIBILITY FOR ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS OR COMMISSIONS ON MY PART IN PREPARATION OF THE DETAILED DRAINAGE PLANS AND SPECIFICATIONS.
2. PLAN REVIEW BY EL PASO COUNTY IS PROVIDED ONLY FOR GENERAL CONFORMANCE WITH DESIGN CRITERIA. EL PASO COUNTY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, DIMENSIONS, AND/OR ELEVATIONS WHICH SHALL BE CONFIRMED AT THE JOB SITE. EL PASO COUNTY, THROUGH APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

SUMMARY - PROPOSED RUNOFF TABLE

DESIGN POINT	BASIN DESIGNATION	BASIN AREA (ACRES)	DIRECT 5-YR RUNOFF (CFS)	DIRECT 100-YR RUNOFF (CFS)	CUMULATIVE 5-YR RUNOFF (CFS)	CUMULATIVE 100-YR RUNOFF (CFS)
1	A1	0.27	1.04	2.02	1.04	2.02
2	A2	0.75	3.29	5.99	3.29	5.99
3	A3	1.18	4.71	8.94	4.71	8.94
R1	R1	0.44	1.66	3.09	1.66	3.09
4	A4	0.31	0.41	1.38	0.41	1.38
5	A5	0.31	0.41	1.47	0.41	1.47
O1		3.26				3.80
O2		0.00				0.00

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Kimley»Horn

2 NORTH NEVADA AVENUE, SUITE 300
COLORADO SPRINGS, COLORADO 80903 (719) 453–0180

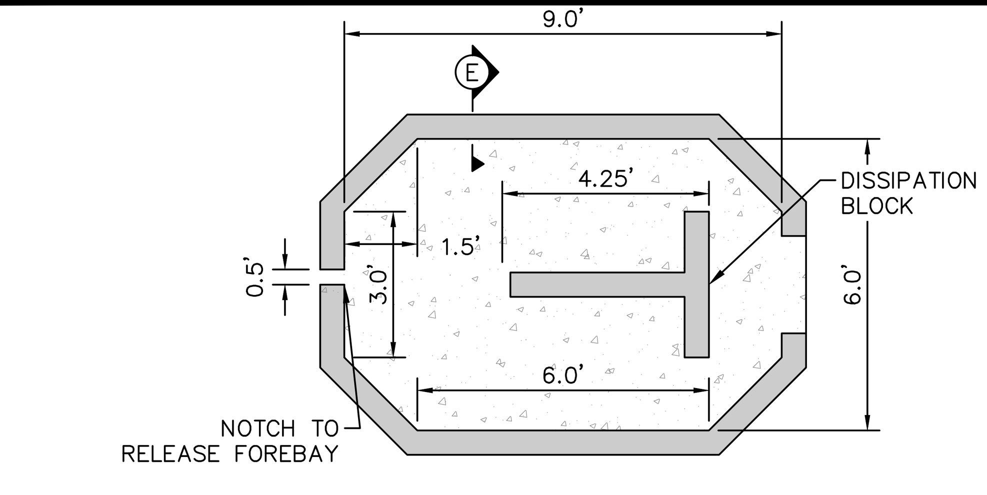
NORTH

GRAPHIC SCALE IN FEET
0 20 40 80

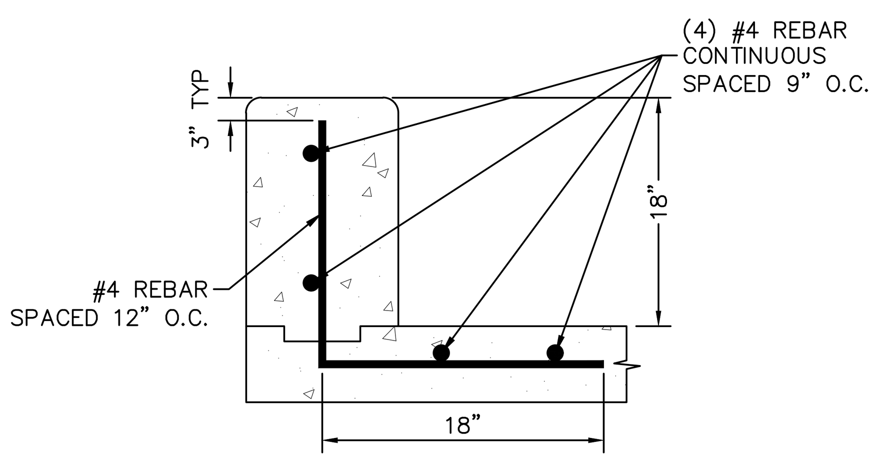
REV: 11/22/19
REV: 10/18/19

PROPOSED DRAINAGE PLAN

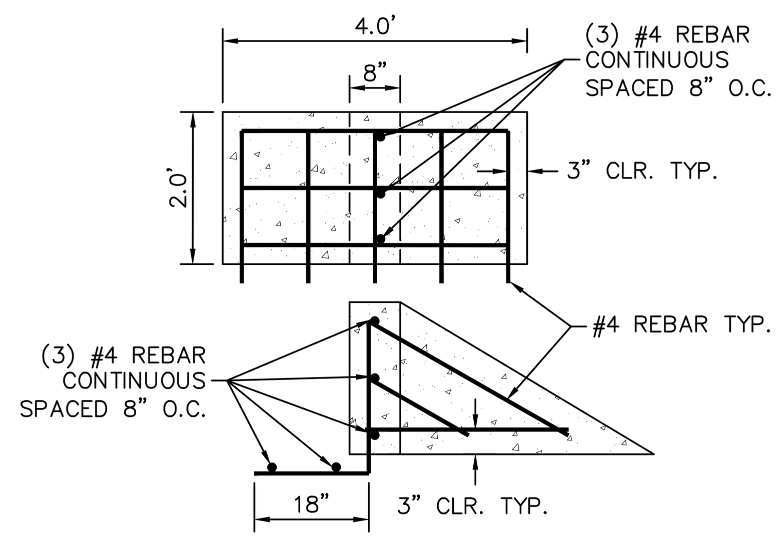
GREEN MOUNTAIN FALLS CHURCH CONSTRUCTION DOCUMENTS - COUNTY FILE NO. PPR1933



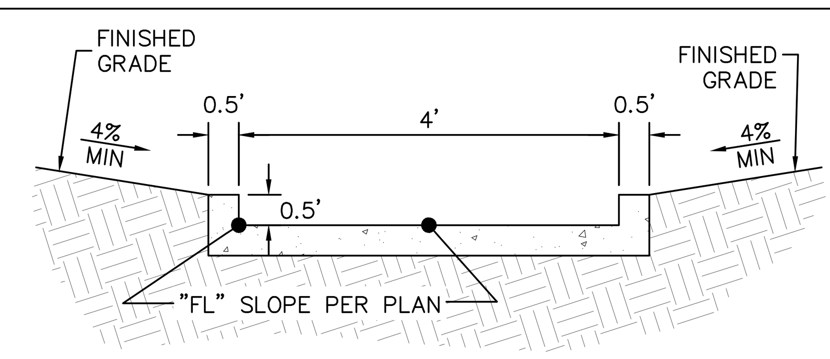
FOREBAY WALL PLAN VIEW DETAIL
N.T.S.



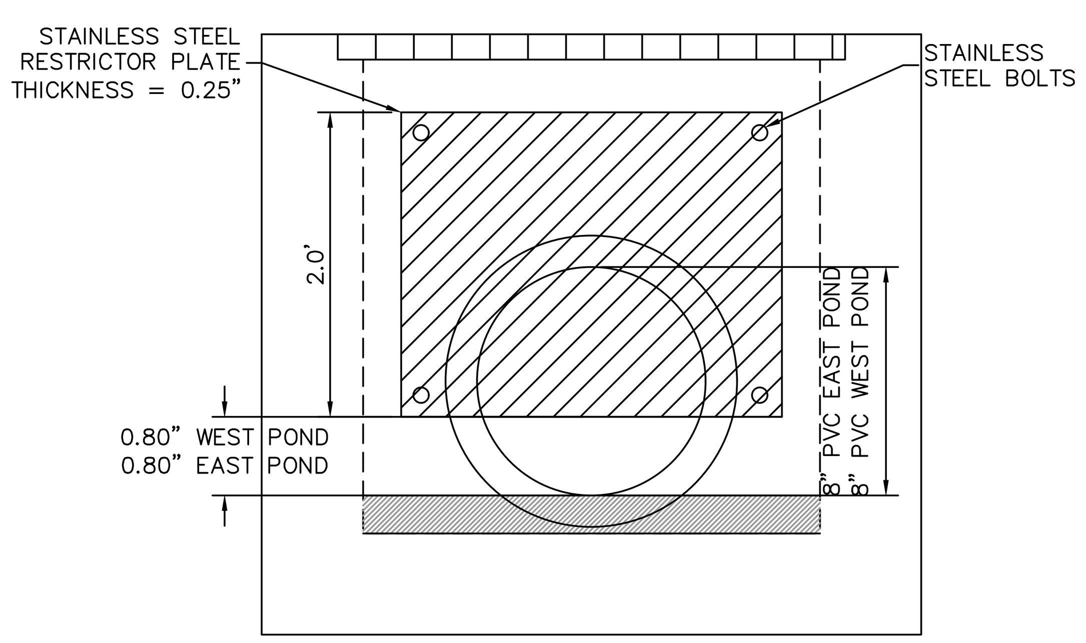
FOREBAY WALL SECTION E
N.T.S.



FOREBAY DISSIPATER DETAIL
N.T.S.



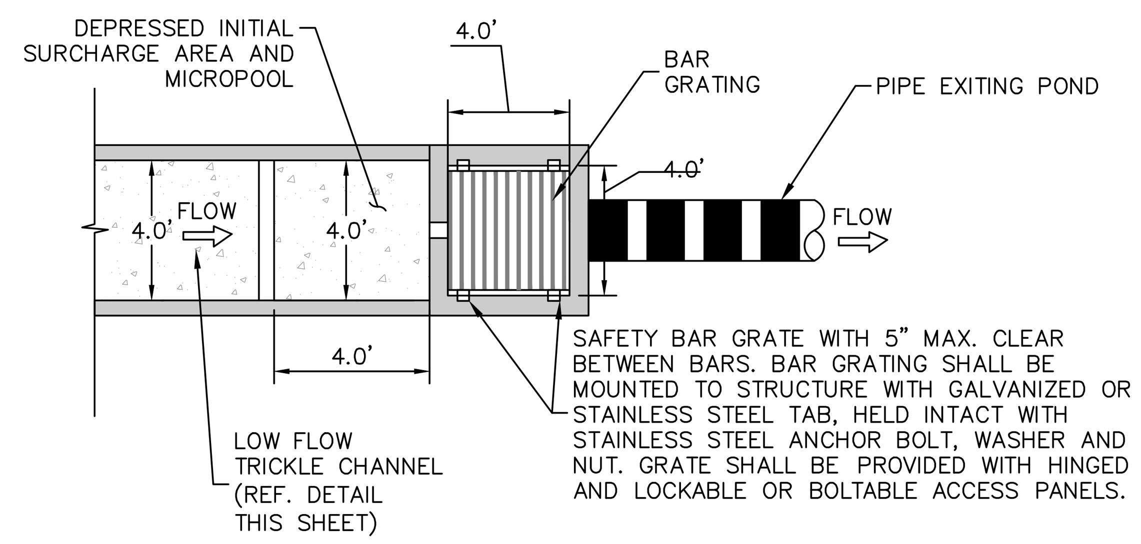
TRICKLE CHANNEL CROSS-SECTION DETAIL
N.T.S.



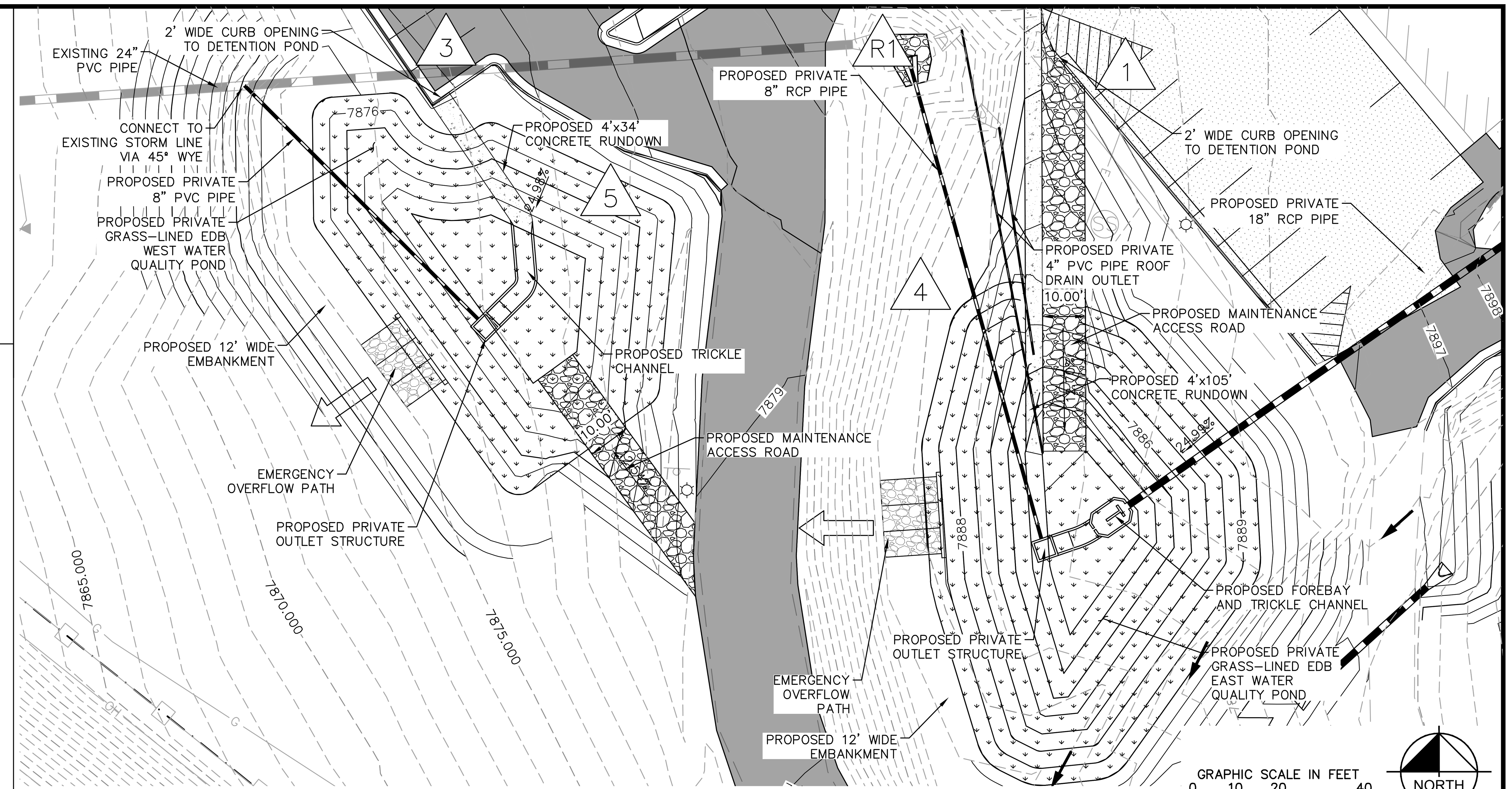
100-YEAR FLOW RESTRICTOR DETAIL
N.T.S.

LEGEND

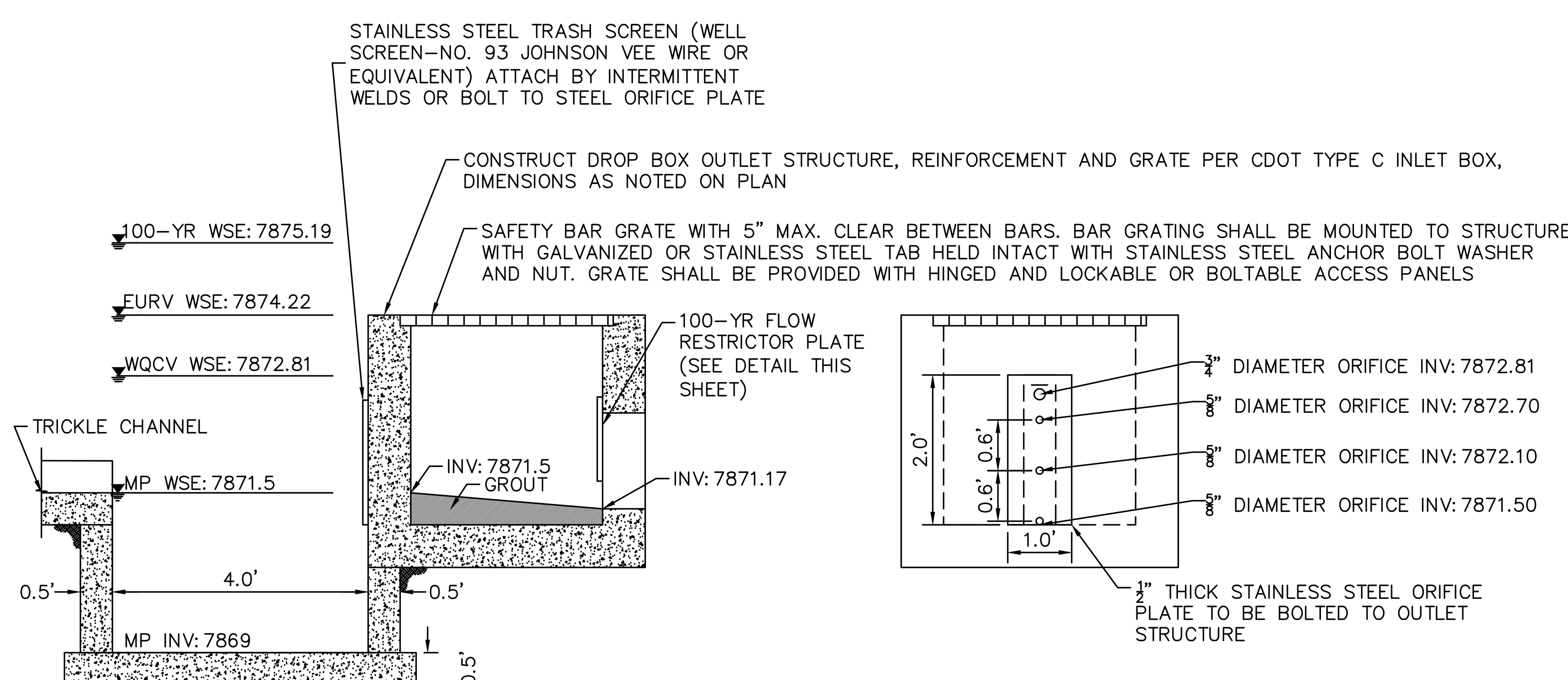
— — —	PROPERTY LINE
——xxxx——	PROPOSED MAJOR CONTOUR
——xxxx——	PROPOSED MINOR CONTOUR
— —xxxx— —	EXISTING MAJOR CONTOUR
— —xxxx— —	EXISTING MINOR CONTOUR



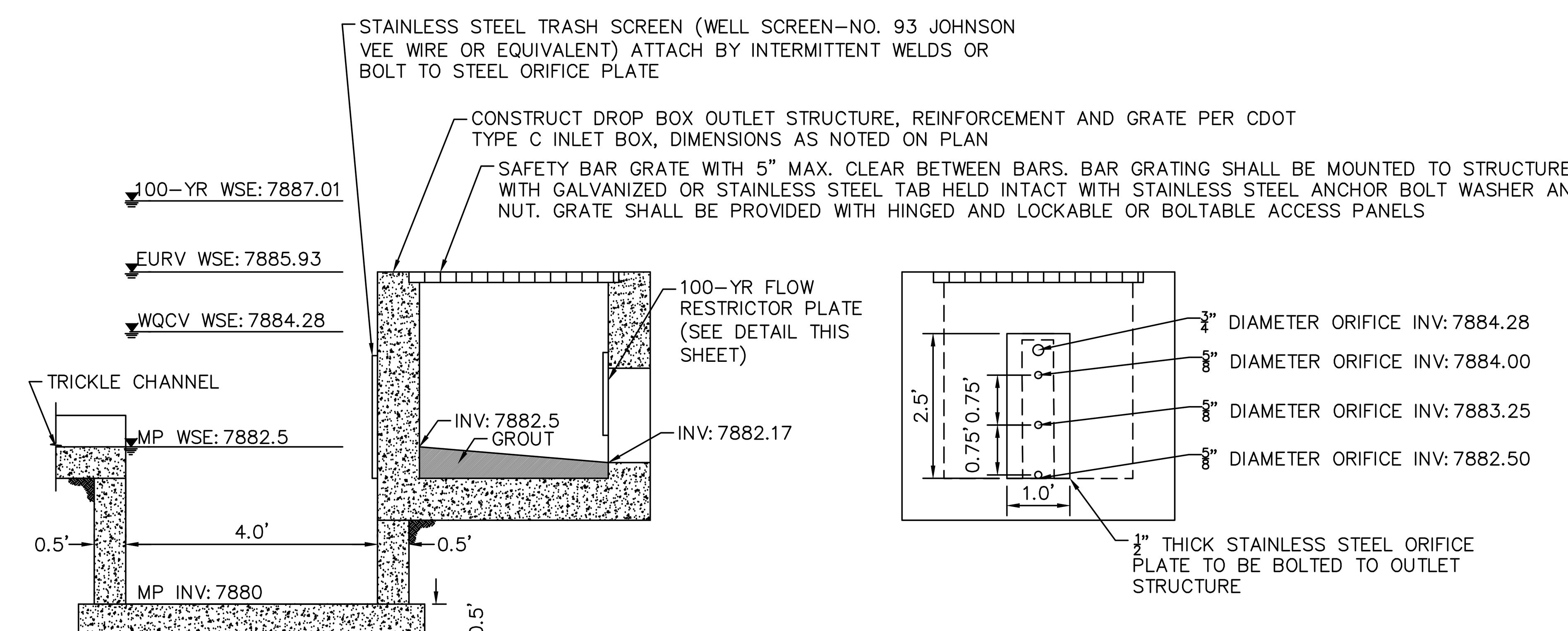
MICROPOOL DETAIL
N.T.S.



EXTENDED DETENTION PONDS



WEST POND OUTLET STRUCTURE PROFILE DETAIL
N.T.S.



EAST POND OUTLET STRUCTURE PROFILE DETAIL
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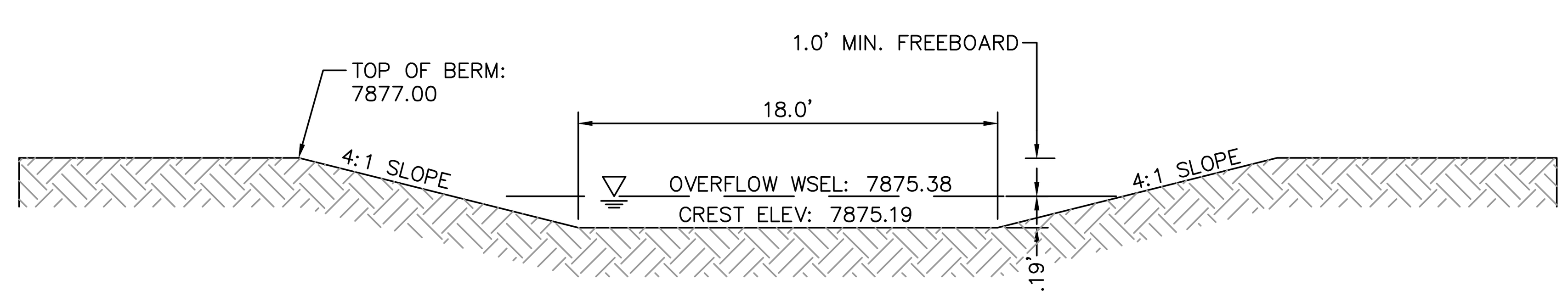
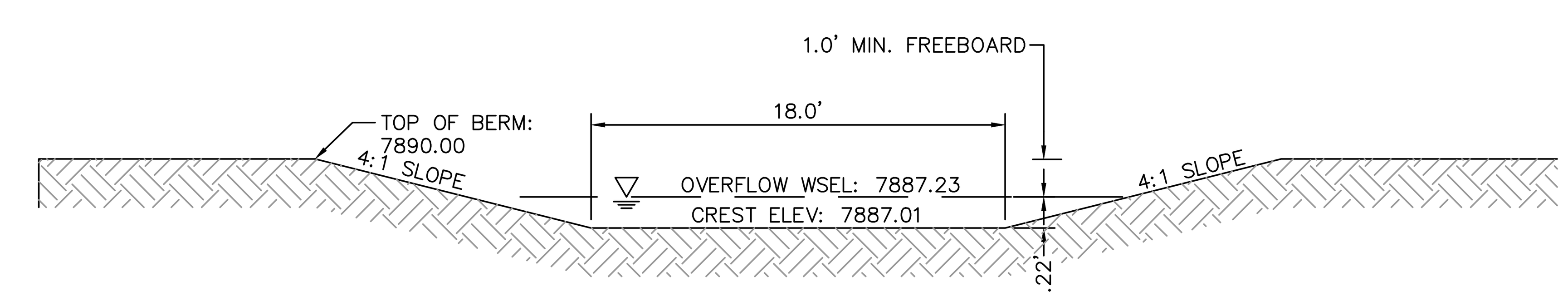


WEST POND EMERGENCY SPILLWAY DETAIL (PROFILE VIEW)
N.T.S.



EAST POND EMERGENCY SPILLWAY DETAIL (PROFILE VIEW)
N.T.S.

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Kimley»Horn

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REV: 11/22/19
REV: 10/18/19

POND DETAILS
SHEET C2.9