MVE, INC.
ENGINEERS SURVEYORS
1903 lelaray street, suite 200
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719.635.5736

# Final Drainage Report

## St. John the Baptist Orthodox Church

**Project No. 61200**

**August 10, 2023**

PCD File No. PPR-22-55

# Final Drainage Report

for

**St. John the Baptist Orthodox Church**
Lot 4, Block 2, Pawnee Rancheros Filing No. 1

**Project No. 61200**

## August 10, 2023

prepared for

**St. John the Baptist Orthodox Church**
7530 Mohawk Road
Colorado, CO 80908

prepared by

**MVE, Inc.**
1903 Lelaray Street, Suite 200
Colorado Springs, CO 80909
719.635.5736

Submit with signatures and stamp next submittal.

# Statements and Acknowledgments

## Engineer's Statement

This report and plan for the drainage design of St. John the Baptist Orthodox Church was prepared by me (or under my direct supervision) and is correct to the best of my knowledge and belief. Said report and plan has been prepared in accordance with the City / County Drainage Report Criteria and 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.

_____ _____

Charles C. Crum, P.E. Colorado No. 13348 Date
For and on Behalf of MVE, Inc.

## Developer's Statement

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

_____ _____

Father Anthony Date
SS Constantine & Helen Orhodox Church
2770 N. Chestnut Street
Colorado Springs, CO 80907

## El Paso County

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

_____ _____

Joshua Palmer, PE Date
County Engineer / ECM Administrator

# Contents

# Final Drainage Report

The purpose of this Final Drainage Report is to identify drainage patterns and quantities within and affecting the proposed St. John the Baptist Orthodox Church site. The report will identify specific solutions to problems on-site and off-site resulting from the proposed project. The report and included maps present results of hydrologic and drainage facilities analyses. The report will discuss the recommended drainage improvements to the site and identify drainage requirements relative to the proposed project. This report has been prepared and submitted in accordance with the requirements of the El Paso County development approval process. An Appendix is included with this report with pertinent calculations and graphs used in the drainage analyses and design.

## 1 General Location and Description

### 1.1 Location

St. John the Baptist Orthodox Church will be located within Lot 4, Block 2, Pawnee Rancheros Filing No. 1 which is within the east half of the southeast quarter of Section 4, Township 14 South, Range 63 West of the 6th Principal Meridian, El Paso County, Colorado. The site is 4.79± acres in area and has a tax schedule number of 53040 05 008 (7530 Mohawk Road). The site is located north of East Woodmen Road and west of Mohawk Road in El Paso County. The site is zoned Rural Residential - 5 Acres with Commercial Airport District Overlay (RR-5 CAD-O) and is vacant. A **Vicinity Map** is included in the **Appendix**. The site is located in the Sand Creek Major Drainage Basin.

### 1.2 Description of Property

Pawnee Rancheros Filing No. 1 is a platted residential subdivision in El Paso County, Colorado. Lot 4, Block 2 of the subdivision is located to the northwest of the intersection of Mohawk Drive and the Woodmen Road East Frontage Road. Site development activities within the subdivision have been residential construction. The Lot 4 site is adjacent to property with buildings and appurtenances to the east & west, and by vacant property to the north. The existing site topography generally slopes to the east, west, and southerly with grades of about 3% to 10%. The existing ground cover is in fair to good condition and consists of native grasses and sparse brush for Lot 4. The site is split by a ridge line traversing the site from the south to the north. Stormwater drainage patterns on the site flow easterly and westerly from the ridge line and in a southerly direction ultimately ending up in El Paso County roadside ditches. Drainage culverts at the southeast corner of said Lot 4 within the El Paso County road right of way drain southerly under the existing Woodmen Road East Frontage Road.

The proposed Site Development Plan for said Lot 4 consists of a new 3475 square-foot Church building along with sidewalks, parking lot, entrance drive, permanent landscaping, and other related site improvements. Access to the Church lot will be provided by one connection to Mohawk Road on the east side of the site.

This report is intended to meet El Paso County requirements for a Final Drainage Report in support of the proposed Development Plan for the St. John the Baptist Orthodox Church on Lot 4. No Drainage Report for Pawnee Rancheros Filing No. 1 has been found in the El Paso County records.

According to the National Resource Conservation Service, there are three (3) soil types in the Lot 4, Block 2, Pawnee Rancheros Filing No. 1 site. Blakeland loamy sand (map unit 8) makes up a very small portion of the eastern side of the site. The soil is deep and somewhat excessively drained. Permeability is rapid, surface runoff is slow, and the hazard of erosion is slight to moderate. Blakeland loamy sand is classified as being part of Hydrologic Soil Group A. Blakeland-Fluvaquentic Halplaquolls (map unit 9) makes up the eastern portion of the soil on the site. The soil is deep and somewhat excessively drained. Permeability is rapid, surface runoff is slow, and the hazard of erosion is slight to moderate. Blakeland-Fluvaquentic Halplaquolls is classified as being part of Hydrologic Soil Group A. Columbine (map unit 19) makes up the western portion of the site. The soil is deep and somewhat well drained. Permeability is rapid, surface runoff is slow, and the hazard of erosion is slight to moderate. Columbine is classified as being part of Hydrologic Soil Group A. A portion of the Soil Map and data tables from the National Cooperative Soil Survey and relevant Official Soil Series Descriptions (OSD) are included in the **Appendix**.[1] [2]

# 2 Drainage Basins and Sub-Basins

## 2.1 Major Basin Descriptions

The St. John the Baptist Orthodox Church site is located within the Sand Creek Drainage Basin (FOFO4000). The Sand Creek Drainage Basin Covers an area of approximately 61 square miles and drains to Fountain Creek. The Sand *Creek Drainage Basin Planning Study* (DBPS) was prepared in 1996 by Kiowa Engineering Corporation and provides development recommendations and requirements for drainage development in the Sand Creek Drainage Basin.[3] The Sand Creek Drainage Basin encompasses a small portion of central El Paso County. The drainage basin drains southwesterly into Fountain Creek. The St. John the Baptist Orthodox Church site is located north of Fountain Creek. The site is located within the upper portion of the Drainage Basin Planning Study. No improvements are recommended on or near the project site. The proposed St. John the Baptist Orthodox Church project is in conformance with the DBPS.

The current Flood Insurance Study of the region includes Flood Insurance Rate Maps (FIRM), effective on December 7, 2018.[4] The proposed subdivision is included in the Community Panel Number 08041C0533G of the Flood Insurance Rate Maps for the El Paso County. No part of the site is shown to be included in a 100-year flood hazard area as determined by FEMA. A portion of the current FEMA Flood Insurance Rate Maps with the site delineated is included in the **Appendix**.

## 2.2 Sub-Basin Description

The existing drainage patterns of the St. John the Baptist Orthodox Church project site are described by three (3) on-site drainage basins, and three (3) off-site drainage basins. All of these basins are previously undisturbed or disturbed to a degree as described below. All existing basin delineations and data are depicted on the attached **Existing Drainage Map**.

### 2.2.1 Existing Drainage Patterns (Off-Site)

St. John the Baptist Orthodox Church directly receives drainage flows from one (1) offsite sub-basin while two (2) additional offsite drainage basins flow onto the property from the El Paso County roadways adjacent to the east side and south side of the site.

Sub-basin OS-1 is located south and east of the site and contains the northern portion of asphalt pavement and roadside of Woodmen Frontage Road and the western portion of pavement and roadside of Mohawk Road. The sub-basin drains easterly and southerly towards the existing 2- 27” Reinforced Concrete Pipes (RCP's) draining southerly under said frontage road.

1 WSS
2 OSD
3 DBPS
4 FIRM

Sub-basin OS-2 is located northerly of the site, is vacant and contains pasture/meadow type ground cover. This sub-basin drains southerly onto the site and join with on-site Basin B.

Sub-basin OS-3 contains a residence, detached garage, a shed, and graveled entrance drives. The remainder of the basin is established pasture/meadow areas and is located northerly of the site. The sub-basin drains easterly then southerly, west of Mohawk Road. These flows continue southerly joining the flows from Sub-basin OS-1 at said existing 2-27" RCP's which drain southerly under said frontage road.

Woodmen Frontage Road and Mohawk Road adjacent to the property do not have roadside ditches. Drainage from the pavement drains off the shoulder and into the subject property.

### 2.2.2 Existing Drainage Patterns (On-Site)

Existing Sub-basin A, located on the western portion of the site, contains pasture/meadow area. The stormwater flows westerly overland and exit the site along the western lot line.

Existing Sub-basin B makes up a small portion of the northeastern area of the site and currently contains established pasture/meadow area. The sub-basin accepts flows from sub-basin OS-2. The combined runoff drains southeasterly and combines with the flows from OS-3.

Existing Sub-basin C makes up a substantial portion of the southeastern portion of the site and currently contains established pasture/meadow area. The Sub-basin currently drains southeasterly towards the northwest corner of Mohawk Road and Woodmen Frontage Road combining with Sub-basins B, OS-1, OS-2 & OS-3 at said existing 2-27" RCP's which drain southerly under said frontage road.

## 3 Drainage Design Criteria

### 3.1 Development Criteria Reference

This Final Drainage Report for development of Lot 4, Block 2, Pawnee Rancheros Filing No. 1 has been prepared according to the report guidelines presented in the latest edition of *El Paso County Drainage Criteria Manual* (DCM)[5]. This manual adopts portions of the City of Colorado Springs Drainage Criteria Manual Volumes 1 and 2, especially concerning the calculation of rainfall runoff flow rates.[6] [7] The hydrologic analysis is based on a collection of data from the DCM, the NRCS Web Soil Survey[8], and existing topographic data by Alessi and Associates, Inc. and Colorado Springs Utilities FIMS.

### 3.2 Previous Drainage Studies

Besides the previously mentioned DBPS, we have not found a Final Drainage Report for Pawnee Rancheros Filing No. 1.

### 3.3 Hydrologic and Hydraulic Criteria

The Rational Method as described in the *El Paso County Drainage Criteria Manual* has been used for all Storm Runoff calculations, as the development and all sub-basins are less than 130 acres in area. "Colorado Springs Rainfall Intensity Duration Frequency" curves, Figure 6-5 in the DCM, was used to obtain the design rainfall values; a copy is included in the **Appendix**. The "Overland (Initial) Flow Equation" (Eq. 6-8) in the DCM, and Manning's equation with estimated depths were used in time of concentration calculations. "Runoff Coefficients for Rational Method", Table 6-6 in the DCM, was utilized as a guide in estimating runoff coefficient and Percent Impervious values; a copy is included in the **Appendix**. Peak runoff discharges were calculated for each drainage sub-basin for

5 EPC DCM
6 CS DCM Vol 1
7 CS DCM Vol 2
8 WSS

both the 5-year storm event and the 100-year storm event with the Rational Method formula, (Eq. 6-5) in the DCM.[9]

Storm drain pipes and Inlets are analyzed and designed using the procedures in Chapter 7, Sections 3.0 and 4.0 of the *Mile High Flood District (MHFD) Urban Storm Drainage Criteria Manual, Volume 1.*[10] Calculations are done with the aid of the MHFD Street and Inlet Hydraulics Workbook Version 5.01 and UD-Sewer 2009 Version 1.2.1. Culverts are analyzed and designed using the procedures found in Chapter 11, Sections 3.0 and 4.0 of the *Mile High Flood District (MHFD) Urban Storm Drainage Criteria Manual, Volume 2.*[11] The MHFD Culvert Design Worksheet V4.00 or the HY-8 computer program Version 7.60 by the Federal Highway Administration were used as an aid.

# 4 Drainage Facility Design

## 4.1 General Concept

The intent of the drainage concept presented in this Final Drainage Report is to allow for the development of a new 3475 square-foot Church building along with sidewalks, parking lot, entrance drive, permanent landscaping, and other related site improvements and safely routing developed flows through the site to the previously constructed drainage piping system under said Woodmen Frontage Road. Existing drainage patterns will be maintained as much a practically possible.

The existing percent imperviousness of the site is 0.0%. The proposed improvements will increase the imperviousness of the site to 9.8%.

The existing and proposed drainage hydrologic conditions are described in more detail below. Input data and results for all calculations are included in the **Appendix**. Drainage maps for the hydrology are also included in the **Appendix**.

## 4.2 Specific Details

### 4.2.1 Existing Hydrologic Conditions

As shown on the included **Existing Drainage Map** the existing site has been delineated with three (3) on-site sub-basins (A, B, & C) and three (3) offsite sub-basins (OS-1, OS-2, & OS-3, all draining as previously described above. Storm runoff concerning the subject site has been calculated for this report as discussed below.

Existing **Design Point 1 (EX-1)**: **Sub-basin OS-2** located adjacent to the northern Lot line of the subject site contains 1.66 acres. The sub-basin contains established pasture/meadow ground cover. The sub-basin generates runoff flows of $Q_5$ = 0.5 cfs and $Q_{100}$ = 3.7 cfs that drain southerly into the site along said Lot line to existing Sub-basin B.

Existing **Design Point 2 (EX-2)**: **Sub-basin B** is 0.82 acres and contains established pasture/meadow ground cover in the undeveloped northeastern portion Lot 4, Pawnee Rancheros Filing No. 1. The sub-basin drains southeasterly with a combined (OS-2 & B) peak runoff discharges of $Q_5$ = 0.8 cfs and $Q_{100}$ = 5.5 cfs and then continues southerly.

Existing **Design Point 3 (EX-3)**: **Sub-basin C** is 2.24 acres and contains established pasture/meadow ground cover in the undeveloped southeastern portion Lot 4, Pawnee Rancheros Filing No. 1. The sub-basin produces flows of $Q_5$ = 0.7 cfs and $Q_{100}$ = 5.0 cfs which drain to the northwest corner of the intersection of Mohawk Road and Woodmen Frontage Road.

Existing **Design Point 4 (EX-4)**: **Sub-basin A** is 1.73 acres and contains established pasture/meadow ground cover in the undeveloped western portion Lot 4, Pawnee Rancheros Filing No. 1. The combined peak runoff is $Q_5$ = 0.6 cfs and $Q_{100}$ = 4.0 cfs which drain westerly and exit said Lot 4 along the westerly boundary.

9 EPC DCM
10 MHFD V1
11 MHFD V2

Add OS-3 in the description.



Existing **Design Point 5 (EX-5)**: Combined Sub-basins OS-1, OS-2, B, & C contain a total of 7.83 acres. The flows from these Sub-basins combine in the area of the southeast corner of Lot 4, Pawnee Rancheros Filing No. 1. These combined Sub-basins drains southerly through the existing 2 – 27" RCP's under Woodmen Frontage Road. The combined peak runoff discharges of $Q_5$ = 4.3 cfs and $Q_{100}$ = 17.5 cfs flow southerly through said pipes. After crossing under the Woodmen Frontage Road, flows enter the existing storm drain system along Woodmen Road before crossing south under Woodmen Road and into Sand Creek. Analysis of this Woodmen Road storm drain system is beyond the scope of this Report.

### 4.2.2 Proposed Hydrologic Conditions

As shown on the enclosed **Proposed Drainage Map**, the developed site has been delineated into ten (10) on-site sub-basins A1, A2, B1, C1, C2, C3, C4, and C5. There are also three (3) offsite sub-basins OS-1, OS-2, and OS-3. The existing and proposed calculationd for sub-basin OS-1, OS-2 and OS-3 are the same in both the existing and proposed conditions. Storm flows from the "A" Sub-basins will drain westerly exiting Lot 4 along its western Lot line. The "B" Sub-basin drain easterly toward Mohawk Road. The "C" Sub-basins will combine their storm flows and drain southwesterly towards the southeast corner of Lot 4. The collected flows of Sub-basins B1, C1, C2, C3, C4, and C5 combined with those of OS-1, OS-2 and OS-3 will be carried southerly through the existing 2 – 27" RCP's under Woodmen Frontage Road.

**Design Point 1 (DP1)**: **Sub-basin A1,** containing 0.06 acres with new sidewalk and grassed ground cover producing storm runoff flows of $Q_5$ = 0.2 cfs and $Q_{100}$ = 0.4 cfs that drain westerly into Sub-basin A-2.

**Design Point 2 (DP2)**: **Sub-basin A2** is 1.71 acres in area located adjacent to the western edge of the site. The sub-basin contains established pasture/meadow ground cover producing storm runoff flows of $Q_5$ = 0.5 cfs and $Q_{100}$ = 4.0 cfs and combines with **DP1** for a combined area of 1.77 acres. The overland peak discharges of $Q_5$ = 0.7 cfs and $Q_{100}$ = 4.3cfs flow overland exiting Lot 4 along its western Lot line. The increase in flows from existing to proposed are $Q_5$ = 0.1 cfs and $Q_{100}$ = 0.3 cfs.

**Design Point 3 (DP3)**: **Sub-basin B1** is 0.82 acres in area located in the northeastern portion of Lot 4. The Sub-basin contains established pasture/meadow ground cover and the proposed driveway with overland flows and flows from the proposed drive producing storm runoff flows of $Q_5$ = 0.4 cfs and $Q_{100}$ = 2.0 cfs. The flows combined with those of OS-2 and OS-3 cross a low point in the driveway with peak discharges of $Q_5$ = 2.1 cfs and $Q_{100}$ = 10.2 cfs. Calculations for this low point in the driveway are included in the **Appendix**. Note that the entire Sub-basin B1 was used in this calculation.

**Design Point 4 (DP4)**: **Sub-basins C1, C2 & C4** combine to be 1.17 acres located in the central portion of Lot 4. **C1** is 0.74 acres and contains established pasture/meadow ground cover with overland flows to the southeast and sheets across the proposed sidewalk entering the proposed drive and parking lot with peak flows of $Q_5$ = 0.2 cfs and $Q_{100}$ = 1.7 cfs. **C2** is 0.13 acres and contains established pasture/meadow ground cover and proposed sidewalk which will flow to the southeast along the sidewalk before spreading out and sheeting across the proposed walkway into the proposed parking lot with peak flows of $Q_5$ = 0.1 cfs and $Q_{100}$ = 0.5 cfs. **C4** is 0.31 acres containing the new parking lot a portion of the entrance drive. These three Sub-basins combine for a peak runoff discharge of $Q_5$ = 1.4 cfs and $Q_{100}$ = 4.0 cfs which exits the southeast corner of said parking Lot through a 2' wide curb opening. Calculations for this opening and riprap outfall are included in the **Appendix**. Flow continue into Sub-basin C-5 towards **DP5**.

**Sub-basin C3,** containing 0.48 acres consist of the proposed building, walks and landscape along with grassed ground cover producing storm runoff flows of $Q_5$ = 0.4 cfs and $Q_{100}$ = 1.4 cfs that drain south and east where they join with the flows from DP4 and continue into Sub-basin C-5.

**Sub-basin C5,** containing 0.57 acres consist of pasture/meadow groud cover at the southeast corner of the site producing storm runoff flows of $Q_5$ = 0.2 cfs and $Q_{100}$ = 1.3 cfs that drain south to a low point at the northwest corner of the Woodmen Frontage Road and Mohawk Road at **DP5**.

**Design Point 5 (DP5)**: **Sub-basins OS-1, OS-2, OS-3, B1, & C1-C5** combine to be 7.81 acres located in the central southeastern portion of Lot 4 and represent the entirety of flows entering the existing double 27" RCP. The sub-basins are a combination existing established pasture/meadow ground cover and hard surfacing from the proposed new construction. The combined sub-basins will produce flows of $Q_5$ = 5.4 cfs and $Q_{100}$ = 18.8 cfs which drain southerly to the existing 2 – 27" RCP's under Woodmen Frontage Road. The increase in flows from existing to proposed are $Q_5$ = 1.1 cfs and $Q_{100}$ = 1.3 cfs. The existing double 27" RCP is in good condition but need vegatative clearing at the entrance and are calculated to be able to covey the increased flows from this development. Calculations for these existing pipes are included in the **Appendix**.

### 4.3 Four Step Process

The El Paso County Engineering Criteria Manual (Appendix I, Section I.7.2 ) requires the consideration of a "Four Step Process for receiving water protection that focuses on reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainageways, and implementing long term source controls".

1) Runoff Reduction Practices are employed in this project. Impervious surfaces have been reduced as much as practically possible. There are minimal proposed concrete or other hard surfaces as required for the effective use of the property. Also, some of the proposed roof surfaces and paved surfaces will drain onto grass buffers and/or swales before entering El Paso County right of ways.

2) There are no drainage paths on the site that are required to be stabilized as they are well vegetated with no visual signs of erosion. There are no significant areas of concentrated flows.

3) Lot 4 is a 4.7+/- acre site. The development will disturb 0.99 acres. The proposed disturbance is less than one acre. No water quality treatment with WQCV is required and no stormwater control measures are required for this Lot as the disturbance area is less than one acre.

4) The project contains no potentially hazardous uses. The site is not anticipated to contain storage of potentially harmful substances or support the use of potentially harmful substances. No site specific or other source control BMPs are required.

## 5 Drainage and Bridge Fees

Drainage fees were paid at the time of the initial plat, and are therefore not due at this time.

## 6 Conclusion

This Final Drainage Report presents existing and proposed drainage conditions for the proposed St. John the Baptist Orthodox Church project in Lot 4, Block 2, Pawnee Rancheros Filing No. 1. The development will have negligible and inconsequential effects on the existing site drainage and drainage conditions downstream. The existing percent imperviousness of the site is 0.0%. The proposed improvements will increase the imperviousness of the site to 9.8%. The proposed project will not, with respect to stormwater runoff, negatively impact the adjacent properties and downstream properties.

Unresolved:
Discuss the conditions of the roadside ditches along Mohawk Road and Woodmen Frontage Road. Provide channel analysis and if improvements to the ditches are required (i.e vegetation clearing, grading, etc)

# References

*NCSS Web Soil Survey*. United States Department of Agriculture, Natural Resources Conservation Service ("http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx", accessed May 19, 2021).

*NRCS Official Soil Series Descriptions*. United States Department of Agriculture, Natural Resources Conservation Service ("http://soils.usda.gov/technical/classification/osd/index.html", accessed May 19, 2021).

*Sand Creek Drainage Basin Planning Study*. Kiowa Engineering Corp. (Colorado Springs: El Paso County, January 1996).

*Flood Insurance Rate Map*. Federal Emergency Management Agency, National Flood Insurance Program (Washington D.C.: FEMA, December 7, 2018).

*Drainage Criteria Manual Volume 2, Stormwater Quality Policies, Procedures and Best Management Practices (BMPs)*. City of Colorado Spring Engineering Division (Colorado Springs: , May 2014).

*City of Colorado Springs Drainage Criteria Manual, Volume 1*. City of Colorado Springs Engineering Division Staff, Matrix Design Group/Wright Water Engineers (Colorado Springs: , May 2014).

*Drainage Criteria Manual for County of El Paso, Colorado*. El Paso County Department of Public Works Engineering Division, HDR Infrastructure Inc., City of Colorado Springs Department of Public Works Engineering Division (: , Updated October 31, 2018).

*City of Colorado Springs Drainage Criteria Manual Volume 1*. City of Colorado Springs Engineering Division with Matrix Design Group and Wright Water Engineers (Colorado Springs, Colorado: , May 2014).

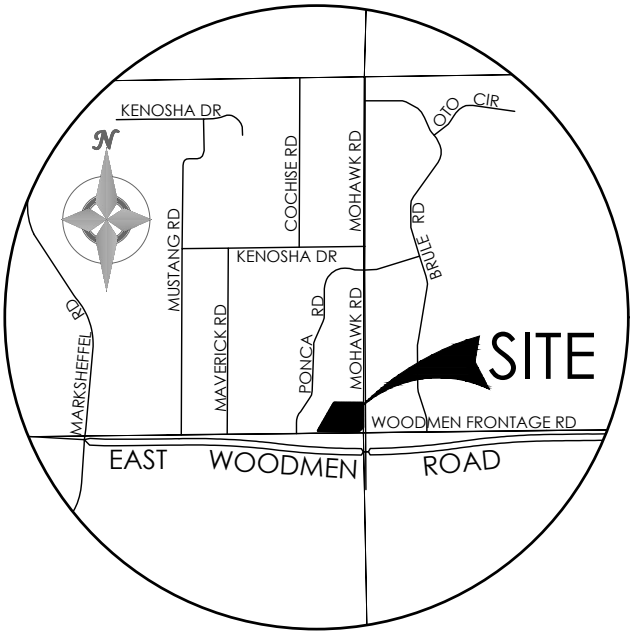
*Urban Storm Drainage Criteria Manual: Volume 2, Structures, Storage, and Recreation*. Urban Drainage and Flood Control District (Denver, Colorado: , Revised September, 2017).

*Urban Storm Drainage Criteria Manual: Volume 1, Management, Hydrology and Hydraulics*. Urban Drainage and Flood Control District (Denver, Colorado: , Revised August, 2018).

# Appendices

## 7 General Maps and Supporting Data

Vicinity Map
Portions of Flood Insurance Rate Map
NRCS Soil Map and Tables
SCS Soil Type Descriptions
Hydrologic Soil Group Map and Tables




# VICINITY MAP

NOT TO SCALE

# National Flood Hazard Layer FIRMette

FEMA

104°40'10"W 38°56'44"N


Feet

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

1:6,000

104°39'32"W 38°56'16"N

*Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020*

## 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 Cross Sections with 1% Annual Chance
- 17.5 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

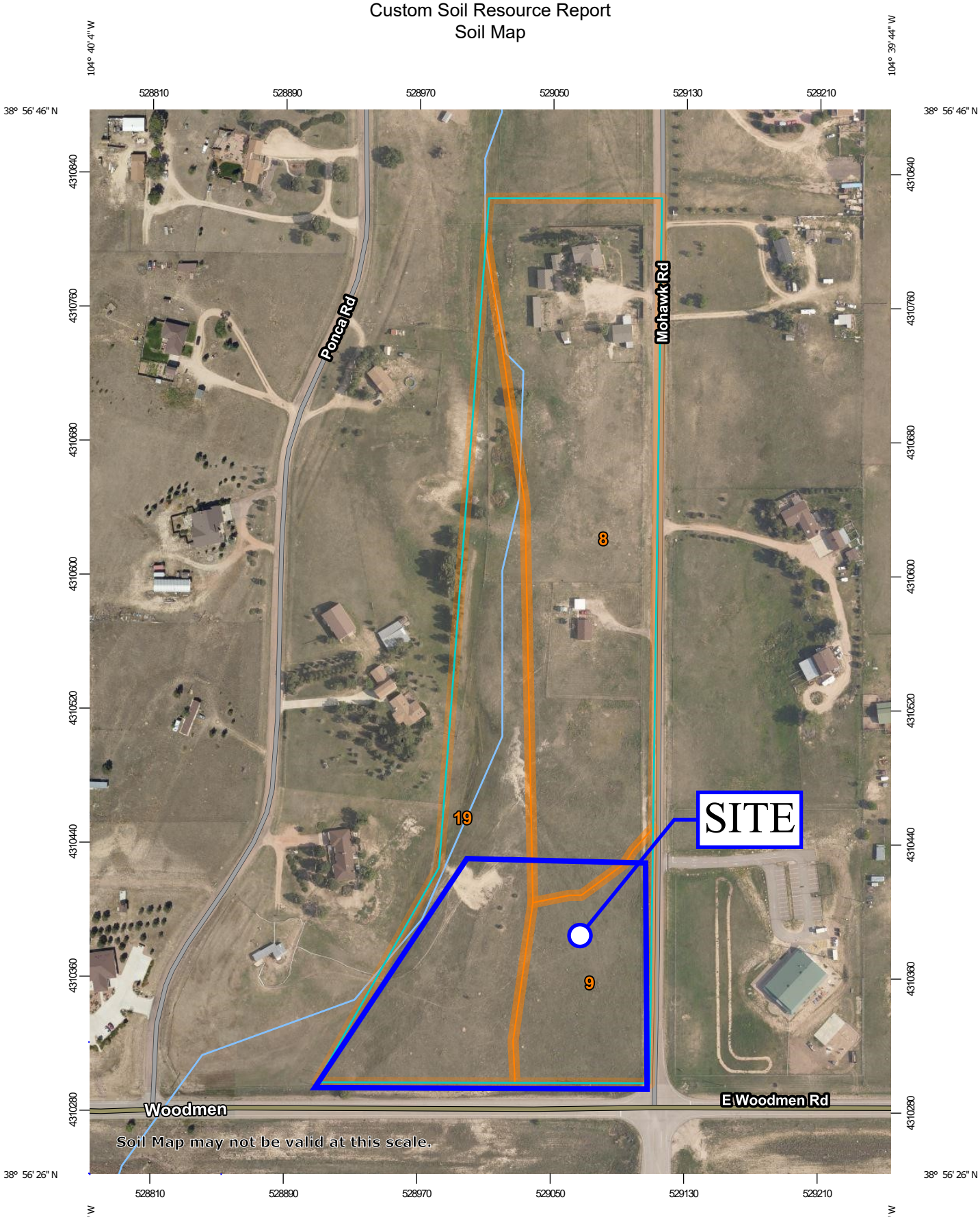
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

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 5/11/2023 at 12:14 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.

# Custom Soil Resource Report
## Soil Map




Map Scale: 1:3,100 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 45 90 180 270

Feet: 0 150 300 600 900

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: El Paso County Area, Colorado
Survey Area Data: Version 20, Sep 2, 2022

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

Date(s) aerial images were photographed: Aug 19, 2018—Sep 23, 2018

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

# Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|---|---|---|---|
| 8 | Blakeland loamy sand, 1 to 9 percent slopes | 8.5 | 50.6% |
| 9 | Blakeland-Fluvaquentic Haplaquolls | 2.3 | 14.0% |
| 19 | Columbine gravelly sandy loam, 0 to 3 percent slopes | 5.9 | 35.4% |
| **Totals for Area of Interest** | | **16.7** | **100.0%** |

# Map Unit Descriptions

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

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

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

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

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

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

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

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

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

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

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

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

# El Paso County Area, Colorado

## 8—Blakeland loamy sand, 1 to 9 percent slopes

### Map Unit Setting

*National map unit symbol:* 369v
*Elevation:* 4,600 to 5,800 feet
*Mean annual precipitation:* 14 to 16 inches
*Mean annual air temperature:* 46 to 48 degrees F
*Frost-free period:* 125 to 145 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Blakeland and similar soils:* 98 percent
*Minor components:* 2 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Blakeland

#### Setting

*Landform:* Flats, hills
*Landform position (three-dimensional):* Side slope, talf
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

#### Typical profile

*A - 0 to 11 inches:* loamy sand
*AC - 11 to 27 inches:* loamy sand
*C - 27 to 60 inches:* sand

#### Properties and qualities

*Slope:* 1 to 9 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Somewhat excessively drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum content:* 5 percent
*Available water supply, 0 to 60 inches:* Low (about 4.5 inches)

#### Interpretive groups

*Land capability classification (irrigated):* 3e
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* A
*Ecological site:* R049XB210CO - Sandy Foothill
*Hydric soil rating:* No

### Minor Components

#### Other soils

*Percent of map unit:* 1 percent

*Hydric soil rating:* No

**Pleasant**

*Percent of map unit:* 1 percent
*Landform:* Depressions
*Hydric soil rating:* Yes

## 9—Blakeland-Fluvaquentic Haplaquolls

**Map Unit Setting**

*National map unit symbol:* 36b6
*Elevation:* 3,500 to 5,800 feet
*Mean annual precipitation:* 13 to 17 inches
*Mean annual air temperature:* 46 to 55 degrees F
*Frost-free period:* 110 to 165 days
*Farmland classification:* Not prime farmland

**Map Unit Composition**

*Blakeland and similar soils:* 60 percent
*Fluvaquentic haplaquolls and similar soils:* 38 percent
*Minor components:* 2 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

**Description of Blakeland**

**Setting**

*Landform:* Flats, hills
*Landform position (three-dimensional):* Side slope, talf
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Sandy alluvium derived from arkose and/or eolian deposits derived from arkose

**Typical profile**

*A - 0 to 11 inches:* loamy sand
*AC - 11 to 27 inches:* loamy sand
*C - 27 to 60 inches:* sand

**Properties and qualities**

*Slope:* 1 to 9 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Somewhat excessively drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Calcium carbonate, maximum content:* 5 percent
*Available water supply, 0 to 60 inches:* Low (about 4.5 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 3e
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* A
*Ecological site:* R049XB210CO - Sandy Foothill
*Hydric soil rating:* No

## Description of Fluvaquentic Haplaquolls

**Setting**

*Landform:* Swales
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium

**Typical profile**

*H1 - 0 to 12 inches:* variable
*H2 - 12 to 60 inches:* stratified very gravelly sand to loam

**Properties and qualities**

*Slope:* 1 to 2 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Poorly drained
*Runoff class:* Very high
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.20 to 6.00 in/hr)
*Depth to water table:* About 0 to 24 inches
*Frequency of flooding:* Occasional
*Frequency of ponding:* None
*Maximum salinity:* Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
*Available water supply, 0 to 60 inches:* Moderate (about 6.2 inches)

**Interpretive groups**

*Land capability classification (irrigated):* 6w
*Land capability classification (nonirrigated):* 6w
*Hydrologic Soil Group:* D
*Ecological site:* R048AY241CO - Mountain Meadow
*Hydric soil rating:* Yes

## Minor Components

**Other soils**

*Percent of map unit:* 1 percent
*Hydric soil rating:* No

**Pleasant**

*Percent of map unit:* 1 percent
*Landform:* Depressions
*Hydric soil rating:* Yes

## 19—Columbine gravelly sandy loam, 0 to 3 percent slopes

### Map Unit Setting

*National map unit symbol:* 367p
*Elevation:* 6,500 to 7,300 feet
*Mean annual precipitation:* 14 to 16 inches
*Mean annual air temperature:* 46 to 50 degrees F
*Frost-free period:* 125 to 145 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Columbine and similar soils:* 97 percent
*Minor components:* 3 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Columbine

#### Setting

*Landform:* Fans, fan terraces, flood plains
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium

#### Typical profile

*A - 0 to 14 inches:* gravelly sandy loam
*C - 14 to 60 inches:* very gravelly loamy sand

#### Properties and qualities

*Slope:* 0 to 3 percent
*Depth to restrictive feature:* More than 80 inches
*Drainage class:* Well drained
*Runoff class:* Very low
*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water supply, 0 to 60 inches:* Very low (about 2.5 inches)

#### Interpretive groups

*Land capability classification (irrigated):* 4e
*Land capability classification (nonirrigated):* 6e
*Hydrologic Soil Group:* A
*Ecological site:* R049XY214CO - Gravelly Foothill
*Hydric soil rating:* No

**Minor Components**

**Fluvaquentic haplaquolls**
*Percent of map unit:* 1 percent
*Landform:* Swales
*Hydric soil rating:* Yes

**Other soils**
*Percent of map unit:* 1 percent
*Hydric soil rating:* No

**Pleasant**
*Percent of map unit:* 1 percent
*Landform:* Depressions
*Hydric soil rating:* Yes

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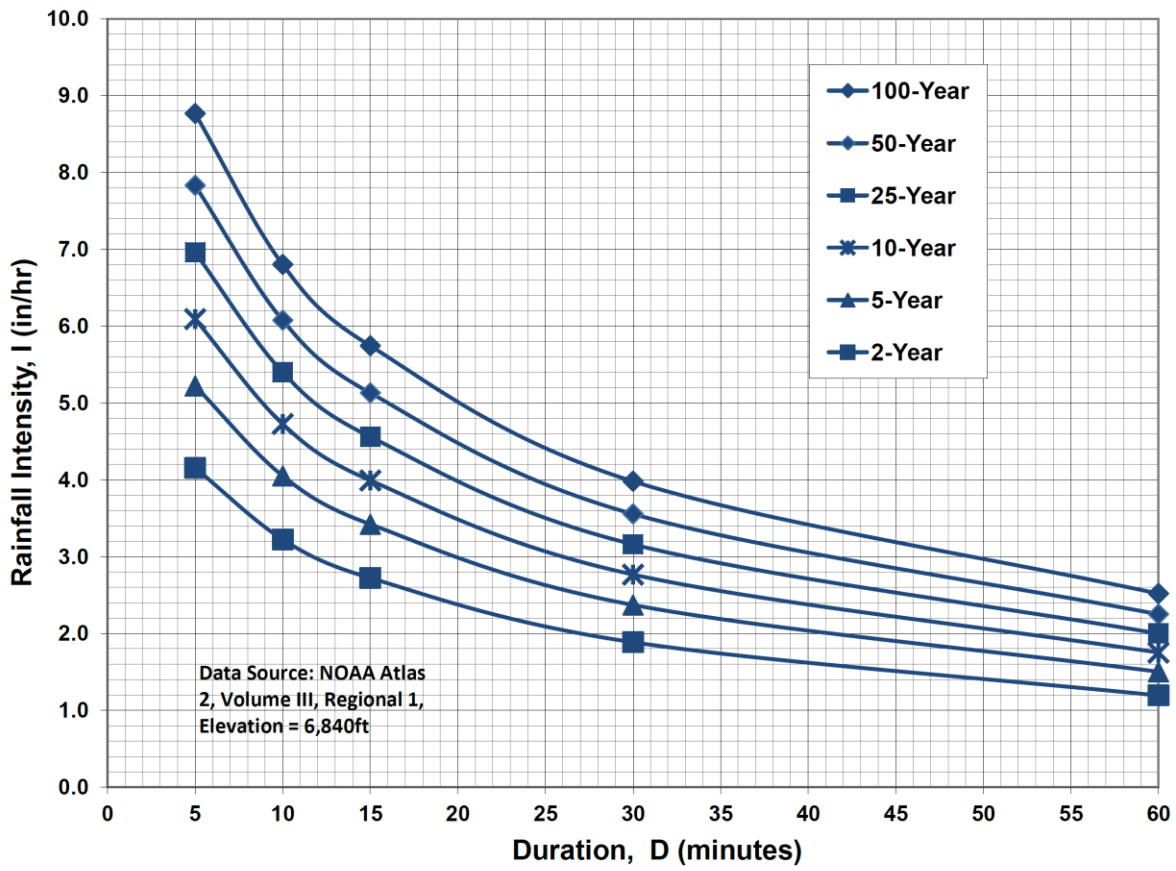
# 8 Hydrologic Calculations

Runoff Coefficients and Percent Imperviousness Table 6-6
Colorado Springs Rainfall Intensity Duration Frequency Figure 6-5
Hydrologic Calculations Summary Form SF-1 for Existing & Developed Conditions
Hydrologic Calculations Summary 5-yr Form SF-2 for Existing & Developed Conditions
Hydrologic Calculations Summary 100-yr Form SF-2 for Existing & Developed Conditions

**Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency**




**IDF Equations**

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

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

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

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

$I_{5} = -1.50 \ln(D) + 7.583$

$I_{2} = -1.19 \ln(D) + 6.035$

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

## Table 6-6. Runoff Coefficients for Rational Method

(Source: UDFCD 2001)

| Land Use or Surface Characteristics | Percent Impervious | Runoff Coefficients | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2-year | | 5-year | | 10-year | | 25-year | | 50-year | | 100-year | |
| | | HSG A&B | HSG C&D | HSG A&B | HSG C&D | HSG A&B | HSG C&D | HSG A&B | HSG C&D | HSG A&B | HSG C&D | HSG A&B | HSG C&D |
| Business | | | | | | | | | | | | | |
| Commercial Areas | 95 | 0.79 | 0.80 | 0.81 | 0.82 | 0.83 | 0.84 | 0.85 | 0.87 | 0.87 | 0.88 | 0.88 | 0.89 |
| Neighborhood Areas | 70 | 0.45 | 0.49 | 0.49 | 0.53 | 0.53 | 0.57 | 0.58 | 0.62 | 0.60 | 0.65 | 0.62 | 0.68 |
| | | | | | | | | | | | | | |
| Residential | | | | | | | | | | | | | |
| 1/8 Acre or less | 65 | 0.41 | 0.45 | 0.45 | 0.49 | 0.49 | 0.54 | 0.54 | 0.59 | 0.57 | 0.62 | 0.59 | 0.65 |
| 1/4 Acre | 40 | 0.23 | 0.28 | 0.30 | 0.35 | 0.36 | 0.42 | 0.42 | 0.50 | 0.46 | 0.54 | 0.50 | 0.58 |
| 1/3 Acre | 30 | 0.18 | 0.22 | 0.25 | 0.30 | 0.32 | 0.38 | 0.39 | 0.47 | 0.43 | 0.52 | 0.47 | 0.57 |
| 1/2 Acre | 25 | 0.15 | 0.20 | 0.22 | 0.28 | 0.30 | 0.36 | 0.37 | 0.46 | 0.41 | 0.51 | 0.46 | 0.56 |
| 1 Acre | 20 | 0.12 | 0.17 | 0.20 | 0.26 | 0.27 | 0.34 | 0.35 | 0.44 | 0.40 | 0.50 | 0.44 | 0.55 |
| | | | | | | | | | | | | | |
| Industrial | | | | | | | | | | | | | |
| Light Areas | 80 | 0.57 | 0.60 | 0.59 | 0.63 | 0.63 | 0.66 | 0.66 | 0.70 | 0.68 | 0.72 | 0.70 | 0.74 |
| Heavy Areas | 90 | 0.71 | 0.73 | 0.73 | 0.75 | 0.75 | 0.77 | 0.78 | 0.80 | 0.80 | 0.82 | 0.81 | 0.83 |
| | | | | | | | | | | | | | |
| Parks and Cemeteries | 7 | 0.05 | 0.09 | 0.12 | 0.19 | 0.20 | 0.29 | 0.30 | 0.40 | 0.34 | 0.46 | 0.39 | 0.52 |
| Playgrounds | 13 | 0.07 | 0.13 | 0.16 | 0.23 | 0.24 | 0.31 | 0.32 | 0.42 | 0.37 | 0.48 | 0.41 | 0.54 |
| Railroad Yard Areas | 40 | 0.23 | 0.28 | 0.30 | 0.35 | 0.36 | 0.42 | 0.42 | 0.50 | 0.46 | 0.54 | 0.50 | 0.58 |
| | | | | | | | | | | | | | |
| Undeveloped Areas | | | | | | | | | | | | | |
| Historic Flow Analysis--Greenbelts, Agriculture | 2 | 0.03 | 0.05 | 0.09 | 0.16 | 0.17 | 0.26 | 0.26 | 0.38 | 0.31 | 0.45 | 0.36 | 0.51 |
| Pasture/Meadow | 0 | 0.02 | 0.04 | 0.08 | 0.15 | 0.15 | 0.25 | 0.25 | 0.37 | 0.30 | 0.44 | 0.35 | 0.50 |
| Forest | 0 | 0.02 | 0.04 | 0.08 | 0.15 | 0.15 | 0.25 | 0.25 | 0.37 | 0.30 | 0.44 | 0.35 | 0.50 |
| Exposed Rock | 100 | 0.89 | 0.89 | 0.90 | 0.90 | 0.92 | 0.92 | 0.94 | 0.94 | 0.95 | 0.95 | 0.96 | 0.96 |
| Offsite Flow Analysis (when landuse is undefined) | 45 | 0.26 | 0.31 | 0.32 | 0.37 | 0.38 | 0.44 | 0.44 | 0.51 | 0.48 | 0.55 | 0.51 | 0.59 |
| | | | | | | | | | | | | | |
| Streets | | | | | | | | | | | | | |
| Paved | 100 | 0.89 | 0.89 | 0.90 | 0.90 | 0.92 | 0.92 | 0.94 | 0.94 | 0.95 | 0.95 | 0.96 | 0.96 |
| Gravel | 80 | 0.57 | 0.60 | 0.59 | 0.63 | 0.63 | 0.66 | 0.66 | 0.70 | 0.68 | 0.72 | 0.70 | 0.74 |
| | | | | | | | | | | | | | |
| Drive and Walks | 100 | 0.89 | 0.89 | 0.90 | 0.90 | 0.92 | 0.92 | 0.94 | 0.94 | 0.95 | 0.95 | 0.96 | 0.96 |
| Roofs | 90 | 0.71 | 0.73 | 0.73 | 0.75 | 0.75 | 0.77 | 0.78 | 0.80 | 0.80 | 0.82 | 0.81 | 0.83 |
| Lawns | 0 | 0.02 | 0.04 | 0.08 | 0.15 | 0.15 | 0.25 | 0.25 | 0.37 | 0.30 | 0.44 | 0.35 | 0.50 |

Job No.: **61200** Date: **8/10/2023 11:41**

Project: **St. John's Orthodox Church** Calcs By: **OA**

Checked By:

## Time of Concentration (Modified from Standard Form SF-1)

| Sub-Basin | Sub-Basin Data | | | | Overland | | | Shallow Channel | | | | Channelized | | | | $t_c$ Check | | $t_c$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Area (Acres) | $C_5$ | $C_{100}$/CN | % Imp. | $L_0$ (ft) | $S_0$ (%) | $t_i$ (min) | $L_{0t}$ (ft) | $S_{0t}$ (ft/ft) | $v_{0sc}$ (ft/s) | $t_t$ (min) | $L_{0c}$ (ft) | $S_{0c}$ (ft/ft) | $v_{0c}$ (ft/s) | $t_c$ (min) | L (min) | $t_{c,alt}$ (min) | (min) |
| OFFSITE | | | | | | | | | | | | | | | | | | |
| OS-1 | 0.60 | 0.53 | 0.68 | 55% | 10 | 20% | 1.2 | 400 | 0.025 | 1.1 | 6.0 | 0 | 0.000 | 0.0 | 0.0 | 410 | 12.3 | 7.2 |
| OS-2 | 1.66 | 0.08 | 0.35 | 0% | 292 | 5% | 18.3 | 162 | 0.025 | 1.1 | 2.5 | 0 | 0.000 | 0.0 | 0.0 | 454 | 12.5 | 12.5 |
| OS-3 | 2.51 | 0.26 | 0.48 | 26% | 55 | 4% | 7.3 | 1012 | 0.052 | 1.6 | 10.5 | 0 | 0.000 | 0.0 | 0.0 | 1067 | 15.9 | 15.9 |
| **EXISTING ONSITE** | | | | | | | | | | | | | | | | | | |
| A | 1.73 | 0.08 | 0.35 | 0% | 190 | 7% | 13.5 | 0 | 0.000 | 0.0 | 0.0 | 0 | 0.000 | 0.0 | 0.0 | 190 | 11.1 | 11.1 |
| B | 0.82 | 0.08 | 0.35 | 0% | 300 | 5% | 18.4 | 0 | 0.000 | 0.0 | 0.0 | 0 | 0.000 | 0.0 | 0.0 | 300 | 11.7 | 11.7 |
| C | 2.24 | 0.08 | 0.35 | 0% | 283 | 5% | 18.7 | 155 | 0.019 | 1.0 | 2.7 | 0 | 0.000 | 0.0 | 0.0 | 438 | 12.4 | 12.4 |
| **PROPOSED ONSITE** | | | | | | | | | | | | | | | | | | |
| A1 | 0.06 | 0.74 | 0.84 | 80% | 62 | 1% | 5.5 | 0 | 0.000 | 0.0 | 0.0 | 0 | 0.000 | 0.0 | 0.0 | 62 | 10.3 | 5.5 |
| A2 | 1.71 | 0.08 | 0.35 | 0% | 190 | 7% | 13.1 | 0 | 0.000 | 0.0 | 0.0 | 0 | 0.000 | 0.0 | 0.0 | 190 | 11.1 | 11.1 |
| B1 | 0.82 | 0.13 | 0.39 | 6% | 288 | 6% | 16.9 | 0 | 0.000 | 0.0 | 0.0 | 76 | 0.007 | 0.8 | 1.6 | 364 | 12.0 | 12.0 |
| C1 | 0.74 | 0.08 | 0.35 | 0% | 201 | 6% | 14.1 | 0 | 0.000 | 0.0 | 0.0 | 0 | 0.000 | 0.0 | 0.0 | 201 | 11.1 | 11.1 |
| C2 | 0.13 | 0.22 | 0.46 | 17% | 35 | 6% | 5.3 | 86 | 0.058 | 1.7 | 0.8 | 0 | 0.000 | 0.0 | 0.0 | 121 | 10.7 | 6.1 |
| C3 | 0.48 | 0.19 | 0.43 | 15% | 44 | 2% | 8.3 | 157 | 0.064 | 1.8 | 1.5 | 57 | 0.070 | 2.0 | 0.5 | 258 | 11.4 | 10.3 |
| C4 | 0.31 | 0.83 | 0.90 | 91% | 35 | 1% | 2.6 | 0 | 0.000 | 0.0 | 0.0 | 246 | 0.007 | 1.3 | 3.2 | 281 | 11.6 | 5.8 |
| C5 | 0.57 | 0.08 | 0.35 | 0% | 177 | 3% | 17.4 | 95 | 0.021 | 1.0 | 1.6 | 0 | 0.000 | 0.0 | 0.0 | 272 | 11.5 | 11.5 |

Job No.: **61200**
Project: **St. John's Orthodox Church**
Design Storm: **5-Year Storm** *(20% Probability)*
Jurisdiction: **DCM**

Date: **8/10/2023 11:41**
Calcs By: **OA**
Checked By:

## Sub-Basin and Combined Flows (Modified from Standard Form SF-2)

| | | | | Direct Runoff | | | | Combined Runoff | | | | Streetflow | | | Pipe Flow | | | | | Travel Time | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DP | Sub-Basin | Area (Acres) | C5 | $t_c$ (min) | CA (Acres) | I5 (in/hr) | Q5 (cfs) | $t_c$ (min) | CA (Acres) | I5 (in/hr) | Q5 (cfs) | Slope (%) | Length (ft) | Q (cfs) | Q (cfs) | Slope (%) | Mnngs n | Length (ft) | $D_{Pipe}$ (in) | Length (ft) | $v_{0sc}$ (ft/s) | $t_t$ (min) |
| **OFFSITE SUB-BASINS** | | | | | | | | | | | | | | | | | | | | | | |
| | OS-1 | 0.60 | 0.53 | 7.2 | 0.32 | 4.61 | 1.45 | | | | | | | | | | | | | | | |
| 1 | OS-2 | 1.66 | 0.08 | 12.5 | 0.13 | 3.79 | 0.50 | | | | | | | | | | | | | | | |
| | OS-3 | 2.51 | 0.26 | 15.9 | 0.66 | 3.43 | 2.27 | | | | | | | | | | | | | | | |
| **EXISTING ONSITE** | | | | | | | | | | | | | | | | | | | | | | |
| EX-4 | A | 1.73 | 0.08 | 11.1 | 0.14 | 3.98 | 0.55 | | | | | | | | | | | | | | | |
| | B | 0.82 | 0.08 | 11.7 | 0.07 | 3.90 | 0.26 | | | | | | | | | | | | | | | |
| EX-3 | C | 2.24 | 0.08 | 12.4 | 0.18 | 3.80 | 0.68 | | | | | | | | | | | | | | | |
| EX-2 | OS-2, B | 2.48 | 0.08 | | | | | 12.5 | 0.20 | 3.79 | 0.8 | | | | | | | | | | | |
| EX-5 | OS-1-3, B, C | 7.83 | 0.17 | | | | | 18.8 | 1.36 | 3.18 | 4.3 | | | | | | | | | | | |
| **PROPOSED ONSITE** | | | | | | | | | | | | | | | | | | | | | | |
| 1 | A1 | 0.06 | 0.74 | 5.5 | 0.04 | 5.02 | 0.22 | | | | | | | | | | | | | | | |
| | A2 | 1.71 | 0.08 | 11.1 | 0.14 | 3.98 | 0.54 | | | | | | | | | | | | | | | |
| | B1 | 0.82 | 0.13 | 12.0 | 0.10 | 3.85 | 0.40 | | | | | | | | | | | | | | | |
| | B2 | | | | | | | | | | | | | | | | | | | | | |
| | C1 | 0.74 | 0.08 | 11.1 | 0.06 | 3.97 | 0.23 | | | | | | | | | | | | | | | |
| | C2 | 0.13 | 0.22 | 6.1 | 0.03 | 4.86 | 0.14 | | | | | | | | | | | | | | | |
| | C3 | 0.48 | 0.19 | 10.3 | 0.09 | 4.09 | 0.38 | | | | | | | | | | | | | | | |
| | C4 | 0.31 | 0.83 | 5.8 | 0.25 | 4.95 | 1.26 | | | | | | | | | | | | | | | |
| | C5 | 0.57 | 0.08 | 11.5 | 0.05 | 3.92 | 0.18 | | | | | | | | | | | | | | | |
| 2 | A1, A2 | 1.77 | 0.10 | | | | | 11.1 | 0.18 | 3.98 | 0.7 | | | | | | | | | | | |
| 3 | OS-2, OS-3, B1 | 4.53 | 0.14 | | | | | 15.9 | 0.62 | 3.43 | 2.1 | | | | | | | | | | | |
| 4 | C2, C3, C4 | 1.17 | 0.29 | | | | | 11.1 | 0.34 | 3.97 | 1.4 | | | | | | | | | | | |
| 5 | OS-1-3, B1, C1-C5 | 7.81 | 0.22 | | | | | 18.8 | 1.69 | 3.18 | 5.4 | | | | | | | | | | | |

DCM: I = C1 * ln (tc) + C2
C1: 1.5
C1: 7.583

Job No.: **61200**
Project: **St. John's Orthodox Church**
Design Storm: **100-Year Storm** *(1% Probability)*
Jurisdiction: **DCM**

Date: **8/10/2023 11:41**
Calcs By: **OA**
Checked By:

**Sub-Basin and Combined Flows** (Modified from Standard Form SF-2)

| | | | | Direct Runoff | | | | Combined Runoff | | | | Streetflow | | | Pipe Flow | | | | | Travel Time | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DP | Sub-Basin | Area (Acres) | C100 | $t_c$ (min) | CA (Acres) | I100 (in/hr) | Q100 (cfs) | $t_c$ (min) | CA (Acres) | I100 (in/hr) | Q100 (cfs) | Slope (%) | Length (ft) | Q (cfs) | Q (cfs) | Slope (%) | Mnngs n | Length (ft) | $D_{Pipe}$ (in) | Length (ft) | $v_{0sc}$ (ft/s) | $t_t$ (min) |
| **OFFSITE SUB-BASINS** | | | | | | | | | | | | | | | | | | | | | | |
| | OS-1 | 0.60 | 0.68 | 7.2 | 0.41 | 7.75 | 3.16 | | | | | | | | | | | | | | | |
| 1 | OS-2 | 1.66 | 0.35 | 12.5 | 0.58 | 6.37 | 3.71 | | | | | | | | | | | | | | | |
| | OS-3 | 2.51 | 0.48 | 15.9 | 1.21 | 5.76 | 6.95 | | | | | | | | | | | | | | | |
| **EXISTING ONSITE** | | | | | | | | | | | | | | | | | | | | | | |
| EX-4 | A | 1.73 | 0.35 | 11.1 | 0.61 | 6.68 | 4.04 | | | | | | | | | | | | | | | |
| | B | 0.82 | 0.35 | 11.7 | 0.29 | 6.54 | 1.87 | | | | | | | | | | | | | | | |
| EX-3 | C | 2.24 | 0.35 | 12.4 | 0.79 | 6.38 | 5.02 | | | | | | | | | | | | | | | |
| EX-2 | OS-2, B | 2.48 | 0.35 | | | | | 12.5 | 0.87 | 6.37 | 5.5 | | | | | | | | | | | |
| EX-5 | OS-1-3, B, C | 7.83 | 0.42 | | | | | 18.8 | 3.27 | 5.34 | 17.5 | | | | | | | | | | | |
| **PROPOSED ONSITE** | | | | | | | | | | | | | | | | | | | | | | |
| 1 | A1 | 0.06 | 0.84 | 5.5 | 0.05 | 8.43 | 0.42 | | | | | | | | | | | | | | | |
| | A2 | 1.71 | 0.35 | 11.1 | 0.60 | 6.68 | 4.00 | | | | | | | | | | | | | | | |
| | B1 | 0.82 | 0.39 | 12.0 | 0.32 | 6.47 | 2.04 | | | | | | | | | | | | | | | |
| | B2 | | | | | | | | | | | | | | | | | | | | | |
| | C1 | 0.74 | 0.35 | 11.1 | 0.26 | 6.67 | 1.72 | | | | | | | | | | | | | | | |
| | C2 | 0.13 | 0.46 | 6.1 | 0.06 | 8.17 | 0.47 | | | | | | | | | | | | | | | |
| | C3 | 0.48 | 0.43 | 10.3 | 0.21 | 6.87 | 1.42 | | | | | | | | | | | | | | | |
| | C4 | 0.31 | 0.90 | 5.8 | 0.28 | 8.30 | 2.32 | | | | | | | | | | | | | | | |
| | C5 | 0.57 | 0.35 | 11.5 | 0.20 | 6.58 | 1.32 | | | | | | | | | | | | | | | |
| 2 | A1, A2 | 1.77 | 0.37 | | | | | 11.1 | 0.65 | 6.68 | 4.3 | | | | | | | | | | | |
| 3 | OS-2, OS-3, B1 | 4.53 | 0.39 | | | | | 15.9 | 1.78 | 5.76 | 10.2 | | | | | | | | | | | |
| 4 | C2, C3, C4 | 1.17 | 0.51 | | | | | 11.1 | 0.60 | 6.67 | 4.0 | | | | | | | | | | | |
| 5 | OS-1-3, B1, C1-C5 | 7.81 | 0.45 | | | | | 18.8 | 3.52 | 5.34 | 18.8 | | | | | | | | | | | |

Proposed drainage summary shows C1 instead of C3. It does not appear C3 flows go towards DP4. Please verify and revise.

DCM: I = C1 * ln (tc) + C2
C1: 2.52
C1: 12.735

# Sub-Basin OS-1 Runoff Calculations

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **A** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| Surface | Area (SF) | Area (Acres) | Runoff Coefficient C2 | C5 | C10 | C25 | C50 | C100 | % Imperv. |
|---|---|---|---|---|---|---|---|---|---|
| Paved | 14,214 | 0.33 | 0.89 | 0.9 | 0.92 | 0.94 | 0.95 | 0.96 | 100% |
| Pasture/Meadow | 11,733 | 0.27 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| **Combined** | **25,947** | **0.60** | **0.50** | **0.53** | **0.57** | **0.63** | **0.66** | **0.68** | **54.8%** |

25947

## Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft  $C_v$: 7

| | L (ft) | $\Delta Z_0$ (ft) | $S_0$ (ft/ft) | v (ft/s) | t (min) | $t_{Alt}$ (min) | |
|---|---|---|---|---|---|---|---|
| Total | 410 | 12 | - | - | - | - | |
| Initial Time | 10 | 2 | 0.200 | - | 1.2 | 12.3 | DCM Eq. 6-8 |
| Shallow Channel | 400 | 10 | 0.025 | 1.1 | 6.0 | - | DCM Eq. 6-9 |
| Channelized | | | 0.000 | 0.0 | 0.0 | - | V-Ditch |
| | | | | **$t_c$** | **7.2 min.** | | |

The maximum overland length for urban conditions is 100 feet. Please revise all time of concentration calculations.

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 3.68 | 4.61 | 5.38 | 6.15 | 6.92 | 7.75 |
| **Runoff (cfs)** | 1.1 | **1.5** | 1.8 | 2.3 | 2.7 | **3.2** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | 1.1 | **1.5** | 1.8 | 2.3 | 2.7 | **3.2** |

DCM: I = C1 * ln (tc) + C2

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

# Sub-Basin OS-2 Runoff Calculations

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **A** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | 72,518 | 1.66 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| **Combined** | **72,518** | **1.66** | **0.02** | **0.08** | **0.15** | **0.25** | **0.30** | **0.35** | **0.0%** |
| | 72518 | | | | | | | | |

## Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft  $C_v$: 7

| | L (ft) | $\Delta Z_0$ (ft) | $S_0$ (ft/ft) | v (ft/s) | t (min) | $t_{Alt}$ (min) | |
|---|---|---|---|---|---|---|---|
| Total | 454 | 19 | - | - | - | - | |
| Initial Time | 292 | 15 | 0.051 | - | 18.3 | 12.5 | DCM Eq. 6-8 |
| Shallow Channel | 162 | 4 | 0.025 | 1.1 | 2.5 | - | DCM Eq. 6-9 |
| Channelized | | | 0.000 | 0.0 | 0.0 | - | V-Ditch |
| | | | | **$t_c$** | **12.5** | **min.** | |

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 3.03 | 3.79 | 4.42 | 5.06 | 5.69 | 6.37 |
| **Runoff (cfs)** | 0.1 | **0.5** | 1.1 | 2.1 | 2.8 | **3.7** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | 0.1 | **0.5** | 1.1 | 2.1 | 2.8 | **3.7** |

DCM: I = C1 * ln (tc) + C2

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

# Sub-Basin OS-3 Runoff Calculations

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **A** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | 77,339 | 1.78 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| Gravel | 18,572 | 0.43 | 0.57 | 0.59 | 0.63 | 0.66 | 0.68 | 0.7 | 80% |
| Roofs | 1,530 | 0.04 | 0.71 | 0.73 | 0.75 | 0.78 | 0.8 | 0.81 | 90% |
| Paved | 11,749 | 0.27 | 0.89 | 0.9 | 0.92 | 0.94 | 0.95 | 0.96 | 100% |
| **Combined** | **109,190** | **2.51** | **0.22** | **0.26** | **0.32** | **0.40** | **0.44** | **0.48** | **25.6%** |

109190

## Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft  $C_v$: 7

| | L (ft) | $\Delta Z_0$ (ft) | $S_0$ (ft/ft) | v (ft/s) | t (min) | $t_{Alt}$ (min) | |
|---|---|---|---|---|---|---|---|
| Total | 1,067 | 55 | - | - | - | - | |
| Initial Time | 55 | 2 | 0.036 | - | 7.3 | 15.9 | DCM Eq. 6-8 |
| Shallow Channel | 1,012 | 53 | 0.052 | 1.6 | 10.5 | - | DCM Eq. 6-9 |
| Channelized | | | 0.000 | 0.0 | 0.0 | - | V-Ditch |
| | | | | **$t_c$** | **15.9 min.** | | |

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 2.74 | 3.43 | 4.00 | 4.57 | 5.15 | 5.76 |
| **Runoff (cfs)** | 1.5 | **2.3** | 3.2 | 4.6 | 5.7 | **7.0** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | 1.5 | **2.3** | 3.2 | 4.6 | 5.7 | **7.0** |

DCM: I = C1 * ln (tc) + C2

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

# Sub-Basin A Runoff Calculations (DP EX-4)

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **A** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | 75,346 | 1.73 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| **Combined** | **75,346** | **1.73** | **0.02** | **0.08** | **0.15** | **0.25** | **0.30** | **0.35** | **0.0%** |
| | 75346 | | | | | | | | |

## Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft  $C_v$: 7

| | L (ft) | $\Delta Z_0$ (ft) | $S_0$ (ft/ft) | v (ft/s) | t (min) | $t_{Alt}$ (min) | |
|---|---|---|---|---|---|---|---|
| Total | 190 | 13 | - | - | - | - | |
| Initial Time | 190 | 13 | 0.068 | - | 13.5 | 11.1 | DCM Eq. 6-8 |
| Shallow Channel | | | 0.000 | 0.0 | 0.0 | - | DCM Eq. 6-9 |
| Channelized | | | 0.000 | 0.0 | 0.0 | - | V-Ditch |
| | | | | **$t_c$** | **11.1** | **min.** | |

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 3.18 | 3.98 | 4.64 | 5.31 | 5.97 | 6.68 |
| **Runoff (cfs)** | 0.1 | **0.6** | 1.2 | 2.3 | 3.1 | **4.0** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | 0.1 | **0.6** | 1.2 | 2.3 | 3.1 | **4.0** |

DCM: I = C1 * ln (tc) + C2

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

# Sub-Basin B Runoff Calculations

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **A** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| Surface | Area (SF) | Area (Acres) | Runoff Coefficient C2 | C5 | C10 | C25 | C50 | C100 | % Imperv. |
|---|---|---|---|---|---|---|---|---|---|
| Pasture/Meadow | 35,632 | 0.82 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| **Combined** | **35,632** | **0.82** | **0.02** | **0.08** | **0.15** | **0.25** | **0.30** | **0.35** | **0.0%** |

35632

## Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$ = 300 ft; $C_v$ = 7

| | L (ft) | $\Delta Z_0$ (ft) | $S_0$ (ft/ft) | v (ft/s) | t (min) | $t_{Alt}$ (min) | |
|---|---|---|---|---|---|---|---|
| Total | 300 | 16 | - | - | - | - | |
| Initial Time | 300 | 16 | 0.053 | - | 18.4 | 11.7 | DCM Eq. 6-8 |
| Shallow Channel | | | 0.000 | 0.0 | 0.0 | - | DCM Eq. 6-9 |
| Channelized | | | 0.000 | 0.0 | 0.0 | - | V-Ditch |
| | | | | **$t_c$** | **11.7** | **min.** | |

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 3.11 | 3.90 | 4.55 | 5.20 | 5.85 | 6.54 |
| **Runoff (cfs)** | 0.1 | **0.3** | 0.6 | 1.1 | 1.4 | **1.9** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | 0.1 | **0.3** | 0.6 | 1.1 | 1.4 | **1.9** |

DCM: I = C1 * ln (tc) + C2

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

# Sub-Basin C Runoff Calculations (DP EX-3)

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **A** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | 97,787 | 2.24 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| **Combined** | **97,787** | **2.24** | **0.02** | **0.08** | **0.15** | **0.25** | **0.30** | **0.35** | **0.0%** |
| | 97787 | | | | | | | | |

## Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft  $C_v$: 7

| | L (ft) | $\Delta Z_0$ (ft) | $S_0$ (ft/ft) | v (ft/s) | t (min) | $t_{Alt}$ (min) | |
|---|---|---|---|---|---|---|---|
| Total | 438 | 16 | - | - | - | - | |
| Initial Time | 283 | 13 | 0.046 | - | 18.7 | 12.4 | DCM Eq. 6-8 |
| Shallow Channel | 155 | 3 | 0.019 | 1.0 | 2.7 | - | DCM Eq. 6-9 |
| Channelized | | | 0.000 | 0.0 | 0.0 | - | V-Ditch |
| | | | | **$t_c$** | **12.4** | **min.** | |

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 3.04 | 3.80 | 4.44 | 5.07 | 5.70 | 6.38 |
| **Runoff (cfs)** | 0.1 | **0.7** | 1.5 | 2.8 | 3.8 | **5.0** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | 0.1 | **0.7** | 1.5 | 2.8 | 3.8 | **5.0** |

DCM: I = C1 * ln (tc) + C2

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

# Combined Sub-Basin Runoff Calculations

Includes Basins OS-2 B

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **B** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | 108,150 | 2.48 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| **Combined** | **108,150** | **2.48** | **0.02** | **0.08** | **0.15** | **0.25** | **0.30** | **0.35** | **0.0%** |

## Basin Travel Time

| | Sub-basin or Channel Type | Material Type | L (ft) | Elev. $\Delta Z_0$ (ft) | $Q_i$ (cfs) | Base or Dia (ft) | Sides z:1 (ft/ft) | v (ft/s) | t (min) |
|---|---|---|---|---|---|---|---|---|---|
| Furthest Reach | OS-2 | - | 454 | 19 | - | - | - | - | 12.5 |
| Channelized-1 | | | | | | | | | |
| Channelized-2 | | | | | | | | | |
| Channelized-3 | | | | | | | | | |
| Total | | | 454 | 19 | | | | | |
| | | | | | | | | **$t_c$ (min)** | **12.5** |

## Storage Volume

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | 40 | -hr release time | | Detention is NOT required | | |
| EURV | 0.00 | (in) | a = | 1 | | Water Quality is NOT required | | |
| WQCV | 0.00 | (in) | | | | | | |
| i (return period) | 5-year | 10-year | 100-year | | **Design Volume ($ft^3$)** | | | |
| $K_i$ (ft) | 0.0000 | 0.0000 | 0 | | % Storage | 100-year | WQCV | Total |
| $V_i$ (acre-ft) | 0.000 | 0.000 | 0 | EURV | 0% | 0 | 0 | **0** |
| $V_i$ ($ft^3$) | 0 | 0 | 0 | WQCV | 0% | | 0 | **0** |

## Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

| | | |
|---|---|---|
| Contributing Basins/Areas | | |
| $Q_{Minor}$ | | (cfs) - 5-year Storm |
| $Q_{Major}$ | | (cfs) - 100-year Storm |

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 3.03 | 3.79 | 4.42 | 5.06 | 5.69 | 6.37 |
| **Site Runoff (cfs)** | 0.15 | **0.75** | 1.65 | 3.14 | 4.24 | **5.53** |
| **OffSite Runoff (cfs)** | - | **0.00** | - | - | - | **0.00** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | - | **0.8** | - | - | - | **5.5** |
| DCM: I = C1 * ln (tc) + C2 | | | | | | |
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

Runoff from Offsite basins have been assumed constant, despite additional times of concentration.

# Combined Sub-Basin Runoff Calculations

Includes Basins OS-1 OS-2 OS-3 B C

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **B** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | 295,009 | 6.77 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| Paved | 25,963 | 0.60 | 0.89 | 0.9 | 0.92 | 0.94 | 0.95 | 0.96 | 100% |
| Gravel | 18,572 | 0.43 | 0.57 | 0.59 | 0.63 | 0.66 | 0.68 | 0.7 | 80% |
| Roofs | 1,530 | 0.04 | 0.71 | 0.73 | 0.75 | 0.78 | 0.8 | 0.81 | 90% |
| **Combined** | **341,074** | **7.83** | **0.12** | **0.17** | **0.24** | **0.33** | **0.37** | **0.42** | **12.4%** |

## Basin Travel Time

| | Sub-basin or Channel Type | Material Type | L (ft) | Elev. $\Delta Z_0$ (ft) | $Q_i$ (cfs) | Base or Dia (ft) | Sides z:1 (ft/ft) | v (ft/s) | t (min) |
|---|---|---|---|---|---|---|---|---|---|
| Furthest Reach | OS-3 | - | 1,067 | 55 | - | - | - | - | 15.9 |
| Channelized-1 | V-Ditch | 3 | 269 | 5 | 7 | 0 | 2 | 1.6 | 2.9 |
| Channelized-2 | | | | | | | | | |
| Channelized-3 | | | | | | | | | |
| Total | | | 1,336 | 60 | | | | | |

3 = Natural, Winding, significant vegetation

**$t_c$ (min)** **18.8**

## Storage Volume

40 -hr release time — Detention is NOT required

EURV 0.00 (in) a = 1 — Water Quality is NOT required

WQCV 0.00 (in)

| i (return period) | 5-year | 10-year | 100-year | | **Design Volume ($ft^3$)** | | | |
|---|---|---|---|---|---|---|---|---|
| $K_i$ (ft) | 0.0000 | 0.0000 | 0 | | % Storage | 100-year | WQCV | Total |
| $V_i$ (acre-ft) | 0.000 | 0.000 | 0 | EURV | 0% | 0 | 0 | **0** |
| $V_i$ ($ft^3$) | 0 | 0 | 0 | WQCV | 0% | | 0 | **0** |

## Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

$Q_{Minor}$ (cfs) - 5-year Storm

$Q_{Major}$ (cfs) - 100-year Storm

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 2.54 | 3.18 | 3.71 | 4.24 | 4.77 | 5.34 |
| **Site Runoff (cfs)** | 2.38 | **4.31** | 6.90 | 10.87 | 13.92 | **17.46** |
| **OffSite Runoff (cfs)** | - | **0.00** | - | - | - | **0.00** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | - | **4.3** | - | - | - | **17.5** |

DCM: I = C1 * ln (tc) + C2

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

Runoff from Offsite basins have been assumed constant, despite additional times of concentration.

# Sub-Basin A1 Runoff Calculations

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **A** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | 175 | 0.00 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| Landscaping | 343 | 0.01 | 0.03 | 0.09 | 0.17 | 0.26 | 0.31 | 0.36 | 2% |
| Paved | 2,084 | 0.05 | 0.89 | 0.9 | 0.92 | 0.94 | 0.95 | 0.96 | 100% |
| **Combined** | **2,602** | **0.06** | **0.72** | **0.74** | **0.77** | **0.80** | **0.82** | **0.84** | **80.4%** |
| | 2602 | | | | | | | | |

## Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft  $C_v$: 7

| | L (ft) | $\Delta Z_0$ (ft) | $S_0$ (ft/ft) | v (ft/s) | t (min) | $t_{Alt}$ (min) | |
|---|---|---|---|---|---|---|---|
| Total | 62 | 1 | - | - | - | - | |
| Initial Time | 62 | 1 | 0.008 | - | 5.5 | 10.3 | DCM Eq. 6-8 |
| Shallow Channel | | | 0.000 | 0.0 | 0.0 | - | DCM Eq. 6-9 |
| Channelized | | | 0.000 | 0.0 | 0.0 | - | V-Ditch |
| | | | | **$t_c$** | **5.5** | **min.** | |

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 4.00 | 5.02 | 5.86 | 6.69 | 7.53 | 8.43 |
| **Runoff (cfs)** | 0.2 | **0.2** | 0.3 | 0.3 | 0.4 | **0.4** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | 0.2 | **0.2** | 0.3 | 0.3 | 0.4 | **0.4** |
| DCM: I = C1 * ln (tc) + C2 | | | | | | |
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

# Sub-Basin A1 Runoff Calculations

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **A** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | 74,448 | 1.71 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| Landscaping | | | 0.03 | 0.09 | 0.17 | 0.26 | 0.31 | 0.36 | 2% |
| Paved | | | 0.89 | 0.9 | 0.92 | 0.94 | 0.95 | 0.96 | 100% |
| **Combined** | **74,448** | **1.71** | **0.02** | **0.08** | **0.15** | **0.25** | **0.30** | **0.35** | **0.0%** |
| | 74448 | | | | | | | | |

## Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft  $C_v$: 7

| | L (ft) | $\Delta Z_0$ (ft) | $S_0$ (ft/ft) | v (ft/s) | t (min) | $t_{Alt}$ (min) | |
|---|---|---|---|---|---|---|---|
| Total | 190 | 14 | - | - | - | - | |
| Initial Time | 190 | 14 | 0.074 | - | 13.1 | 11.1 | DCM Eq. 6-8 |
| Shallow Channel | | | 0.000 | 0.0 | 0.0 | - | DCM Eq. 6-9 |
| Channelized | | | 0.000 | 0.0 | 0.0 | - | V-Ditch |
| | | | | **$t_c$** | **11.1** | **min.** | |

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 3.18 | 3.98 | 4.64 | 5.31 | 5.97 | 6.68 |
| **Runoff (cfs)** | 0.1 | **0.5** | 1.2 | 2.3 | 3.1 | **4.0** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | 0.1 | **0.5** | 1.2 | 2.3 | 3.1 | **4.0** |

DCM: I = C1 * ln (tc) + C2

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

# Sub-Basin B1 Runoff Calculations

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **A** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | 33,320 | 0.76 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| Landscaping | 168 | 0.00 | 0.03 | 0.09 | 0.17 | 0.26 | 0.31 | 0.36 | 2% |
| Paved | 2,100 | 0.05 | 0.89 | 0.9 | 0.92 | 0.94 | 0.95 | 0.96 | 100% |
| **Combined** | **35,588** | **0.82** | **0.07** | **0.13** | **0.20** | **0.29** | **0.34** | **0.39** | **5.9%** |
| | 35588 | | | | | | | | |

## Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft  $C_v$: 7

| | L (ft) | $\Delta Z_0$ (ft) | $S_0$ (ft/ft) | v (ft/s) | t (min) | $t_{Alt}$ (min) | |
|---|---|---|---|---|---|---|---|
| Total | 364 | 17 | - | - | - | - | |
| Initial Time | 288 | 16 | 0.056 | - | 16.9 | 12.0 | DCM Eq. 6-8 |
| Shallow Channel | | | 0.000 | 0.0 | 0.0 | - | DCM Eq. 6-9 |
| Channelized | 76 | 1 | 0.007 | 0.8 | 1.6 | - | V-Ditch |
| | | | | **$t_c$** | **12.0** | **min.** | |

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 3.08 | 3.85 | 4.50 | 5.14 | 5.78 | 6.47 |
| **Runoff (cfs)** | 0.2 | **0.4** | 0.7 | 1.2 | 1.6 | **2.0** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | 0.2 | **0.4** | 0.7 | 1.2 | 1.6 | **2.0** |

DCM: I = C1 * ln (tc) + C2

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

# Sub-Basin C1 Runoff Calculations

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **A** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | 32,203 | 0.74 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| Landscaping | | | 0.03 | 0.09 | 0.17 | 0.26 | 0.31 | 0.36 | 2% |
| Paved | | | 0.89 | 0.9 | 0.92 | 0.94 | 0.95 | 0.96 | 100% |
| **Combined** | **32,203** | **0.74** | **0.02** | **0.08** | **0.15** | **0.25** | **0.30** | **0.35** | **0.0%** |
| | 32203 | | | | | | | | |

## Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft  $C_v$: 7

| | L (ft) | $\Delta Z_0$ (ft) | $S_0$ (ft/ft) | v (ft/s) | t (min) | $t_{Alt}$ (min) | |
|---|---|---|---|---|---|---|---|
| Total | 201 | 13 | - | - | - | - | |
| Initial Time | 201 | 13 | 0.065 | - | 14.1 | 11.1 | DCM Eq. 6-8 |
| Shallow Channel | | | 0.000 | 0.0 | 0.0 | - | DCM Eq. 6-9 |
| Channelized | | | 0.000 | 0.0 | 0.0 | - | V-Ditch |
| | | | | **$t_c$** | **11.1** | **min.** | |

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 3.17 | 3.97 | 4.63 | 5.29 | 5.96 | 6.67 |
| **Runoff (cfs)** | 0.0 | **0.2** | 0.5 | 1.0 | 1.3 | **1.7** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | 0.0 | **0.2** | 0.5 | 1.0 | 1.3 | **1.7** |

DCM: I = C1 * ln (tc) + C2

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

# Sub-Basin C2 Runoff Calculations

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **A** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | 4,529 | 0.10 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| Landscaping | | | 0.03 | 0.09 | 0.17 | 0.26 | 0.31 | 0.36 | 2% |
| Paved | 945 | 0.02 | 0.89 | 0.9 | 0.92 | 0.94 | 0.95 | 0.96 | 100% |
| **Combined** | **5,474** | **0.13** | **0.17** | **0.22** | **0.28** | **0.37** | **0.41** | **0.46** | **17.3%** |
| | 5474 | | | | | | | | |

## Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft  $C_v$: 7

| | L (ft) | $\Delta Z_0$ (ft) | $S_0$ (ft/ft) | v (ft/s) | t (min) | $t_{Alt}$ (min) | |
|---|---|---|---|---|---|---|---|
| Total | 121 | 7 | - | - | - | - | |
| Initial Time | 35 | 2 | 0.057 | - | 5.3 | 10.7 | DCM Eq. 6-8 |
| Shallow Channel | 86 | 5 | 0.058 | 1.7 | 0.8 | - | DCM Eq. 6-9 |
| Channelized | | | 0.000 | 0.0 | 0.0 | - | V-Ditch |
| | | | | **$t_c$** | **6.1 min.** | | |

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 3.88 | 4.86 | 5.67 | 6.49 | 7.30 | 8.17 |
| **Runoff (cfs)** | 0.1 | **0.1** | 0.2 | 0.3 | 0.4 | **0.5** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | 0.1 | **0.1** | 0.2 | 0.3 | 0.4 | **0.5** |

DCM: I = C1 * ln (tc) + C2

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

Please verify percent impervious calculations. The basin is missing paved area.

# Sub-Basin C3 Runoff Calculations

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **A** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| Surface | Area (SF) | Area (Acres) | Runoff Coefficient C2 | C5 | C10 | C25 | C50 | C100 | % Imperv. |
|---|---|---|---|---|---|---|---|---|---|
| Pasture/Meadow | 12,113 | 0.28 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| Landscaping | 5,398 | 0.12 | 0.03 | 0.09 | 0.17 | 0.26 | 0.31 | 0.36 | 2% |
| Paved | | | 0.89 | 0.9 | 0.92 | 0.94 | 0.95 | 0.96 | 100% |
| Roofs | 3,496 | 0.08 | 0.71 | 0.73 | 0.75 | 0.78 | 0.8 | 0.81 | 90% |
| **Combined** | **21,007** | **0.48** | **0.14** | **0.19** | **0.25** | **0.34** | **0.39** | **0.43** | **15.5%** |

21007

## Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$ 300 ft  $C_v$ 7

| | L (ft) | $\Delta Z_0$ (ft) | $S_0$ (ft/ft) | v (ft/s) | t (min) | $t_{Alt}$ (min) | |
|---|---|---|---|---|---|---|---|
| Total | 258 | 15 | - | - | - | - | |
| Initial Time | 44 | 1 | 0.023 | - | 8.3 | 11.4 | DCM Eq. 6-8 |
| Shallow Channel | 157 | 10 | 0.064 | 1.8 | 1.5 | - | DCM Eq. 6-9 |
| Channelized | 57 | 4 | 0.070 | 2.0 | 0.5 | - | V-Ditch |
| | | | | **$t_c$** | **10.3** | **min.** | |

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 3.26 | 4.09 | 4.77 | 5.45 | 6.13 | 6.87 |
| **Runoff (cfs)** | 0.2 | **0.4** | 0.6 | 0.9 | 1.1 | **1.4** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | 0.2 | **0.4** | 0.6 | 0.9 | 1.1 | **1.4** |

DCM: I = C1 * ln (tc) + C2

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

# Sub-Basin C4 Runoff Calculations

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **A** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | | | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| Landscaping | 1,245 | 0.03 | 0.03 | 0.09 | 0.17 | 0.26 | 0.31 | 0.36 | 2% |
| Paved | 12,208 | 0.28 | 0.89 | 0.9 | 0.92 | 0.94 | 0.95 | 0.96 | 100% |
| **Combined** | **13,453** | **0.31** | **0.81** | **0.83** | **0.85** | **0.88** | **0.89** | **0.90** | **90.9%** |

13453

## Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft  $C_v$: 7

| | L (ft) | $\Delta Z_0$ (ft) | $S_0$ (ft/ft) | v (ft/s) | t (min) | $t_{Alt}$ (min) | |
|---|---|---|---|---|---|---|---|
| Total | 281 | 2 | - | - | - | - | |
| Initial Time | 35 | 1 | 0.014 | - | 2.6 | 11.6 | DCM Eq. 6-8 |
| Shallow Channel | | | 0.000 | 0.0 | 0.0 | - | DCM Eq. 6-9 |
| Channelized | 246 | 2 | 0.007 | 1.3 | 3.2 | - | C&G |
| | | | | **$t_c$** | **5.8 min.** | | |

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 3.94 | 4.95 | 5.77 | 6.59 | 7.42 | 8.30 |
| **Runoff (cfs)** | 1.0 | **1.3** | 1.5 | 1.8 | 2.0 | **2.3** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | 1.0 | **1.3** | 1.5 | 1.8 | 2.0 | **2.3** |

DCM: I = C1 * ln (tc) + C2

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

# Sub-Basin C5 Runoff Calculations

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **A** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | 24,887 | 0.57 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| Landscaping | | | 0.03 | 0.09 | 0.17 | 0.26 | 0.31 | 0.36 | 2% |
| Paved | | | 0.89 | 0.9 | 0.92 | 0.94 | 0.95 | 0.96 | 100% |
| **Combined** | **24,887** | **0.57** | **0.02** | **0.08** | **0.15** | **0.25** | **0.30** | **0.35** | **0.0%** |
| | 24887 | | | | | | | | |

## Basin Travel Time

Shallow Channel Ground Cover: Short Pasture/Lawns

$L_{max,Overland}$: 300 ft  $C_v$: 7

| | L (ft) | $\Delta Z_0$ (ft) | $S_0$ (ft/ft) | v (ft/s) | t (min) | $t_{Alt}$ (min) | |
|---|---|---|---|---|---|---|---|
| Total | 272 | 7 | - | - | - | - | |
| Initial Time | 177 | 5 | 0.028 | - | 17.4 | 11.5 | DCM Eq. 6-8 |
| Shallow Channel | 95 | 2 | 0.021 | 1.0 | 1.6 | - | DCM Eq. 6-9 |
| Channelized | | | 0.000 | 0.0 | 0.0 | - | V-Ditch |
| | | | | **$t_c$** | **11.5** | **min.** | |

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 3.13 | 3.92 | 4.57 | 5.22 | 5.88 | 6.58 |
| **Runoff (cfs)** | 0.0 | **0.2** | 0.4 | 0.7 | 1.0 | **1.3** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | 0.0 | **0.2** | 0.4 | 0.7 | 1.0 | **1.3** |
| DCM: I = C1 * ln (tc) + C2 | | | | | | |
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

# Combined Sub-Basin Runoff Calculations

Includes Basins A1 A2

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **B** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | 74,623 | 1.71 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| Landscaping | 343 | 0.01 | 0.03 | 0.09 | 0.17 | 0.26 | 0.31 | 0.36 | 2% |
| Paved | 2,084 | 0.05 | 0.89 | 0.9 | 0.92 | 0.94 | 0.95 | 0.96 | 100% |
| **Combined** | **77,050** | **1.77** | **0.04** | **0.10** | **0.17** | **0.27** | **0.32** | **0.37** | **2.7%** |

## Basin Travel Time

| | Sub-basin or Channel Type | Material Type | L (ft) | Elev. $\Delta Z_0$ (ft) | $Q_i$ (cfs) | Base or Dia (ft) | Sides z:1 (ft/ft) | v (ft/s) | t (min) |
|---|---|---|---|---|---|---|---|---|---|
| Furthest Reach | A2 | - | 190 | 14 | - | - | - | - | 11.1 |
| Channelized-1 | | | | | | | | | |
| Channelized-2 | | | | | | | | | |
| Channelized-3 | | | | | | | | | |
| Total | | | 190 | 14 | | | | | |
| | | | | | | | | **$t_c$ (min)** | **11.1** |

## Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

$Q_{Minor}$ (cfs) - 5-year Storm

$Q_{Major}$ (cfs) - 100-year Storm

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 3.18 | 3.98 | 4.64 | 5.31 | 5.97 | 6.68 |
| **Site Runoff (cfs)** | 0.24 | **0.72** | 1.40 | 2.52 | 3.35 | **4.33** |
| **OffSite Runoff (cfs)** | - | **0.00** | - | - | - | **0.00** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | - | **0.7** | - | - | - | **4.3** |
| DCM: I = C1 * ln (tc) + C2 | | | | | | |
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

Runoff from Offsite basins have been assumed constant, despite additional times of concentration.

# Combined Sub-Basin Runoff Calculations

Includes Basins OS-2 OS-3 B1

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **B** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | 183,177 | 4.21 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| Landscaping | 168 | 0.00 | 0.03 | 0.09 | 0.17 | 0.26 | 0.31 | 0.36 | 2% |
| Paved | 13,849 | 0.32 | 0.89 | 0.9 | 0.92 | 0.94 | 0.95 | 0.96 | 100% |
| **Combined** | **197,194** | **4.53** | **0.08** | **0.14** | **0.20** | **0.30** | **0.35** | **0.39** | **7.0%** |

## Basin Travel Time

| | Sub-basin or Channel Type | Material Type | L (ft) | Elev. $\Delta Z_0$ (ft) | $Q_i$ (cfs) | Base or Dia (ft) | Sides z:1 (ft/ft) | v (ft/s) | t (min) |
|---|---|---|---|---|---|---|---|---|---|
| Furthest Reach | OS-3 | - | 1,067 | 55 | - | - | - | - | 15.9 |
| Channelized-1 | | | | | | | | | |
| Channelized-2 | | | | | | | | | |
| Channelized-3 | | | | | | | | | |
| Total | | | 1,067 | 55 | | | | | |
| | | | | | | | | **$t_c$ (min)** | **15.9** |

## Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

$Q_{Minor}$ (cfs) - 5-year Storm

$Q_{Major}$ (cfs) - 100-year Storm

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 2.74 | 3.43 | 4.00 | 4.57 | 5.15 | 5.76 |
| **Site Runoff (cfs)** | 1.01 | **2.14** | 3.70 | 6.18 | 8.05 | **10.24** |
| **OffSite Runoff (cfs)** | - | **0.00** | - | - | - | **0.00** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | - | **2.1** | - | - | - | **10.2** |
| DCM: I = C1 * ln (tc) + C2 | | | | | | |
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

Runoff from Offsite basins have been assumed constant, despite additional times of concentration.

# Combined Sub-Basin Runoff Calculations

Includes Basins C1 C2 C4

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **B** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | 36,732 | 0.84 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| Landscaping | 1,245 | 0.03 | 0.03 | 0.09 | 0.17 | 0.26 | 0.31 | 0.36 | 2% |
| Paved | 13,153 | 0.30 | 0.89 | 0.9 | 0.92 | 0.94 | 0.95 | 0.96 | 100% |
| **Combined** | **51,130** | **1.17** | **0.24** | **0.29** | **0.35** | **0.43** | **0.47** | **0.51** | **25.8%** |

## Basin Travel Time

| | Sub-basin or Channel Type | Material Type | L (ft) | Elev. $\Delta Z_0$ (ft) | $Q_i$ (cfs) | Base or Dia (ft) | Sides z:1 (ft/ft) | v (ft/s) | t (min) |
|---|---|---|---|---|---|---|---|---|---|
| Furthest Reach | C1 | - | 201 | 13 | - | - | - | - | 11.1 |
| Channelized-1 | | | | | | | | | |
| Channelized-2 | | | | | | | | | |
| Channelized-3 | | | | | | | | | |
| Total | | | 201 | 13 | | | | | |
| | | | | | | | | **$t_c$ (min)** | **11.1** |

## Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

$Q_{Minor}$ (cfs) - 5-year Storm

$Q_{Major}$ (cfs) - 100-year Storm

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 3.17 | 3.97 | 4.63 | 5.29 | 5.96 | 6.67 |
| **Site Runoff (cfs)** | 0.91 | **1.36** | 1.90 | 2.66 | 3.27 | **3.97** |
| **OffSite Runoff (cfs)** | - | **0.00** | - | - | - | **0.00** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | - | **1.4** | - | - | - | **4.0** |

DCM: I = C1 * ln (tc) + C2

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

Runoff from Offsite basins have been assumed constant, despite additional times of concentration.

# Combined Sub-Basin Runoff Calculations

Includes Basins OS-1 OS-2 OS-3 B1 C1 C2 C3 C4 C5

| | | | |
|---|---|---|---|
| Job No.: | **61200** | Date: | **8/10/2023 11:41** |
| Project: | **St. John's Orthodox Church** | Calcs by: | **OA** |
| | | Checked by: | |
| Jurisdiction | **DCM** | Soil Type | **B** |
| Runoff Coefficient | **Surface Type** | Urbanization | **Urban** |

## Basin Land Use Characteristics

| | Area | | Runoff Coefficient | | | | | | % |
|---|---|---|---|---|---|---|---|---|---|
| **Surface** | **(SF)** | **(Acres)** | **C2** | **C5** | **C10** | **C25** | **C50** | **C100** | **Imperv.** |
| Pasture/Meadow | 268,642 | 6.17 | 0.02 | 0.08 | 0.15 | 0.25 | 0.3 | 0.35 | 0% |
| Landscaping | 6,811 | 0.16 | 0.03 | 0.09 | 0.17 | 0.26 | 0.31 | 0.36 | 2% |
| Paved | 41,216 | 0.95 | 0.89 | 0.9 | 0.92 | 0.94 | 0.95 | 0.96 | 100% |
| Roofs | 5,026 | 0.12 | 0.71 | 0.73 | 0.75 | 0.78 | 0.8 | 0.81 | 90% |
| Gravel | 18,572 | 0.43 | 0.57 | 0.59 | 0.63 | 0.66 | 0.68 | 0.7 | 80% |
| **Combined** | **340,267** | **7.81** | **0.17** | **0.22** | **0.28** | **0.36** | **0.41** | **0.45** | **17.8%** |

## Basin Travel Time

| | Sub-basin or Channel Type | Material Type | L (ft) | Elev. $\Delta Z_0$ (ft) | $Q_i$ (cfs) | Base or Dia (ft) | Sides z:1 (ft/ft) | v (ft/s) | t (min) |
|---|---|---|---|---|---|---|---|---|---|
| Furthest Reach | OS-3 | - | 1,067 | 55 | - | - | - | - | 15.9 |
| Channelized-1 | V-Ditch | 3 | 269 | 5 | 7 | 0 | 2 | 1.6 | 2.9 |
| Channelized-2 | | | | | | | | | |
| Channelized-3 | | | | | | | | | |
| Total | | | 1,336 | 60 | | | | | |

3 = Natural, Winding, significant vegetation

**$t_c$ (min)** **18.8**

## Contributing Offsite Flows (Added to Runoff and Allowed Release, below.)

Contributing Basins/Areas

$Q_{Minor}$ (cfs) - 5-year Storm

$Q_{Major}$ (cfs) - 100-year Storm

## Rainfall Intensity & Runoff

| | 2-Yr | 5-Yr | 10-Yr | 25-Yr | 50-Yr | 100-Yr |
|---|---|---|---|---|---|---|
| **Intensity (in/hr)** | 2.54 | 3.18 | 3.71 | 4.24 | 4.77 | 5.34 |
| **Site Runoff (cfs)** | 3.29 | **5.39** | 8.08 | 12.06 | 15.18 | **18.77** |
| **OffSite Runoff (cfs)** | - | **0.00** | - | - | - | **0.00** |
| **Release Rates (cfs/ac)** | - | - | - | - | - | - |
| **Allowed Release (cfs)** | - | **5.4** | - | - | - | **18.8** |

DCM: I = C1 * ln (tc) + C2

| | | | | | | |
|---|---|---|---|---|---|---|
| C1 | 1.19 | 1.5 | 1.75 | 2 | 2.25 | 2.52 |
| C2 | 6.035 | 7.583 | 8.847 | 10.111 | 11.375 | 12.735 |

## Notes

Runoff from Offsite basins have been assumed constant, despite additional times of concentration.

# 9 Hydraulic Calculations

18” RCP Hydraulic Grade Line Calculation

# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Aug 10 2023

## DRIVEWAY LOW POINT

**Triangular**

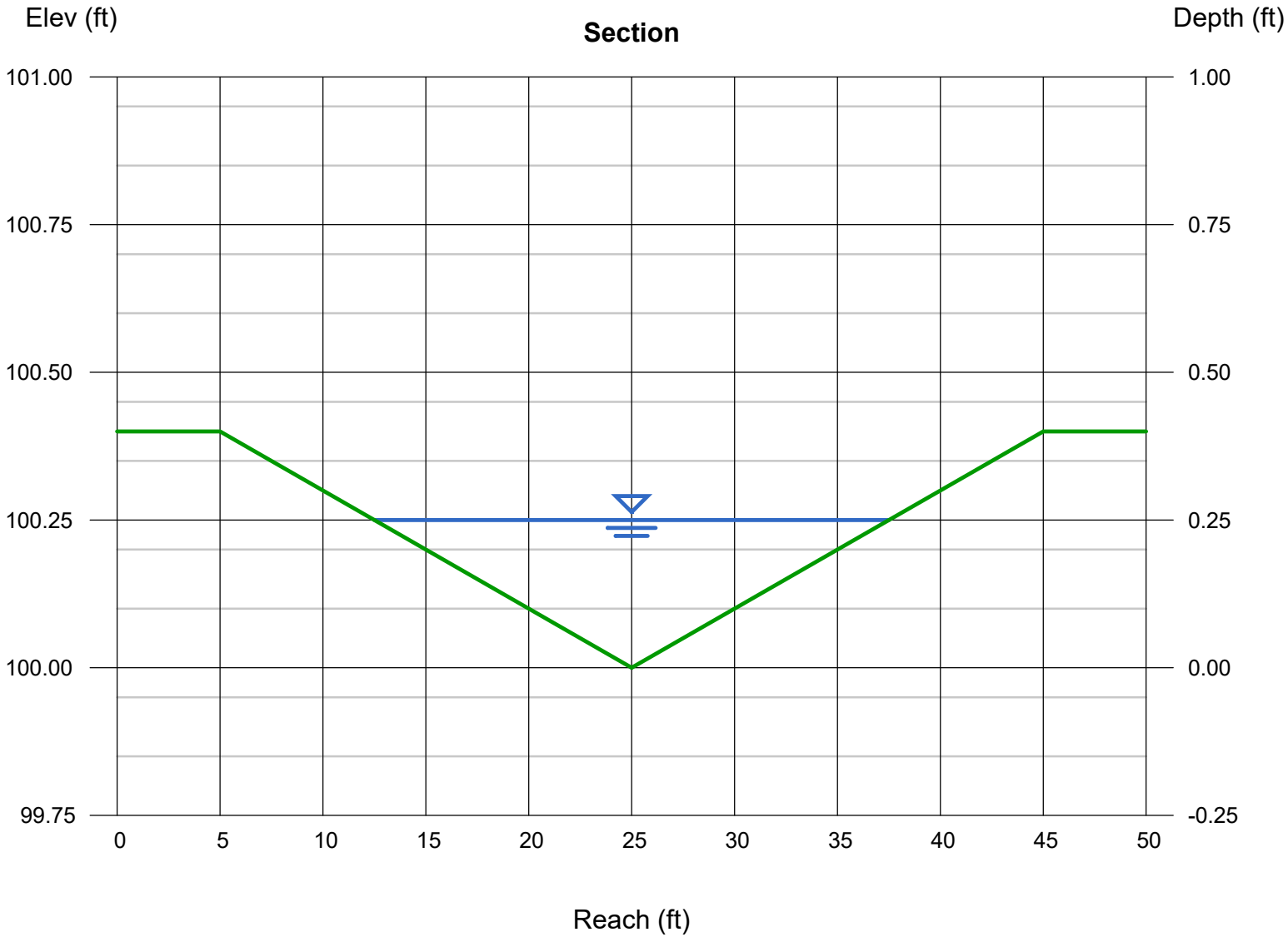
| | |
|---|---|
| Side Slopes (z:1) | = 50.00, 50.00 |
| Total Depth (ft) | = 0.40 |
| Invert Elev (ft) | = 100.00 |
| Slope (%) | = 2.00 |
| N-Value | = 0.015 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 10.20 |

**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.25 |
| Q (cfs) | = 10.20 |
| Area (sqft) | = 3.13 |
| Velocity (ft/s) | = 3.26 |
| Wetted Perim (ft) | = 25.01 |
| Crit Depth, Yc (ft) | = 0.31 |
| Top Width (ft) | = 25.00 |
| EGL (ft) | = 0.42 |



# Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Aug 10 2023

## CURB OPENING

**Rectangular**

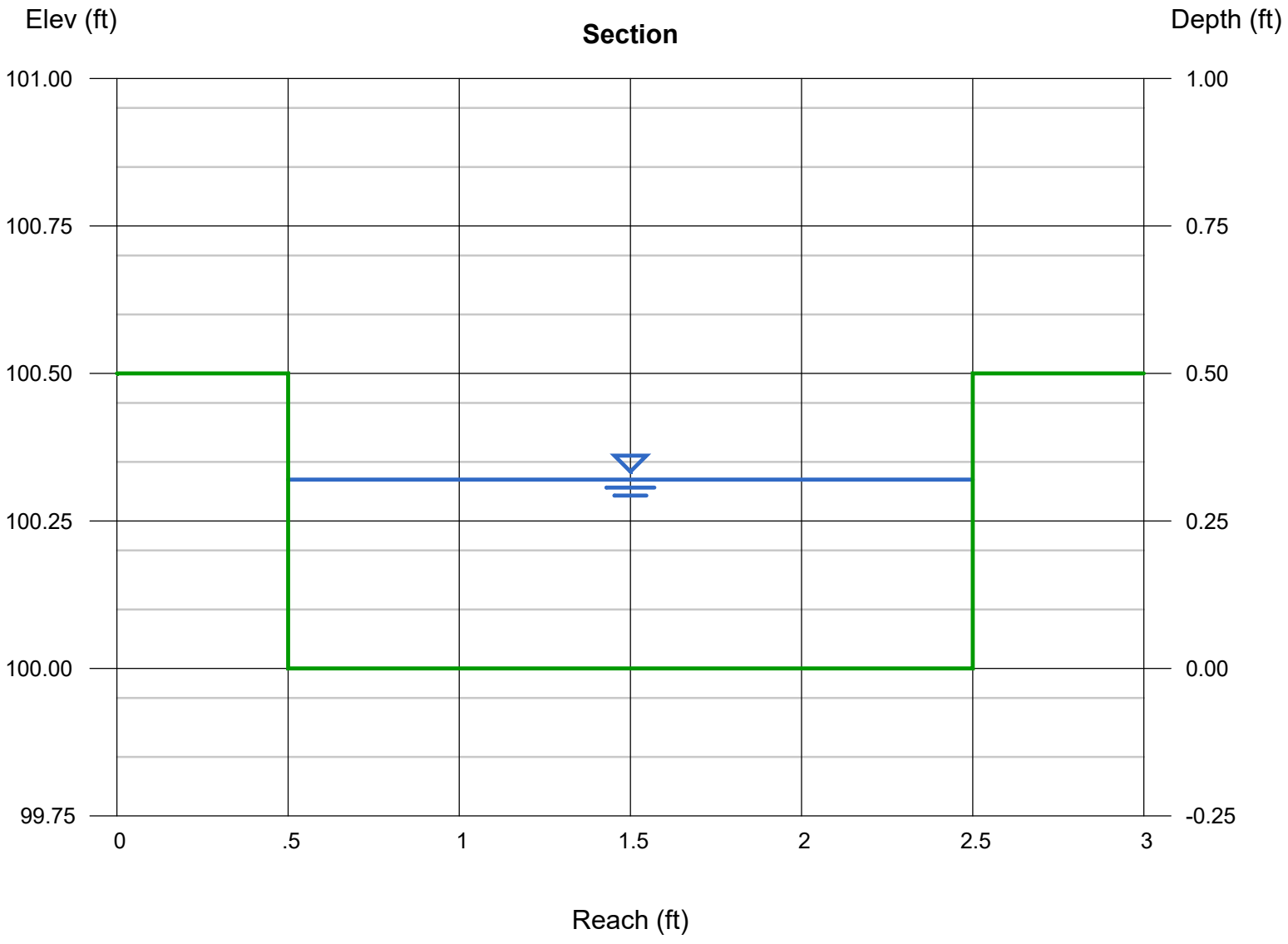
| | |
|---|---|
| Bottom Width (ft) | = 2.00 |
| Total Depth (ft) | = 0.50 |
| Invert Elev (ft) | = 100.00 |
| Slope (%) | = 2.00 |
| N-Value | = 0.013 |

**Calculations**

| | |
|---|---|
| Compute by: | Known Q |
| Known Q (cfs) | = 4.00 |

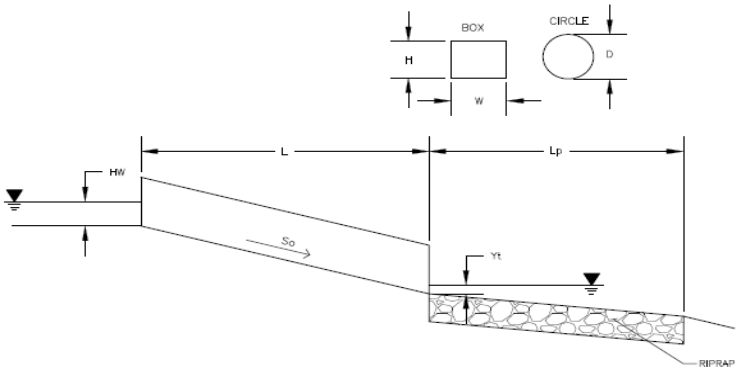
**Highlighted**

| | |
|---|---|
| Depth (ft) | = 0.32 |
| Q (cfs) | = 4.000 |
| Area (sqft) | = 0.64 |
| Velocity (ft/s) | = 6.25 |
| Wetted Perim (ft) | = 2.64 |
| Crit Depth, Yc (ft) | = 0.50 |
| Top Width (ft) | = 2.00 |
| EGL (ft) | = 0.93 |



# Determination of Culvert Headwater and Outlet Protection

**Project:** 61200
**Basin ID:** Curb Opening Riprap Calculation




**Soil Type:**
Choose One:
(●) Sandy
( ) Non-Sandy

**Supercritical Flow! Using Ha to calculate protection type.**

## Design Information (Input):

| | | | | |
|---|---|---|---|---|
| | Design Discharge | Q = | 4 | cfs |
| **Circular Culvert:** | | | | |
| | Barrel Diameter in Inches | D = | | inches |
| | Inlet Edge Type (Choose from pull-down list) | | | |
| **Box Culvert:** | | | **OR** | |
| | Barrel Height (Rise) in Feet | Height (Rise) = | 0.5 | ft |
| | Barrel Width (Span) in Feet | Width (Span) = | 2 | ft |
| | Inlet Edge Type (Choose from pull-down list) | | Square Edge w/ 0 deg. Flared Wingwall | |
| | Number of Barrels | No = | 1 | |
| | Inlet Elevation | Elev IN = | 6909.8 | ft |
| | Outlet Elevation **OR** Slope | Elev OUT = | 6909.3 | ft |
| | Culvert Length | L = | 3 | ft |
| | Manning's Roughness | n = | 0.013 | |
| | Bend Loss Coefficient | $k_b$ = | 0 | |
| | Exit Loss Coefficient | $k_x$ = | 1 | |
| | Tailwater Surface Elevation | Elev $Y_t$ = | | ft |
| | Max Allowable Channel Velocity | V = | 5 | ft/s |

## Required Protection (Output):

| | | | |
|---|---|---|---|
| Tailwater Surface Height | $Y_t$ = | 0.20 | ft |
| Flow Area at Max Channel Velocity | $A_t$ = | 0.80 | $ft^2$ |
| Culvert Cross Sectional Area Available | A = | 1.00 | $ft^2$ |
| Entrance Loss Coefficient | $k_e$ = | 0.70 | |
| Friction Loss Coefficient | $k_f$ = | 0.24 | |
| Sum of All Losses Coefficients | $k_s$ = | 1.94 | ft |
| Culvert Normal Depth | $Y_n$ = | 0.16 | ft |
| Culvert Critical Depth | $Y_c$ = | 0.50 | ft |
| Tailwater Depth for Design | d = | 0.50 | ft |
| Adjusted Diameter **OR** Adjusted Rise | $H_a$ = | 0.33 | ft |
| Expansion Factor | 1/(2*tan(Θ)) = | 3.43 | |
| Flow/Diameter$^{2.5}$ **OR** Flow/(Span * Rise$^{1.5}$) | Q/WH^1.5 = | 5.66 | $ft^{0.5}/s$ |
| Froude Number | Fr = | 5.50 | **Supercritical!** |
| Tailwater/Adjusted Diameter **OR** Tailwater/Adjusted Rise | Yt/H = | 0.61 | |
| Inlet Control Headwater | $HW_I$ = | 1.08 | ft |
| Outlet Control Headwater | $HW_O$ = | 0.48 | |
| **Design Headwater Elevation** | **HW =** | **6,910.88** | **ft** |
| **Headwater/Diameter OR Headwater/Rise Ratio** | **HW/H =** | **2.15** | **HW/H > 1.5!** |
| Minimum Theoretical Riprap Size | $d_{50}$ = | 1 | in |
| Nominal Riprap Size | $d_{50}$ = | 6 | in |
| **UDFCD Riprap Type** | **Type =** | **VL** | |
| **Length of Protection** | **$L_p$ =** | **5** | **ft** |
| **Width of Protection** | **T =** | **4** | **ft** |

# Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Aug 10 2023

## 61200 - Woodmen Frontage Road Double 27in RCP

| | | |
|---|---|---|
| Invert Elev Dn (ft) | = | 6903.75 |
| Pipe Length (ft) | = | 65.40 |
| Slope (%) | = | 3.90 |
| Invert Elev Up (ft) | = | 6906.30 |
| Rise (in) | = | 27.0 |
| Shape | = | Circular |
| Span (in) | = | 27.0 |
| No. Barrels | = | 2 |
| n-Value | = | 0.013 |
| Culvert Type | = | Circular Concrete |
| Culvert Entrance | = | Groove end projecting (C) |
| Coeff. K,M,c,Y,k | = | 0.0045, 2, 0.0317, 0.69, 0.2 |

**Embankment**

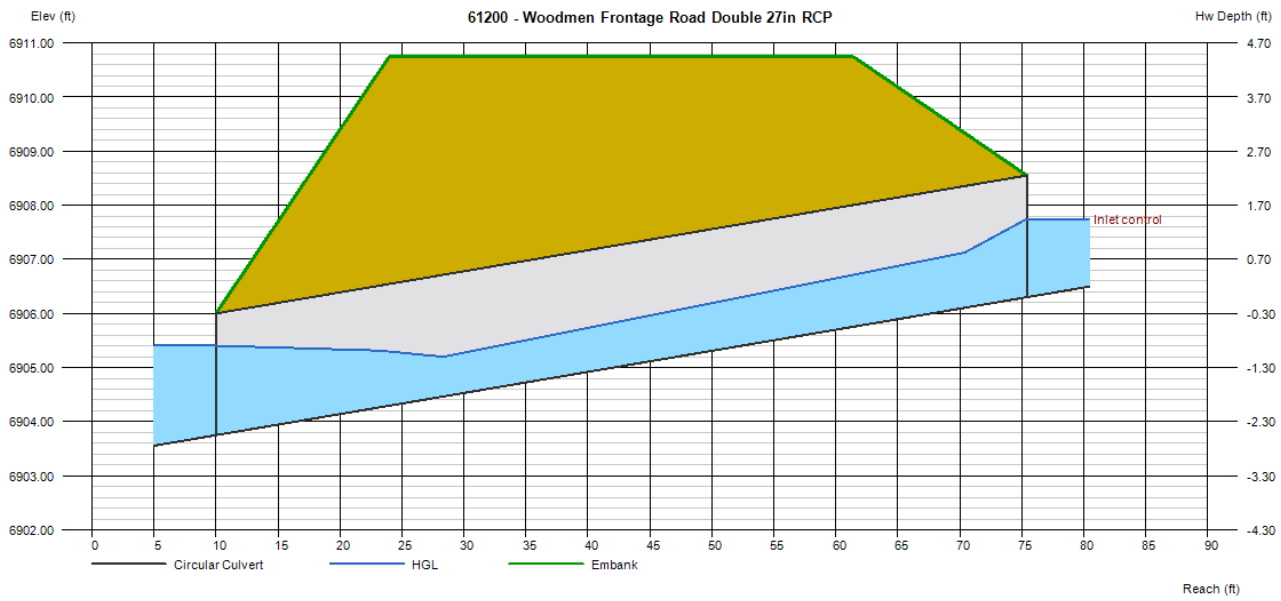
| | | |
|---|---|---|
| Top Elevation (ft) | = | 6910.74 |
| Top Width (ft) | = | 37.50 |
| Crest Width (ft) | = | 0.00 |

**Calculations**

| | | |
|---|---|---|
| Qmin (cfs) | = | 5.40 |
| Qmax (cfs) | = | 18.80 |
| Tailwater Elev (ft) | = | (dc+D)/2 |

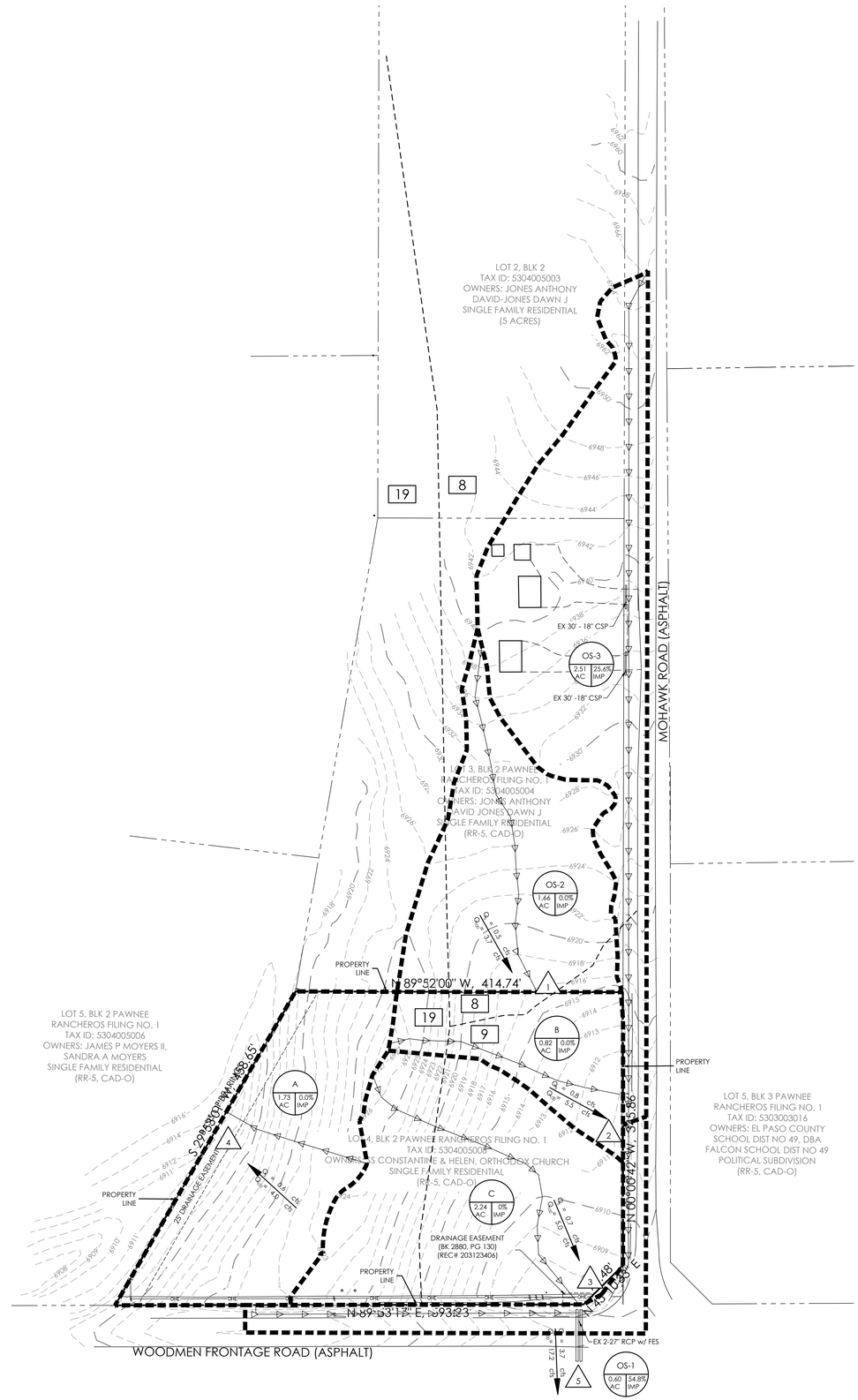
**Highlighted**

| | | |
|---|---|---|
| Qtotal (cfs) | = | 18.80 |
| Qpipe (cfs) | = | 18.80 |
| Qovertop (cfs) | = | 0.00 |
| Veloc Dn (ft/s) | = | 3.00 |
| Veloc Up (ft/s) | = | 5.13 |
| HGL Dn (ft) | = | 6905.40 |
| HGL Up (ft) | = | 6907.36 |
| Hw Elev (ft) | = | 6907.75 |
| Hw/D (ft) | = | 0.64 |
| Flow Regime | = | Inlet Control |



# 10 Report Maps

Offsite & Existing Drainage Map (Map Pocket)
Developed Drainage Map (Map Pocket)




Unresolved:
Show/label ditches discussed in the report.

## LEGAL DESCRIPTION

LOT 4, BLOCK 2, PAWNEE RANCHEROS, FILING NO. 1, EXCEPT THAT PORTION DESCRIBED IN WARRANTY DEED RECORDED JUNE 4, 2003 UNDER RECEPTION NO. 203123405, COUNTY OF EL PASO, STATE OF COLORADO.

## LEGEND

- PROPERTY LINE
- EASEMENT LINE
- LOT LINE

**EXISTING**

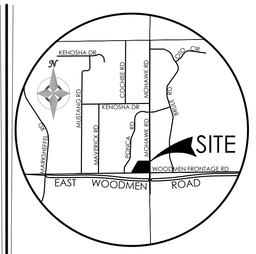
- ASPHALT AREA
- GRAVEL AREA
- 5985 INDEX CONTOUR
- 84 INTERMEDIATE CONTOUR
- BASIN BOUNDARY
- Q = 19.0 cfs, Q100 = 60.0 cfs — GENERAL FLOW/DIRECTION
- TIME OF CONCENTRATION PATH
- A1 / 1.0 AC / 50% IMP — BASIN LABEL: AREA IN ACRES, PERCENT IMPERVIOUS
- 1 — DESIGN POINT
- 86 / 56 — LIMITS OF SOIL TYPE

## DRAINAGE BASIN SUMMARY TABLE

| DESIGN POINT | INCLUDED BASINS | AREA (AC) | Tc (MIN) | RUNOFF Q5 | RUNOFF Q100 |
|---|---|---|---|---|---|
| | OS-1 | 0.60 | 7.2 | 1.5 | 3.2 |
| EX-1 | OS-2 | 1.66 | 12.5 | 0.5 | 3.7 |
| | OS-3 | 2.51 | 15.9 | 2.3 | 7.0 |
| EX-4 | A | 1.73 | 11.1 | 0.6 | 4.0 |
| | B | 0.82 | 11.7 | 0.3 | 1.9 |
| EX-2 | OS-2, B | 2.48 | 12.5 | 0.8 | 5.5 |
| EX-3 | C | 2.24 | 12.4 | 0.7 | 5.0 |
| EX-5 | OS-1, OS-2, OS-3, B, C | 7.83 | 18.8 | 4.3 | 17.5 |

## FLOODPLAIN STATEMENT

NO PORTION OF THE SUBJECT PROPERTY IS LOCATED WITHIN A FEMA DESIGNATED SPECIAL FLOOD HAZARD AREA (SFHA) AS INDICATED ON THE FLOOD INSURANCE RATE MAPS (FIRM) FOR EL PASO COUNTY, COLORADO AND INCORPORATED AREAS - MAP NUMBERS 08041C0533G, EFFECTIVE DECEMBER 7, 2018.




VICINITY MAP
NOT TO SCALE

BENCHMARK
FOUND 1" od PIPE FLUSH GROUND LEVEL TOP OF EL = 6915'

N

20 0 30 80 150
SCALE: 1"=80' 1:960

MVE, INC.
ENGINEERS | SURVEYORS
1903 lelaray street, suite 200 colorado springs co 80909 719.635.5736

REVISIONS

DESIGNED BY
DRAWN BY
CHECKED BY
AS-BUILTS BY
CHECKED BY

# ST. JOHN THE BAPTIST ORTHODOX CHURCH

## DRAINAGE MAP (EXISTING)

MVE PROJECT 61200
MVE DRAWING DRAIN-EX

AUGUST 10, 2023
**SHEET** 1 **OF** 1

## LEGAL DESCRIPTION

LOT 4, BLOCK 2, PAWNEE RANCHEROS, FILING NO. 1, EXCEPT THAT PORTION DESCRIBED IN WARRANTY DEED RECORDED JUNE 4, 2003 UNDER RECEPTION NO. 203123405, COUNTY OF EL PASO, STATE OF COLORADO.

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- Q = 19.0 cfs, $Q_{100}$ = 60.0 cfs — GENERAL FLOW/DIRECTION
- TIME OF CONCENTRATION PATH
- A1: 1.0 AC, 50% IMP — BASIN LABEL, AREA IN ACRES, PERCENT IMPERVIOUS
- 1 — DESIGN POINT
- 86 / 56 — LIMITS OF SOIL TYPE

**PROPOSED**

- ASPHALT AREA
- CONCRETE AREA
- 22 — INDEX CONTOUR
- 84 — INTERMEDIATE CONTOUR

## DRAINAGE BASIN SUMMARY TABLE

| DESIGN POINT | INCLUDED BASINS | AREA (AC) | Tc (MIN) | RUNOFF Q5 | RUNOFF Q100 |
|---|---|---|---|---|---|
| 1 | A1 | 0.06 | 5.5 | 0.2 | 0.4 |
| | A2 | 1.71 | 11.1 | 0.5 | 4.0 |
| 2 | A1, A2 | 1.77 | 11.1 | 0.7 | 4.3 |
| | B1 | 0.82 | 12.0 | 0.4 | 2.0 |
| 3 | OS-2, OS-3, B1 | 4.53 | 15.9 | 2.1 | 10.2 |
| | C1 | 0.74 | 11.1 | 0.2 | 1.7 |
| | C2 | 0.13 | 6.1 | 0.1 | 0.5 |
| | C3 | 0.48 | 10.3 | 0.4 | 1.4 |
| | C4 | 0.31 | 5.8 | 1.3 | 2.3 |
| 4 | C1, C2, C4 | 1.17 | 11.1 | 1.4 | 4.0 |
| | C5 | 0.57 | 11.5 | 0.2 | 1.3 |
| 5 | OS-1, OS-2, OS-3, B1, C1-C5 | 7.81 | 18.8 | 5.4 | 18.8 |
| | | | | | |
| | | | | | |

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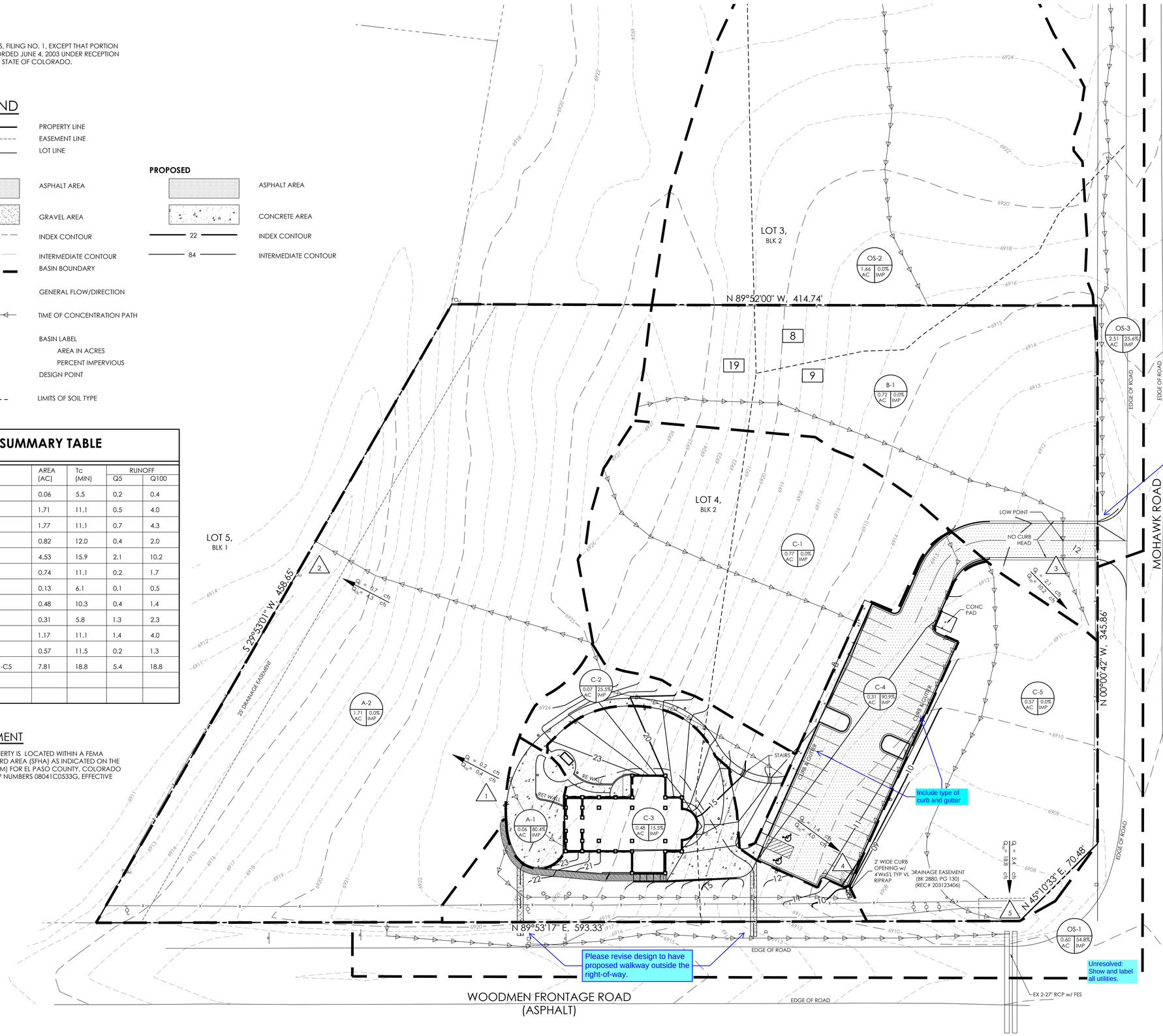


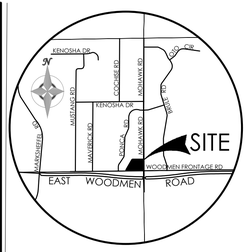


## VICINITY MAP

NOT TO SCALE

BENCHMARK
FOUND 1" od PIPE FLUSH GROUND LEVEL TOP OF EL = 6915'

1" = 30' 1:360

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## DRAINAGE MAP (PROPOSED)

MVE PROJECT 61200
MVE DRAWING DRAIN-PP

AUGUST 10, 2023

**SHEET** 1 **OF** 1