



## **PRELIMINARY DRAINAGE REPORT**

*for*

**SOUTH FLATROCK TRAIL ROADWAY EXTENSION  
AURORA, CO**

*Prepared for*

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**AUGUST 2022**

**Approved For One Year From This Date**

\_\_\_\_\_  
**City Engineer**

\_\_\_\_\_  
**Date**

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**Water Department**

\_\_\_\_\_  
**Date**

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## A. INTRODUCTION

### 1. Location

This extension of South Flatrock Trail is within existing 70' width right-of-way from existing South Flatrock Trail (constructed by Murphy Creek East Filing No. 1 (*EDN 221063*), at East Warren Place to future East Yale Avenue. More specifically, the property is a part of Section 19, Township 4 South, Range 65 west of the Sixth Principal Meridian.

The site is bounded on the north by Murphy Creek East Filing No. 1 (**Error! Reference source not found.***EDN 221063*) (currently under construction), on the east by future Murphy Creek East Filing No. 3 (*RSN 1627119*), on the south by East Yale Ave., and on the west by Murphy Creek Filing No. 7 (*EDN 223038*).

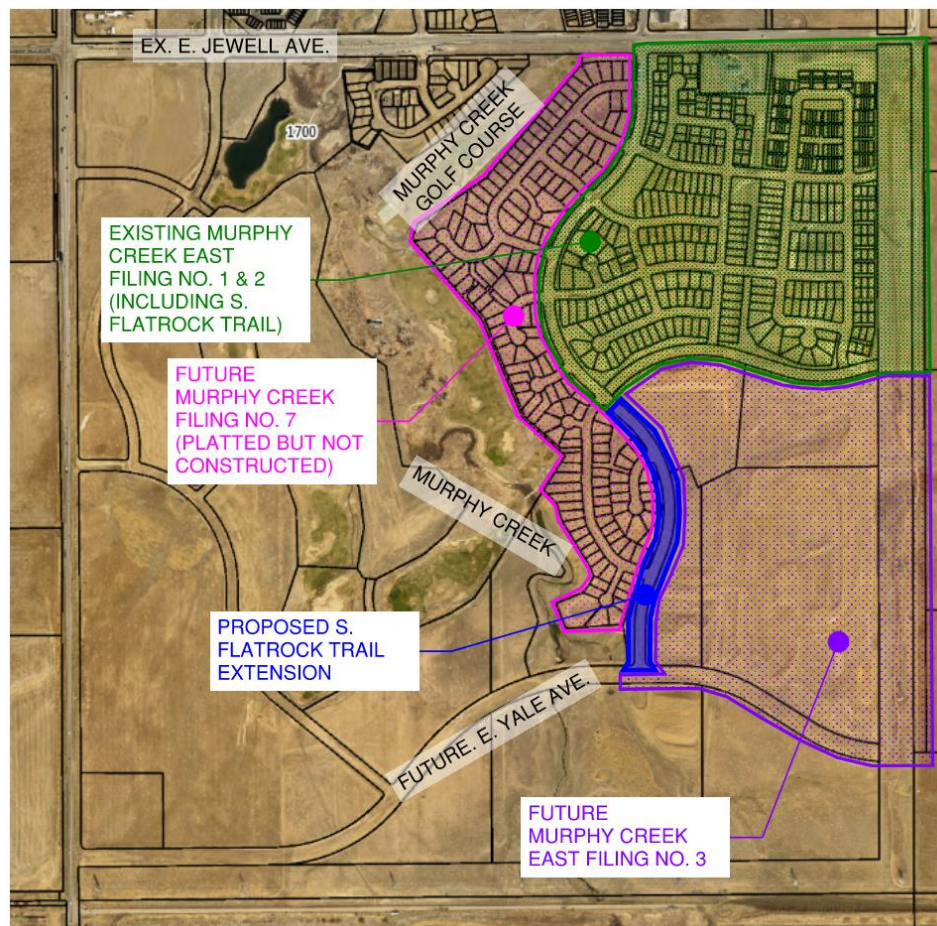


Figure 1 – Vicinity Map

Projects that are approved or are to be constructed ahead of South Flatrock Trail:

- Murphy Creek East (Harvest Ridge) Subdivision Filing No. 1, 2, 3, & 4 Master Drainage Report (*Murphy Creek East MDR*), approved, *EDN 220220*
- Murphy Creek East (Harvest Ridge) Subdivision Filing No. 1 Final Drainage Report (*Murphy Creek East FDR*), approved, *EDN 221063*
- Murphy Creek East Filing No. 1 Offsite Infrastructure Site Plan, approved, *EDN 221064*

- Murphy Creek East Filing No. 1 Civil Plans, approved, *EDN 221063*
- Murphy Creek Metropolitan District (South of East Jewell Avenue) Construction Plans, approved, *EDN 205189*

Projects that are future or are to be constructed after South Flatrock Trail:

- Murphy Creek Filing No. 7, approved, *EDN 223038RSN 1627119*
- Murphy Creek East Filing No. 3, currently under review, *RSN 1627119*

## 2. Proposed Development

The project consists of the construction of an approximately 2,030 lineal foot of 70' right-of-way collector roadway. A typical section is provided in the Civil Plans showing the asphalt paved lane widths, concrete curb and gutter, landscape tree line buffer, and detached concrete pedestrian sidewalk. The roadway follows the previously existing right-of-way alignment for South Flatrock Trail from East Warren Place in the north to East Yale Avenue in the south. The site consists of 142,009 square feet, or 3.43 acres.

The road construction for this project began several years ago. Utilities were installed and the street was rough graded. Curbs and asphalt were not installed, however. This project proposed to complete this road, while maintaining the existing infrastructure as much as feasible.

Where this project connects to existing South Flatrock Trail in the north (constructed by Murphy Creek East Filing No. 1 (**Error! Reference source not found.**)), the existing infrastructure by others will be completed prior to the initiation of this project. This includes two sump inlets receiving drainage for this extension as well as the curb and asphalt that this project ties to.

The Civil Plans submitted to the City of Aurora show all of the existing utilities that were previously constructed including water main, sanitary sewer, and storm sewer infrastructure. The existing storm system is designed to collect and convey stormwater runoff tributary to the roadway which ultimately is conveyed to Pond C located toward the south of the project area, near East Yale Avenue, or Pond 7-C (constructed by Murphy Creek East Filing No. 1 (**Error! Reference source not found.**)) to the south adjacent to Murphy Creek. This project proposes to maintain existing drainage patterns, and coordination with the design team of Murphy Creek Filing No. 3 (*RSN 1627119*) is ongoing to ensure Pond C has adequate capacity to accommodate the increase in runoff associated with the S. Flatrock Trail Extension project.

The purpose of this report is to analyze the existing and developed conditions for the proposed paving project as it relates to stormwater runoff and capture volumes. A Master Drainage Report (Murphy Creek East (Harvest Ridge) Subdivision Filing No. 1, 2, 3, & 4 Master Drainage Report ()) for this area has been approved by the City of Aurora. This report will also ensure that the design is in conformance with the Murphy Creek East MDR. Hydrology exhibits and calculations are included in Appendix D.

### Property Description

This project includes existing right-of-way dedicated for the South Flatrock Trail extension between East Warren Place and East Yale Avenue. This land is currently overlot graded for the future corridor and has utilities installed including water main, sanitary sewer, and storm sewer. These utilities were

installed as a part of the Murphy Creek Metropolitan District Construction Plans (*EDN 205189*). This project proposed to maintain the existing utilities and finalize the road paving.

The north end of the paving project begins at the intersection of East Warren Place south of the Murphy Creek East Filing No. 1 development (**Error! Reference source not found.**). This development and a portion of the South Flatrock Trail extension runoff outfall to an offsite pond, Pond 7-C. This drainage is not tributary to the South Flatrock Trail, but instead is routed through a temporary channel (constructed by Murphy Creek East Filing No. 1 (**Error! Reference source not found.**)) to the west.

In the south, the storm system was previously constructed in accordance with the Construction Drawings developed dated 06/20/2001 (*EDN 205189*). At present, Pond C located east of South Flatrock Trail and north of East Yale Avenue has been excavated but a trickle channel, micropool, and outlet structure with orifice plate, well screen, and trash rack have not been installed.

Directly east and west of the existing right-of-way is undisturbed land consisting of pervious soil with native weeds and grasses. Murphy Creek East Filing No. 3 is to be developed in the future east of South Flatrock Trail. Murphy Creek Filing No. 7 (including the area where Pond 7-C is located) is to be developed in the future west of South Flatrock Trail. Coordination between all of these projects is ongoing to ensure the design is adequate and in conformance with master studies.

The soil on the property consists of Renohill-Buick loams, which is classified as hydrological soil group D by the NRCS Web Soil Survey. Type D soil was used in the calculations of this report. The existing property is overlot graded for the Flatrock Trail Extension roadway, and the site is divided by a highpoint near the middle of the roadway, with lowpoints at the north and south ends of the roadway. Existing slopes range from 1% to 3%.

### **Type of Development**

The paving of the South Flatrock Trail right-of-way corridor results in an increased percent imperviousness for the tributary area of Pond C and Pond 7-C. Pond 7-C to the west and the outfall channel were designed by Murphy Creek East Filing No. 1 (**Error! Reference source not found.**). These will be reviewed to ensure that slight additional flow can be adequately handled within their existing system.

The existing percent imperviousness for the roadway area to be constructed by this project is assumed to be 5%. In the ultimate condition, when the roadway is constructed, the on-site basins will have a percent imperviousness of 100%. This change does not negatively impact downstream infrastructure, as the roadway design and section has not changed and preceded the design of the surrounding infrastructure.

Pond C to the south is where a water quality and detention pond has been partially constructed as a temporary sediment basin for the overlot grading and utility construction of the South Flatrock Trail corridor in the past. The existing storm system was constructed per the approved plans for Murphy Creek Metropolitan District (*EDN 205189*) which assumed a 70' collector road corridor for South Flatrock Trail. Because the typical section for the developed conditions matches that of previous reports, the existing storm system is sufficient. Hydraulic design calculations verifying the storm system are provided in Appendix E.

### 3. Requested Variances;

**Variance Request 1:** This request is to allow for water quality and detention to be provided off-site as a part of this project.

**Variance Request 1 Justification:** This project does not propose any storm infrastructure as the drainage infrastructure is already existing. The roadway extension project and the associated runoff is captured by the existing infrastructure and is being treated and detained off-site. The Master Drainage Report anticipated and accommodated this project in the design. The project is located within Basin F7-C and Basin C of the Master Drainage Plan, and will be treated in ponds F7-C and C.

## B. HISTORIC DRAINAGE

### 1. Overall Basin Description

#### Offsite Basins

A significant amount of flow currently traverses the existing right-of-way of South Flatrock Trail. A majority of this runoff is routed to the existing infrastructure that is currently onsite. This project proposes a street through the right-of-way that will route more flow into existing infrastructure, or capture it within curb and gutter to be routed to inlets.

The Murphy Creek East MDR () shows the ultimate assumed flows for the area adjacent to this project. There is ongoing coordination with the future Murphy Creek East Filing No. 3 project (east of South Flatrock Trail) and it has been decided that the South Flatrock Trail project would analyze the ultimate condition described in the Murphy Creek East Filing 3 PDR. This provides a more detailed account of the ultimate conditions that will have to be taken into consideration when compared to the general concepts proposed in the Murphy Creek MDR. As such, that project will be responsible for ensuring their design is in conformance with master studies.

There are two offsite basins adjacent to the site. Both of these basins are defined in the Murphy Creek East (Harvest Ridge) Subdivision Filing No. 1, 2, 3, & 4 Master Drainage Report ().

- 1) Offsite Basin 1 (OS1) is a combination of Basins D and OS-2 from the approved MDR and consists of 61.6 acres. Together these basins contribute 41.61 and 160.93 cfs in the minor and major storm events. However, the Murphy Creek Filing No. 3 PDR prepared by Redland combines Basins C and D from the Murphy Creek East MDR. This is the condition by which the existing storm network is analyzed due to the higher level of detail and more current design when compared to the original MDR.
- 2) Offsite Basin 2 (OS2) corresponds to Basin C of the approved MDR and consists of 34.6 acres. This basin contributes 28.85 and 114.28 cfs in the minor and major storm events. The Murphy Creek East Filing 3 PDR is proposing that existing Pond D be abandoned and EURV Pond C be expanded. The PDR states that the tributary area for Pond C will be 92.41 acres with a composite percent impervious of 31%. Pond C will have a release rate of 0.9 cfs in the minor storm event, and 153.2 cfs in the major storm event.

### **Major Drainageways**

The site lies within the Sand Creek Drainage Basin, which is the ultimate outfall for the site. Murphy Creek is the major drainageway through the site with several major tributaries to Murphy Creek that also flow through the site. These tributaries include: East Murphy Creek Tributary, Gun Club Tributary, Alexandra Gulch, and Harvest Gulch. The FEMA map, included in Appendix C, shows the site lies within Zone X, which is described as an area with minimal flood hazard.

### **2. Drainage Patterns Through Property**

South Flatrock Trail is currently overlaid graded for the future corridor, with all existing flows ultimately being discharged into the Murphy Creek Floodplain (FEMA FIRM 08005C0212K 12/17/2010). These flows are conveyed and treated via temporary swale (Murphy Creek East Filing No. 1 Offsite ISP, 1506588), existing Private Water Quality Pond C (Murphy Creek East MDR), and existing F7-C Pond (Murphy Creek East Filing No. 1 Offsite ISP, 1506588).

### **3. Outfalls Downstream from Property**

There are no new water quality ponds associated with this project. All flows from the site will be treated in the existing Water Quality Pond C which is to be improved per the Murphy Creek East Filing 3 PDR or routed via an existing temporary swale to the existing F7-C Pond from Murphy Creek East Filing No. 1 Offsite Infrastructure Site Plan (210121).

## **C. DESIGN CRITERIA**

### **1. References**

#### **Existing Drainage Reports**

A Final Drainage Study & Water Quality Control Design for Murphy Creek Subdivision Filing No. 7 (Reference 6, 2003) (C.O.A. approval 202195) prepared by Costin Engineering consultants, Inc. has been previously approved on January 2, 2004. This report also references two other adjacent drainage reports, Final Drainage Study, Murphy Creek filing No. 8 (C.O.A. approval 205203) and Preliminary Drainage Study for Murphy Creek Filing No. 9 (C.O.A. approval 201170) both prepared by Peak Civil Engineering Co.

#### **Mile High Flood District Criteria**

The water quality ponds were sized using the Mile High Flood District (MHFD) UD-Detention spreadsheet found in Appendix B for WQ and EURV detention.

#### **City Master Plan and Floodplain Studies**

- A. Master Drainage Plan for Murphy Creek, a Planned Community was completed by Costin Engineering Consultants, Inc. (Reference 1, 1998) (C.O.A. approval 980080).
- B. 2008 Murphy Creek OSP
- C. Murphy Creek East (Harvest Ridge) Subdivision Filing No. 1, 2, 3, & 4 Master Drainage Report (Also referenced as Murphy Creek East MDR) (Approved)
- D. Murphy Creek Fluvial Hazard Zone Mapping Report, dated January 2021

### **2. Hydrologic Criteria**

#### **Rainfall Source**

The rainfall data that was used for this report was taken from NOAA Atlas 14 Rainfall Data which is included in Appendix D and presented in the table below.

2-YR	5-YR	10-YR	50-YR	100-YR
0.86	1.14	1.40	2.12	2.47

### **Calculation Method**

The rational method was used for this Drainage Report.

### **Water Quality Capture Volume Computation Method**

The volumes for the water quality ponds were calculated based on MHFD's criteria.

### **Design Frequencies**

A 2-year design frequency was used for the minor storm and a 100-year design frequency was used for the major storm.

## **3. Hydraulic Criteria**

The City of Aurora Storm Drainage Design & Technical Criteria was used in conjunction with the MHFD Urban Storm Drainage Criteria Manual. The 2-year and 100-year events were used to size the water quality ponds. These ponds have been sized to capture and treat 1.2 \* WQCV and the EURV and it will not be required to detain the 100-year detention volume. Calculations for sizing can be found in Appendix E. It should be noted that storm sewer infrastructure including pipes and inlets will be sized and model as part of the Final Drainage Report and are not included with the preliminary report. The design storm for the storm drains is the 100-year storm event.

City of Aurora allowable pavement encroachment and depth of flow design criteria in the SDDTC Manual are to be met (Section 3.32). The depth of flow in streets is not to overtop curb for the minor storm and the maximum depth of water over the gutter flowline shall not exceed 12" for the major storm event. Street and cross plan flow depth calculations are to be included in the Final Drainage Report.

City of Aurora pond design criteria in the SDDTC Manual are to be met including Section 6.32 for freeboard requirements. The minimum freeboard for open space detention facilities is 1.0' above the computed 100-year water surface elevation. The emergency overflow weir sill shall be set at the freeboard elevation. The pond embankment will be constructed a minimum of 1.0' above the maximum overflow depth for the emergency overflow for the 100-year developed overflow conditions as required by the MFHD criteria.

## **D. DRAINAGE PLAN**

### **1. General Concept**

Offsite drainage basins will be conveyed through the site via existing storm infrastructure. Per the Murphy Creek East Filing 3 PDR, all flows from Basins OS1 and OS2 will be collected and treated at Water Quality Pond C. Flows are then routed south and west via existing storm infrastructure under the proposed S. Flatrock Trail. Flows are then routed west to discharge into Murphy Creek via an existing grouted boulder outfall. Offsite basin OS2 is collected by the existing private water quality Pond C constructed with The Murphy Creek East MDR (). After treatment, flows are collected at the outlet structure at DP-2 and routed west under the proposed S. Flatrock Trail to be discharged into Murphy Creek via the existing storm sewer and existing grouted boulder outfall. There

The water quality ponds, outlet structures, and associated on-site drainage facilities will be the responsibility of the homeowner's association that will be created with the development of this site.

## **2. Specific Details**

SDDTCM Section 2.32.D.2 subsections b, f, g, h, i, j, and k do not apply to this drainage plan, as the storm infrastructure discussed in this report is existing, the site is currently overlot graded, and off-site runoff is captured by the surrounding developments.

### **Basin A1**

Basin A1 is 1.20 acres primarily consisting of roadway drainage. Stormwater runoff from Basin A1 is collected in the roadway where it is conveyed via curb and gutter to be collected by an existing 10' CDOT Type R sump inlet (DP-A1), it is then conveyed southwest via existing storm infrastructure constructed as a part of the Murphy Creek Filing No. 7 (*EDN 223038*) development. Runoff is then discharged to existing Pond F7-C and ultimately discharged into Murphy Creek. Flows from Basin A1 amount to 3.16 cfs during the minor event and 9.20 cfs during the major event. Emergency overflow is conveyed southwest via the curb and gutter constructed as a part of Murphy Creek Filing No. 7 to an existing 15' Type R sump inlet located in S. Eaton Pkwy.

### **Basin A2**

Basin A2 is 0.80 acres primarily consisting of roadway drainage. Stormwater runoff from Basin A2 is collected in the roadway where it is conveyed via curb and gutter to collected by an existing CDOT 15' Type R sump inlet (DP-A2), it is then conveyed southwest via existing storm infrastructure constructed as a part of the Murphy Creek Filing No. 7 (*EDN 223038*) development. Runoff is then discharged to existing Pond F7-C and ultimately discharged into Murphy Creek. Flows from Basin A2 amount to 2.08 cfs during the minor event and 6.07 cfs during the major event. Emergency overflow is conveyed northeast via curb and gutter to the existing 5' Type R sump inlet constructed as a part Murphy Creek East Filing No. 1 (*EDN 221063*).

### **Basin B1**

Basin B1 is 1.00 acres primarily consisting of roadway drainage. Stormwater runoff from Basin B1 is collected in the roadway where it is conveyed via curb and gutter to collected by an existing CDOT 10' Type R sump inlet (DP-B1), it is then routed east under S. Flatrock Trail to be collected at the existing private EURV Pond C. It is then released via outlet structure to be conveyed west and south under S. Flatrock Trail via existing storm infrastructure to discharge into Murphy Creek. Flows from Basin B1 amount to 2.60 cfs during the minor event and 7.58 cfs during the major event. Emergency overflow overtops the curb and gutter to flow directly to the outfall location of EURV Pond C and Murphy Creek.

### **Basin B2**

Basin B2 is 1.00 acres primarily consisting of roadway drainage. Stormwater runoff from Basin B2 is collected in the roadway where it is conveyed via curb and gutter to collected by an existing CDOT 15' Type R sump inlet (DP-B2), it is then routed east to be collected at the existing private EURV Pond C. It is then released via outlet structure to be conveyed west and south under S. Flatrock Trail to discharge into Murphy Creek. Flows from Basin B2 amount to 2.60 cfs during the minor event and 7.58 cfs during the major event. Emergency overflow overtops the curb and gutter to flow directly into EURV Pond C.

## **E. CONCLUSIONS**

### **1. Compliance with Standards**

This Drainage Report and associated Site Plan are in conformance with the City of Aurora Storm Drainage Criteria and the MHFD Urban Storm Drainage Criteria Manuals.

## **2. Summary of Concepts**

There are two existing water quality ponds, Ponds C and F7-C, that are to be utilized by this project. All of the storm infrastructure is existing or proposed by others.

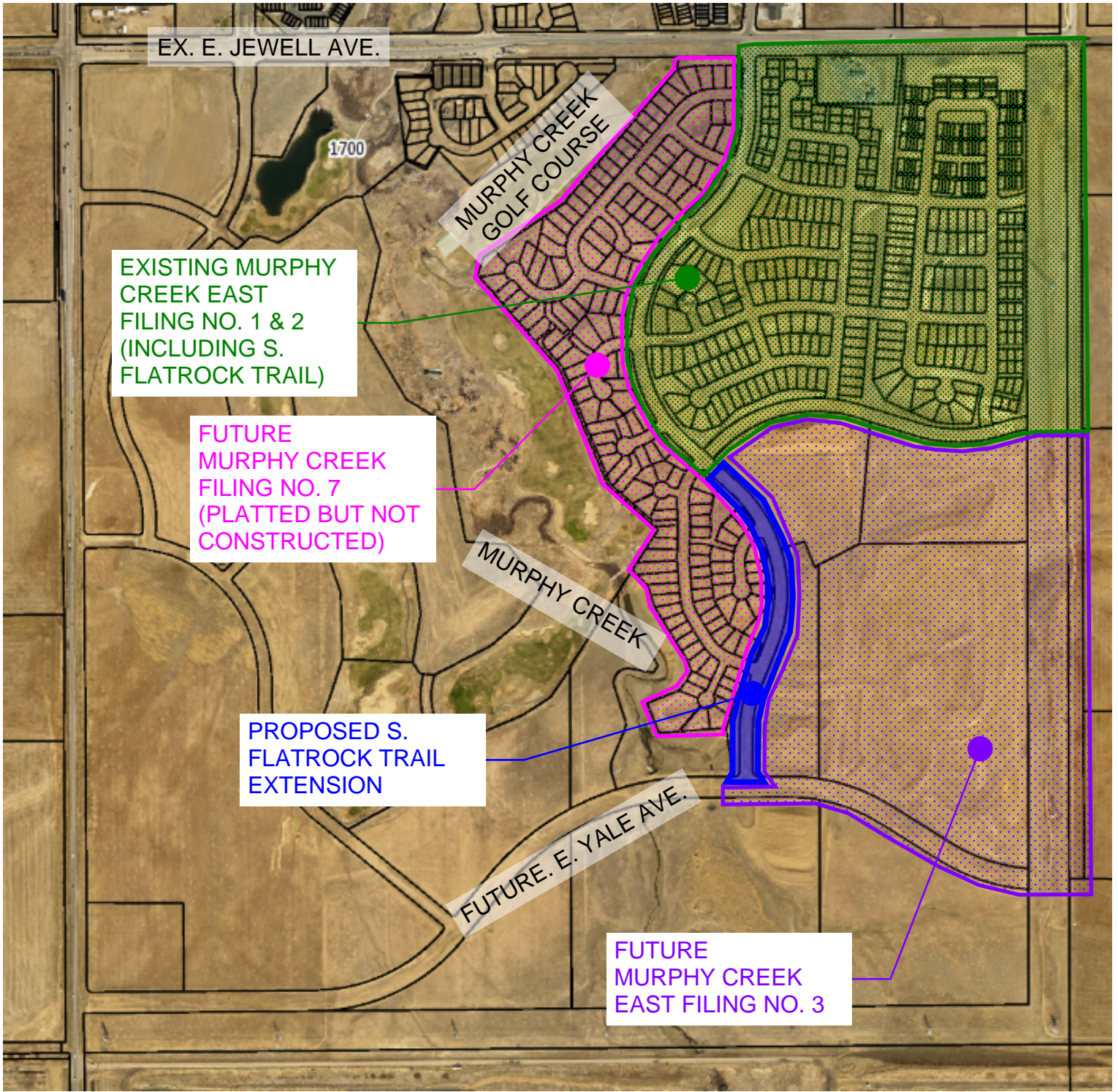
Storm water will be collected by existing inlets and will flow overland to be collected in water quality ponds. Pond D will release attenuated flows through previously constructed storm sewer into Murphy Creek and Pond C will release attenuated flows directly into Murphy Creek. The proposed drainage patterns follow those proposed in the Master Drainage Plan for Murphy Creek, a Planned Community (Reference 1, 1998) and the Murphy Creek East MDR.

## **F. REFERENCES**

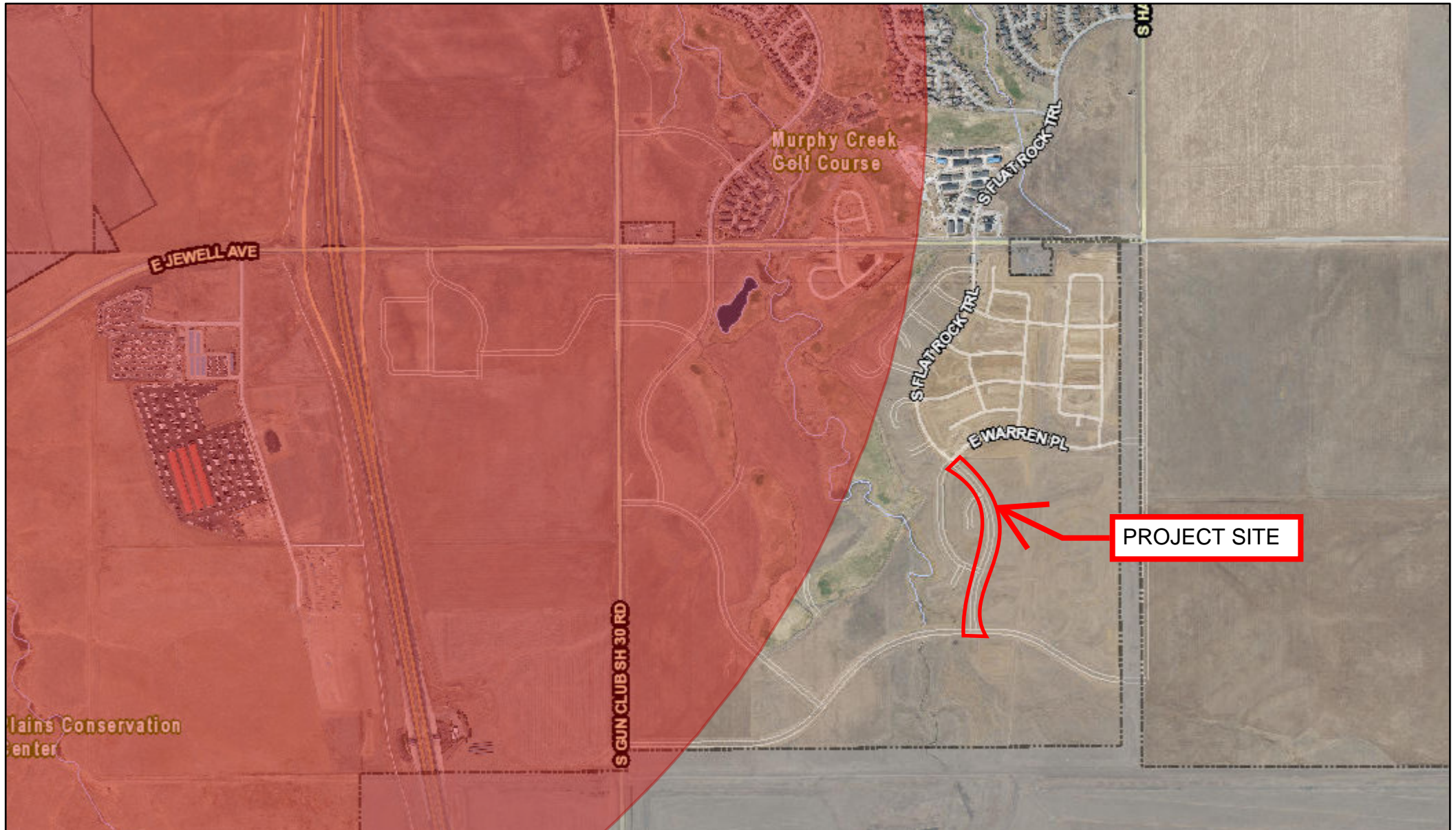
1. Master Drainage Plan for Murphy Creek, a Planned Community, Costin Engineering Consultants, Inc., last revised February 1998. (COA # 980080).
2. Flood Insurance Rate Map, City of Aurora Colorado, Federal Emergency Management Agency Panel No. 08005C0212K, last revised December 17, 2010.
3. Web Soil Survey, Natural Resource Conservation Service. [websoilsurvey.nrcs.usda.gov](http://websoilsurvey.nrcs.usda.gov)
4. City of Aurora Storm Drainage Design & Technical Criteria, City of Aurora, dated October 11<sup>th</sup>, 2010.
5. Mile High Flood District Urban Storm Drainage Criteria Manuals, Mile High Flood District, Vol. 1 Revised August 2018, Vol. 2 Revised September 2017, Vol. 3 Dated November 2010.
6. Murphy Creek Proposed Amendment to the General Development Plan, Costin Engineering Consultants, Inc., dated October 25, 1999.
7. Murphy Creek Filing 9 (COA EDN 205204)
8. Murphy Creek Filing 8 (COA EDN 205203)
9. Murphy Creek Golf Course Plans (COA EDN 980087)
10. Murphy Creek East (Harvest Ridge) Subdivision Filing No. 1, 2, 3, & 4 Master Drainage Report (Also referenced as Murphy Creek East MDR) (220220, Approved)
11. Murphy Creek East (Harvest Ridge) Subdivision Filing No. 1 & 2 Preliminary Drainage Report (Also referenced as Murphy Creek East PDR) (221062, Approved)
12. Murphy Creek Filing #7 (COA EDN 202195)
13. Murphy Creek Subdivision Filing #7 (COA EDN 20003064)
14. Murphy Creek East Filing No. 1 Offsite Infrastructure Site Plan (210121, Currently Under Review)
15. Murphy Creek East Filing No. 1 Civil Plans (EDN 221063, Currently Under Review)
16. Murphy Creek Fluvial Hazard Zone Mapping, January 2021
17. Murphy Creek East (Harvest Ridge) Subdivision Filing No. 1 & 2 Final Drainage Report, (Murphy Creek East FDR), currently under review, EDN 221063
18. Murphy Creek East Filing 3 Preliminary Drainage Report, (Murphy Creek East Filing 3 PDR), Redland, dated May 6<sup>th</sup> 2022, currently under review



## **APPENDIX A – Vicinity Map**

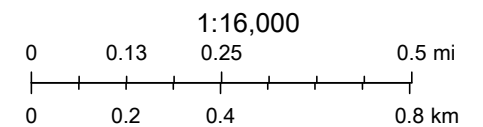


# AIRPORT BOUNDARY BUFFER MAP



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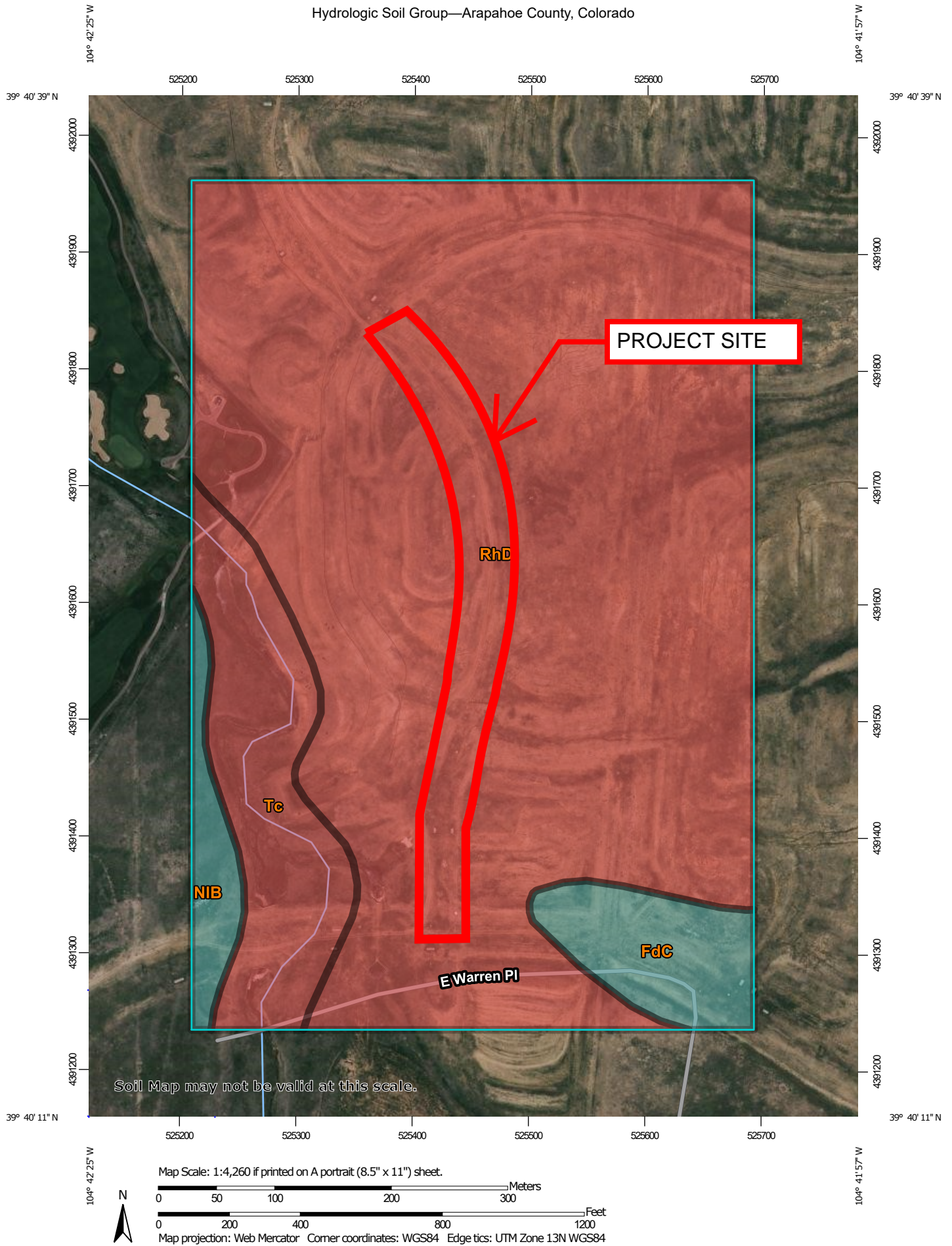
 Regional Airport Detention Pond Buffers






## **APPENDIX B – Soil Survey**









Hydrologic Soil Group—Arapahoe County, Colorado



**MAP LEGEND****Area of Interest (AOI)**
 Area of Interest (AOI)
**Soils****Soil Rating Polygons**





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


**Soil Rating Lines**






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


**Soil Rating Points**

-  A
-  A/D
-  B
-  B/D

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

**Water Features**
 Streams and Canals
**Transportation**

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

**Background**
 Aerial Photography
**MAP INFORMATION**

The soil surveys that comprise your AOI were mapped at 1:20,000.

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: Arapahoe County, Colorado  
Survey Area Data: Version 18, Sep 1, 2022

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

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

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

## Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
FdC	Fondis silt loam, 3 to 5 percent slopes	C	4.3	4.9%
NIB	Nunn loam, 1 to 3 percent slopes	C	2.3	2.7%
RhD	Renohill-Buick loams, 3 to 9 percent slopes	D	71.6	82.1%
Tc	Terrace escarpments	D	9.1	10.4%
<b>Totals for Area of Interest</b>			<b>87.2</b>	<b>100.0%</b>

## Description

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

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

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

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

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

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

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

## Rating Options

*Aggregation Method:* Dominant Condition

*Component Percent Cutoff:* None Specified

*Tie-break Rule:* Higher



## **APPENDIX C – FEMA Flood Insurance Rate Map**

NOTES TO USERS

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

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

**Coastal Base Flood Elevations** shown on this map apply only to landward of the North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Silvatelev Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Silvatelev Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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

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

The projection used in the preparation of this map was Universal Transverse Mercator (UTM) zone 18. The horizontal datum was NAD83 (GRS80) spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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

NGS Information Services  
NGA-1 NGS12  
National Geodetic Survey  
SSMC-1 80022  
1315 East West Highway  
Silver Spring, MD 20910-2282

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

**Base map** information shown on this FIRM was provided by the Arapahoe County and Cities of Aurora and Littleton GIS departments. The coordinate system used for production of the digital FIRM is Universal Transverse Mercator, Zone 18N, referenced to the North American Datum of 1983 and the GRS 80 spheroid, Western Hemisphere.

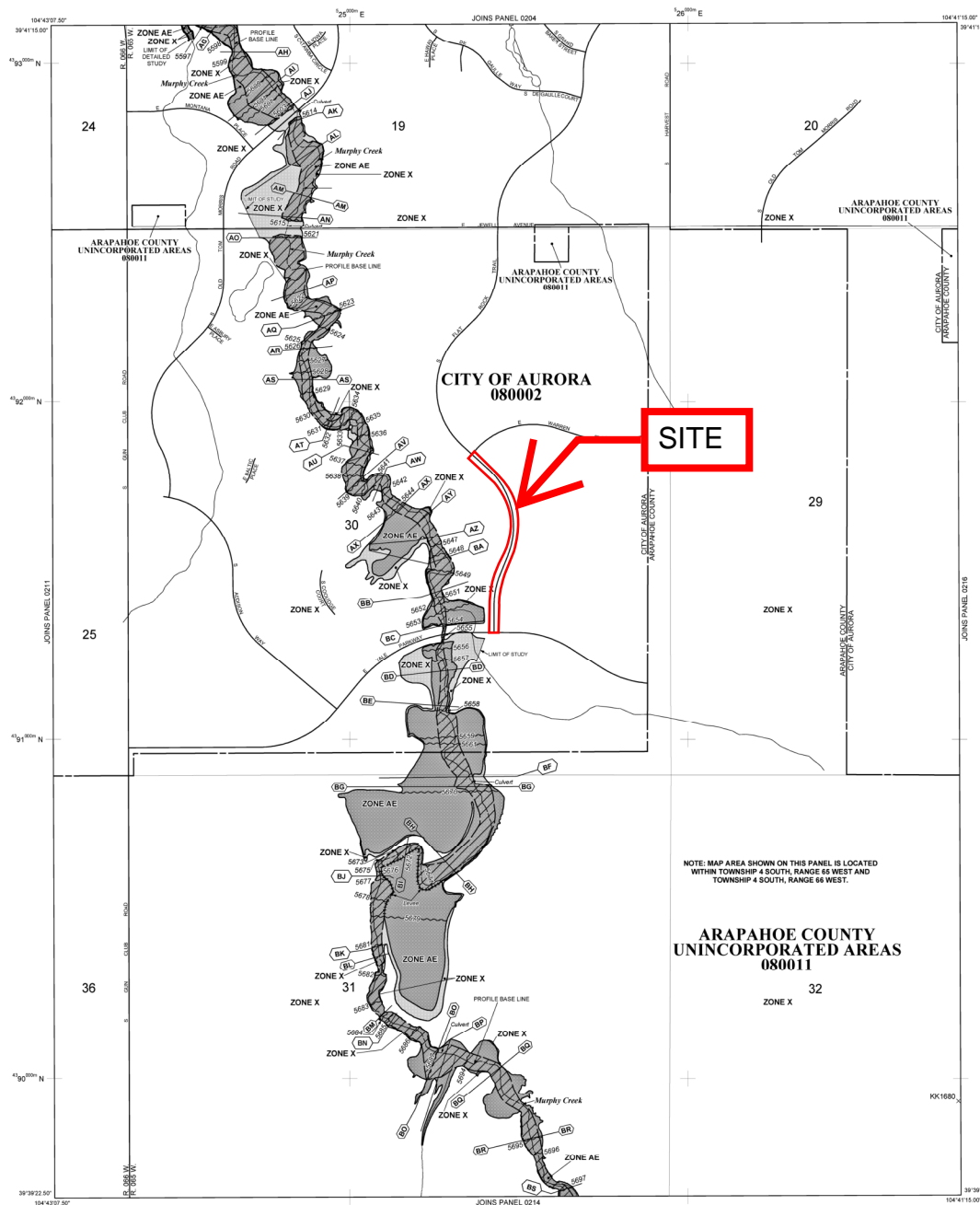
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

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

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

Contact the **FEMA Map Service Center** at 1-800-358-9610 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9600 and its website at <http://www.msc.fema.gov>.

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



**LEGEND**

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

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Areas (SFHAs) are shown on this map. The SFHAs are defined by the Flood Insurance Study (FIS) report for this jurisdiction. The SFHAs are defined by the Flood Insurance Study (FIS) report for this jurisdiction. The SFHAs are defined by the Flood Insurance Study (FIS) report for this jurisdiction.

**NO BASE FLOOD ELEVATIONS DETERMINED:**

**ZONE A**  
Zone A flood elevations determined.

**ZONE AE**  
Zone AE flood elevations determined.

**ZONE AH**  
Zone AH flood depths of 1 to 3 feet (usually sheet flow on sloping terrain) are shown. Flood depths are shown. Flood depths are shown.

**ZONE AO**  
Zone AO flood depths of 1 to 3 feet (usually sheet flow on sloping terrain) are shown. Flood depths are shown. Flood depths are shown.

**ZONE AR**  
Zone AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently identified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

**ZONE ARH**  
Zone ARH Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no base flood elevations determined.

**ZONE V**  
Zone V Coastal flood zone with velocity hazard (wave action); no base flood elevations determined.

**ZONE VE**  
Zone VE Coastal flood zone with velocity hazard (wave action); base flood elevations determined.

**FLOODWAY AREAS IN ZONE AE**

**OTHER FLOOD AREAS**

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

**OTHER AREAS**

**ZONE X**  
Zone X Areas determined to be outside the 0.2% annual chance floodplain.

**ZONE D**  
Zone D Areas in which flood hazards are undetermined, but possible.

**COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS**

**OTHERWISE PROTECTED AREAS (OPAs)**

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

**Map Symbols:**

- Floodplain boundary
- Floodway boundary
- Zone boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different base flood elevations
- Base Flood Elevation line and value, elevation in feet
- Base Flood Elevation value where uniform within zone, elevation in feet
- Reference to the North American Vertical Datum of 1988 (NAVD 88)
- Cross section line
- Traverse line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 100-year Universal Transverse Mercator grid lines, zone 18
- 500-foot grid lines, New York State Plane coordinate system, east zone (NAD 83)
- Transverse Mercator
- Bench mark (see explanation in Notes to Users section of this FIRM panel)
- River Mile
- MAP REPOSITORIES
- Refer to Map Repository list on Map Index
- EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
- EFFECTIVE DATE OF REVISIONS TO THIS PANEL
- December 17, 2010 - to update map format, to change Special Flood Hazard Areas, and to change base flood elevations

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

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-358-9600.

**MAP SCALE 1" = 600'**

250 500 1000 FEET

150 0 150 300 METERS

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 4 SOUTH, RANGE 66 WEST AND TOWNSHIP 4 SOUTH, RANGE 66 WEST.

**ARAPAHOE COUNTY UNINCORPORATED AREAS 080011**

**NFIP PANEL 021K**

**FIRM FLOOD INSURANCE RATE MAP ARAPAHOE COUNTY, COLORADO AND INCORPORATED AREAS**

**PANEL 212 OF 725**  
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

**CONTAINS:**

COMMUNITY	NUMBER	PANEL	SUFFIX
ARAPAHOE COUNTY	080011	0212	K
AURORA, CITY OF	080022	0212	K

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

**MAP NUMBER 08005C0212K**

**MAP REVISED DECEMBER 17, 2010**

**Federal Emergency Management Agency**



## **APPENDIX D – Hydrological Calculations**



**NOAA Atlas 14, Volume 8, Version 2**  
**Location name: Aurora, Colorado, USA\***  
**Latitude: 39.6705°, Longitude: -104.7018°**  
**Elevation: m/ft\*\***  
 \* source: ESRI Maps  
 \*\* source: USGS



### POINT PRECIPITATION FREQUENCY ESTIMATES

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

NOAA, National Weather Service, Silver Spring, Maryland

[PF\\_tabular](#) | [PF\\_graphical](#) | [Maps & aeriels](#)

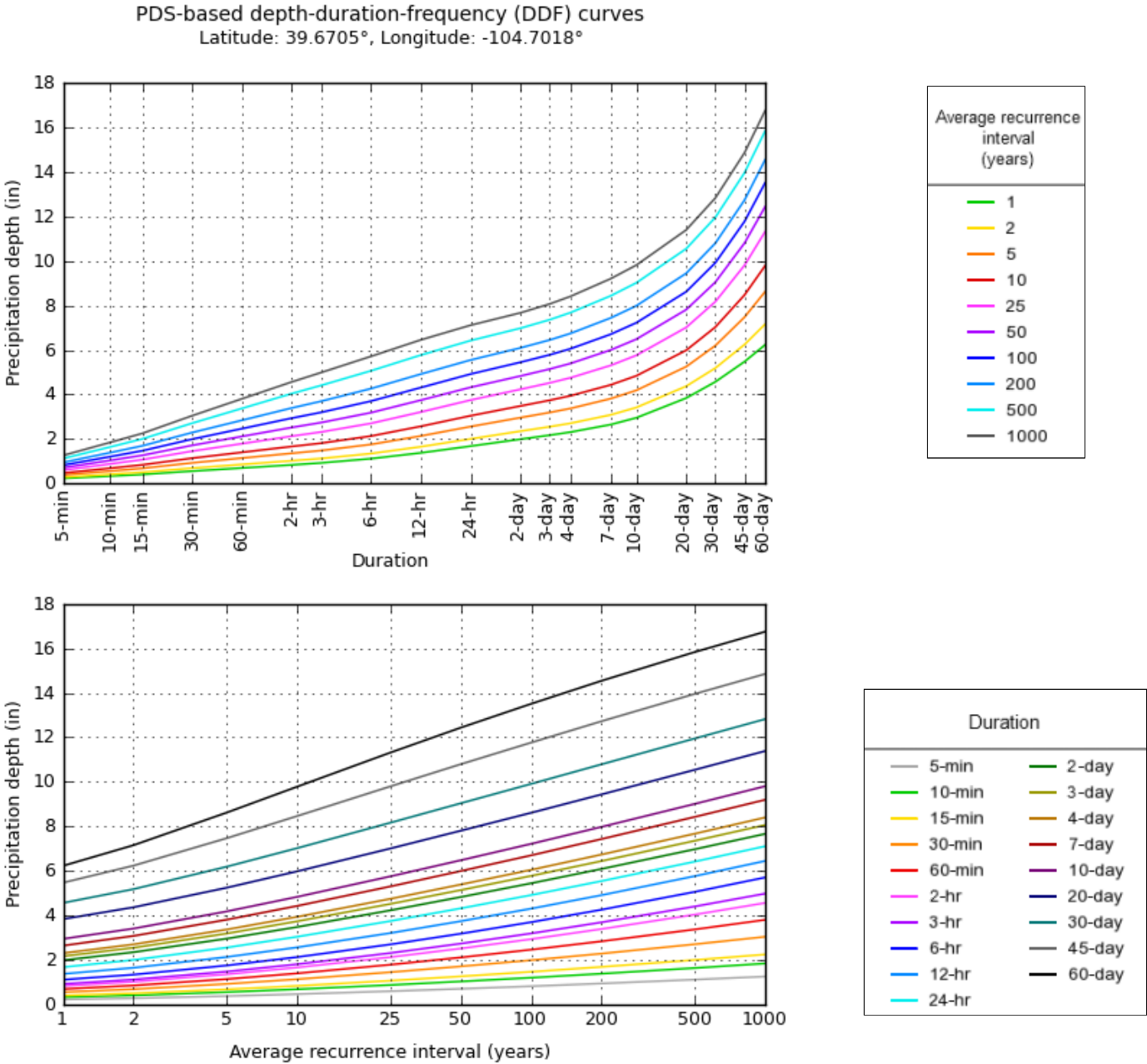
### PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) <sup>1</sup>										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.229 (0.185-0.284)	0.284 (0.230-0.353)	0.382 (0.308-0.476)	0.470 (0.377-0.588)	0.601 (0.469-0.786)	0.709 (0.538-0.936)	0.824 (0.603-1.11)	0.948 (0.664-1.31)	1.12 (0.755-1.59)	1.26 (0.823-1.80)
10-min	0.335 (0.271-0.416)	0.416 (0.337-0.517)	0.560 (0.451-0.697)	0.689 (0.552-0.861)	0.880 (0.686-1.15)	1.04 (0.788-1.37)	1.21 (0.883-1.63)	1.39 (0.973-1.92)	1.64 (1.11-2.32)	1.85 (1.21-2.63)
15-min	0.408 (0.331-0.507)	0.508 (0.411-0.631)	0.683 (0.550-0.851)	0.840 (0.673-1.05)	1.07 (0.837-1.40)	1.27 (0.961-1.67)	1.47 (1.08-1.99)	1.69 (1.19-2.34)	2.00 (1.35-2.83)	2.25 (1.47-3.21)
30-min	0.558 (0.452-0.693)	0.692 (0.560-0.860)	0.928 (0.748-1.16)	1.14 (0.913-1.43)	1.45 (1.13-1.90)	1.72 (1.30-2.26)	1.99 (1.46-2.69)	2.29 (1.61-3.16)	2.71 (1.82-3.84)	3.05 (1.99-4.34)
60-min	0.698 (0.565-0.867)	0.858 (0.694-1.07)	1.14 (0.922-1.42)	1.40 (1.12-1.75)	1.79 (1.40-2.35)	2.12 (1.61-2.80)	2.47 (1.81-3.33)	2.84 (1.99-3.93)	3.38 (2.27-4.78)	3.81 (2.48-5.43)
2-hr	0.838 (0.683-1.03)	1.02 (0.834-1.26)	1.36 (1.10-1.68)	1.67 (1.34-2.07)	2.13 (1.68-2.77)	2.52 (1.93-3.31)	2.94 (2.17-3.94)	3.39 (2.40-4.66)	4.04 (2.74-5.68)	4.57 (3.00-6.45)
3-hr	0.926 (0.757-1.14)	1.12 (0.918-1.38)	1.48 (1.21-1.82)	1.81 (1.47-2.24)	2.31 (1.83-3.00)	2.74 (2.11-3.58)	3.20 (2.37-4.27)	3.70 (2.63-5.05)	4.41 (3.01-6.16)	4.98 (3.29-7.01)
6-hr	1.12 (0.919-1.36)	1.35 (1.11-1.64)	1.76 (1.44-2.14)	2.13 (1.74-2.61)	2.70 (2.15-3.47)	3.18 (2.46-4.12)	3.70 (2.76-4.90)	4.26 (3.05-5.77)	5.06 (3.48-7.02)	5.71 (3.80-7.96)
12-hr	1.38 (1.14-1.66)	1.65 (1.37-2.00)	2.14 (1.76-2.59)	2.57 (2.10-3.13)	3.21 (2.56-4.08)	3.74 (2.91-4.79)	4.31 (3.24-5.64)	4.92 (3.54-6.58)	5.77 (3.99-7.91)	6.45 (4.33-8.91)
24-hr	1.68 (1.40-2.01)	2.00 (1.67-2.40)	2.56 (2.12-3.08)	3.05 (2.51-3.68)	3.75 (3.00-4.70)	4.32 (3.38-5.47)	4.92 (3.71-6.36)	5.55 (4.02-7.34)	6.42 (4.47-8.70)	7.11 (4.81-9.73)
2-day	1.99 (1.67-2.37)	2.35 (1.97-2.80)	2.96 (2.47-3.53)	3.48 (2.89-4.17)	4.23 (3.41-5.24)	4.83 (3.79-6.05)	5.45 (4.14-6.97)	6.09 (4.44-7.98)	6.98 (4.89-9.35)	7.67 (5.23-10.4)
3-day	2.17 (1.83-2.57)	2.55 (2.14-3.02)	3.19 (2.67-3.79)	3.74 (3.11-4.46)	4.52 (3.65-5.56)	5.14 (4.05-6.40)	5.78 (4.41-7.35)	6.45 (4.72-8.39)	7.36 (5.18-9.81)	8.07 (5.53-10.9)
4-day	2.31 (1.95-2.73)	2.71 (2.28-3.20)	3.37 (2.83-3.99)	3.94 (3.29-4.68)	4.75 (3.84-5.82)	5.39 (4.26-6.69)	6.05 (4.63-7.66)	6.74 (4.95-8.74)	7.67 (5.42-10.2)	8.40 (5.78-11.3)
7-day	2.65 (2.24-3.11)	3.08 (2.61-3.62)	3.81 (3.22-4.49)	4.43 (3.72-5.23)	5.30 (4.32-6.45)	6.00 (4.77-7.38)	6.70 (5.16-8.42)	7.44 (5.49-9.56)	8.43 (5.99-11.1)	9.20 (6.37-12.3)
10-day	2.95 (2.51-3.45)	3.41 (2.90-3.99)	4.18 (3.54-4.90)	4.84 (4.07-5.69)	5.76 (4.70-6.97)	6.48 (5.17-7.94)	7.22 (5.57-9.03)	7.98 (5.92-10.2)	9.01 (6.44-11.8)	9.81 (6.83-13.0)
20-day	3.84 (3.28-4.45)	4.37 (3.74-5.07)	5.25 (4.47-6.10)	5.98 (5.07-6.98)	7.01 (5.75-8.39)	7.81 (6.27-9.46)	8.61 (6.70-10.7)	9.44 (7.05-12.0)	10.5 (7.59-13.7)	11.4 (7.99-15.0)
30-day	4.57 (3.92-5.27)	5.18 (4.45-5.99)	6.19 (5.30-7.17)	7.02 (5.98-8.16)	8.16 (6.72-9.71)	9.04 (7.28-10.9)	9.91 (7.73-12.2)	10.8 (8.09-13.6)	11.9 (8.63-15.4)	12.8 (9.05-16.8)
45-day	5.47 (4.72-6.29)	6.24 (5.38-7.17)	7.47 (6.41-8.60)	8.47 (7.23-9.79)	9.80 (8.08-11.6)	10.8 (8.72-12.9)	11.8 (9.20-14.3)	12.7 (9.57-15.9)	14.0 (10.1-17.8)	14.9 (10.5-19.3)
60-day	6.23 (5.39-7.13)	7.16 (6.18-8.20)	8.62 (7.42-9.90)	9.78 (8.38-11.3)	11.3 (9.34-13.3)	12.4 (10.1-14.8)	13.5 (10.6-16.4)	14.5 (11.0-18.0)	15.8 (11.5-20.1)	16.7 (11.9-21.7)

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).  
 Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.  
 Please refer to NOAA Atlas 14 document for more information.

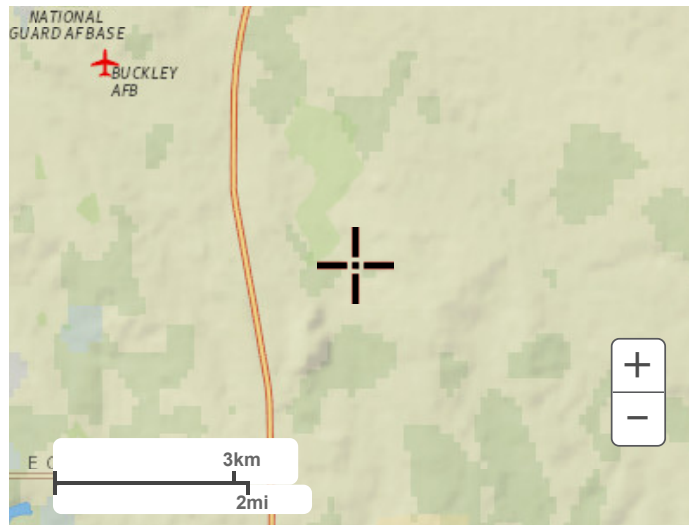
[Back to Top](#)

### PF graphical



**Maps & aerials**

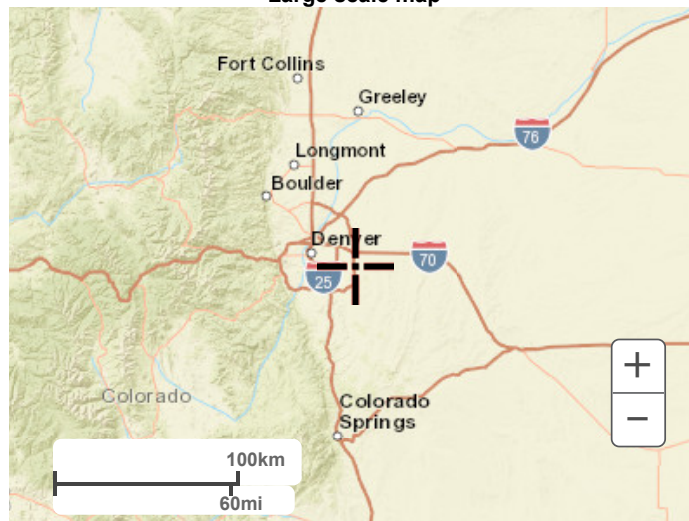
**Small scale terrain**



Large scale terrain



Large scale map



Large scale aerial

**TABLE 1**  
**RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS**

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
<u>Business:</u>					
Commercial Areas	95	.87	.87	.88	.89
Neighborhood Areas	85	.60	.65	.70	.80
<u>Residential:</u>					
Single-Family (**)	(*)	.40	.45	.50	.60
Multi-Unit (detached)	60	.45	.50	.60	.70
Multi-Unit (attached)	75	.60	.65	.70	.80
1/2 Acre Lot or Larger	(*)	.30	.35	.40	.60
Apartments	80	.65	.70	.70	.80
<u>Industrial:</u>					
Light Areas	80	.71	.72	.76	.82
Heavy Areas	90	.80	.80	.85	.90
<u>Parks, Cemeteries</u>	5	.10	.10	.35	.60
<u>Playgrounds</u>	10	.15	.25	.35	.65
<u>Schools</u>	50	.45	.50	.60	.70
<u>Railroad Yard Areas</u>	15	.40	.45	.50	.60
<u>Undeveloped Areas:</u>					
Historic Flow Analysis, Greenbelts, Agricultural	2	(See "Lawns")			
Off-Site Flow Analysis (when land use not defined)	45	.43	.47	.55	.65

**TABLE 1** (continued)

**RUNOFF COEFFICIENTS AND PERCENTS IMPERVIOUS**

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY			
		2	5	10	100
<u>Streets:</u>					
Paved	100	.87	.88	.90	.93
Gravel	40	.15	.25	.35	.65
<u>Concrete Drive and Walks</u>	96	.87	.87	.88	.89
<u>Roofs</u>	90	.80	.85	.90	.90
<u>Lawns, Sandy Soil (A and B Soils):</u>	2				
2% Slope		.05	.06	.08	.10
2-7% Slope		.10	.11	.13	.15
>7% Slope		.15	.16	.18	.20
<u>Lawns, Clay Soil (C and D Soils):</u>	5				
2% Slope		.13	.14	.15	.17
2-7% Slope		.18	.19	.20	.22
>7% Slope		.25	.27	.30	.35

NOTE:       These Rational Formula coefficients may not be valid for large basins

(\*)See Figures RO-3 through RO-5 of USDCM Volume 1 for percent impervious.

(\*\*)Up to 5 units per acre. Single-family with more than 5 units per acre, use values for multi-unit/detached

PROJECT INFORMATION

Project Name: S. Flatrock Trail Extension

Project Number: 21003852

Submittal: PDR

Calculated By: EAP

Calculated By Date: 5/12/2023

Checked By: RDL

Checked By Date: May-23

2 Year 1-Hour Point Depth (in) 0.86

5 Year 1-Hour Point Depth (in) 1.14

10 Year 1-Hour Point Depth (in) 1.40

25 Year 1-Hour Point Depth (in) 1.79

50 Year 1-Hour Point Depth (in) 2.12

100 Year 1-Hour Point Depth (in) 2.47

Rainfall Data Source NOAA Atlas 14

Soil Type (A,B,C,D) D

COMPOSITE C-FACTOR & WEIGHTED PERCENT IMPERVIOUSNESS ANALYSIS  
HISTORIC CONDITIONS

Project Name: S. Flatrock Trail Extension  
Project Number: 21003852  
Submittal: PDR

Date: 5/12/2023      Calculated By: EAP  
Date: 5/12/2023      Checked By: RDL

Table 1: Runoff Coefficients and Percent Impervious"

	I (%)	C2	C5	C10	C25	C50	C100
Paved Streets	100%	0.87	0.88	0.90	0.91	0.92	0.93
Roofs	90%	0.80	0.85	0.90	0.90	0.90	0.90
Concrete Drive & Walks	96%	0.87	0.87	0.88	0.88	0.89	0.89
Ponds	100%	0.87	0.88	0.90	0.91	0.92	0.93
Lawns (C and D Soils)	5%	0.18	0.19	0.20	0.20	0.21	0.22

BASIN	DESIGN POINT	Total Area  (AC)	Urban  (Y/N)	Paved Streets  (AC)	Roofs  (AC)	Concrete Drive & Walks  (AC)	Ponds  (AC)	Lawns (C and D Soils)  (AC)	Area Check  (AC)	Comp. i (%)  i	Comp. C2	Comp. C5	Comp. C10	Comp. C25	Comp. C50	Comp. C100
A1	A1	1.03	Y					1.03	Ok	5.0%	0.18	0.19	0.20	0.20	0.21	0.22
A2	A2	0.76	Y					0.76	Ok	5.0%	0.18	0.19	0.20	0.20	0.21	0.22
B1	B1	1.00	Y					1.00	Ok	5.0%	0.18	0.19	0.20	0.20	0.21	0.22
B2	B2	1.00	Y					1.00	Ok	5.0%	0.18	0.19	0.20	0.20	0.21	0.22
OS1	1	61.67	Y					61.67	Ok	5.0%	0.18	0.19	0.20	0.20	0.21	0.22
OS2	2	38.21	Y					38.21	Ok	5.0%	0.18	0.19	0.20	0.20	0.21	0.22

STANDARD FORM SF-2  
TIME OF CONCENTRATION  
HISTORIC CONDITION

Project Name: S. Flatrock Trail Extension  
Project Number: 21003852  
Submittal: PDR

Date: 5/12/2023      Calculated By: EAP  
Date: 5/12/2023      Checked By: RDL

SUB-BASIN DATA				INITIAL/OVERLAND TIME (Ti)			CHANNELIZED TRAVEL TIME (Tt)					MINIMUM Tc IN URBAN AREAS Tc CHECK (Urbanized Basins)			FINAL Tc	REMARKS
DESIG:	AREA (acres)	C <sub>5</sub>	i (%)	LENGTH (ft)	AVG. SLOPE (%)	Ti (min)	Convey Factor (8)	LENGTH (ft)	AVG. SLOPE (%)	VEL (fps)	Tt (min)	COMP Tc (13)	TOTAL LENGTH (ft) (14)	Tc CHECK (min) (15)	Tc (min) (16)	
A1	1.03	0.19	5%	22	2.0%	6.1	10	740	2.0%	1.4	8.7	14.9	762	11.7	11.7	
A2	0.76	0.19	5%	22	2.0%	6.1	10	775	2.0%	1.4	9.1	15.3	797	11.7	11.7	
B1	1.00	0.19	5%	22	2.0%	6.1	10	780	2.0%	1.4	9.2	15.3	802	11.7	11.7	
B2	1.00	0.19	5%	22	2.0%	6.1	10	780	2.0%	1.4	9.2	15.3	802	11.7	11.7	
OS1	61.67	0.19	5%	100	2.5%	12.1	10	1,070	2.0%	1.4	12.6	24.8	1,170	11.7	11.7	
OS2	38.21	0.19	5%	300	2.0%	22.6	10	500	2.0%	1.4	5.9	28.5	800	11.7	11.7	

- (1) Basin Description linked to C-Value Sheet

(2) Basin Area linked to C-Value Sheet

(3) Basin C<sub>5</sub> linked to C-Value Sheet

(4) Basin Impervious % linked to C-Value Sheet

(5) Input Basin Initial/Overland Length

(6) Input Basin Initial/Overland Slope

(7) Basin Initial/Overland Time  $[0.395(1.1-C_5) \cdot \sqrt{L}]/(S_0^{0.33})$

(8) Input Conveyance Factor for Tt
- |                                       |  |      |  |
|---------------------------------------|--|------|--|
| Conveyance Factor K From UD Table 6-2 |  | (9)  | Input Length for Tt                        |
| Type of Land Surface                  | Conveyance Coefficient, C <sub>v</sub> | (10) | Input Slope for Tt                         |
| Heavy Meadow                          | 2.5                                    | (11) | Equation 6-4 = $K \cdot \sqrt{S_0}$        |
| Tillage/Field                         | 5                                      | (12) | Equation 6-4 = $L_t / 60 \cdot V_t$        |
| Short Pasture and Lawns               | 7                                      | (13) | (7) + (12)                                 |
| Nearly Bare Ground                    | 10                                     | (14) | (5) + (9)                                  |
| Grassed Waterway                      | 15                                     | (15) | Equation 5.4 = $((L/180)+10)$ , max L=300' |
| Paved Areas                           | 20                                     | (16) | Compares Minimum Tc between (13) and (15)  |

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

Project Name: S. Flatrock Trail Extension  
Project Number: 21003852  
Submittal: PDR

Design Storm: 2 Year

Date: 5/12/2023  
Date: 5/12/2023  
Calculated By: EAP  
Checked By: RDL

DESCRIPTION	DESIGN POINT	DIRECT RUNOFF								TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIG.	AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	I (in/hour)	D Depth (in)	Q (cfs)	Tc (min)	(C A) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in.)	LENGTH (ft)	VELOCITY (fps)	Tt (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	
		A1	1.03	0.18	11.7	0.19	2.18	0.42	0.40													
		A2	0.76	0.18	11.7	0.14	2.18	0.42	0.30													
		B1	1.00	0.18	11.7	0.18	2.18	0.42	0.39													
		B2	1.00	0.18	11.7	0.18	2.18	0.42	0.39													
		OS1	61.67	0.18	11.7	11.10	2.18	0.42	24.20													
		OS2	38.21	0.18	11.7	6.88	2.18	0.42	14.99													

- (1) Basin Description linked to C-Value Sheet

(2) Basin Design Point

(3) Enter the Basin Name from C Value Sheet

(4) Basin Area linked to C-Value Sheet

(5) Composite C linked to C-Value Sheet

(6) Time of Concentration linked to C-Value Sheet
- P1 = 0.858

NOAA Atlas 14

(7) =(4) \* (5)

(8) =28.5\*P/(10+ (6) )^0.786

(9) = (6) \* (8)/60

(10) =(7) \* (8)

(11) =(6) + (21)

(12) Add the Basin Areas (7) to get the combined basin AC
- (13) =28.5\*P/(10+ (10) )^0.786

(14) Sum of Qs

(15) Additonal Street Overland Flow

(16) Additonal Street Overland Flow

(17) Design Pipe Flow

(18) Pipe Slope
- (19) Pipe Size

(20) Length

(21) Velocity From Flowmaster

(22) =(19) / (20) / 60

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

Project Name: S. Flatrock Trail Extension  
Project Number: 21003852  
Submittal: PDR

Design Storm: 100 Year

Date: 5/12/2023  
Date: 5/12/2023  
Calculated By: EAP  
Checked By: RDL

DESCRIPTION	DESIGN POINT	DIRECT RUNOFF								TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIG.	AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	I (in/hour)	D Depth (in)	Q (cfs)	Tc (min)	(C A) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in.)	LENGTH (ft)	VELOCITY (fps)	Tt (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	
		A1	1.03	0.22	11.7	0.23	6.27	1.22	1.42													
		A2	0.76	0.22	11.7	0.17	6.27	1.22	1.05													
		B1	1.00	0.22	11.7	0.22	6.27	1.22	1.38													
		B2	1.00	0.22	11.7	0.22	6.27	1.22	1.38													
		OS1	61.67	0.22	11.7	13.57	6.27	1.22	85.13													
		OS2	38.21	0.22	11.7	8.41	6.27	1.22	52.75													

- (1) Basin Description linked to C-Value Sheet

(2) Basin Design Point

(3) Enter the Basin Name from C Value Sheet

(4) Basin Area linked to C-Value Sheet

(5) Composite C linked to C-Value Sheet

(6) Time of Concentration linked to C-Value Sheet
- P1 = 2.47

NOAA Atlas 14

(7) =(4) \* (5)

(8) =28.5\*P/(10+ (6) )^0.786

(9) = (6) \* (8)/60

(10) =(7) \* (8)

(11) =(6) + (21)

(12) Add the Basin Areas (7) to get the combined basin AC
- (13) =28.5\*P/(10+ (10) )^0.786

(14) Sum of Qs

(15) Additional Street Overland Flow

(16) Additional Street Overland Flow

(17) Design Pipe Flow

(18) Pipe Slope
- (19) Pipe Size

(20) Length

(21) Velocity From Flowmaster

(22) =(19) / (20) / 60

PROJECT INFORMATION

Project Name: S. Flatrock Trail Extension

Project Number: 21003852

Submittal: PDR

Calculated By: EAP

Calculated By Date: 5/12/2023

Checked By: RDL

Checked By Date: May-23

2 Year 1-Hour Point Depth (in) 0.86

5 Year 1-Hour Point Depth (in) 1.14

10 Year 1-Hour Point Depth (in) 1.40

25 Year 1-Hour Point Depth (in) 1.79

50 Year 1-Hour Point Depth (in) 2.12

100 Year 1-Hour Point Depth (in) 2.47

Rainfall Data Source NOAA Atlas 14

Soil Type (A,B,C,D) D

COMPOSITE C-FACTOR & WEIGHTED PERCENT IMPERVIOUSNESS ANALYSIS  
ULTIMATE CONDITION

Project Name: S. Flatrock Trail Extension  
Project Number: 21003852  
Submittal: PDR

Date: 5/12/2023      Calculated By: EAP  
Date: 5/12/2023      Checked By: RDL

Table 1: Runoff Coefficients and Percent Impervious"

	I (%)	C2	C5	C10	C25	C50	C100
Paved Streets	100%	0.87	0.88	0.90	0.91	0.92	0.93
Roofs	90%	0.80	0.85	0.90	0.90	0.90	0.90
Concrete Drive & Walks	96%	0.87	0.87	0.88	0.88	0.89	0.89
Ponds	100%	0.87	0.88	0.90	0.91	0.92	0.93
Lawns (C and D Soils)	5%	0.18	0.19	0.20	0.20	0.21	0.22

BASIN	DESIGN POINT	Total Area  (AC)	Urban  (Y/N)	Paved Streets  (AC)	Roofs  (AC)	Concrete Drive & Walks  (AC)	Ponds  (AC)	Lawns (C and D Soils)  (AC)	Area Check  (AC)	Comp. i (%)  i	Comp. C2	Comp. C5	Comp. C10	Comp. C25	Comp. C50	Comp. C100
A1	A1	1.03	Y	1.03					Ok	100.0%	0.87	0.88	0.90	0.91	0.92	0.93
A2	A2	0.76	Y	0.76					Ok	100.0%	0.87	0.88	0.90	0.91	0.92	0.93
B1	B1	1.00	Y	1.00					Ok	100.0%	0.87	0.88	0.90	0.91	0.92	0.93
B2	B2	1.00	Y	1.00					Ok	100.0%	0.87	0.88	0.90	0.91	0.92	0.93
OS1	2	70.72	Y						Ok	40.0%	0.90	0.90	0.90	0.90	0.90	0.90
OS2		21.66	Y						Ok	5.0%	0.90	0.90	0.90	0.90	0.90	0.90

STANDARD FORM SF-2  
TIME OF CONCENTRATION  
ULTIMATE CONDITION

Project Name: S. Flatrock Trail Extension  
Project Number: 21003852  
Submittal: PDR

Date: 5/12/2023      Calculated By: EAP  
Date: 5/12/2023      Checked By: RDL

SUB-BASIN DATA				INITIAL/OVERLAND TIME (Ti)			CHANNELIZED TRAVEL TIME (Tt)					MINIMUM Tc IN URBAN AREAS Tc CHECK (Urbanized Basins)			FINAL Tc	REMARKS
DESIG:	AREA (acres)	C <sub>5</sub>	i (%)	LENGTH (ft)	AVG. SLOPE (%)	Ti (min)	Convey Factor	LENGTH (ft)	AVG. SLOPE (%)	VEL (fps)	Tt (min)	COMP Tc	TOTAL LENGTH (ft)	Tc CHECK (min)	Tc (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	
A1	1.03	0.88	100%				20								5.0	
A2	0.76	0.88	100%				20								5.0	
B1	1.00	0.88	100%				20								5.0	
B2	1.00	0.88	100%				20								5.0	
OS1	70.72	0.00	40%				20								5.0	BASIN C FROM MCE FIL. 3 USED
OS2	21.66	0.00	5%				20								5.0	BASIN OS-1 FROM MCE FIL. 3 USED

- (1) Basin Description linked to C-Value Sheet
- (2) Basin Area linked to C-Value Sheet
- (3) Basin C<sub>5</sub> linked to C-Value Sheet
- (4) Basin Impervious % linked to C-Value Sheet
- (5) Input Basin Initial/Overland Length
- (6) Input Basin Initial/Overland Slope
- (7) Basin Initial/Overland Time  $[0.395(1.1-C_5)*vL]/(S_0^{0.33})$
- (8) Input Conveyance Factor for Tt

Conveyance Factor K From UD Table 6-2	
Type of Land Surface	Conveyance Coefficient, C <sub>v</sub>
Heavy Meadow	2.5
Tillage/Field	5
Short Pasture and Lawns	7
Nearly Bare Ground	10
Grassed Waterway	15
Paved Areas	20

- (9) Input Length for Tt
- (10) Input Slope for Tt
- (11) Equation 6-4 =  $K * vS_0$
- (12) Equation 6-4 =  $L_t / 60 * V_t$
- (13) (7) + (12)
- (14) (5) + (9)
- (15) Equation 5.4 =  $((L/180)+10)$ , max L=300'
- (16) Compares Minimum Tc between (13) and (15)

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

Project Name: S. Flatrock Trail Extension  
Project Number: 21003852  
Submittal: PDR

Design Storm: 2 Year

Date: 5/12/2023      Calculated By: EAP  
Date: 5/12/2023      Checked By: RDL

DESCRIPTION	DESIGN POINT	DIRECT RUNOFF								TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIG.	AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	I (in/hour)	D Depth (in)	Q (cfs)	Tc (min)	(C A) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in.)	LENGTH (ft)	VELOCITY (fps)	Tt (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	
		A1	1.03	0.87	5.0	0.90	2.91	0.24	2.61													
		A2	0.76	0.87	5.0	0.66	2.91	0.24	1.92													
		B1	1.00	0.87	5.0	0.87	2.91	0.24	2.53													
		B2	1.00	0.87	5.0	0.87	2.91	0.24	2.53													
		OS1	70.72						67.00													CALCULATED BY MCE FIL. 3 PDR (BASIN C TOTAL) (RSN 1627119)
		OS2	21.66						8.10													CALCULATED BY MCE FIL. 3 PDR (BASIN OS-1) (RSN 1627119)

- (1) Basin Description linked to C-Value Sheet

(2) Basin Design Point

(3) Enter the Basin Name from C Value Sheet

(4) Basin Area linked to C-Value Sheet

(5) Composite C linked to C-Value Sheet

(6) Time of Concentration linked to C-Value Sheet
- P1 = 0.858

NOAA Atlas 14

(7) =(4) \* (5)

(8) =28.5\*P/(10+ (6) )^0.786

(9) = (6) \* (8)/60

(10) =(7) \* (8)

(11) =(6) + (21)

(12) Add the Basin Areas (7) to get the combined basin AC
- (13) =28.5\*P/(10+ (10) )^0.786

(14) Sum of Qs

(15) Additional Street Overland Flow

(16) Additional Street Overland Flow

(17) Design Pipe Flow

(18) Pipe Slope
- (19) Pipe Size

(20) Length

(21) Velocity From Flowmaster

(22) =(19) / (20) / 60

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

Project Name: S. Flatrock Trail Extension  
Project Number: 21003852  
Submittal: PDR

Design Storm: 100 Year

Date: 5/12/2023  
Date: 5/12/2023  
Calculated By: EAP  
Checked By: RDL

DESCRIPTION	DESIGN POINT	DIRECT RUNOFF								TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
		AREA DESIG.	AREA (Acres)	RUNOFF COEFF	Tc (min)	C A (Acres)	I (in/hour)	D Depth (in)	Q (cfs)	Tc (min)	(C A) (Acres)	I (in/hour)	Q (cfs)	SLOPE (%)	STREET FLOW (cfs)	DESIGN FLOW (cfs)	SLOPE (%)	PIPE SIZE (in.)	LENGTH (ft)	VELOCITY (fps)	Tt (min)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	
		A1	1.03	0.93	5.0	0.96	8.38	0.70	8.03													
		A2	0.76	0.93	5.0	0.71	8.38	0.70	5.92													
		B1	1.00	0.93	5.0	0.93	8.38	0.70	7.79													
		B2	1.00	0.93	5.0	0.93	8.38	0.70	7.79													
		OS1	70.72						267.90													CALCULATED BY MCE FIL. 3 PDR (BASIN C TOTAL) (RSN 1627119)
		OS2	21.66						27.10													CALCULATED BY MCE FIL. 3 PDR (BASIN OS-1) (RSN 1627119)

- (1) Basin Description linked to C-Value Sheet

(2) Basin Design Point

(3) Enter the Basin Name from C Value Sheet

(4) Basin Area linked to C-Value Sheet

(5) Composite C linked to C-Value Sheet

(6) Time of Concentration linked to C-Value Sheet
- P1 = 2.47

NOAA Atlas 14

(7) =(4) \* (5)

(8) =28.5\*P/((10+ (6) )^0.786

(9) = (6) \* (8)/60

(10) =(7) \* (8)

(11) =(6) + (21)

(12) Add the Basin Areas (7) to get the combined basin AC
- (13) =28.5\*P/((10+ (10) )^0.786

(14) Sum of Qs

(15) Additonal Street Overland Flow

(16) Additonal Street Overland Flow

(17) Design Pipe Flow

(18) Pipe Slope
- (19) Pipe Size

(20) Length

(21) Velocity From Flowmaster

(22) =(19) / (20) / 60



## **APPENDIX E – Hydraulic Calculations**

# Weir Flow Calculations

(including irregular sections)

Reference: Techniques of Water-Resources Investigations of the  
United States Geological Survey, Holsing, 1968

Project: Flatrock Trail - Murphy

Project #: 21003852

Date: 07.05.2023

By: KMB

Location: Inlet A1 Overflow Weir

100 -Year

## Calculations Summary

Q, Design (cfs)	Min Elev. (ft)	Water Depth (ft)	WSEL (ft)	C	Q, Calc (cfs)
8.03	74.47	0.25	74.72	3.00	14.49

## Weir Flow Section and Calculations

Sta (ft)	Elev (ft)	Lsegment (ft)	Lweir (ft)	Hmax (ft)	Hmin (ft)	Qsegment (cfs)	Qtotal (cfs)
17+68.01	74.84	0.00	0.00	0.00	0.00	0.00	0.00
17+93.01	74.65	25.00	9.25	0.07	0.00	0.21	0.21
18+18.01	74.52	25.00	25.00	0.20	0.07	3.84	4.05
18+43.01	74.47	25.00	25.00	0.25	0.20	8.03	12.08
18+68.01	74.86	25.00	16.04	0.25	0.00	2.41	14.49
18+93.01	75.50	25.00	0.00	0.00	0.00	0.00	14.49
19+18.01	76.15	25.00	0.00	0.00	0.00	0.00	14.49

Min Elev--> 74.47 Length--> 75.3 Total Q --> 14.49

$Q^* = 2/5 * C * L * (H_{max}^{2.5} - H_{min}^{2.5}) / (H_{max} - H_{min})$ .....For sloping segment, i.e. Different H at sides

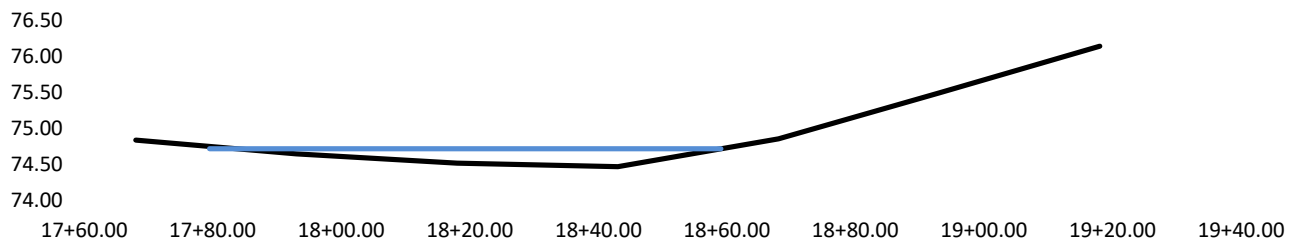
$Q = C * L * H^{1.5}$ .....For flat segment, i.e. Constant H

Q=Weir Flow

C=Weir flow coefficient

L=Weir Section segment length

H=Water head above crest at the upstream side of weir



# Weir Flow Calculations

(including irregular sections)

Reference: Techniques of Water-Resources Investigations of the  
United States Geological Survey, Holsing, 1968

Project: Flatrock Trail - Murphy

Project #: 21003852

Date: 07.05.2023

By: KMB

Location: Inlet A2 Overflow Weir

100 -Year

## Calculations Summary

Q, Design (cfs)	Min Elev. (ft)	Water Depth (ft)	WSEL (ft)	C	Q, Calc (cfs)
5.92	74.47	0.21	74.68	3.00	9.76

## Weir Flow Section and Calculations

Sta (ft)	Elev (ft)	Lsegment (ft)	Lweir (ft)	Hmax (ft)	Hmin (ft)	Qsegment (cfs)	Qtotal (cfs)
17+68.01	74.84	0.00	0.00	0.00	0.00	0.00	0.00
17+93.01	74.65	25.00	3.79	0.03	0.00	0.02	0.02
18+18.01	74.52	25.00	25.00	0.16	0.03	2.29	2.31
18+43.01	74.47	25.00	25.00	0.21	0.16	5.92	8.23
18+68.01	74.86	25.00	13.38	0.21	0.00	1.53	9.76
18+93.01	75.50	25.00	0.00	0.00	0.00	0.00	9.76
19+18.01	76.15	25.00	0.00	0.00	0.00	0.00	9.76

Min Elev--> 74.47 Length--> 67.2 Total Q --> 9.76

$Q^* = 2/5 * C * L * (H_{max}^{2.5} - H_{min}^{2.5}) / (H_{max} - H_{min})$ .....For sloping segment, i.e. Different H at sides

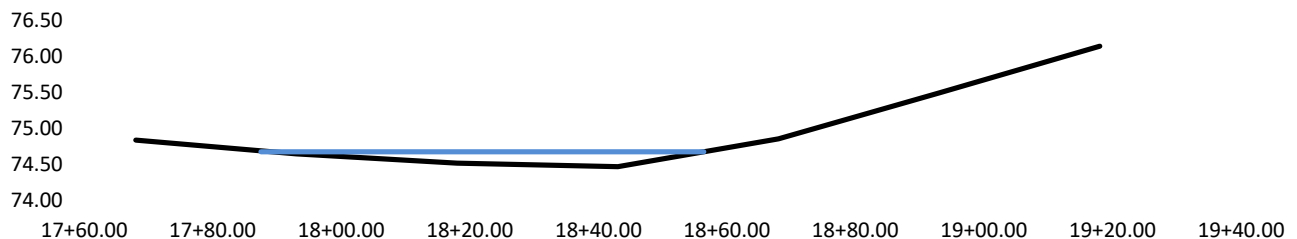
$Q = C * L * H^{1.5}$ .....For flat segment, i.e. Constant H

Q=Weir Flow

C=Weir flow coefficient

L=Weir Section segment length

H=Water head above crest at the upstream side of weir



# Weir Flow Calculations

(including irregular sections)

Reference: Techniques of Water-Resources Investigations of the  
United States Geological Survey, Holsing, 1968

Project: Flatrock Trail - Murphy

Project #: 21003852

Date: 07.05.2023

By: KMB

Location: Inlet B1 & B2 Overflow Weir

100 -Year

## Calculations Summary

Q, Design (cfs)	Min Elev. (ft)	Water Depth (ft)	WSEL (ft)	C	Q, Calc (cfs)
7.79	62.03	0.25	62.28	3.00	15.91

## Weir Flow Section and Calculations

Sta (ft)	Elev (ft)	Lsegment (ft)	Lweir (ft)	Hmax (ft)	Hmin (ft)	Qsegment (cfs)	Qtotal (cfs)
0+80.00	63.70	0.00	0.00	0.00	0.00	0.00	0.00
0+93.98	63.57	13.98	0.00	0.00	0.00	0.00	0.00
1+43.98	63.12	50.00	0.00	0.00	0.00	0.00	0.00
1+93.98	62.70	50.00	0.00	0.00	0.00	0.00	0.00
2+43.98	62.27	50.00	1.13	0.01	0.00	0.00	0.00
2+93.98	62.03	50.00	50.00	0.25	0.01	7.79	7.79
3+43.98	62.26	50.00	50.00	0.25	0.02	8.11	15.90
3+93.98	62.99	50.00	1.35	0.02	0.00	0.00	15.91
4+43.98	64.20	50.00	0.00	0.00	0.00	0.00	15.91
4+93.98	65.84	50.00	0.00	0.00	0.00	0.00	15.91

Min Elev--> 62.03 Length--> 102.5 Total Q --> 15.91

$Q^* = 2/5 * C * L * (H_{max}^{2.5} - H_{min}^{2.5}) / (H_{max} - H_{min})$ .....For sloping segment, i.e. Different H at sides

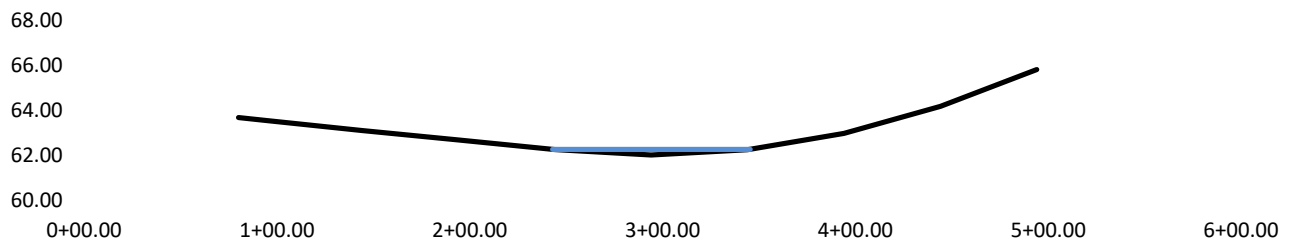
$Q = C * L * H^{1.5}$ .....For flat segment, i.e. Constant H

Q=Weir Flow

C=Weir flow coefficient

L=Weir Section segment length

H=Water head above crest at the upstream side of weir





## **APPENDIX F – Reference Materials**

# Preliminary Drainage Report

## Murphy Creek East Filing 3

Prepared for:

**Joseph Huey**  
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Englewood, CO 80112  
(720) 369-3835  
[Joseph.Huey@Lennar.com](mailto:Joseph.Huey@Lennar.com)

Prepared by:



May 6<sup>th</sup>, 2022

Project No. 21030

**Approved for One Year From this Date**

\_\_\_\_\_  
City Engineer

\_\_\_\_\_  
Date

\_\_\_\_\_  
Water Department

\_\_\_\_\_  
Date

### **Proposed Development**

The site was partially graded in 2008. Since then the existing vegetation of the Site that grew back is mostly native prairie grasses. Soil data for the site was obtained from the United States Department of Agriculture Natural Resources Conservation Service (NRCS) Web Soil Survey. Soils within the site are predominately Hydrologic Soil Type D with about 15 percent Type C. The soils encountered on the site consist of Renohill-Buick Loams and Fondis Silt Loams. A map depicting the soil type along with a description of the hydrologic soil group is contained within Appendix A. Type D soils have been used for the purposes of this report.

Since the site was partially graded in 2008 the existing slope conditions generally range from 2% to 8% in areas where homes and roads were proposed and 20% to 35% where drainage ways and ponds were proposed.

Proposed land uses within the site include: single family residential, and park space.

There is one variance being proposed in the site at this time. It is being requested that Pond C, which is being proposed at the southwest portion of the site, be designed as a EURV pond. Pond C was designed and approved as a EURV pond in the Murphy Creek East (Harvest Ridge) Subdivision Filing No. 1, 2, 3, 4 Master Drainage Report, Prepared by CVL, November 2020. Also, Section 3.64 of the City of Aurora Storm Drainage Criteria states that an exemption from the detention requirements may be granted at the option of the City if runoff from single-family developments which have five dwelling units per acre or less, discharge to an improved publicly dedicated storm drain facility, and result in no adverse impacts. The proposed site currently has 3.5 dwelling units per acre.

## **Historic Drainage**

### **Overall Basin Description**

The overall Murphy Creek East development encompasses approximately 218 acres which has been planned for single family residential dwelling units, multifamily dwelling units, a school, and open space. The Filing 3 portion of the overall development consists of 84 acres which includes 253 single-family lots, and 29 tracts.

The area in which the Murphy Creek East Filing 3 site is located was included in the Murphy Creek East (Harvest Ridge) Subdivision Filing No. 1, 2, 3, 4 Master Drainage Report, prepared by CVL, November 2020. The Site is located within Major Basins C and D of the Master Drainage Report.

Major Basins C and D are a part of the Murphy Creek Drainage Basin. Murphy Creek flows predominantly from south to north and is tributary to Sand Creek. The entire Murphy Creek

Basin is approximately 8,172 acres, with approximately 213 acres being a part of the Murphy Creek East Development.

The Site lies within FEMA designated Zone X floodplain limits. FEMA Flood Insurance Rate Map (FIRM) panel 08005C0212K, which is included in Appendix A. There are no existing local irrigation ditches or canals within the development. A tributary to Murphy Creek lies directly to the south of the site but is not within the drainage boundaries of Filing 3.

In the Master Drainage Report Major Basins C and D are planned to receive offsite flows from the east where proposed development Harvest Ridge is currently being planned. Full detention with 90 percent release rate is being planned for those offsite facilities. Harvest Ridge has provided the flows that the site will need to receive. Since the sites are being designed at the same time constant coordination between the two sites will continue to happen.

#### **Drainage Patterns Through Property**

The flows on the site will generally sheet flow to the southwest until picked up by storm infrastructure. It will then be routed to EURV Pond C where it will be treated and released into the Murphy Creek Tributary.

#### **Outfalls Downstream from Property**

EURV Pond C discharges into an existing outfall. This outfall was designed and built as a part of the Murphy Creek Metropolitan District (South of East Jewell Avenue) (Then Water Quality Pond G conveying flow from Basin G) construction plans approved in 2005. This outfall was designed as a grouted boulder stilling basin with the intent to take 224.8 cfs of flow and slow it down to achieve a velocity of 5 fps in the adjacent channel. This outfall has been unmaintained since it was built. Pictures of the outfall taken in November 2021 are attached below. The Preliminary Drainage Report for Murphy Creek Subdivision Filing No. 9 proposed that a release structure be built to help convey the flow of Pond C (Then Water Quality Pond 1 conveying flow from Basin A). That structure was never built. **Proposed EURV Pond C is connecting into that existing outfall and has an outlet structure which has a 100-year release rate of 153.2 cfs.** Since EURV Pond C has a lower release rate than what was proposed for the outfall, the downstream outfall should work as intended. It is recommended that this outfall be cleaned, maintained, and inspected to confirm that it is still able to achieve its original purpose.

The area included in Major Basin C and D was a part of the Murphy Creek Flood Hazard Area Delineation (FHAD), prepared by Moser & associates Engineering, Inc., August 2006. This area was also included in the Murphy Creek and Tributaries Watersheds Outfall Systems Planning (OSP), prepared by Moser & associates Engineering, Inc, October 2008, and the Murphy Creek East (Harvest Ridge) Subdivision Filing No. 1, 2, 3, 4, Master Drainage Report, prepared by CVL Engineering, November 2020.

The OSP and FHAD are primarily focused on Murphy Creek. Harvest Gulch which runs to the south of the site was recommended to be improved once development of the area begins. Improvements to Harvest Gulch will not be included with the development of Filing 3.

The Murphy Creek East (Harvest Ridge) Subdivision Filing No. 1, 2, 3, 4 Master Drainage Report has Major Basin C and D both being detained by EURV ponds then being discharged into Murphy Creek. The standard for detention ponds in Aurora is that all detention ponds must be designed for 100-year full spectrum detention. The basin C and D ponds were originally designed in the Murphy Creek Metropolitan District (South of E. Jewell Avenue) Final Drainage Report, Prepared by Peak Civil Consultants, November 2005. This report was a part of the construction in the site that halted in 2008 and was abandoned. The ponds were designed as water quality ponds. The Master Drainage Report prepared by CVL in November 2020 adopted the design of those ponds and upgraded them to EURV ponds. The City of Aurora Storm Drainage Design and Technical Criteria section 3.64 2 states that an exemption from the detention requirement may be granted at the option of the City under the condition that runoff from a single-family development which have five dwelling units per acre or less, discharge to an improved publicly dedicated storm drain facility, and result in no adverse impacts. The site has less than 5 dwelling units per acre which is why EURV ponds and not 100 year full spectrum ponds are being proposed.

**Major Basin C and D have been combined in this report and now get detained by one pond, Pond C. Pond C's design and comparison to the Master Drainage Report are discussed in detail in the Proposed Permanent BMP section below.**

### **Specific Details**

The major basin within which the Site has been subdivided into smaller basins for the purposes of determining peak flow rates and sizing storm sewer infrastructure, which includes inlet and conduit sizing, and determining peak flow rates at various points within the major basin. Major Basins C and D identified in the Murphy Creek East (Harvest Ridge) Subdivision Filing No. 1, 2, 3, 4 Master Drainage Report and their ponds have been combined into one basin labeled as Major Basin C and one pond labeled as Pond C in this report.

### **Major Basin C**

Major Basin C is the only onsite basin that is in the site. Runoff from this basin flows to Pond C. Pond C outfalls to a short existing channel which drains into Murphy Creek. Major Basin C

detain the Excess Urban Runoff Volume (EURV) and routes the 100-year flow through the pond. The City of Aurora Storm Drainage Design and Technical Criteria states that all detention ponds must be designed to treat the 100-year storm. Under section 3.64 in the drainage standards it states that if the site is under 5 dwelling units per acre that there can be an exemption to the City's standards. Since the site is under 5 dwelling units per acre and EURV ponds were designed in the master studies, Pond C is being designed to treat the EURV and not the 100-year flow. The WQCV for Pond C has been increased by 20% to account for sedimentation. The pond and the respective tributary basins are discussed in further detail below.

### EURV Pond C

EURV Pond C is located in the southwest portion of the site within Basin PC and will treat and detain runoff from all of the basins onsite and an offsite undeveloped area. The pond is proposed in a location where an old water quality pond was built and plans to use existing drainage structures. The land uses of the basins onsite are single family detached homes, single family alley loaded homes, and park area. In the Murphy Creek East Subdivision Filing No. 1, 2, 3, 4 Master Drainage Report the basins contributing to ponds on site had a combined tributary area of 96.1 acres with a composite imperviousness of 44.5%. The actual combined tributary area of Pond C is 92.41 acres with a composite imperviousness of 31%. The EURV storage volume for Pond C is 2.61 acre-feet. The additional volume needed to route the 100-year storm through the ponds is 1.71 acre-feet causing the total volume needed to be 4.32 acre-feet. The release rate of the EURV is 1.0 cfs and the release rate of the 100-year storm is 153.2 cfs.

EURV Pond C's outlet structure will tie into existing storm sewer which is located under South Flatrock Trail and discharge into an existing channel. This channel was designed with a stilling basin which had the intent to slow 224.8 cfs of flow into 5 fps in the adjacent channel. With EURV Pond C's release rating being 153.2 cfs and the additional water quality being provided by this pond the existing outfall structure should work as intended. However, since it was built the outfall has not been maintained so it is recommended to clean, maintain, and inspect the outfall to make sure it works as intended.

## Conclusion

### Compliance with Standards

This drainage report presents the concepts for the drainage analysis for the Murphy Creek East Filing 3 development and complies with the City of Aurora's Storm Drainage Design and Technical Criteria and the MHFD Urban Storm Drainage Criteria Manual.

## MHFD-Detention, Version 4.04 (February 2021)

Basin ID: EURV POND C

### Example Zone Configuration (Retention Pond)

Selected BMP Type =	<b>EDB</b>	
Watershed Area =	92.41	acres
Watershed Length =	3,400	ft
Watershed Length to Centroid =	1,955	ft
Watershed Slope =	0.022	ft/ft
Watershed Imperviousness =	31.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	40.0	hours

Location for 1-hr Rainfall Depths = Aurora - Municipal Center

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

Water Quality Capture Volume (WQCV) =	<u>1,428</u>	acre-feet
Excess Urban Runoff Volume (EQRV) =	<u>2,668</u>	acre-feet
2-yr Runoff Volume ( $P1 = 0.98$ in.) =	<u>2,197</u>	
5-yr Runoff Volume ( $P1 = 1.38$ in.) =	<u>4,740</u>	acre-feet
10-yr Runoff Volume ( $P1 = 1.62$ in.) =	<u>6,491</u>	acre-feet
25-yr Runoff Volume ( $P1 = 2.1$ in.) =	<u>9,812</u>	acre-feet
50-yr Runoff Volume ( $P1 = 2.32$ in.) =	<u>12,338</u>	acre-feet
100-yr Runoff Volume ( $P1 = 2.67$ in.) =	<u>15,532</u>	acre-feet
500-yr Runoff Volume ( $P1 = 3.3$ in.) =	<u>20,598</u>	acre-feet
Approximate 2-yr Detention Volume =	<u>1,846</u>	acre-feet
Approximate 5-yr Detention Volume =	<u>3,423</u>	acre-feet
Approximate 10-yr Detention Volume =	<u>3,988</u>	acre-feet
Approximate 25-yr Detention Volume =	<u>4,830</u>	acre-feet
Approximate 50-yr Detention Volume =	<u>5,206</u>	acre-feet
Approximate 100-yr Detention Volume =	<u>6,521</u>	acre-feet

Zone 1 Volume (WQCV) =	1.428	acre-feet
Zone 2 Volume (EURV - Zone 1) =	1.180	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	3.912	acre-feet
Total Detention Basin Volume =	6.521	acre-feet
Initial Surge Volume (ISV) =	user	ft <sup>3</sup>
Initial Surge Depth (ISD) =	user	ft
Total Available Detention Depth ( $H_{total}$ ) =	user	ft
Depth of Trickle Channel ( $H_{TC}$ ) =	user	ft
Slope of Trickle Channel ( $S_{TC}$ ) =	user	ft/ft
Slopes of Main Basin Sides ( $S_{main}$ ) =	user	H:V
Basin Length-to-Width Ratio ( $R_{LW}$ ) =	user	

Initial Surcharge Area ( $A_{SV}$ )	=	user	ft <sup>2</sup>
Surcharge Volume Length ( $L_{SV}$ )	=	user	ft
Surcharge Volume Width ( $W_{SV}$ )	=	user	ft
Depth of Basin Floor ( $H_{FLOOR}$ )	=	user	ft
Length of Basin Floor ( $L_{FLOOR}$ )	=	user	ft
Width of Basin Floor ( $W_{FLOOR}$ )	=	user	ft
Area of Basin Floor ( $A_{FLOOR}$ )	=	user	ft <sup>2</sup>
Volume of Basin Floor ( $V_{FLOOR}$ )	=	user	ft <sup>3</sup>
Depth of Main Basin ( $H_{MAIN}$ )	=	user	ft
Length of Main Basin ( $L_{MAIN}$ )	=	user	ft
Width of Main Basin ( $W_{MAIN}$ )	=	user	ft
Area of Main Basin ( $A_{MAIN}$ )	=	user	ft <sup>2</sup>
Volume of Main Basin ( $V_{MAIN}$ )	=	user	ft <sup>3</sup>
Calculated Total Basin Volume ( $V_{TOTAL}$ )	=	user	acre-feet

Optional User Overrides	
1.428	acre-feet
	acre-feet
0.98	inches
1.38	inches
1.62	inches
2.00	inches
2.32	inches
2.67	inches
	inches

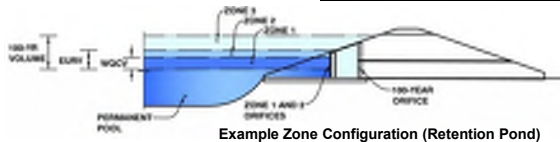
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# DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: MURPHY CREEK EAST FILING 3

Basin ID: EURV POND C



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.38	1.428	Orifice Plate
Zone 2 (EURV)	6.05	1.180	Orifice Plate
Zone 3 (100-year)	#VALUE!	3.912	Weir&Pipe (Restrict)
Total (all zones)		6.521	

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

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

Calculated Parameters for Underdrain  
Underdrain Orifice Area =  ft<sup>2</sup>  
Underdrain Orifice Centroid =  feet

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

Invert of Lowest Orifice =  ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Orifice Plate =  ft (relative to basin bottom at Stage = 0 ft)  
Orifice Plate: Orifice Vertical Spacing =  inches  
Orifice Plate: Orifice Area per Row =  sq. inches (use rectangular openings)

Calculated Parameters for Plate  
WQ Orifice Area per Row =  ft<sup>2</sup>  
Elliptical Half-Width =  feet  
Elliptical Slot Centroid =  feet  
Elliptical Slot Area =  ft<sup>2</sup>

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.71	3.41					
Orifice Area (sq. inches)	4.74	4.74	4.74					

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

User Input: Vertical Orifice (Circular or Rectangular)

Invert of Vertical Orifice =   ft (relative to basin bottom at Stage = 0 ft)  
Depth at top of Zone using Vertical Orifice =   ft (relative to basin bottom at Stage = 0 ft)  
Vertical Orifice Diameter =   inches

Calculated Parameters for Vertical Orifice  
Vertical Orifice Area =   ft<sup>2</sup>  
Vertical Orifice Centroid =   feet

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

Overflow Weir Front Edge Height, H<sub>o</sub> =   ft (relative to basin bottom at Stage = 0 ft)  
Overflow Weir Front Edge Length =   feet  
Overflow Weir Grate Slope =   H:V  
Horiz. Length of Weir Sides =   feet  
Overflow Grate Type =    
Debris Clogging % =   %

Calculated Parameters for Overflow Weir  
Height of Grate Upper Edge, H<sub>u</sub> =   feet  
Overflow Weir Slope Length =   feet  
Grate Open Area / 100-yr Orifice Area =   
Overflow Grate Open Area w/o Debris =   ft<sup>2</sup>  
Overflow Grate Open Area w/ Debris =   ft<sup>2</sup>

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

Depth to Invert of Outlet Pipe =   ft (distance below basin bottom at Stage = 0 ft)  
Outlet Pipe Diameter =   inches  
Restrictor Plate Height Above Pipe Invert =  inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate  
Outlet Orifice Area =  ft<sup>2</sup>  
Outlet Orifice Centroid =  feet  
Half-Central Angle of Restrictor Plate on Pipe =  radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

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

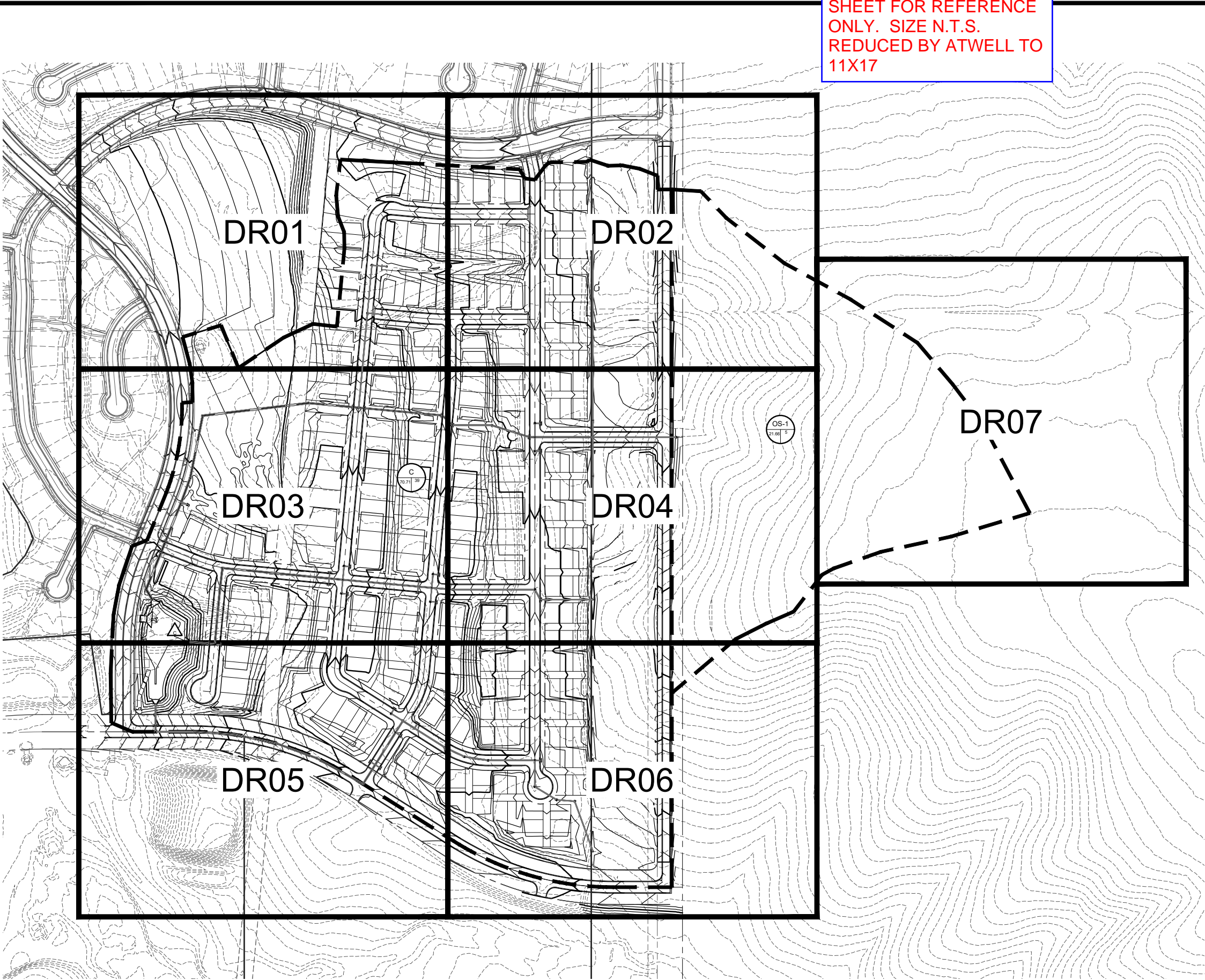
Calculated Parameters for Spillway  
Spillway Design Flow Depth =  feet  
Stage at Top of Freeboard =  feet  
Basin Area at Top of Freeboard =  acres  
Basin Volume at Top of Freeboard =  acre-ft

## Routed Hydrograph Results

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

	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
Design Storm Return Period	N/A	N/A	0.98	1.38	1.62	2.00	2.32	2.67	3.30
One-Hour Rainfall Depth (in)	N/A	N/A	0.98	1.38	1.62	2.00	2.32	2.67	3.30
CUHP Runoff Volume (acre-ft)	1.428	2.608	2.197	4.740	6.491	9.812	12.338	15.532	20.598
Inflow Hydrograph Volume (acre-ft)	N/A	N/A	2.197	4.740	6.491	9.812	12.338	15.532	20.598
CUHP Predevelopment Peak Q (cfs)	N/A	N/A	2.7	24.8	37.1	71.4	92.8	120.6	163.3
OPTIONAL Override Predevelopment Peak Q (cfs)	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre)	N/A	N/A	0.03	0.27	0.40	0.77	1.00	1.30	1.77
Peak Inflow Q (cfs)	N/A	N/A	22.3	50.5	65.7	107.4	133.7	167.7	220.4
Peak Outflow Q (cfs)	0.7	1.0	0.9	17.5	38.3	83.6	114.2	153.2	216.2
Ratio Peak Outflow to Predevelopment Q	N/A	N/A	N/A	0.7	1.0	1.2	1.2	1.3	1.3
Structure Controlling Flow	Plate	Plate	Plate	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	Spillway
Max Velocity through Grate 1 (fps)	N/A	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0
Max Velocity through Grate 2 (fps)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours)	38	52	48	61	59	55	53	50	46
Time to Drain 99% of Inflow Volume (hours)	40	56	51	66	65	63	62	60	58
Maximum Ponding Depth (ft)	4.38	6.05	5.24	7.22	7.41	7.71	7.89	8.09	8.31
Area at Maximum Ponding Depth (acres)	0.65	0.77	0.71	0.85	0.87	0.89	0.90	0.92	0.94
Maximum Volume Stored (acre-ft)	1.434	2.614	2.017	3.562	3.716	3.989	4.142	4.324	4.538

I:\2021\21030 - Murphy Creek\CAD\Sheet Sets\Drainage\Basins Index.dwg tab: INDEX May 17, 2022 - 2:15pm mwatson



SHEET FOR REFERENCE ONLY. SIZE N.T.S. REDUCED BY ATWELL TO 11X17

**KEY MAP**  
N.T.S.

BENCHMARK: CITY OF AURORA BENCHMARK KNOWN AS 456530SW00, BEING A CHISELED SQUARE ON THE WEST CONCRETE BASE OF A 4-LEGGED PCO TOWER AT THE NE CORNER OF THE INTERSECTION OF S. GUN CLUB ROAD AND YALE LAND LINE. ELEVATION IS 5700.12' (NAVD88 DATUM)

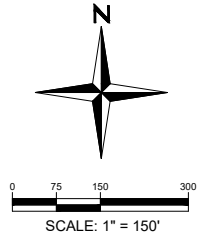
**NOTES**

1. CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, OF DIMENSIONS AND ELEVATIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF AURORA, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.

2. MURPHY CREEK EAST FILING 3 HAS A DENSITY OF LESS THAN FIVE DWELLING UNITS PER ACRE.

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DRAINAGE LEGEND

- 5281----- EXISTING MINOR CONTOUR  
-----5280----- EXISTING MAJOR CONTOUR  
-----5281----- PROPOSED MINOR CONTOUR  
-----5280----- PROPOSED MAJOR CONTOUR  
- - - - - PROPOSED BASIN BOUNDARY

BASIN ID

% IMPERVIOUS

BASIN AREA (ACRES)

DETENTION POND

Approved for One Year From this Date

City Engineer

Date

Water Department

Date

WHERE GREAT PLACES BEGIN

720.383.4793 Office  
1500 West Canal Court  
Littleton, Colorado 80120  
REDLAND.COM

MURPHY CREEK EAST FILING 3

SHEET

DRAINAGE INDEX

DR00

**MURPHY CREEK EAST  
(HARVEST RIDGE) SUBDIVISION  
FILING No. 1, 2, 3, 4  
MASTER DRAINAGE REPORT  
AURORA, COLORADO**



Prepared for:

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Contact: Michael Kuykendall  
Phone: (720) 369-3835

Prepared by:

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Phone: (720) 249-3565  
Email: [bschaffer@cvlinc.net](mailto:bschaffer@cvlinc.net)

FACSIMILE  
THIS ELECTRONIC PLAN IS A FACSIMILE OF THE SIGNED AND SEALED PDF SET.

*Brian K. Schaffer*  
CO PROFESSIONAL ENGINEER  
BRIAN SCHAFER CO P.E. NO. 18751

11/19/2020  
DATE

Preparation Date:  
November 2020

GG5

<b>Approved For One Year From This Date</b>	
11/30/2020	
<i>Haley B. Hansen</i> City Engineer	11/23/2020 Date
<i>Tony H. Tran</i> Water Department	11/10/2020 Date

10333 E. Dry Creek Road, Suite 240  
Englewood, Colorado 80112  
cvlinc.net westwoodps.com  
720.482.9526

## 2. Specific Details

Runoff from the site is to be conveyed via streets, pipes, channels, swales, and overland flow. The basins, ponds, and overland conveyance systems are described in the proceeding narrative. Land use assumption values for each basin is included in **Appendix 2A**. Drainage maps showing basin areas are included in **Appendix 5** which has been submitted separately with this report.

### Drainage Basins

Murphy Creek Subdivision Filings No. 1, 2, 3, and 4 are delineated into eight onsite basins and five offsite basins which discharge into Murphy Creek and its tributary, East Murphy Creek. Each onsite basin has an EURV pond which provides water quality for onsite runoff. See **Table 1** for Basin Summary Table.

**Table 1. Basin Summary Table**

Basin ID	Design Point	Area	Imperviousness	Q <sub>2-Year</sub>	Q <sub>100-Year</sub>
		(acres)	(%)	(cfs)	(cfs)
A	1-A	32.2	58.8	43.00	154.12
B	1-B	38.8	51.7	48.18	166.91
<b>C</b>	<b>1-C</b>	<b>34.6</b>	<b>57.2</b>	<b>28.85</b>	<b>114.28</b>
<b>D</b>	<b>1-D</b>	<b>39.3</b>	<b>55.5</b>	<b>33.59</b>	<b>134.23</b>
E	1-E	24.9	64.6	28.11	99.02
J	1-J	2.0	100.0	3.67	10.70
F7-A	1-F7-A	11.4	55.8	15.04	51.95
F7-B	1-F7-B	3.6	62.2	4.92	17.93
F7-C	1-F7-C	16.4	24.6	13.68	43.84
F7-A1	A1-F7	14.5	47.3	14.42	50.40
F7-B1	B1-F7	13.8	47.8	13.43	48.54
F7-C1	C1-F7	21.9	44.7	19.12	68.66
EMC	1-EMC	43.4	77.7	67.33	236.16
OS-1	1-OS	53.9	5.0	15.42	51.36
<b>OS-2</b>	<b>2-OS</b>	<b>22.3</b>	<b>5.0</b>	<b>8.02</b>	<b>26.70</b>
OS-3	3-OS	84.8	5.0	29.02	96.62
OS-4	4-OS	10.3	5.0	3.75	12.50
OS-J	J-OS	8.0	5.0	6.70	11.70

Basin A primarily consists of the lots on the northwest side of the site. Runoff generated by this basin flows to EURV Pond A. This pond ultimately pipes flows west to Murphy Creek and does not collect additional flow.

Basin B primarily consists of the lots on the northeast side of the site. Runoff generated by this basin flows to EURV Pond B. Pond B outfalls to tributary 3000E channel immediately upstream of the culvert under E. Jewell Avenue.

Basin C primarily consists of the lots in the middle of the site north of Yale. Runoff generated by this basin flows to EURV Pond C. Pond C outfalls to Murphy Creek via an existing swale and culvert under S. Flatrock Trail.

Basin D primarily consists of the lots in center of the site. Runoff generated by this basin flows to EURV Pond D. Pond D outfalls to Murphy Creek via an existing swale and culvert under Flatrock Trail.

Basin E primarily consists of the lots on the south side of the site. Runoff generated by this basin flows to EURV Pond E. Pond E outfalls to the existing Tributary 3000E channel to Murphy Creek.

Basin J primarily consists of the additional lanes of Jewell Ave. Runoff generated by this basin flows to the curb and gutter, which continues west to Design Point 1-J. The flow then enters a swale that directs the flow to Detention Pond OS100-20 that discharges to Murphy Creek. Written agreement with the adjoining property owner for the swale is provided in Appendix 4G.

Basin F7-A primarily consists of the lots on the northwest side of the site. Runoff generated by this basin flows to the curb and gutter and the proposed storm sewer network, which continues to Design Point 1-F7-A where it is piped to EURV Pond F7-A in Murphy Creek Subdivision Filing No. 7. This pond will be constructed with Filing No. 1 & 2 even if the construction of Filing No. 7 has not yet begun.

Basin F7-B primarily consists of the lots on the west side of the site. Runoff generated by this basin flows to the curb and gutter, which continues to Design Point 1-F7-B. If Filing No. 7 is constructed first, this flow will be piped to EURV Pond F7-B in Murphy Creek Subdivision Filing No. 7. If construction of Filing No. 7 has not yet occurred, a temporary swale will be constructed to carry the flow to the EURV pond in Filing No. 7. This pond will be constructed with Filing No. 1 & 2 even if the construction of Filing No. 7 has not yet begun.

Basin F7-C primarily consists of the lots on the west side of the site and a large undeveloped area that is being reserved for a potential future school site. Since plans for the school are undetermined at this time, this area is being treated based on historic flows. Any future development will need to provide full spectrum detention prior to tying into the storm system. A pipe will be provided for any future tie-in. Runoff generated by this basin flows to the curb and gutter and the proposed storm sewer system, which continues to Design Point 1-F7-C where it is piped to EURV Pond F7-C in Murphy Creek Subdivision Filing No. 7. If construction of Filing No. 7 has not yet occurred, a temporary swale will be constructed to carry the flow to the EURV pond in Filing No. 7. This pond will be constructed with Filing No. 1 & 2 even if the construction of Filing No. 7 has not yet begun.

Basin OS-1 consists of the open space east of Harvest Road just south of Jewell Avenue. Runoff generated by this basin flows west following historic drainage paths to Design Point 1-OS to

Culvert A under Harvest Road. Flow will then be piped around EURV Pond B west to the existing 2 – 5' x 5' RCBC under Jewell Avenue to the Tributary 3000E Channel and eventually to East Murphy Creek. EURV Pond B was not sized to provide EURV detention and treatment for historic flows from Basin OS-1. Therefore, all future offsite development in this basin will need to release at historic flows and will be required to provide full spectrum detention before allowing flow to cross Harvest Road and enter the site.

Basin OS-2 primarily consists of undeveloped land east of Harvest Road just south of Basin OS-1. Runoff generated by this basin flows west to Design Point 2-OS to Culvert B under Harvest Road where it flows west through Basin D to EURV Pond D. Undeveloped flows were used to size infrastructure for this basin. Therefore, all future development in this basin will need to release at historic flows and will be required to provide full spectrum detention before allowing flow to cross Harvest Road and enter the site.

Basin OS-3 primarily consists of the undeveloped land east of Harvest Road just south of Basin OS-2. Runoff generated by this basin flows west to Design Point 3-OS to Culvert C under Harvest Road where it flows west through Basin E via an open channel named as Tributary 4000E per the 2008 OSP. This Tributary ultimately discharges to Murphy Creek. Undeveloped flows were used for this basin. Therefore, all future offsite development in this basin will need to release at historic flows and will be required to provide full spectrum detention before allowing flow to cross Harvest Road and enter the site.

Basin OS-4 primarily consists of undeveloped land west of Harvest Road just south of onsite Basin E. Runoff generated by this basin flows north to a swale where it flows west to Design Point 4-OS and eventually to Murphy Creek.

Basin EMC primarily consists of undeveloped land north of Jewell Avenue. Runoff generated by this basin flows to the Tributary 3000E Channel where it combines flow from Basin B and Basin OS-1, then flows north to Design Point 3-EMC and eventually to East Murphy Creek. Basin EMC has been analyzed as high-density mixed-use development in conformance with the “*Master Drainage Plan for Murphy Creek*” by Costin Engineering Consultants, INC, April 1998 [Ref. 3].

Basin OS-J primarily consists of vacant graded property that is tributary to the Basin J swale and detention pond south of Jewell Avenue. Runoff generated by this basin flows into the swale to detention pond OS100-20 and eventually to Murphy Creek. This basin is located on land to be developed by Meritage Homes. The future development will include routing for basin J and the final detention pond for all on-site and tributary areas. Preliminary design drawing and permission to grade is provided in Appendix 4G.

### EURV Ponds

In August 2018 Craig Perl, PE, CFM (COA) [Ref. 5] approved multiple EURV ponds in lieu of full spectrum detention. This is allowed because the site will remain below 5 du/ac. As described in Chapter 12 section 3.2 of the USDCM [Ref. 2], the excess urban runoff volume (EURV) is the difference in volume between developed and pre-developed conditions. This volume is usually two to three times the water quality capture volume (WQCV) and has comparable release rates.

EURV Pond B receives flow from Basin B. Pond B provides WQCV and EURV detention for basin runoff. Pond B outfall and emergency overflow for both Basin B and OS-1 are directed north to an existing 2 – 5' x 5' RCBC under Jewell Avenue to the Tributary 3000E Channel (East Murphy Creek). The RCBC under Jewell Avenue will convey the developed 100-yr flow from Basin B and Basin OS-1 with no road overtop.

EURV Pond F7-A (Filing 7 Pond A) is an off-site pond that receives flow from Basin F7-A and F7-A1 (Filing No. 7). The pond is located west of Flatrock Trail and will ultimately provide WQCV and EURV for both project basins. Flows from basin F7-A will be captured with inlet and pipe networks discharging to an open swale near design point 1-F7-A and conveyed to the pond location. Pond F7-A will be constructed, and certification approved by the City of Aurora before any paving begins in tributary basins. If Filing 1 & 2 construction starts prior to Filing 7, the pond and swale will be constructed as part of Filing 1&2 and maintained by the Metropolitan District. The swale path and typical cross section is provided in the plan and will final sized with easement information in the preliminary drainage report. The pond and swale design will be finalized with the final drainage report. Once Filing 7 is constructed a maintenance agreement for the pond will be determined between the owners of the two neighborhoods.

Emergency overflow will be conveyed via future Filing 7 streets and overflow route to Murphy Creek. If Filings No.1 & 2 are constructed prior to Filing No. 7, emergency overflow will flow overland to Murphy Creek. The pond outfall pipe will connect to an existing storm system, at the border of Filing 7 and the Murphy Creek Golf Course as shown in 980080 MDP and 980087 Civil Plans. Additional erosion protection and conveyance elements through the golf course will be designed during the preliminary design if needed. Based on our preliminary calculations, the existing storm sewer has sufficient capacity to convey the 100-yr developed flow from Pond F7-A.

EURV Pond F7-B (Filing 7 Pond B) receives flow from Basins F7-B and F7-B1 (Filing No. 7). The pond is located offsite in Filing 7 west of Flatrock Trail and will ultimately provide WQCV and EURV for both project basins. Flows from basin F7-B will be captured with inlet and pipe networks discharging to an open swale near design point 1-F7-B and conveyed to the pond location. If Filings 1&2 construction starts prior to Filing 7, the pond and swale will be constructed as part of Filing 1&2, and maintained by the Metropolitan District. The swale path and typical cross section is provided in the plan and will final sized with easement information in the preliminary drainage report. Once Filing 7 is constructed a maintenance agreement for the pond will be determined between the owners of the two neighborhoods.

Emergency overflow will be conveyed via overland flow to Murphy Creek. The pond outfall pipe will connect to an existing storm system, at the border of Filing 7 and the Murphy Creek Golf Course as shown in 980080 MDP and 980087 Civil Plans. Additional erosion protection and conveyance elements through the golf course will be designed during the preliminary design if needed. Based on our preliminary calculations, the existing storm sewer has sufficient capacity to convey the 100-yr developed flow from Pond F7-B.

EURV Pond F7-C (Filing 7 Pond C) receives flow from Basins F7-C and F7-C1 (Filing No. 7). The pond is located offsite in Filing 7 west of Flatrock Trail and will ultimately provide EURV

for both project basins. Flows from basin F7-C will be captured with inlet and pipe networks discharging to an open swale near design point 1-F7-C and conveyed to the pond location. If Filing 1 & 2 construction starts prior to Filing 7, the pond and swale will be constructed as part of Filing 1&2, and maintained by the Metropolitan District. The swale will be sized in the preliminary drainage report. The pond and swale design will be finalized with the final drainage report. Once Filing 7 is constructed a maintenance agreement for the pond will be determined between the owners of the two neighborhoods.

Emergency overflow will be conveyed via overland flow to Murphy Creek. The pond outfall pipe will convey flow to Murphy Creek. Additional erosion protection and conveyance elements through the golf course may be utilized to minimize impact. These elements will be designed in the Murphy Creek Filing No. 7 Preliminary Drainage Report by Atwell, LLC or in the Final Drainage Report for Filing No. 1, and 2 if Filing No. 7 has not been designed at that point.

EURV Pond C receives flow from Basin C. The pond provides water quality and excess urban runoff detention for basin runoff. The pond outfalls through an existing RCP located beneath S. Flatrock Trail and the flow is conveyed within existing swale and channel elements to Murphy Creek. The size of the existing system will be confirmed in the preliminary drainage report to ensure that it can convey the 100-year storm developed flow. Emergency overflow will be conveyed south via Flatrock Trail to a shared low point where the discharge will overtop the road and flow directly to Murphy Creek.

EURV Pond D receives flow from Basin D and offsite basin OS-2. The pond provides water quality and excess urban runoff detention for basin runoff. Pond D discharge will be conveyed through a pipe south to the same existing RCP outfall as Pond C. The pipe size will be verified in the preliminary drainage report to ensure that it can handle the 100-year developed flow, or will be replaced. Emergency overflow will be conveyed south via Flatrock Trail to a shared low point where the discharge will overtop the road and flow directly to Murphy Creek.

EURV Pond E receives flow from Basin E. The pond provides water quality and excess urban runoff detention for basin runoff. The downstream swale will be evaluated for capacity and erosion protection requirements for the 100 year storm in the Preliminary Drainage Report. The pond outfalls west, following historic drainage paths, to Murphy Creek.

Drainage corridors will be dedicated for all discharges to the golf course property and/or open space owned by the City of Aurora. Some pipes, swales and erosion protection elements have already been constructed per previous reports and plans. These existing elements shall be surveyed and replaced or repaired to convey flows and prevent erosion with current standards. Corridors for these dedicated areas will be shown in preliminary drainage reports and dedicated with Final CDs.

**Table 2. EURV Pond Summary Table**

POND SUMMARY TABLE						
Pond ID	Contributing Basins	Tributary Area	Average Impervious	1.2 * WQCV	EURV	Peak Inflow Q
		(ac)	(%)	(ac-ft)	(ac-ft)	(cfs)
Pond A	A	32.2	58.8	0.75	1.82	139.1
Pond B	B	38.8	51.7	0.82	1.90	129.3
Pond C	C	34.6	57.2	0.79	1.89	120.0
Pond D	D & OS-2	61.5	37.3	1.06	2.12	135.9
Pond E	E & OS-4	35.2	47.2	0.70	1.57	117.6
Pond F7-A	F7-A & F7-A1	25.9	51.1	0.54	1.25	71.4
Pond F7-B	F7-B & F7-B1	17.4	50.8	0.36	0.84	23.2
Pond F7-C	F7-C & F7-C1	38.3	36.1	0.65	1.27	39.7
Pond OS 100-20	OS-J & J	10.0	24.2	0.13	0.22	14.8
NOTE: These ponds are EURV only and do not provide 100-year detention. They are allowed to release at rates up to the peak 100 year inflow rate.						

### Tributary 3000E and 4000E Channel

Tributary 3000E is located north of Jewell Avenue and is an existing channel that was previously designed in the OSP [Ref. 4]. This channel captures flow from Basins B, OS-1, and EMC. The existing channel slope is approximately 2.7% and erosion is expected due to the relatively steep slope and sandy soils. See **Table 4** for channel flow comparison between previous reports.

**Table 3. Flow Comparison for Tributary 3000E Channel**

Report	E. Jewell Ave. Culvert Flow (cfs)	E. Murphy Creek Channel Flow (cfs)	E. Murphy Creek Channel Slope (ft/ft)
Master Drainage Plan for Murphy Creek (MDP) (Costin Engineering Consultants, Inc.)	425.0	425.0	0.008
Murphy Creek Final Drainage Report Filing No. 8 (Peak Civil Consultants)	425.0	-	-
Outfall Systems Planning Phase 8 - Planning Report (OSP) (Moser & Associates)	225.0 (DP 3560)	345.0 (DP 3550)	0.005

The channel was designed for the flows calculated in the OSP report [Ref. 4].

# SF-1 PROPOSED COMPOSITE BASIN LAND USE

Subdivision: Murphy Creek Farms

Project Name: Murphy Creek Farms  
 Project No. 8130323701  
 Calculated By: EAC  
 Checked By: BS  
 Date: 9/24/2020

Basin	Total Area	Soil Type A	Soil Type B	Soil Type C/D	Single Family Res.**	Multi-Unit Detached	Multi-Unit Attached	Parks, Cemeteries	Paved/ Impervious	Business (Neighborhood Areas)	Undeveloped	Schools	Avg. Imp.	C <sub>2</sub>	C <sub>5</sub>	C <sub>100</sub>
	(acres)	(%)	(%)	(%)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(acres)	(%)			
OS-1	53.89	0.0%	0.0%	100.0%	0.0	0.0	0.0	0.0	0.0	0.0	53.89	0.00	5.0	0.18	0.19	0.22
OS-2	22.26	0.0%	0.0%	100.0%	0.0	0.0	0.0	0.0	0.0	0.0	22.26	0.00	5.0	0.18	0.19	0.22
OS-3	84.83	0.0%	0.0%	100.0%	0.0	0.0	0.0	0.0	0.0	0.0	84.83	0.00	5.0	0.18	0.19	0.22
OS-4	10.26	0.0%	0.0%	100.0%	0.0	0.0	0.0	0.0	0.0	0.0	10.26	0.00	5.0	0.18	0.19	0.22
EMC	43.42	0.0%	0.0%	100.0%	1.7	0.0	0.0	0.0	5.2	32.4	4.10	0.00	77.7	0.58	0.63	0.75
F7-A	11.45	0.0%	0.0%	100.0%	0.0	4.7	0.0	0.0	3.4	0.0	3.34	0.00	55.8	0.50	0.52	0.63
A	32.22	0.0%	0.0%	100.0%	3.1	15.1	0.0	0.0	8.2	0.0	5.82	0.00	58.8	0.50	0.54	0.66
B	38.80	0.0%	0.0%	100.0%	0.0	15.1	0.0	0.0	10.3	0.0	13.37	0.00	51.7	0.47	0.49	0.60
F7-B	3.60	0.0%	0.0%	100.0%	0.0	2.2	0.0	0.0	0.9	0.0	0.50	0.00	62.2	0.52	0.55	0.69
F7-C	16.37	0.0%	0.0%	100.0%	0.1	0.86	0.0	0.0	2.84	0.0	12.57	0.00	24.6	0.32	0.33	0.37
C	34.58	0.0%	0.0%	100.0%	0.0	22.50	6.60	0.0	1.1	0.0	4.38	0.00	57.2	0.46	0.50	0.67
D	39.28	0.0%	0.0%	100.0%	0.0	27.9	4.4	0.0	1.5	0.0	5.48	0.00	55.5	0.45	0.49	0.65
E	24.93	0.0%	0.0%	100.0%	0.0	0.0	18.5	0.0	2.0	0.0	4.43	0.00	64.6	0.55	0.59	0.71
J	2.02	0.0%	0.0%	100.0%	0.0	0.0	0.0	0.0	2.0	0.0	0.00	0.00	100.0	0.87	0.88	0.93
F7-A1	14.46	0.0%	0.0%	100.0%									47.3	0.46	0.49	0.59
F7-B1	13.81	0.0%	0.0%	100.0%									47.8	0.46	0.50	0.61
F7-C1	21.88	0.0%	0.0%	100.0%									44.7	0.44	0.47	0.58
OS-J	8.00	0.0%	0.0%	100.0%	0.00	0.00	0.00	0.00	0.00	0.00	8.00	0.00	5.0	0.18	0.19	0.22

Land Use	% Imp.
Single Family Res.**	45
Multi-Unit Detached	60
Multi-Unit Attached	75
Parks, Cemeteries	5
Paved/ Impervious	100
Business (Neighborhood Areas)	85
Undeveloped	5
Schools	50

\*\* Valid for up to 5 units per acre. Single-family with more than 5 units per acre uses values for multi-unit/ detached

**SF-2 TIME OF CONCENTRATION FOR EACH SUB-BASIN**

SUB-BASIN DATA		INITIAL/OVERLAND FLOW TIME				CHANNELIZED FLOW TIME					TOTAL T <sub>c</sub>	FIRST DESIGN POINT T <sub>c</sub>		EFFECTIVE
DATA											T <sub>c</sub> = T <sub>i</sub> + T <sub>T</sub>	COA T <sub>c</sub> Check		T <sub>c</sub>
BASIN	D.A.	C <sub>5</sub>	L	S	T <sub>i</sub>	L	S	LAND SURFACE	VEL.	T <sub>t</sub>	T <sub>c</sub>	LENGTH	MIN. T <sub>c</sub>	
ID	(AC)		FT	FT/FT	MINUTES	FT	FT/FT		FPS	MINUTES	MINUTES	FT	MINUTES	MINUTES
OS-1	53.89	0.19	300	0.03	19.8	3000	0.02	Short pasture and lawns	1.0	50.5	70.3	3300	28.3	28.3
OS-2	22.26	0.19	300	0.01	28.5	1250	0.04	Short pasture and lawns	1.3	15.9	44.4	1550	18.6	18.6
OS-3	84.83	0.19	300	0.03	20.0	1600	0.04	Short pasture and lawns	1.4	19.0	39.1	1900	20.6	20.6
OS-4	10.26	0.19	250	0.10	12.2	1200	0.02	Short pasture and lawns	1.1	18.8	31.0	1450	18.1	18.1
EMC	43.42	0.63						Paved area				0	10.0	10.0
F7-A	11.45	0.52						Paved area				0	10.0	10.0
A	32.22	0.54						Paved area				0	10.0	10.0
B	38.80	0.49						Paved area				0	10.0	10.0
F7-B	3.60	0.55						Paved area				0	10.0	10.0
F7-C	16.37	0.33						Paved area				0	10.0	10.0
C	34.58	0.50	250	0.05	9.8	2100	0.02	Paved area	2.8	12.4	22.2	2350	23.1	22.2
D	39.28	0.49	300	0.03	12.9	1525	0.02	Paved area	2.8	9.0	21.9	1825	20.1	20.1
E	24.93	0.59	300	0.05	9.4	1060	0.01	Paved area	1.4	12.5	21.9	1360	17.6	17.6
J	2.02	0.88	300	0.02	5.8	976	0.02	Paved area				1276	17.1	17.1

STORM DRAINAGE SYSTEM DESIGN  
(RATIONAL METHOD PROCEDURE)

Subdivision Murphy Creek Farms

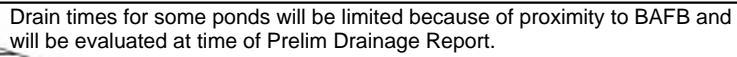
Project Name: Murphy Creek Farms  
Project No. 8130323701  
Calculated By: BP

Design Storm 100 YR  
100-Year P1 = 2.67 in. UDFCD Figure RA-6

	DIRECT RUNOFF								TOTAL RUNOFF						
COMBINED BASINS	Design Point	Area Design.	Area (Ac)	Runoff Coeff. (C100)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)	Inlet Type	Q (Intercept)	Q (Bypass)	Tc (minutes)	C*A (Ac)	I (in/hr)	Q (cfs)
OS-1	1-OS	OS-1	53.89	0.22	28.3	11.86	4.3	51.36	0.0	0.0	51.4	28.3	11.86	4.3	51.4
	1-OS	OS-1										28.3	0.00	4.3	0.0
	1-OS	OS-1										28.3	11.86	4.3	51.4
OS-2	2-OS	OS-2	22.26	0.22	18.6	4.90	5.5	26.70		26.7	0.0	18.6	4.90	5.5	26.7
	2-OS	OS-2							0.0			18.6	4.90	5.5	26.7
	2-OS	OS-2										18.6	0.00	5.5	0.0
OS-3	3-OS	OS-3	84.83	0.22	20.6	18.66	5.2	96.62	0.0	96.6	0.0	20.6	18.66	5.2	96.6
	3-OS	OS-3										20.6	18.66	5.2	96.6
	3-OS	OS-3										20.6	0.00	5.2	0.0
OS-4	4-OS	OS-4	10.26	0.22	18.1	2.26	5.5	12.50	0.0	0.0	12.5	18.1	2.26	5.5	12.5
	4-OS	OS-4										18.1	0.00	5.5	0.0
	4-OS	OS-4										18.1	2.26	5.5	12.5
A	1-A	A	32.22	0.66	10.0	21.34	7.2	154.12	0.0	0.0	154.1	10.0	21.34	7.2	154.1
	1-A	A										10.0	0.00	7.2	0.0
	1-A	A										10.0	21.34	7.2	154.1
B	1-B	B	38.80	0.60	10.0	23.11	7.2	166.91	0.0	0.0	166.9	10.0	23.11	7.2	166.9
	1-B	B										10.0	0.00	7.2	0.0
	1-B	B										10.0	23.11	7.2	166.9
C	1-C	C	34.58	0.67	22.2	23.02	5.0	114.28		114.3	0.0	22.2	23.02	5.0	114.3
	1-C	C							0.0			22.2	23.02	5.0	114.3
	1-C	C										22.2	0.00	5.0	0.0
D	1-D	D	39.28	0.65	20.1	25.65	5.2	134.23		134.2	0.0	20.1	25.65	5.2	134.2
	1-D	D							0.0			20.1	25.65	5.2	134.2
	1-D	D										20.1	0.00	5.2	0.0
D, OS-2	1-D	D	61.55	0.65	20.14	40.19	5.2	210.32		210.3	0.0	20.1	40.19	5.2	210.3

	1-D	D							0.0			20.1	40.19	5.2	210.3
	1-D	D										20.1	0.00	5.2	0.0
E	1-E	E	24.93	0.71	17.6	17.63	5.6	99.02	0.0	99.0	0.0	17.6	17.63	5.6	99.0
	1-E	E										17.6	17.63	5.6	99.0
	1-E	E										17.6	0.00	5.6	0.0
J	1-J	J	2.02	0.93	17.1	1.88	5.7	10.70	SWALE	0.0	10.7	17.1	1.88	5.7	10.7
	1-J	J										17.1	0.00	5.7	0.0
	1-J	J										17.1	1.88	5.7	10.7
OS-1, B	OF-B	0	92.68	0.60	28.33	55.20	4.3	239.12	Existing 2 - 5' x 5' RCBC at E. Jewell Ave	239.1	0.0	28.3	55.20	4.3	239.1
	OF-B	0										28.3	55.20	4.3	239.1
	OF-B	0										28.3	0.00	4.3	0.0
EMC	1-EMC	EMC	43.42	0.75	10.0	32.69	7.2	236.16	0.0	236.2	0.0	10.0	32.69	7.2	236.2
	1-EMC	EMC										10.0	32.69	7.2	236.2
	1-EMC	EMC										10.0	0.00	7.2	0.0
OS-1, B and EMC	1-EMC	0	136.10	0.75	28.33	102.48	4.3	443.93	0.0	443.9	0.0	28.3	102.48	4.3	443.9
	1-EMC	0										28.3	102.48	4.3	443.9
	1-EMC	0										28.3	0.00	4.3	0.0
F7-A	1-F7-A	F7-A	11.45	0.63	10.0	7.19	7.2	51.95	0.0	51.9	0.0	10.0	7.19	7.2	51.9
	1-F7-A	F7-A										10.0	7.19	7.2	51.9
	1-F7-A	F7-A										10.0	0.00	7.2	0.0
F7-B	1-F7-B	F7-B	3.60	0.69	10.0	2.48	7.2	17.93	0.0	17.9	0.0	10.0	2.48	7.2	17.9
	1-F7-B	F7-B										10.0	2.48	7.2	17.9
	1-F7-B	F7-B										10.0	0.00	7.2	0.0
F7-C	1-F7-C	F7-C	16.37	0.37	10.0	6.07	7.2	43.84	0.0	0.0	43.8	10.0	6.07	7.2	43.8
	1-F7-C	F7-C										10.0	0.00	7.2	0.0
	1-F7-C	F7-C										10.0	6.07	7.2	43.8
F7-A1	A1-F7	F7-A1	14.46	0.59	15.8	8.53	5.9	50.40	0.0	0.0	50.4	15.8	8.53	5.9	50.4
	A1-F7	F7-A1										15.8	0.00	5.9	0.0
	A1-F7	F7-A1										15.8	8.53	5.9	50.4
F7-B1	B1-F7	F7-B1	13.81	0.61	16.7	8.42	5.8	48.54	0.0	0.0	48.5	16.7	8.42	5.8	48.5
	B1-F7	F7-B1										16.7	0.01	5.8	0.0
	B1-F7	F7-B1										16.7	8.42	5.8	48.5
F7-C1	C1-F7	F7-C1	21.88	0.58	18.9	12.69	5.4	68.66	0.0	0.0	68.7	18.9	12.69	5.4	68.7
	C1-F7	F7-C1										18.9	-0.01	5.4	0.0
	C1-F7	F7-C1										18.9	12.70	5.4	68.7
OS-J	J-OS	OS-J	8.00	0.22	12.3	1.76	6.6	11.7	POND	0.0	20.7	17.1	3.64	5.7	20.7
	J-OS	OS-J										17.1	0.00	5.7	0.0
	J-OS	OS-J										17.1	3.64	5.7	20.7

*MHFD-Detention, Version 4.02 (February 2020)*

Basin ID: **EURV Pond C**

### Watershed Information

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

Water Quality Capture Volume (WQCV) =	0.785	acre-feet	0.785	acre-feet
Excess Urban Runoff Volume (EURV) =	1.892	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.98 in.) =	1.552	acre-feet	0.98	inches
5-yr Runoff Volume (P1 = 1.13 in.) =	1.913	acre-feet		inches
10-yr Runoff Volume (P1 = 1.39 in.) =	2.606	acre-feet		inches
25-yr Runoff Volume (P1 = 1.77 in.) =	3.808	acre-feet		inches
50-yr Runoff Volume (P1 = 2.08 in.) =	4.722	acre-feet		inches
100-yr Runoff Volume (P1 = 2.67 in.) =	6.577	acre-feet	2.67	inches
500-yr Runoff Volume (P1 = 3.3 in.) =	8.481	acre-feet		inches
Approximate 2-yr Detention Volume =	1.385	acre-feet		
Approximate 5-yr Detention Volume =	1.837	acre-feet		
Approximate 10-yr Detention Volume =	2.210	acre-feet		
Approximate 25-yr Detention Volume =	2.643	acre-feet		
Approximate 50-yr Detention Volume =	2.851	acre-feet		
Approximate 100-yr Detention Volume =	3.642	acre-feet		

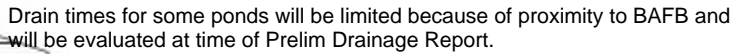
**1.2 \* WQCV**

100-year detention is not required pond is 1.2 \* WQ and EURV only

Initial Surcharge Area ( $A_{ISV}$ ) =		ft <sup>2</sup>
Surcharge Volume Length ( $L_{ISV}$ ) =		
Surcharge Volume Width ( $W_{ISV}$ ) =		
Depth of Basin Floor ( $H_{FLOOR}$ ) =		ft
Length of Basin Floor ( $L_{FLOOR}$ ) =		
Width of Basin Floor ( $W_{FLOOR}$ ) =		
Area of Basin Floor ( $A_{FLOOR}$ ) =		ft <sup>2</sup>
Volume of Basin Floor ( $V_{FLOOR}$ ) =		
Depth of Main Basin ( $H_{MAIN}$ ) =		ft
Length of Main Basin ( $L_{MAIN}$ ) =		
Width of Main Basin ( $W_{MAIN}$ ) =		
Area of Main Basin ( $A_{MAIN}$ ) =		ft <sup>2</sup>
Volume of Main Basin ( $V_{MAIN}$ ) =		
Calculated Total Basin Volume ( $V_{TOTAL}$ ) =		acre-feet

[illegible]

*MHFD-Detention, Version 4.02 (February 2020)*

Basin ID: **EURV Pond D**

### Example Zone Configuration (Retention Pond)

Initial Surcharge Area ( $A_{ISW}$ ) =		ft <sup>2</sup>
Surcharge Volume Length ( $L_{ISW}$ ) =		ft
Surcharge Volume Width ( $W_{ISW}$ ) =		ft
Depth of Basin Floor ( $H_{LFLOOR}$ ) =		ft
Length of Basin Floor ( $L_{LFLOOR}$ ) =		ft
Width of Basin Floor ( $W_{LFLOOR}$ ) =		ft
Area of Basin Floor ( $A_{LFLOOR}$ ) =		ft <sup>2</sup>
Volume of Basin Floor ( $V_{LFLOOR}$ ) =		ft <sup>3</sup>
Depth of Main Basin ( $H_{MAIN}$ ) =		ft
Length of Main Basin ( $L_{MAIN}$ ) =		ft
Width of Main Basin ( $W_{MAIN}$ ) =		ft
Area of Main Basin ( $A_{MAIN}$ ) =		ft <sup>2</sup>
Volume of Main Basin ( $V_{MAIN}$ ) =		ft <sup>3</sup>
Calculated Total Basin Volume ( $V_{TOTAL}$ ) =		acre-feet

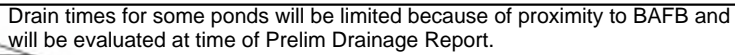
### Optional User Overrides

1.062	acre-feet
	acre-feet
0.98	inches
	inches
	inches
	inches
	inches
2.67	inches
	inches

100-year detention is not required pond is  $1.2 * WQ$  and EURV only

MHFD-Detention\_v4-02\_Pond D, Basin

*MHFD-Detention, Version 4.02 (February 2020)*

Basin ID: **EURV Pond F7-C**

### Watershed Information

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

Water Quality Capture Volume (WQCV) =	0.648	acre-feet	0.648	acre-feet
Excess Urban Runoff Volume (EURV) =	1.273	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.98 in.) =	1.067	acre-feet	0.98	inches
5-yr Runoff Volume (P1 = 1.13 in.) =	1.414	acre-feet		inches
10-yr Runoff Volume (P1 = 1.39 in.) =	2.128	acre-feet		inches
25-yr Runoff Volume (P1 = 1.77 in.) =	3.485	acre-feet		inches
50-yr Runoff Volume (P1 = 2.08 in.) =	4.485	acre-feet		inches
100-yr Runoff Volume (P1 = 2.67 in.) =	6.572	acre-feet	2.67	inches
500-yr Runoff Volume (P1 = 3.3 in.) =	8.664	acre-feet		inches
Approximate 2-yr Detention Volume =	0.909	acre-feet		
Approximate 5-yr Detention Volume =	1.330	acre-feet		
Approximate 10-yr Detention Volume =	1.611	acre-feet		
Approximate 25-yr Detention Volume =	1.988	acre-feet		
Approximate 50-yr Detention Volume =	2.166	acre-feet		
Approximate 100-yr Detention Volume =	2.962	acre-feet		

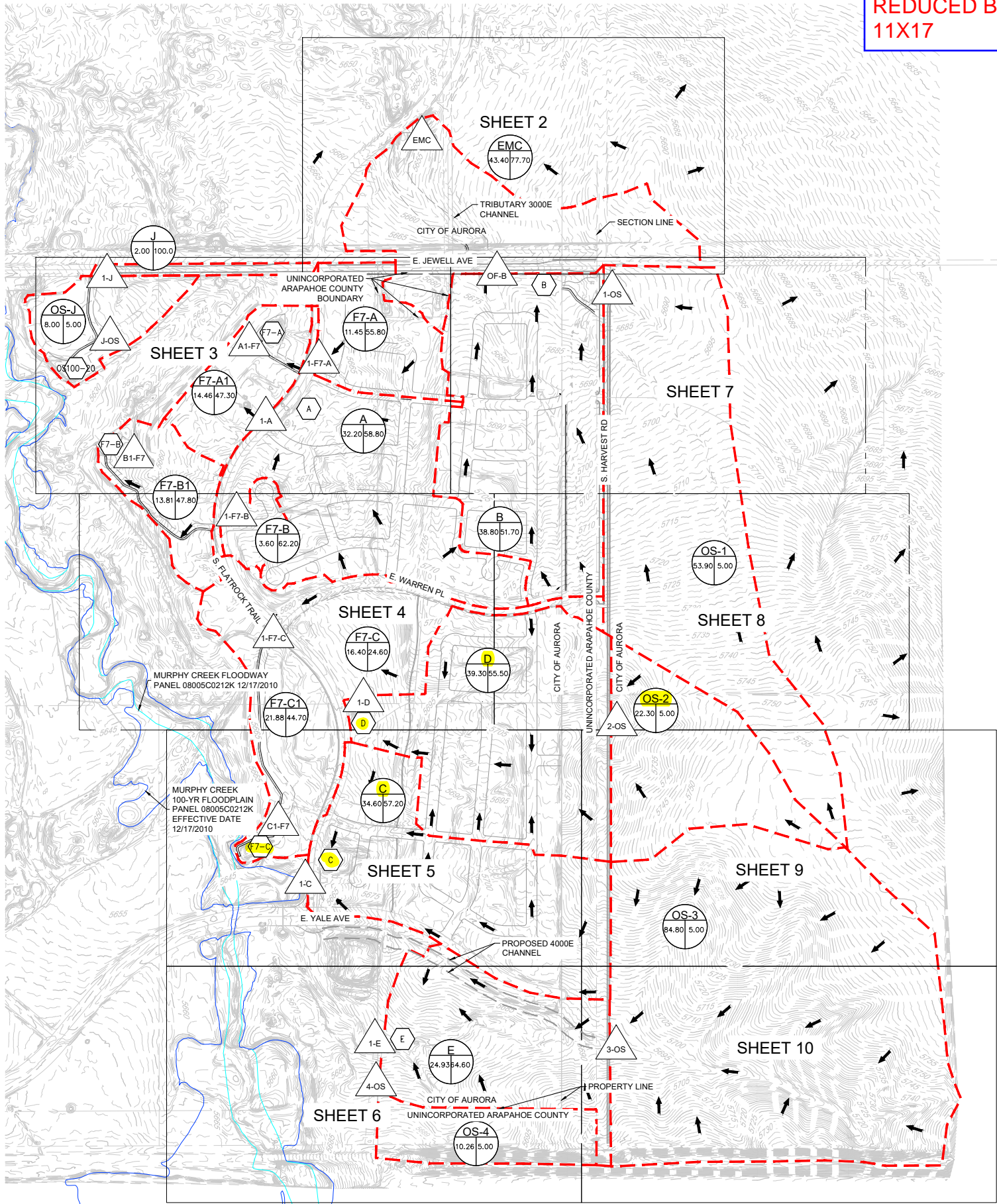
## 1.2 \* WQCV

**Total detention volume is less than 100-year volume.**

Initial Surcharge Area ( $A_{ISW}$ ) =		ft <sup>2</sup>
Surcharge Volume Length ( $L_{ISW}$ ) =		
Surcharge Volume Width ( $W_{ISW}$ ) =		ft
Depth of Basin Floor ( $H_{FLOOR}$ ) =		ft
Length of Basin Floor ( $L_{FLOOR}$ ) =		ft
Width of Basin Floor ( $W_{FLOOR}$ ) =		ft
Area of Basin Floor ( $A_{FLOOR}$ ) =		ft <sup>2</sup>
Volume of Basin Floor ( $V_{FLOOR}$ ) =		ft <sup>3</sup>
Depth of Main Basin ( $H_{MAIN}$ ) =		ft
Length of Main Basin ( $L_{MAIN}$ ) =		ft
Width of Main Basin ( $W_{MAIN}$ ) =		ft
Area of Main Basin ( $A_{MAIN}$ ) =		ft <sup>2</sup>
Volume of Main Basin ( $V_{MAIN}$ ) =		ft <sup>3</sup>
Calculated Total Basin Volume ( $V_{TOTAL}$ ) =		acre-feet

[illegible]

N:\PROJECTS\MURPHY CREEK FARMS - LENNAR\DCS\ENGINEERING\DRAINAGE\WATER REPORT\DRAINAGE MAPS\OVERALL DRAINAGE MAP - MDR.DWG, CSD.CHART, 11/19/2020 1:53 PM



SHEET FOR REFERENCE ONLY. SIZE N.T.S. REDUCED BY ATWELL TO 11X17

\* NO PAVING WILL BE PERMITTED WITHIN AREAS TRIBUTARY TO OFFSITE PONDS F7-A, F7-B, F7-C, AND OS100-20 UNTIL THE COA HAS APPROVED POND CERTIFICATION LETTERS FOR THESE PONDS.

POND SUMMARY TABLE						
Pond ID	Contributing Basins	Tributary Area	Average Impervious	1.2 * WQCV	EURV	Peak Inflow Q
		(ac)	(%)	(ac-ft)	(ac-ft)	(cfs)
Pond A	A	32.2	58.8	0.75	1.82	139.1
Pond B	B	38.8	51.7	0.82	1.90	129.3
Pond C	C	34.6	57.2	0.79	1.89	120.0
Pond D	D & OS-2	61.5	37.3	1.06	2.12	135.9
Pond E	E & OS-4	35.2	47.2	0.70	1.57	117.6
Pond F7-A	F7-A & F7-A1	25.9	51.1	0.54	1.25	71.4
Pond F7-B	F7-B & F7-B1	17.4	50.8	0.36	0.84	23.2
Pond F7-C	F7-C & F7-C1	38.3	36.1	0.65	1.27	39.7
Pond OS 100-20	OS-J & J	10.0	24.2	0.13	0.22	14.8

NOTE: These ponds are EURV only and do not provide 100-year detention. They are allowed to release at rates up to the peak 100 year inflow rate.

BASIN SUMMARY TABLE					
Basin ID	Design Point	Area (acres)	Imperviousness (%)	Q2-Year (cfs)	Q100-Year (cfs)
A	1-A	32.2	58.8	43.00	154.12
B	1-B	38.8	51.7	48.18	166.91
C	1-C	34.6	57.2	28.85	114.28
D	1-D	39.3	55.5	33.59	134.23
E	1-E	24.9	64.6	28.11	99.02
J	1-J	2.0	100.0	3.67	10.70
F7-A	1-F7-A	11.4	55.8	15.04	51.95
F7-B	1-F7-B	3.6	62.2	4.92	17.93
F7-C	1-F7-C	16.4	24.6	13.68	43.84
F7-A1	A1-F7	14.5	47.3	14.42	50.40
F7-B1	B1-F7	13.8	47.8	13.43	48.54
F7-C1	C1-F7	21.9	44.7	19.12	68.66
EMC	1-EMC	43.4	77.7	67.33	236.16
OS-1	1-OS	53.9	5.0	15.42	51.36
OS-2	2-OS	22.3	5.0	8.02	26.70
OS-3	3-OS	84.8	5.0	29.02	96.62
OS-4	4-OS	10.3	5.0	3.75	12.50
OS-J	J-OS	8.0	5.0	6.70	11.70

**LEGEND**

X-X BASIN DESIGNATION  
A = AREA IN ACRES  
X = PERCENT IMPERVIOUSNESS

DESIGN POINT

DETENTION POND

PROPOSED MAJOR BASIN BOUNDARY

PROPOSED MINOR BASIN BOUNDARY

LIMITS OF CONSTRUCTION

EXISTING MAJOR CONTOUR

EXISTING MINOR CONTOUR

PROPOSED MAJOR CONTOUR

PROPOSED MINOR CONTOUR

100-YR FLOODPLAIN

FLOODWAY

PROPOSED STORM EXISTING STORM

PROPERTY BOUNDARY EASEMENT

EMERGENCY OVERFLOW PATH

FLOW DIRECTION

- NOTE:
- CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, OF DIMENSIONS AND EVALUATIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF AURORA, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.
  - ALL STORM DRAIN WITHIN PUBLIC STREETS WILL BE PUBLICLY MAINTAINED UNLESS OTHERWISE NOTED.
  - EURV PONDS A, B, C, D, E, F7-A, F7-B, F7-C, POND OUTFALL PIPES, AND ALL SWALES WILL BE MAINTAINED BY THE MURPHY CREEK METROPOLITAN DISTRICT.
  - TRIBUTARY 3000E CHANNEL AND 4000E CHANNEL WILL BE DESIGNED AND CONSTRUCTED TO BE MHFD MAINTENANCE ELIGIBLE.
  - THIS SINGLE FAMILY DEVELOPMENT WILL HAVE A DENSITY OF FIVE DWELLING UNITS PER ACRE OR LESS.
  - STREAM CORRIDORS WILL BE EVALUATED IN GREATER DETAIL FOR STABILITY AS THEY ARE INCORPORATED INTO THE LAND USE CHANGES. IMPROVEMENTS WILL BE INFORMED BY GEOMORPHIC PRINCIPLES. STRUCTURAL STABILITY WILL BE PROVIDED THROUGH NATURAL MATERIALS LIKE VEGETATION AND IMPORTED ROCK THAT WORKS COHESIVELY WITH THE OTHER REGIONAL INFRASTRUCTURE.

**BENCHMARK**  
A CITY OF AURORA BENCHMARK KNOWN AS 456518SW001 (FORMERLY KNOWN AS M-095) BEING A 3" DIAMETER BRASS CAP IN CONCRETE AT THE NORTH RIGHT OF WAY FENCE LINE OF EAST MISSISSIPPI AVENUE, NEAR THE NORTH QUARTER CORNER OF SECTION 19, TOWNSHIP 4 SOUTH, RANGE 65 WEST, HAVING A PUBLISHED ELEVATION OF 5603.652, NAVD 1988 DATUM.

FACSIMILE  
THIS ELECTRONIC PLAN IS A FACSIMILE OF THE SIGNED AND SEALED PDF SET.

Brian J. Schaffer  
CO PROFESSIONAL ENGINEER  
BRIAN SCHAFFER, CO P.E. NO. 19873

11/19/2020  
DATE

APPROVED FOR ONE YEAR FROM THIS DATE  
11/30/2020

CITY ENGINEER  
WATER DEPARTMENT

11/23/2020  
DATE  
11/29/2020  
DATE

PREPARED UNDER THE  
SUPERVISION OF

BRIAN SCHAFFER  
COLORADO P.E. 57673

10333 E. Dry Creek Rd  
Suite 240  
Englewood, CO 80112  
Tel: 720-482-9526  
CULINC.NET

**CML**  
CONSULTANTS

LENNAR CORPORATION  
9781 S. MERIDIAN BLVD., SUITE 120  
ENGLEWOOD, CO 80112  
TEL: (303) 754-0600

MURPHY CREEK EAST (HARVEST RIDGE)  
FILING NO. 1, 2, 3 & 4  
MDR - DRAINAGE MAPS

SCALE: AS SHOWN

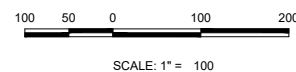
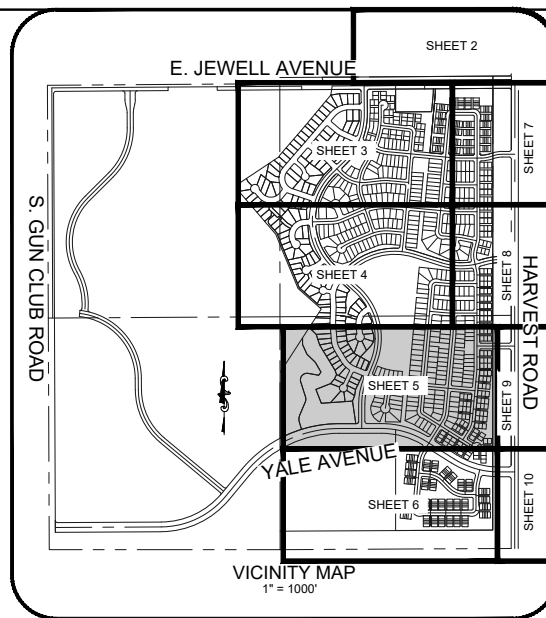
DRAWN BY: BTP

CHECKED BY: BS

DATE: NOVEMBER 2020

SHEET NUMBER 1

FILE NO: 8130323701



### LEGEND

- |  |  |
|--|--|
|  | X-X BASIN DESIGNATION<br>A = AREA IN ACRES<br>X = PERCENT IMPERVIOUSNESS |
|  | DESIGN POINT   |
|  | DETENTION POND   |
|  | PROPOSED MAJOR<br>BASIN BOUNDARY   |
|  | PROPOSED MINOR<br>BASIN BOUNDARY   |
|  | LIMITS OF CONSTRUCTION   |
|  | EXISTING MAJOR CONTOUR   |
|  | EXISTING MINOR CONTOUR   |
|  | PROPOSED MAJOR CONTOUR   |
|  | PROPOSED MINOR CONTOUR   |
|  | 100-YR FLOODPLAIN  |
|  | FLOODWAY   |
|  | PROPOSED STORM   |
|  | EXISTING STORM   |
|  | PROPERTY BOUNDARY  |
|  | EASEMENT   |
|  | EMERGENCY OVERFLOW PATH  |
|  | GENERAL BASIN FLOW<br>DIRECTION  |

NOTE:

1. CITY OF AURORA PLAN REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH CITY OF AURORA DESIGN CRITERIA AND THE CITY CODE. THE CITY IS NOT RESPONSIBLE FOR THE ACCURACY AND ADEQUACY OF THE DESIGN, OF DIMENSIONS AND EVALUATIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE. THE CITY OF AURORA, THROUGH THE APPROVAL OF THIS DOCUMENT, ASSUMES NO RESPONSIBILITY FOR THE COMPLETENESS AND/OR ACCURACY OF THIS DOCUMENT.
- ALL STORM DRAIN WITHIN PUBLIC STREETS WILL BE PUBLICLY MAINTAINED UNLESS OTHERWISE NOTED.
3. ELEV. POND 5 A, B, C, D, E, FTA, F-B, F-T, C, AND OS100-20 POND OUTFALL PIPES, AND ALL SVALES WILL BE MAINTAINED BY THE MURPHY CREEK METROPOLITAN DISTRICT UNTIL ADJACENT LAND DEVELOPS.
4. TRIBUTARY 3000E CHANNEL AND 4000E CHANNEL WILL BE DESIGNED AND CONSTRUCTED TO BE MHFD MAINTENANCE ELIGIBLE DESIGNATED AS PUBLIC MAINTENANCE.
5. THIS SINGLE FAMILY DEVELOPMENT WILL HAVE A DENSITY OF FIVE DWELLING UNITS PER ACRE OR LESS.
6. STREAM CORRIDORS WILL BE EVALUATED IN GREATER DETAIL FOR STABILITY AS THEY ARE INCORPORATED INTO THE LAND USE EUPHROS. IMPROVEMENTS WILL BE PROVIDED BY GEOMORPHIC PRINCIPLES. STRUCTURAL STABILITY WILL BE PROVIDED THROUGH NATURAL MATERIALS LIKE VEGETATION AND IMPORTED ROCK THAT WORKS COHESIVELY WITH THE OTHER REGIONAL INFRASTRUCTURE.

PREPARED UNDER THE  
SUPERVISION OF

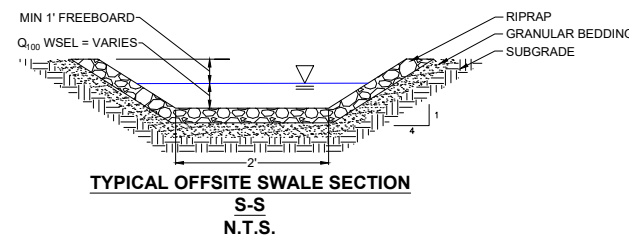
BRIAN SCHAFFER  
COLORADO P.E. 57673

BASIN SUMMARY TABLE					
Basin ID	Design Point	Area	Imperviousness	Q2-Year	Q100-Year
		(acres)	(%)	(cfs)	(cfs)
A	1-A	32.2	58.8	43.00	154.12
B	1-B	38.8	51.7	48.18	166.91
C	1-C	34.6	57.2	28.85	114.28
D	1-D	39.3	55.5	33.59	134.23
E	1-E	24.9	64.6	28.11	99.02
J	1-J	2.0	100.0	3.67	10.70
F7-A	1-F7-A	11.4	55.8	15.04	51.95
F7-B	1-F7-B	3.6	62.2	4.92	17.93
F7-C	1-F7-C	16.4	24.6	13.68	43.84
F7-A1	A1-F7	14.5	47.3	14.42	50.40
F7-B1	B1-F7	13.8	47.8	13.43	48.54
F7-C1	C1-F7	21.9	44.7	19.12	68.66
EMC	1-EMC	43.4	77.7	67.33	236.16
OS-1	1-OS	53.9	5.0	15.42	51.36
OS-2	2-OS	22.3	5.0	8.02	26.70
OS-3	3-OS	84.8	5.0	29.02	96.62
OS-4	4-OS	10.3	5.0	3.75	12.50
OS-J	J-OS	8.0	5.0	6.70	11.70

### POND SUMMARY TABLE

POND SUMMARY TABLE						
Pond ID	Contributing Basins	Tributary Area	Average Impervious	1.2 * WQCV	EURV	Peak Inflow Q
		(ac)	(%)	(ac-ft)	(ac-ft)	(cfs)
Pond A	A	32.2	58.8	0.75	1.82	139.1
Pond B	B	38.8	51.7	0.82	1.90	129.3
Pond C	C	34.6	57.2	0.79	1.89	120.0
Pond D	D & OS-2	61.5	37.3	1.06	2.12	135.9
Pond E	E & OS-4	35.2	47.2	0.70	1.57	117.6
Pond F7-A	F7-A & F7-A1	25.9	51.1	0.54	1.25	71.4
Pond F7-B	F7-B & F7-B1	17.4	50.8	0.36	0.84	23.2
Pond F7-C	F7-C & F7-C1	38.3	36.1	0.65	1.27	39.7
Pond OS 100-20	OS-J & J	10.0	24.2	0.13	0.22	14.8

NOTE: These ponds are EURV only and do not provide 100-year detention. They are allowed to release at rates up to the peak 100 year inflow rate.



SHEET FOR REFERENCE  
ONLY. SIZE N.T.S.  
REDUCED BY ATWELL TO  
11X17

FACSIMILE  
THIS ELECTRONIC PLAN IS A FACSIMILE OF THE SIGNED AND SEALED PDF SET

Brian K. Shaffer  
CO PROFESSIONAL ENGINEER  
BRIAN SHAFFER, CO P.E. NO. 5873

11/19/2020

**BENCHMARK**  
A CITY OF AURORA BENCHMARK KNOWN AS 4S6518SW001 (FORMERLY KNOWN AS M-095) BEING A 3" DIAMETER BRASS CAP IN CONCRETE AT THE NORTH RIGHT OF WAY FENCE LINE OF EAST MISSISSIPPI AVENUE NEAR THE NORTH QUARTER CORNER OF SECTION 19, TOWNSHIP 4 SOUTH, RANGE 65 WEST, HAVING A PUBLISHED ELEVATION OF 5603.652 NAVD 1988 DATUM.

10333 E. Dry Creek Rd  
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TEL: (303) 754-0600

**MURPHY CREEK EAST (HARVEST RIDGE)  
FILING NO. 1, 2, 3 & 4  
MDR - DRAINAGE MAPS**

DRAWN BY:	BTP	SCALE:	AS SHOWN
CHECKED BY:	BS	FILE NO:	8130323701
DATE:	NOVEMBER 2020		

5

MATCHLINE - SHEET 4

MATCHLINE - SHEET 7

MATCHLINE - SHEET 9

BASIN SUMMARY TABLE					
Basin ID	Design Point	Area	Imperviousness	Q2-Year	Q100-Year
		(acres)	(%)	(cfs)	(cfs)
A	1-A	32.2	58.8	43.00	154.12
B	1-B	38.8	51.7	48.18	166.91
C	1-C	34.6	57.2	28.85	114.28
D	1-D	39.3	55.5	33.59	134.23
E	1-E	24.9	64.6	28.11	99.02
J	1-J	2.0	100.0	3.67	10.70
F7-A	1-F7-A	11.4	55.8	15.04	51.95
F7-B	1-F7-B	3.6	62.2	4.92	17.93
F7-C	1-F7-C	16.4	24.6	13.68	43.84
F7-A1	A1-F7	14.5	47.3	14.42	50.40
F7-B1	B1-F7	13.8	47.8	13.43	48.54
F7-C1	C1-F7	21.9	44.7	19.12	68.66
EMC	1-EMC	43.4	77.7	67.33	236.16
OS-1	1-OS	53.9	5.0	15.42	51.36
OS-2	2-OS	22.3	5.0	8.02	26.70
OS-3	3-OS	84.8	5.0	29.02	96.62
OS-4	4-OS	10.3	5.0	3.75	12.50
OS-J	J-OS	8.0	5.0	6.70	11.70

POND SUMMARY TABLE						
Pond ID	Contributing Basins	Tributary Area	Average Impervious	1.2 * WQCV	EURV	Peak Inflow Q
		(ac)	(%)	(ac-ft)	(ac-ft)	(cfs)
Pond A	A	32.2	58.8	0.75	1.82	139.1
Pond B	B	38.8	51.7	0.82	1.90	129.3
Pond C	C	34.6	57.2	0.79	1.89	120.0
Pond D	D & OS-2	61.5	37.3	1.06	2.12	135.9
Pond E	E & OS-4	35.2	47.2	0.70	1.57	117.6
Pond F7-A	F7-A & F7-A1	25.9	51.1	0.54	1.25	71.4
Pond F7-B	F7-B & F7-B1	17.4	50.8	0.36	0.84	23.2
Pond F7-C	F7-C & F7-C1	38.3	36.1	0.65	1.27	39.7
Pond OS 100-20	OS-J & J	10.0	24.2	0.13	0.22	14.8

NOTE: These ponds are EURV only and do not provide 100-year detention. They are allowed to release at rates up to the peak 100 year inflow rate.

SHEET FOR REFERENCE ONLY. SIZE N.T.S. REDUCED BY ATWELL TO 11X17

NOTE:

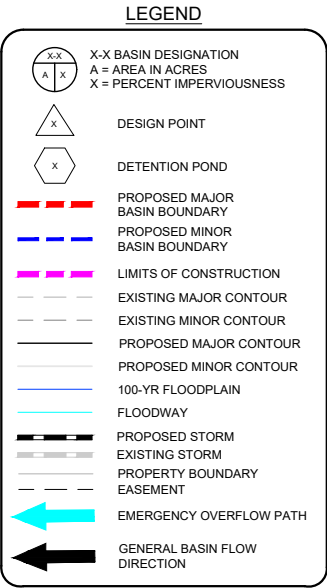
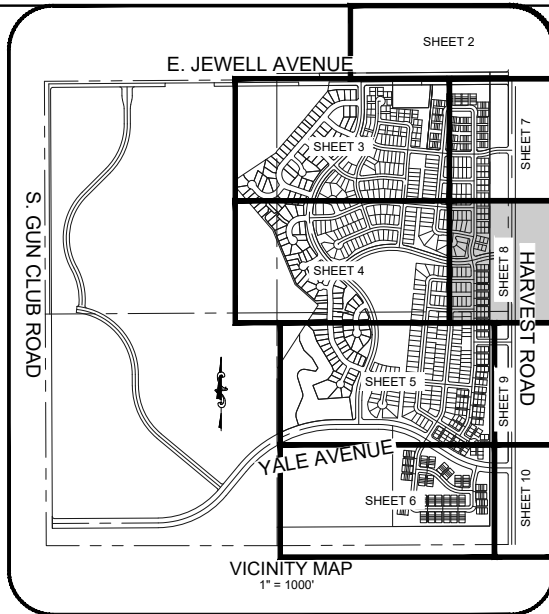
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BENCH MARK  
A CITY OF AURORA BENCHMARK KNOWN AS 4S6518SW001 (FORMERLY KNOWN AS M-095) BEING A 3" DIAMETER BRASS CAP IN CONCRETE AT THE NORTH RIGHT OF WAY FENCE LINE OF EAST MISSISSIPPI AVENUE, NEAR THE NORTH QUARTER CORNER OF SECTION 19, TOWNSHIP 4 SOUTH, RANGE 65 WEST, HAVING A PUBLISHED ELEVATION OF 5603.652, NAVD 1988 DATUM.

FACSIMILE  
THIS ELECTRONIC PLAN IS A FACSIMILE OF THE SIGNED AND SEALED PDF SET.  
  
BRIAN SCHAFFER  
CO PROFESSIONAL ENGINEER  
BRIAN SCHAFFER, CO P.E. NO. 38673  
  
11/19/2020  
DATE

PREPARED UNDER THE SUPERVISION OF

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9781 S. MERIDIAN BLVD., SUITE 120  
ENGLEWOOD, CO 80112  
TEL: (303) 754-0600

MURPHY CREEK EAST (HARVEST RIDGE)  
FILING NO. 1, 2, 3 & 4  
MDR - DRAINAGE MAPS

SCALE:  
AS SHOWN

DRAWN BY: BTP  
CHECKED BY: BS  
DATE: NOVEMBER 2020

FILE NO:  
8130323701

SHEET NUMBER  
8

No. Revisions Date Appr. Date

N:\PROJECTS\MURPHY CREEK FARMS - LENNAR\DCS\ENGINEERING\DRAINAGE\WATER DRAINAGE REPORT\DRAINAGE MAPS\DRAINAGE MAP - PROPOSED 1TH SUBMITTAL.DWG, CS.CLOCKHART, 11/19/2020 2:00 PM

MATCHLINE - SHEET 5

MATCHLINE - SHEET 8

MATCHLINE - SHEET 10

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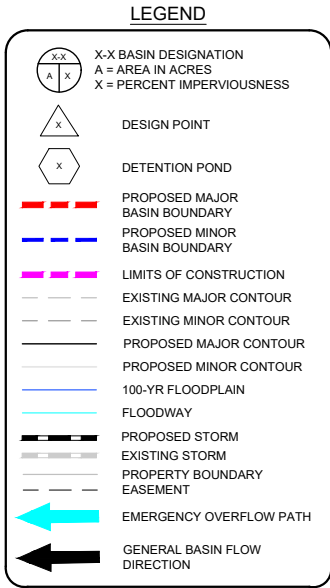
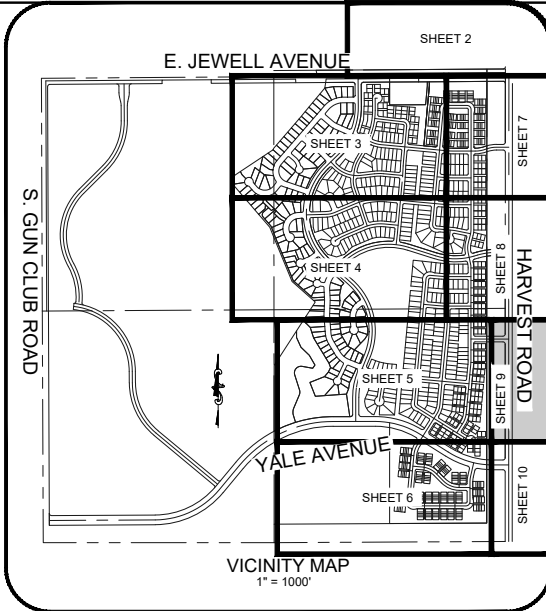
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