FINAL DRAINAGE REPORT
FOR
SCHMIDT PARCEL EARLY GRADING

Prepared For:

Turkey Canon Quarry, LLC
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SEPTEMBER 2022
Project No. 25188.13

Prepared By:
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PCD Filing No.:
CDR-22-007

J·R ENGINEERING

FINAL DRAINAGE REPORT FOR
SCHMIDT PARCEL SEPTEMBER 2022

ENGINEER'S STATEMENT:

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

Mike Bramlett, Colorado P.E. 32314
For and On Behalf of JR Engineering, LLC

COLORADO LICENSED
MIKE BRAMLETT
MB
32314
9/6/22
PROFESSIONAL ENGINEER

DEVELOPER'S STATEMENT:

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

Business Name: Turkey Canon Quarry, LLC

By:

Title: V. P.

Address: 20 Boulder Crescent, Suite 200
Colorado Springs, CO 80903

El Paso County:

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

APPROVED
Engineering Department
12/07/2022 4:07:18 PM
dsdnijkamp
EPC Planning & Community Development Department

Joshua Palmer, P.E.
County Engineer/ ECM Administrator

Date

Conditions:

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PURPOSE

This document is the Final Drainage Report for the Schmidt Parcel. The purpose of this report is to identify on-site and off-site drainage patterns, areas tributary to the site, and to safely route storm water to adequate outfall facilities.

GENERAL SITE DESCRIPTION

GENERAL LOCATION

The Schmidt Parcel (hereby referred to as the "site") is a proposed development with a total area of approximately 97 acres.

The site is located in the southwest quarter of Section 32, Township 12 South, Range 65 West of the Sixth Principal Meridian in the County of El Paso, State of Colorado. The site is located between Black Forest Road and Vollmer Road. The site is bounded by the Trails at Forest Meadows Fillings 3 and 4 to the south, by Silver Pond subdivision and Holiday Hills Filing No.1 to the north, by Black Forest Road to the West and by Vollmer Road to the East. The parcel is planned to be platted after approval of the Preliminary Plan. Refer to the vicinity map in Appendix A for additional information.

DESCRIPTION OF PROPERTY

The site is currently being designed to partly fill in the large pit in the middle of the site. Eventually the parcel will be platted as single and multi-family residential lots and associated development. The site is comprised of variable sloping grasslands that generally slope(s) downward to the west at 2 to 25% towards the Cottonwood Creek tributary basin.

Per a NRCS web soil survey, the site is made up of Type A and B soils. Type A soils have a high infiltration rate when thoroughly wet, while Type B soils have a moderate infiltration when thoroughly wet. Refer to the soil survey map in Appendix A for additional information.

Cottonwood Creek is within the western portion of the site. However there is no proposed disturbance within the creek.

There are no known irrigation facilities located on the project site.

FLOODPLAIN STATEMENT

Based on the FEMA Firm Maps Number 08041C0529G revised December 7, 2018, the vast majority of the development is located within Zone X, or areas area outside the Special Flood Hazard Area (SFHA) and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. A portion of the site is within Zone AE directly adjacent to Cottonwood Creek. The area of disturbance for site grading is located outside of the delineated floodway within Zone X. The FEMA map containing the site has been presented in Appendix A.

EXISTING DRAINAGE CONDITIONS

MAJOR BASIN DESCRIPTIONS

The site lies within the Sand Creek and Cottonwood Creek Drainage Basins. Approximately 16 acres on the sites eastern property line is in the Sand Creek Drainage Basin, while the remainder of the site lies within the Cottonwood Creek Drainage Basin.

Cottonwood Creek transverse the site on the west side of the property running north to south. The reach that runs through the site was studied in the “Cottonwood Creek Drainage Basin Planning Study” (Cottonwood DBPS) completed by Matrix Design Group in July 2019. According to the Cottonwood Creek DBPS reach RUC160 runs through the site, and has been identified as being in stable condition.

The Sand Creek Basin was studied by the City of Colorado Springs in “Sand Creek Drainage Basin Planning Study” (Sand DBPS) completed by Stantec in January 2021. The Sand Creek DBPS assumed the Schmidt Parcel property to have an "Open Space" use for the majority of the site, which is consistent with the proposed development at this time. However, the Cottonwood Creek DBPS assumed a 2.5 Acre Rural Residential Land use for the majority of the site. The site generally drains from northeast to southwest consisting of slopes that range from 2 to 25 %. Currently, the site is undeveloped and a large pit exists in the middle.

EXISTING SUB-BASIN DRAINAGE

The existing condition consists of nine onsite basins and four offsite basins. Values for Basins OSI4 and OSB4 came from “Silver Ponds Subdivision Filing No.1 Final Drainage Report”, by M.V.E Inc. revised May 5th 1996.

Basin OSI4 (Q5 = 19.0 cfs, Q100 = 44.2 cfs) is 27.16 acres of an existing developed subdivision know as Silver Ponds Subdivision Filing 1.Values for this basin were taken from “Silver Ponds Subdivision Filing No.1 Final Drainage Report”, by M.V.E Inc. revised May 5th 1996. Runoff from this basin flows south and enters the site across the northern property line at DPI4. Flow from this basin is routed through Basin EX3 to DP3.1 (Q5 = 17.0 cfs, Q100 = 40.0 cfs) where flow enters Cottonwood Creek.

Basin OSB4 (Q5 = 39.1 cfs, Q100 = 89.8 cfs) is 52.02 acres of an existing developed subdivision know as Silver Ponds Subdivision Filing 1.Values for this basin were taken from “Silver Ponds Subdivision Filing No.1 Final Drainage Report”, by M.V.E Inc. revised May 5th 1996. Runoff from this basin flows south and enters the site across the northern property line at DPB4. Flow from this basin is routed through Basin EX7 to DP7.1 (Q5 = 43.1, Q100 = 97.9 cfs) where flow enters the adjacent property.

Basin OS1 (Q5 = 0.2 cfs, Q100 = 1.5 cfs) is 0.61 acres of dirt roadway. Runoff from this basin flows south and enters the site across the northern property line at DP10. Flow from this basin is routed through Basins EX2 and EX4 to DP4.1 (Q5 = 7.6cfs, Q100 = 50.9 cfs) where flow remains in the existing pit until it evaporates or infiltrates.

Basin OS2 (Q5 = 0.1 cfs, Q100 = 0.6 cfs) is 0.22 acres of dirt roadway. Runoff from this basin flows south and enters the site across the northern property line at DP11. Flow from this basin is routed through Basin EX1 to DP1.1 (Q5 = 2.8 cfs, Q100 = 19.0 cfs) where flow enters Vollmer Road right of way.

Basin EX1 (Q5 = 2.8 cfs, Q100 = 18.8 cfs) is 15.6 acres of undeveloped land at the eastern portion of the site. Runoff from this basin drains to Vollmer Road right of way at DP1. Flows from Basin OS2 is routed through Basin EX1, and exists the site at DP1.1 (Q5 = 2.8 cfs, Q100 = 19.0 cfs). Flow continues southwest along Vollmer Road right of way and follows existing drainage patterns. There is no drainage infrastructure at DP1.1 in the existing condition. Runoff that enters Vollmer Road right of way is assumed to overtop the crown of Vollmer Road and continues to flow southeast towards Sand Creek.

Basin EX2 (Q5 = 3.1 cfs, Q100 = 20.6 cfs) is 22.9 acres of undeveloped land. Runoff from this basin overland flows south where it meets the bottom of an existing berm along the southern boundary. Flow is directed into the existing pit at DP2. Flow enters the basin at DP10 from basin OS1 and is routed through basin EX2 to DP2.1 (Q5 = 3.2 cfs, Q100 = 21.1 cfs). Flows from DP2.1 continue to flow to DP4.1 (Q5 = 7.6cfs, Q100 = 50.9 cfs) where runoff remains in the pit.

Basin EX3 (Q5 = 0.5 cfs, Q100 = 3.1 cfs) is 2.50 acres of undeveloped land adjacent to the northern property line. Runoff from this basin flows north down slope of the existing berm and is routed along the base of the berm to DP3. Off-site runoff enters the basin along the northern property line from Basin OSI4. Flows are routed together at DP3.1 (Q5 = 17.0 cfs, Q100 = 40.0 cfs) and then flow west and enter Cottonwood Creek.

Basin EX4 (Q5 = 7.6 cfs, Q100 = 51.0 cfs) is 33.1 acres of undeveloped land that mainly consists of an existing pit that is approximately 31 acres in area and 15 feet deep. Runoff from this basin flows south to DP4. Flow enters the basin at DP 2.1 (Q5 = 3.2 cfs, Q100 = 21.1 cfs) and is routed to DP4.1 (Q5 = 7.6cfs, Q100 = 50.9 cfs). Currently there is no outlet for the pit and runoff remains in the pit and either evaporates or infiltrates over time.

Basin EX5 (Q5 = 2.2 cfs, Q100 = 14.7 cfs) is 8.0 acres of undeveloped land that drains to the west, directly into Cottonwood Creek. Flows from DP5 and DP6 combine at DP6.1 (Q5 = 3.1 cfs, Q100 = 21.0 cfs). Flow leaves the site at DP6.1 and continues to flow in Cottonwood Creek to the southwest.

Basin EX6 (Q5 = 0.9 cfs, Q100 = 6.3 cfs) is 3.4 acres of undeveloped land that drains to the east, directly into Cottonwood Creek. Flows from DP5 and DP6 combine at DP6.1 (Q5 = 3.1 cfs, Q100 = 21.0 cfs). Flow leaves the site at DP6.1 and continues to flow in Cottonwood Creek to the southwest.

Basin EX7 (Q5 = 0.9, Q100 = 5.7 cfs) is 2.9 acres of undeveloped land that drains southwest to DP7. Off-site flows enter the site at DPB4 (Q5 = 39.1, Q100 = 89.8 cfs). Flows from OSB4 are routed through the basin via overland flow to DP7.1 (Q5 = 43.1, Q100 = 97.9 cfs) where flow leaves the site and enters the adjacent property.

Basin EX8 (Q5 = 1.3 cfs, Q100 = 8.5 cfs) is 6.40 acres of undeveloped land that drains to the south via overland flow to DP8. Flow exists the site at DP8 and continues to flow onto the adjacent property to the south known as the Trails at Forest Meadows Filing 4.

Basin EX9 (Q5 = 0.9 cfs, Q100 = 6.0 cfs) is 2.4 acres of undeveloped land that drains south down slope of the existing berm via overland flow. Runoff from this basin leaves the site across the southern boundary and enters the subdivision to the south at DP9.

PROPOSED DRAINAGE CONDITIONS

PROPOSED SUB-BASIN DRAINAGE

The proposed basin (and sub-basin) delineation is shown on the drainage basin map within Appendix D and is described as follows.

Basin A (Q_5=1.9 cfs, Q_{100}=13.0 cfs) is 11.7 acres of native and stabilized vegetation. Runoff from this basin drains south east and enters purposed swale B1-B1. Flow for Basin A enters Basin B at design point 1. Flow from DP1 is routed through Basins B and F where flow is ultimately routed to the proposed sediment basin at DP6.1 (Q_5=10.1 cfs, Q_{100}=68.7 cfs).

Basin B (Q_5=3.5 cfs, Q_{100}= 23.8 cfs) is 22.0 acres of native and stabilized vegetation. Runoff from this basin drains south west and enters purposed swale B1-B1. Flow for Basin B enters Basin F at design point 2. Flow is routed through Basin F to the purposed sediment basin at DP6.1 (Q_5=10.1 cfs, Q_{100}=68.7 cfs).

Basin C (Q_5=0.8 cfs, Q_{100}=5.5 cfs) is 4.0 acres of undeveloped land with native vegetation. Runoff from this basin drains south east to DP3, where flow enters Vollmer Road right of way. There is no drainage infrastructure at DP3. Runoff that enters Vollmer Road right of way flows existing drainage patterns and is assumed to overtop the crown of Vollmer Road and continues to flow southeast towards Sand Creek. Total runoff entering the right of way has decreased from (Q_5=2.8 cfs, Q_{100}=19.0 cfs) in the existing condition to (Q_5=0.8 cfs, Q_{100}=5.5 cfs) in the proposed condition.

Basin D (Q_5=0.6 cfs, Q_{100}=4.3 cfs) is 2.6 acres of native and stabilized vegetation. Runoff from this basin drains south to DP4. Flow from Basin D overland flows to the adjacent site to the south known as Trails at Forest Meadows Filings 3. Runoff from the site was accounted for in "Trails at Forest Meadows Filing No. 3 Final Drainage Report" (Trails No. 3 FDR) completed by M&S Civil Consultants in August 2015. In the Trails No. 3 FDR flows from the Schmidt parcel were accounted for in Basins OS2 and OS3. The basins total 1.56 acres and send a total flow of Q_5=1.0 cfs and Q_{100}= 3.6 cfs. Proposed condition flows remain reasonable consistent with accounted for flows from the Trails No. 3 FDR. There are no expected negative downstream impacts expected from basin D.

Basin E (Q_5=0.2 cfs, Q_{100}= 1.5 cfs) is 1.6 acres of stabilized earthen channel known as Swale B2-B2. Runoff from this basin drains west to DP5. Off-site flow enters the basin at DPI4 from the neighboring site the north known as Silver Ponds Subdivision Filing No. 1. Flows from Basin E and OSI4 combine and enter Cottonwood Creek at DP5.1 (Q_5= 13.2 cfs, Q_{100}= 30.5 cfs).

Basin F (Q_5=5.7 cfs, Q_{100}= 42.6 cfs) is 36.6 acres of native and stabilized vegetation. Grading efforts in this basin are to provide a sediment basin to provide water quality and detention for the parcel as well as providing a smooth ~2.0% plane to convey runoff to the sediment basin. Runoff from this basin drains southwest to DP6. Flow enters the basin at DP2.1 (Q_5= 5.3 cfs, Q_{100}= 36.2 cfs) from Basins A and B. Flow combines in the proposed sediment basin at DP6.1 (Q_5=10.1 cfs, Q_{100}=68.7 cfs).

Basin G (Q_5=1.0 cfs, Q_{100}= 7.0cfs) is 4.3 acres of undeveloped land that drains to the south at DP7. Runoff from this basin overland flow to DP7 and continues to flow onto the adjacent property to the south known as the Trails at Forest Meadows Filing 4. This basin was studied in "Trails at Forest Meadows Filing No. 4 Final Drainage Report" (Trails No. 4 FDR) completed by M&S Civil Consultants in April 2016, as basin OS5. Basin OS5 from the Trails No. 4 FDR had an area of 4.46 acres with flows of Q_5 = 2.1 cfs and Q_{100}= 9.0 cfs. Developed runoff remains relatively consistent with expected flows for the Trails No. 4 FDR. There are no expected negative downstream impacts expected from this basin.

Basin H (Q_5=1.9 cfs, Q_{100}= 12.7 cfs) is 10.2 acres of undeveloped land that drains to the west, directly into Cottonwood Creek at DP8. Flows from DP8 and DP9 combine at DP9.1 (Q_5=2.6 cfs,

Q_{100}= 18.7 cfs) where flow leaves the site and continues to flow in Cottonwood Creek to the southwest.

Basin I (Q_5=0.6 cfs, Q_{100}= 4.2 cfs) is 3.4 acres of undeveloped land that drains to the east, directly into Cottonwood Creek at DP9. Flows from DP8, DP9 and outflow from the Sediment Basin combine at DP9.1 (Q_5=2.6 cfs, Q_{100}= 18.7 cfs) where flow leaves the site and continues to flow in Cottonwood Creek to the southwest.

Basin J (Q_5=0.7 cfs, Q_{100}= 4.7 cfs) is 2.9 of undeveloped land that drains southwest to DP10. Off-site flows enter the site at DPB4 (Q_5=39.1 cfs, Q_{100}= 89.8 cfs). Flows from OSB4 are routed through the basin via overland flow to DP10.1 (Q_5=43.1 cfs, Q_{100}= 97.9 cfs) where flow leaves the site and enters the adjacent property.

Basin OSI4 (Q5 = 19.0 cfs, Q100 = 44.2 cfs) is 27.16 acres of an existing developed subdivision know as Silver Ponds Subdivision Filing 1.Values for this basin were taken from "Silver Ponds Subdivision Filing No.1 Final Drainage Report", by M.V.E Inc. revised May 5th 1996. Runoff from this basin flows south and enters the site across the northern property line at DPI4. Flow from this basin is routed through Basin E to DP5.1 (Q5 = 13.2 cfs, Q100 = 30.5 cfs) where flow enters Cottonwood Creek. There is no significant change in flows going to Cottonwood Creek in the proposed condition than there was in the existing condition, as the flows were already concentrated towards the creek.

Basin OSB4 (Q5 = 39.1 cfs, Q100 = 89.8 cfs) is 52.02 acres of an existing developed subdivision know as Silver Ponds Subdivision Filing 1.Values for this basin were taken from "Silver Ponds Subdivision Filing No.1 Final Drainage Report", by M.V.E Inc. revised May 5th 1996. Runoff from this basin flows south and enters the site across the northern property line at DPB4. Flow from this basin is routed through Basin J to DP10.1 (Q5 = 43.1 cfs, Q100 = 97.9 cfs) where flow enters the adjacent property. Since there is no proposed changes made in basin J, flows remain the same as in the proposed condition as the existing condition.

DRAINAGE DESIGN CRITERIA

DEVELOPMENT CRITERIA REFERENCE

Storm drainage analysis and design criteria for this project were taken from the "*City of Colorado Springs/El Paso County Drainage Criteria Manual*" Volumes 1 and 2 (EPCDCM), dated October 12, 1994, the "*Urban Storm Drainage Criteria Manual*" Volumes 1 to 3 (USDCM) and Chapter 6 and Section 3.2.1 of Chapter 13 of the "*Colorado Springs Drainage Criteria Manual*" (CSDCM), dated May 2014, as adopted by El Paso County.

HYDROLOGIC CRITERIA

All hydrologic data was obtained from the "*El Paso Drainage Criteria Manual*" Volumes 1 and 2, and the "*Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual*" Volumes 1, 2, and 3. Onsite drainage improvements were designed based on the 5 year (minor) storm event and the 100-year (major) storm event. Runoff was calculated using the Rational Method, and rainfall intensities for the 5-year and the 100-year storm return frequencies were obtained from Table 6-2 of the CSDCM. One hour point rainfall data for the storm events is identified in the chart below. Runoff coefficients were determined based on proposed land use and from data in Table 6-6 from the CSDCM. Time of concentrations were developed using equations from CSDCM. All runoff calculations and applicable charts and graphs are included in the Appendices.

Table 1 - 1-hr Point Rainfall Data

Storm	Rainfall (in.)
5-year	1.50
100-year	2.52

HYDRAULIC CRITERIA

The Rational Method and USDCM's SF-2 and SF-3 forms were used to determine the runoff from the minor and major storms on the site, and the UDFCD MHFD-Detention v4.05 spreadsheet was utilized for evaluating the proposed sediment basin. Hydraflow Express was used to model swale capacity calculations as shown in Appendix C. Proposed swales B1, B2, and C have been designed to meet El Paso County criteria for velocity, freeboard, and stability. All proposed swales will be temporary until the time of construction for the proposed single and multi-family developments proposed for this site.

DRAINAGE FACILITY DESIGN

FOUR STEP PROCESS TO MINIMIZE ADVERSE IMPACTS OF URBANIZATION

In accordance with the El Paso County Drainage Criteria Manual Volume 2, this site has implemented the four step process to minimize adverse impacts of urbanization. The four step process includes reducing runoff volumes, treating the water quality capture volume (WQCV), stabilizing drainage ways, and implementing long-term source controls.

Flow from the site enters Cottonwood Creek in two locations. At the northwestern corner of the property known as DP3.1 (Q5 = 17.0 cfs, Q100 = 40.0 cfs) in existing condition & DP5.1 (Q_5= 13.2 cfs, Q_{100}= 30.5 cfs) in proposed condition. Flow also enters Cottonwood Creek at the western boundary known a DP 6.1 (Q5 = 3.1 cfs, Q100 = 21.0 cfs) in existing condition & DP9.1 (Q_5=2.6 cfs, Q_{100}= 18.7 cfs) in proposed condition. Flow entering Cottonwood Creek has slightly decreased in the proposed condition at both locations. There is no expected changes in water surface elevations in Cottonwood Creek with the development of this site.

Step 1 – Reducing Runoff Volumes: The Schmidt Parcel development project does not consists of any proposed hardscape or roofs and therefor all runoffs associated with this development are routed via overland flow or through grass lined swales.

Step 2 – Stabilize Drainageways: The majority of the site lies within the Cottonwood Creek Drainage Basin, while the eastern most portion on the property is within the Sand Creek Drainage Basin. Cottonwood Creek transvers the western portion of the site. Basin and bridge fees will be due at time of platting. There are no proposed improvements with the 100-year flood plain. According "Cottonwood Creek Drainage Basin Planning Study" (Cottonwood DBPS) completed by Matrix Design Group in July 2019, the creek reach that transvers the site is known as RUC160. This reach has been categorized as having no know or future expected erosion issues according to the Cottonwood DBPS Figure 4-7. Proposed outfalls will be analysis in the final design stage for stability. Applicable excerpts from Cottonwood DBPS can be found in Appendix D.

Step 3 – Treat the WQCV: The sites water quality will be provided by a temporary sediment basin. Long term water quality for the site will be provided by on site full spectrum water quality and detention ponds that will be designed at the time of construction documents associated with the single and multi-family developments planed for the site. The runoff from this site will be routed to the proposed sediment basin via overland flow and grassed lined swales. The proposed sediment basin has been designed to promote settlement of suspended solids. The outlet structure has been designed to detain the water quality capture volume (WQCV) for 72 hours per Mile High Flood District guidelines. All flows released from the sediment basin and future ponds will be reduced to less than historic rates.

Step 4 – Consider Need for Industrial and Commercial BMPs: There are no commercial or industrial components to this development; therefore no BMPs of this nature are required. BMPs will be utilized to minimize off-site contaminants and to protect the downstream receiving waters. The site is not a high-risk site per Figure I-1 in ECM Appendix I, therefore specialized BMPs do not need to be considered. Site specific temporary source control BMPs that will be implemented include, but are not limited to, silt fencing placed around downstream areas of disturbance, construction vehicle tracking pads at the entrances, designated vehicle fueling areas, covered storage areas, spill containment and control, etc. The permanent erosion control BMPs include permanent vegetation, permanent swale, and sediment basin.

WATER QUALITY

The sites water quality will be provided by a temporary sediment basin. Long term water quality for the site will be provided by on site full spectrum water quality and detention ponds that will be designed at the time of construction documents associated with the single and multi-family developments planed for the site. The proposed sediment basin was designed per Urban Drainage and Flood Control District guidelines. Flow shall be released per detail per Mile High Flood District detail SC-7. The riser pipe shall be 12” in diameter to be connected to a 12” outfall pipe that will direct flow to swale C-C. An emergency overflow spillway is provided for the sediment basin that is directed into Cottonwood Creek from swale C-C. For this drainage report the design points are discussed in the Proposed Drainage Conditions section of this report. The corresponding design points and basin are shown within the Proposed Drainage Map within Appendix E. For additional information on the proposed sediment basin and outlet characteristics see the MHFD sheets within Appendix C.

EROSION CONTROL PLAN

We respectfully request that the Erosion Control Plan and Cost Estimate be submitted in conjunction with the grading and erosion control plan and construction assurances posted prior to obtaining a grading permit.

OPERATION & MAINTENANCE

In order to ensure the function and effectiveness of the stormwater infrastructure, maintenance activities such as inspection, routine maintenance, restorative maintenance, rehabilitation and repair, are required. The property owner shall be responsible for the inspection, maintenance, rehabilitation and repair of stormwater and erosion control facilities located on the property unless another party accepts such responsibility in writing and responsibility is properly assigned through legal documentation. We respectfully request that the Operation & Maintenance Manual be submitted in conjunction with the construction documents, prior to obtaining a grading permit.

DRAINAGE AND BRIDGE FEES

The site lies within the Cottonwood Creek and Sand Creek Drainage Basins. Anticipated drainage and bridge fees will be provided at time of platting.

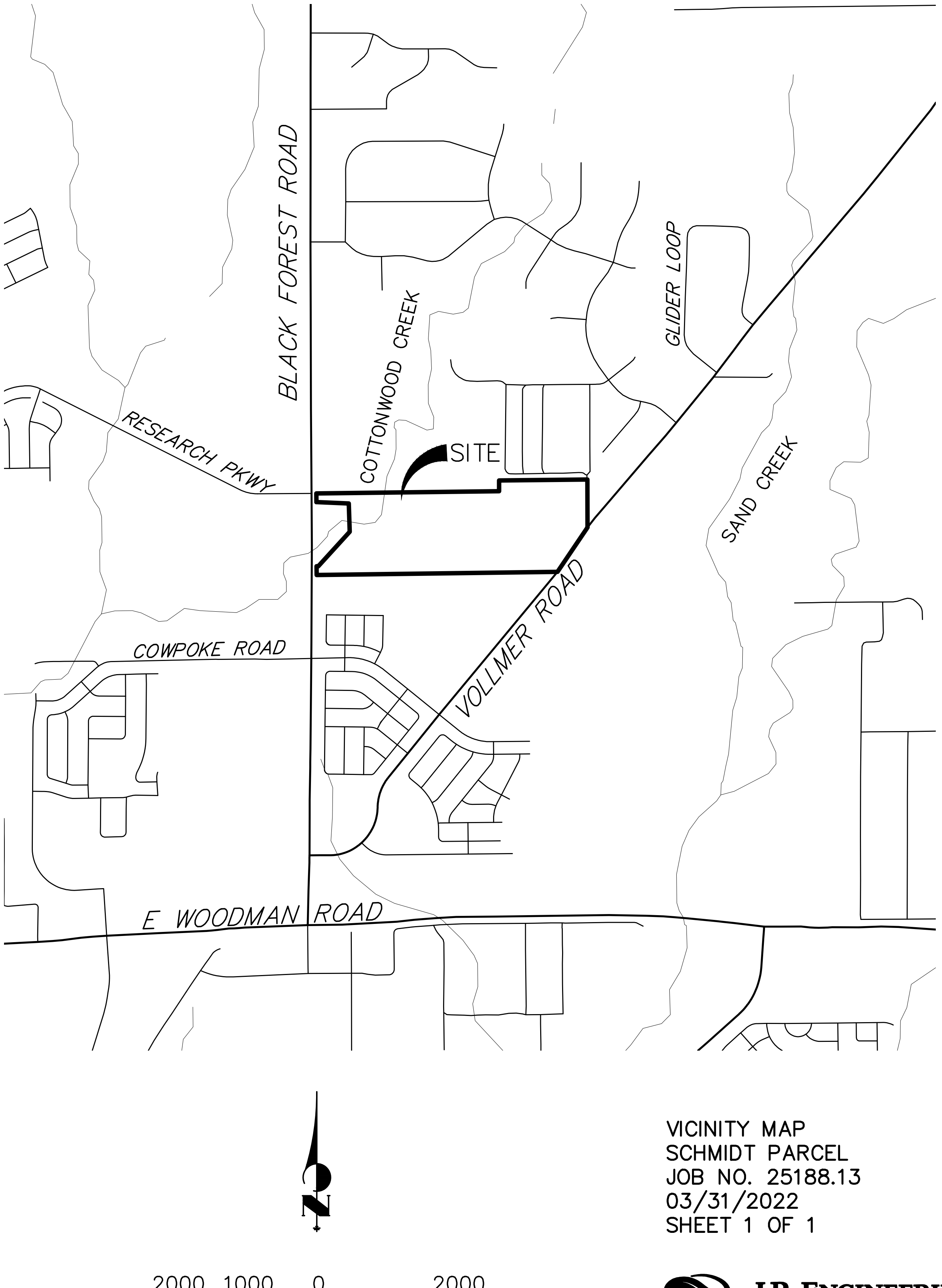
SUMMARY

The proposed Schmidt Parcel drainage improvements were designed to meet or exceed the El Paso County Drainage Criteria. The proposed development will not adversely affect the offsite drainage ways or surrounding development. This report is in conformance and meets the latest El Paso County Storm Drainage Criteria requirements.

REFERENCES

1. "El Paso County and City of Colorado Springs Drainage Criteria Manual, Vol I & II".
2. El Paso County ECM, 2019
3. El Paso County DCM Vol. 1 Update, 2015
4. Urban Storm Drainage Criteria Manual (Volumes 1, 2, and 3), Urban Drainage and Flood Control District, June 2001.
5. Final Drainage Report For Silver Ponds Subdivision Filing No. 1, M.V.E. Inc., Febuary 2, 1995, Revised May 5, 1996.
6. Sand Creek Drainage Basin Planning Study, Stantec, January 2021
7. Cottonwood Creek Drainage Basin Planning Study, Matrix Design Group, July 2019
8. Trails at Forest Meadows Filing No. 3 Final Drainage Report M&S Civil Consultants Inc., August 2015
9. Trails at Forest Meadows Filing No. 4 Final Drainage Report M&S Civil Consultants Inc., April 2016

Appendix A
Vicinity Map, Soil Descriptions, FEMA Floodplain Map



VICINITY MAP
SCHMIDT PARCEL
JOB NO. 25188.13
03/31/2022
SHEET 1 OF 1

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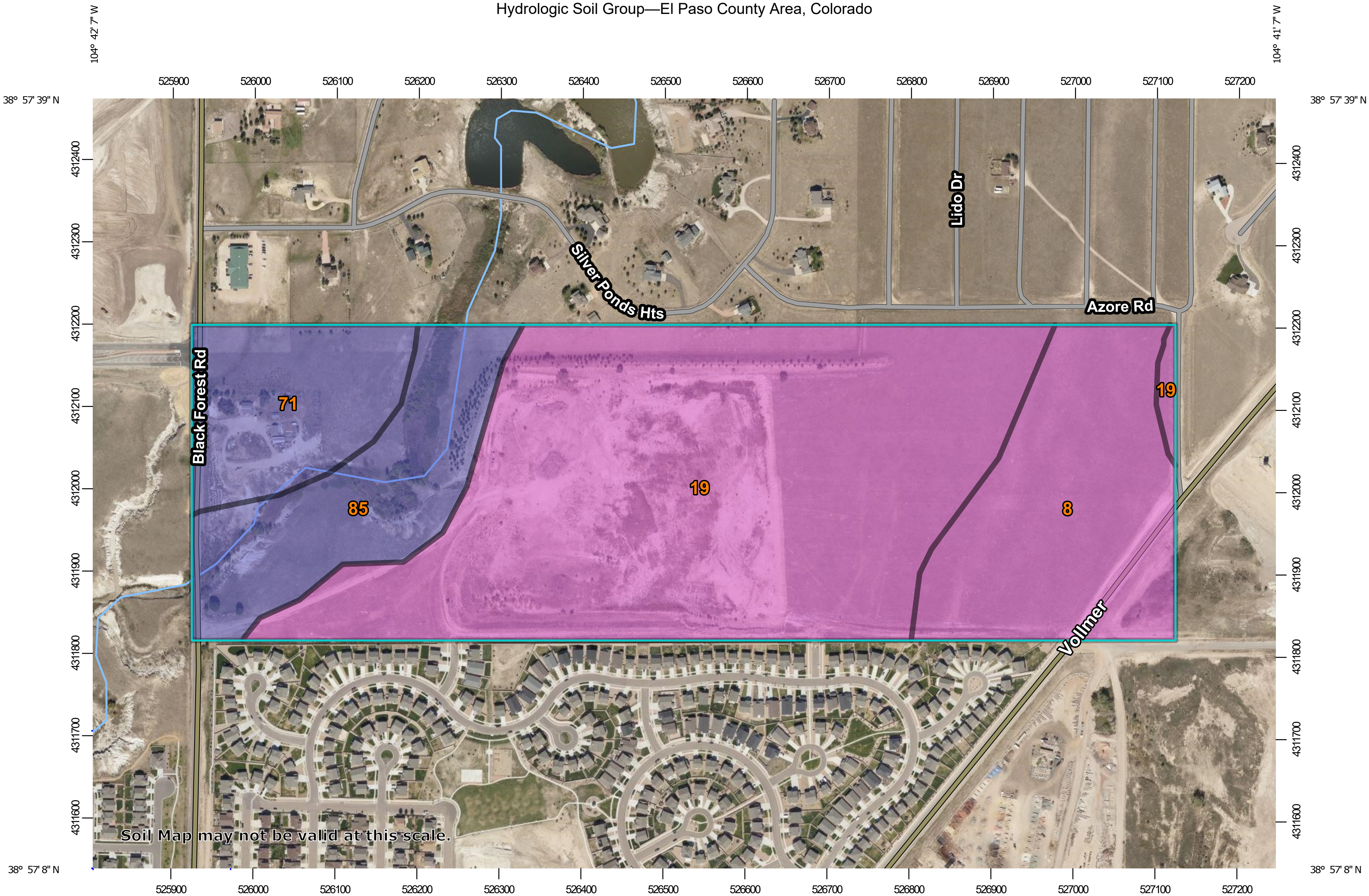


Map Scale: 1:6,600 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 50, 100, 200, 300

Feet: 0, 300, 600, 1200, 1800

N

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

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

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

Soil Rating Lines

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

Soil Rating Points

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

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

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

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

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

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
8	Blakeland loamy sand, 1 to 9 percent slopes	A	22.3	19.5%
19	Columbine gravelly sandy loam, 0 to 3 percent slopes	A	64.2	56.2%
71	Pring coarse sandy loam, 3 to 8 percent slopes	B	12.1	10.6%
85	Stapleton-Bernal sandy loams, 3 to 20 percent slopes	B	15.6	13.6%
Totals for Area of Interest			**114.1**	**100.0%**

Description

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

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

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

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

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

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

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

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOTES TO USERS

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

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

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

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

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

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

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

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

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

Base Map information shown on this FIRM was provided in digital format by El Paso County, Colorado Springs Utilities, and Anderson Consulting Engineers, Inc. These data are current as of 2008.

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

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

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

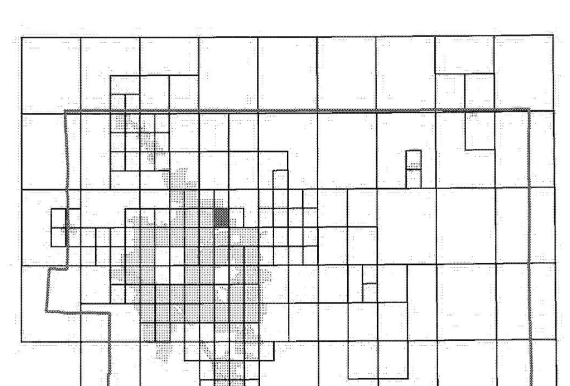
Contact **FEMA Map Service Center** (MSC) via the FEMA Map Information eXchange (FMIX) 1-877-336-2627 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this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

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

El Paso County Vertical Datum Offset Table

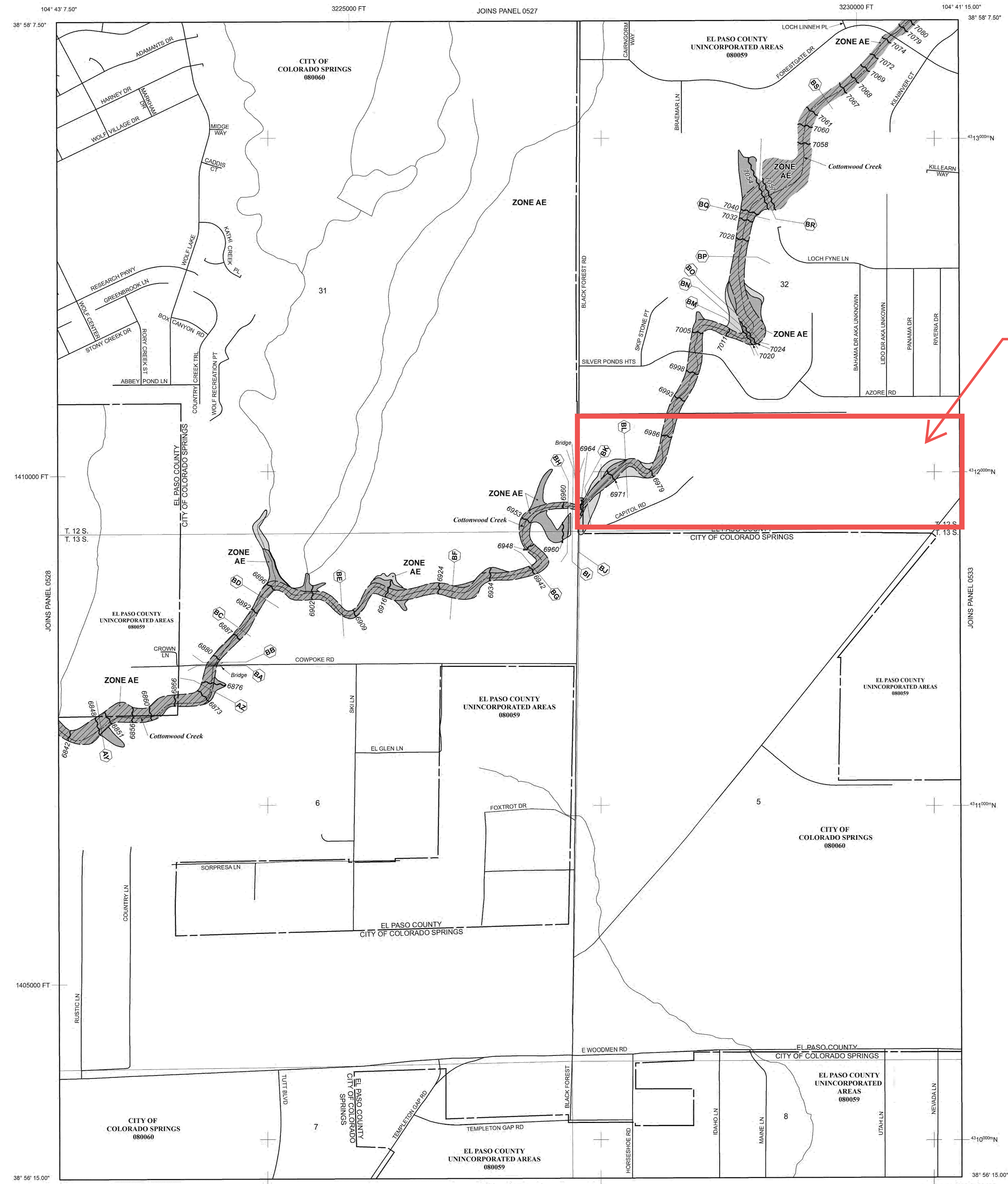
Flooding Source	Vertical Datum Offset (ft)
REFER TO SECTION 3.3 OF THE EL PASO COUNTY FLOOD INSURANCE STUDY FOR STREAM BY STREAM VERTICAL DATUM CONVERSION INFORMATION	

Panel Location Map



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

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



NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 12 SOUTH, RANGE 65 WEST, AND TOWNSHIP 13 SOUTH, RANGE 65 WEST.

LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

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

A — A Cross section line
23 - - - 23 Transect line
97° 07' 30.00" 32° 22' 30.00" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
$^{42}75^{000m}$N — 1000-meter Universal Transverse Mercator grid ticks, zone 13
6000000 FT — 5000-foot grid ticks: Colorado State Plane coordinate system, central zone (FIPSZONE 0502), Lambert Conformal Conic Projection
DX5510 × — Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

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

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

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

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

N

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

PANEL 0529G

NATIONAL FLOOD INSURANCE PROGRAM

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

PANEL 529 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0529	G
EL PASO COUNTY	080059	0529	G

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

MAP NUMBER 08041C0529G

MAP REVISED DECEMBER 7, 2018

Federal Emergency Management Agency

Appendix B
Hydrologic Calculations

COMPOSITE % IMPERVIOUS CALCULATIONS -EXISTING CONDITIONS

Subdivision:
Location: El Paso County

Project Name: Schmidt Parcel
Project No.: 25188.13
Calculated By: APL
Checked By:
Date: 9/2/22

Basin ID	Total Area (ac)	PASTURE/MEADOW (2% Imp.)				Basins Total Weighted C		Basins Total Weighted % Imp.
		C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	
EX1	15.60	0.09	0.36	15.60	2.0%	0.09	0.36	2.0%
EX2	22.90	0.09	0.36	22.90	2.0%	0.09	0.36	2.0%
EX3	2.50	0.09	0.36	2.50	2.0%	0.09	0.36	2.0%
EX4	33.10	0.09	0.36	33.10	2.0%	0.09	0.36	2.0%
EX5	8.00	0.09	0.36	8.00	2.0%	0.09	0.36	2.0%
EX6	3.40	0.09	0.36	3.40	2.0%	0.09	0.36	2.0%
EX7	2.90	0.09	0.36	2.90	2.0%	0.09	0.36	2.0%
EX8	6.40	0.09	0.36	6.40	2.0%	0.09	0.36	2.0%
EX9	2.40	0.09	0.36	2.40	2.0%	0.09	0.36	2.0%
OS1	0.61	0.09	0.36	0.61	2.0%	0.09	0.36	2.0%
OS2	0.22	0.09	0.36	0.22	2.0%	0.09	0.36	2.0%
TOTAL	**98.03**							**2.0%**

STANDARD FORM SF-2 - EXISTING CONDITIONS
TIME OF CONCENTRATION

Subdivision: ______________________

Location: El Paso County

Project Name: Schmidt Parcel

Project No.: 25188.13

Calculated By: APL

Checked By: ______________________

Date: 9/2/22

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					t_c CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
EX1	15.60	A	2%	0.09	0.36	300.0	2.5%	23.2	872	2.5%	5.0	0.8	18.4	41.6	1172.3	35.6	41.6
EX2	22.90	A	2%	0.09	0.36	300.0	2.3%	23.9	1412	1.9%	5.0	0.7	34.1	58.1	1712.0	44.1	58.1
EX3	2.50	A	2%	0.09	0.36	38.0	18.1%	4.3	1278	1.4%	5.0	0.6	36.2	40.6	1315.5	45.2	40.6
EX4	33.10	A	2%	0.09	0.36	300.0	5.4%	18.1	945	2.2%	10.0	1.5	10.6	28.7	1244.7	37.0	28.7
EX5	8.00	B	2%	0.09	0.36	227.0	11.0%	12.5	1054	2.1%	15.0	2.2	8.1	20.5	1281.0	38.7	20.5
EX6	3.40	B	2%	0.09	0.36	202.0	10.4%	12.0	1054	2.1%	15.0	2.2	8.1	20.0	1256.0	38.7	20.0
EX7	2.90	B	2%	0.09	0.36	175.0	2.6%	17.6	0	0.0%	5.0	0.0	0.0	17.6	175.0	25.7	17.6
EX8	6.40	A	2%	0.09	0.36	300.0	2.0%	25.3	453	2.0%	5.0	0.7	10.7	36.0	753.0	31.4	36.0
EX9	2.40	A	2%	0.09	0.36	53	9.0%	6.4	0	0.0%	5.0	0.0	0.0	6.4	53.0	25.7	10.0
OS1	0.61	A	2%	0.09	0.36	30.1	1.8%	8.2	0	0.0%	10.0	0.0	0.0	8.2	30.1	25.7	10.0
OS2	0.22	A	2%	0.09	0.36	34.7	1.8%	8.8	0	0.0%	10.0	0.0	0.0	8.8	34.7	25.7	10.0

NOTES:

$$t_c = t_i + t_t$$ Equation 6-2

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$ Equation 6-3

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L_i = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$ Equation 6-4

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_o = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$
K = NRCS conveyance factor (see Table 6-2).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$ Equation 6-5

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

STANDARD FORM SF-3 - EXISITNG CONDITIONS

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision:
Location: El Paso County
Design Storm: 5-Year

Project Name: Schmidt Parcel
Project No.: 25188.13
Calculated By: APL
Checked By:
Date: 9/2/22

		DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	REMARKS
	1	EX1	15.60	0.09	41.6	1.40	1.99	2.8															Runoff overland flows across exisitng field to DP1 where flow enters Vollmer ROW
	1.1								41.6	1.42	1.99	2.8											Flow for Basin EX1 and OS2 combine at DP 1.1 and enters Vollmer ROW
	2	EX2	22.90	0.09	58.1	2.06	1.49	3.1															Runoff from Basin EX2, overland flows across exsiting field to DP 2 where flow contiues into Basin EX4
	2.1								58.1	2.12	1.49	3.2											Flows Form Basin EX2 and OS1 combine at DP2.1 and enters Basin EX4
	3	EX3	2.50	0.09	40.6	0.23	2.03	0.5															Runoff from Basin EX3 overland flows down berm and flows along bottom of berm to DP3 .
	3.1								40.6	8.37	2.03	17.0											Flows from Basin EX3 and DP I4 combine at DP3.1 and enters Cottonwood Creek
	4	EX4	33.10	0.09	28.7	2.98	2.55	7.6															Runoff form basin EX4 overland flows across steep side slopes into the exisitng pit, flow contuies to travel south and remains in the pit at DP4
	4.1								58.1	5.09	1.49	7.6											Flow for Basin EX4 and desing point DP2.1 combine at DP 4.1
	5	EX5	8.00	0.09	20.5	0.72	3.05	2.2															Runoff from Basin EX5 overland flows down the Cottonwood Creek enbankment slopes & contuies to flow along the thalweg axis of the creek
	6	EX6	3.40	0.09	20.0	0.31	3.09	0.9															Runoff from Basin EX6 overland flows down the Cottonwood Creek enbankment slopes & contuies to flow along the thalweg axis of the creek
	6.1								20.5	1.03	3.05	3.1											Flow from basin EX5 and EX6 combine at DP6.1 and contuines to flow in Cottonwood Creek to the Southwest
	7	EX7	2.90	0.09	17.6	0.26	3.28	0.9															Runoff from Basin EX7, overland flows southwest to the adjacent property at DP7
	7.1								28.7	16.91	2.55	43.1											Flows from Basin EX7 and DP B4 combine at DP7.1 and flow contuines on to neighboring property
	8	EX8	6.40	0.09	36.0	0.58	2.21	1.3															Runoff from Basin EX8, overland flows south to DP8 where flow leaves the site and enters the subdivision to the south
	9	EX9	2.40	0.09	10.0	0.22	4.13	0.9															Runoff from Basin EX9, overland flows south and enters the adjacent property to the south
	10	OS1	0.61	0.09	10.0	0.05	4.13	0.2															Runoff from Basin OS1, overland flows south and enters the site at DP10
	11	OS2	0.22	0.09	10.0	0.02	4.13	0.1															Runoff from Basin OS2, overland flows south and enters the site at DP11
	B4	OSB4	52.02	0.32	28.7	16.65	2.35	39.1															Off-site basin OSB4 Values from Sliver Pond FDR (Bains OS1- B4 & DP8)
	I4	OSI4	27.16	0.30	29.2	8.15	2.33	19.0															Off-site Basin OSI4 Values from Sliver Pond FDR (Bains I4 & DP21)

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

STANDARD FORM SF-3 - EXISITNG CONDITIONS

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Project Name: Schmidt Parcel
Subdivision:
Project No.: 25188.13
Location: El Paso County
Calculated By: APL
Design Storm: 100-Year
Checked By:
Date: 9/2/22

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	EX1	15.60	0.36	41.6	5.62	3.34	18.8															Runoff overland flows across exisitng field to DP1 where flow enters Vollmer ROW
	1.1								41.6	5.70	3.34	19.0											Flow for Basin EX1 and OS2 combine at DP 1.1 and enters Vollmer ROW
	2	EX2	22.90	0.36	58.1	8.24	2.50	20.6															Runoff from Basin EX2, overland flows across exsiting field to DP 2 where flow contiues into Basin EX4
	2.1								58.1	8.46	2.50	21.1											Flows Form Basin EX2 and OS1 combine at DP2.1 and enters Basin EX4
	3	EX3	2.50	0.36	40.6	0.90	3.40	3.1															Runoff from Basin EX3 overland flows down berm and flows along bottom of berm to DP3 .
	3.1								40.6	11.76	3.40	40.0											Flows from Basin EX3 and DP I4 combine at DP3.1 and enters Cottonwood Creek
	4	EX4	33.10	0.36	28.7	11.92	4.28	51.0															Runoff form basin EX4 overland flows across steep side slopes into the exisitng pit, flow contuies to travel south and remains in the pit at DP4
	4.1								58.1	20.38	2.50	50.9											Flow for Basin EX4 and desing point DP2.1 combine at DP 4.1
	5	EX5	8.00	0.36	20.5	2.88	5.12	14.7															Runoff from Basin EX5 overland flows down the Cottonwood Creek enbankment slopes & contuies to flow along the thalweg axis of the creek
	6	EX6	3.40	0.36	20.0	1.22	5.18	6.3															Runoff from Basin EX6 overland flows down the Cottonwood Creek enbankment slopes & contuies to flow along the thalweg axis of the creek
	6.1								20.5	4.10	5.12	21.0											Flow from basin EX5 and EX6 combine at DP6.1 and contuines to flow in Cottonwood Creek to the Southwest
	7	EX7	2.90	0.36	17.6	1.04	5.51	5.7															Runoff from Basin EX7, overland flows southwest to the adjacent property at DP7
	7.1								28.7	22.89	4.28	97.9											Flows from Basin EX7 and DP B4 combine at DP7.1 and flow contuines on to neighboring property
	8	EX8	6.40	0.36	36.0	2.30	3.70	8.5															Runoff from Basin EX8, overland flows south to DP8 where flow leaves the site and enters the subdivision to the south
	9	EX9	2.40	0.36	10.0	0.86	6.93	6.0															Runoff from Basin EX9, overland flows south and enters the adjacent property to the south
	10	OS1	0.61	0.36	10.0	0.22	6.93	1.5															Runoff from Basin OS1, overland flows south and enters the site at DP10
	11	OS2	0.22	0.36	10.0	0.08	6.93	0.6															Runoff from Basin OS2, overland flows south and enters the site at DP11
	B4	OSB4	52.02	0.42	28.7	21.85	4.11	89.8															Off-site basin OSB4 Values from Sliver Pond FDR (Bains OS1- B4 & DP8)
	I4	OSI4	27.16	0.40	29.2	10.86	4.07	44.2															Off-site Basin OSI4 Values from Sliver Pond FDR (Bains I4 & DP21)

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

COMPOSITE % IMPERVIOUS CALCULATIONS -PROPOSED CONDITIONS

Subdivision:
Location: El Paso County

Project Name: Schimidt Parcel
Project No.: 25188.13
Calculated By: APL
Checked By:
Date: 9/2/22

Basin ID	Total Area (ac)	Gravlel (80% Imp.)				PASTURE/MEADOW (0% Imp.)				Basins Total Weighted C		Basins Total Weighted % Imp.
		C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	Area (ac)	Weighted % Imp.	C_5	C_{100}	
A	11.70	0.59	0.70	0.00	0.0%	0.09	0.36	11.70	2.0%	0.09	0.36	2.0%
B	22.00	0.59	0.70	0.45	1.6%	0.09	0.36	21.55	2.0%	0.10	0.37	3.6%
C	4.00	0.59	0.70	0.00	0.0%	0.09	0.36	4.00	2.0%	0.09	0.36	2.0%
D	2.60	0.59	0.70	0.00	0.0%	0.09	0.36	2.60	2.0%	0.09	0.36	2.0%
E	1.60	0.59	0.70	0.00	0.0%	0.09	0.36	1.60	2.0%	0.09	0.36	2.0%
F	36.60	0.59	0.70	0.36	0.8%	0.09	0.36	36.24	2.0%	0.09	0.36	2.8%
G	4.30	0.59	0.70	0.00	0.0%	0.09	0.36	4.30	2.0%	0.09	0.36	2.0%
H	10.20	0.59	0.70	0.00	0.0%	0.09	0.36	10.20	2.0%	0.09	0.36	2.0%
I	3.40	0.59	0.70	0.00	0.0%	0.09	0.36	3.40	2.0%	0.09	0.36	2.0%
J	2.90	0.59	0.70	0.00	0.0%	0.09	0.36	2.90	2.0%	0.09	0.36	2.0%
TOTAL	**99.30**											**2.6%**
SB TOTAL	70.30											2.90%

STANDARD FORM SF-2 - PROPOSED CONDITIONS
TIME OF CONCENTRATION

Subdivision:

Location: El Paso County

Project Name: Schimidt Parcel

Project No.: 25188.13

Calculated By: APL

Checked By:

Date: 9/2/22

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					*tc* CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (ac)	Hydrologic Soils Group	Impervious (%)	C_5	C_{100}	L (ft)	S_o (%)	t_i (min)	L_t (ft)	S_t (%)	K	VEL. (ft/s)	t_t (min)	COMP. t_c (min)	TOTAL LENGTH (ft)	Urbanized t_c (min)	t_c (min)
A	11.70	A	2.0%	0.09	0.36	300.0	2.8%	22.6	1324	1.8%	7.0	0.9	23.6	46.2	1623.7	43.5	46.2
B	22.00	A	3.6%	0.10	0.37	300.0	2.3%	23.8	1402	1.8%	7.0	0.9	24.9	48.6	1701.7	43.7	48.6
C	4.00	A	2.0%	0.09	0.36	300.0	2.1%	24.8	423	2.1%	5.0	0.7	9.8	34.6	722.7	30.9	34.6
D	2.60	A	2.0%	0.09	0.36	231.8	2.6%	20.3	0	0.0%	5.0	0.0	0.0	20.3	231.8	25.7	25.7
E	1.60	A	2.0%	0.09	0.36	35.0	2.9%	7.6	1372	0.8%	7.0	0.6	36.5	44.1	1406.5	53.2	53.2
F	36.60	A	2.8%	0.09	0.36	300.0	2.8%	22.3	1554	2.7%	5.0	0.8	31.6	53.9	1853.8	42.4	53.9
G	4.30	B	2.0%	0.09	0.36	300.0	2.0%	25.1	0	0.0%	5.0	0.0	0.0	25.1	300.0	25.7	25.7
H	10.20	B	2.0%	0.09	0.36	227.0	11.0%	12.5	1054	2.1%	15.0	2.2	8.1	20.6	1281.0	38.8	38.8
I	3.40	B	2.0%	0.09	0.36	202	10.4%	12.0	1054	2.1%	15.0	2.2	8.1	20.1	1256.0	38.7	38.7
J	2.90	B	2.0%	0.09	0.36	175	2.6%	17.7	0	0.0%	5.0	0.0	0.0	17.7	175.0	25.7	25.7

NOTES:

$$t_c = t_i + t_t$$

Where:

t_c = computed time of concentration (minutes)

t_i = overland (initial) flow time (minutes)

t_t = channelized flow time (minutes).

Equation 6-2

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_o^{0.33}}$$

Equation 6-3

Where:

t_i = overland (initial) flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 6-4)
L_i = length of overland flow (ft)
S_o = average slope along the overland flow path (ft/ft).

$$t_t = \frac{L_t}{60K\sqrt{S_o}} = \frac{L_t}{60V_t}$$

Equation 6-4

Where:

t_t = channelized flow time (travel time, min)
L_t = waterway length (ft)
S_o = waterway slope (ft/ft)
V_t = travel time velocity (ft/sec) = $K\sqrt{S_o}$
K = NRCS conveyance factor (see Table 6-2).

$$t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

Equation 6-5

Where:

t_c = minimum time of concentration for first design point when less than t_c from Equation 6-1.
L_t = length of channelized flow path (ft)
i = imperviousness (expressed as a decimal)
S_t = slope of the channelized flow path (ft/ft).

Table 6-2. NRCS Conveyance factors, K

Type of Land Surface	Conveyance Factor, K
Heavy meadow	2.5
Tillage/field	5
Short pasture and lawns	7
Nearly bare ground	10
Grassed waterway	15
Paved areas and shallow paved swales	20

Use a minimum t_c value of 5 minutes for urbanized areas and a minimum t_c value of 10 minutes for areas that are not considered urban. Use minimum values even when calculations result in a lesser time of concentration.

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

Project Name: Schimidt Parcel
Subdivision:
Project No.: 25188.13
Location: El Paso County
Calculated By: APL
Design Storm: 5-Year
Checked By:
Date: 9/2/22

STREET		DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	t_c (min)	C*A (Ac)	*I* (in/hr)	Q (cfs)	tc (min)	C*A (ac)	*I* (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	A	11.70	0.09	46.2	1.05	1.83	1.9															Runoff overland flows to proposed swale and contuies into Basin B at DP1
	2	B	22.00	0.09	48.6	1.98	1.76	3.5															Runoff from Basin B, overland flows to proposed swale and contuies into Basin F at DP2
	2.1								48.6	3.03	1.76	5.3											Flows Form Basin A and B combine at DP2.1 and enters Basin F
	3	C	4.00	0.09	34.6	0.36	2.27	0.8															Runoff overland flows across exisitng field to DP3 where flow enters Vollmer ROW
	4	D	2.60	0.09	25.7	0.23	2.72	0.6															Runoff form basin D overland flows south and enters the adjacent property to the south
	5	E	1.60	0.09	53.2	0.14	1.62	0.2															Runoff from Basin E is collected in the proposed swale and routed west to Cottonwood Creek
	5.1								53.2	8.29	1.62	13.4											Flows from Basins E and DP I4 combine at DP5.1 and contunie into Cottonwood Creek
	6	F	36.60	0.09	53.9	3.29	1.60	5.3															Runoff form basin F overland flows across steep side slopes into the pit, flow contuies to travel south and remains in the pit at DP6
	6.1								53.9	6.33	1.60	10.1											Flow from Basin F and DP2.1 combine at DP6.1 and remain in the pit at DP6.1
	7	G	4.30	0.09	25.7	0.39	2.72	1.1															Runoff from Basin G, overland flows southwest to the adjacent property at DP7
	8	H	10.20	0.09	38.8	0.92	2.10	1.9															Runoff from Basin H overland flows down the Cottonwood Creek enbankment slopes & contuies to flow along the thalweg axis of the creek
	9	I	3.40	0.09	38.7	0.31	2.10	0.6															Runoff from Basin I overland flows down the Cottonwood Creek enbankment slopes & contuies to flow along the thalweg axis of the creek
	9.1								38.8	1.22	2.10	2.7											Flow from Basins H and I combine at DP9.1 and contunie to flow in Cottonwood creek offsite, Emergany Spillway Flows are accouned for in 9.1
	10	J	2.90	0.09	25.7	0.26	2.72	0.7															Runoff from Basin J, overland flows south and enters the site at DP10
	10.1								28.7	16.91	2.55	43.1											Flows from Basins J and DP B4 combine at DP10.1 and enters the adjacent proporerty
	B4	OSB4	52.02	0.32	28.7	16.65	2.35	39.1															Off-site basin OSB4 Values from Sliver Pond FDR (Bains OS1- B4 & DP8)
	I4	OSI4	27.16	0.30	29.2	8.15	2.33	19.0															Off-site Basin OSI4 Values from Sliver Pond FDR (Bains I4 & DP21)

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

STANDARD FORM SF-3 - PROPOSED CONDITIONS

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Project Name: Schimidt Parcel
Subdivision:
Project No.: 25188.13
Location: El Paso County
Calculated By: APL
Design Storm: 100-Year
Checked By:
Date: 9/2/22

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (ac)	Runoff Coeff.	t_c (min)	C*A (ac)	I (in/hr)	Q (cfs)	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Q_{street} (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	A	11.70	0.36	46.2	4.21	3.08	13.0															Runoff overland flows to proposed swale and contuies into Basin B at DP1
	2	B	22.00	0.37	48.6	8.07	2.95	23.8															Runoff from Basin B, overland flows to proposed swale and contuies into Basin F at DP2
	2.1								48.6	12.28	2.95	36.2											Flows Form Basin A and B combine at DP2.1 and enters Basin F
	3	C	4.00	0.36	34.6	1.44	3.80	5.5															Runoff overland flows across exisitng field to DP3 where flow enters Vollmer ROW
	4	D	2.60	0.36	25.7	0.94	4.56	4.3															Runoff form basin D overland flows south and enters the adjacent property to the south
	5	E	1.60	0.36	53.2	0.58	2.72	1.6															Runoff from Basin E is collected in the proposed swale and routed west to Cottonwood Creek
	5.1								53.2	11.44	2.72	31.1											Flows from Basins E and DP I4 combine at DP5.1 and contunie into Cottonwood Creek
	6	F	36.60	0.36	53.9	13.30	2.69	35.7															Runoff form basin F overland flows across steep side slopes into the pit, flow contuies to travel south and remains in the pit at DP6
	6.1								53.9	25.58	2.69	68.7											Flow from Basin F and DP2.1 combine at DP6.1 and remain in the pit at DP6.1
	7	G	4.30	0.36	25.7	1.55	4.56	7.1															Runoff from Basin G, overland flows southwest to the adjacent property at DP7
	8	H	10.20	0.36	38.8	3.67	3.52	12.9															Runoff from Basin H overland flows down the Cottonwood Creek enbankment slopes & contuies to flow along the thalweg axis of the creek
	9	I	3.40	0.36	38.7	1.22	3.52	4.3															Runoff from Basin I overland flows down the Cottonwood Creek enbankment slopes & contuies to flow along the thalweg axis of the creek
	9.1								38.8	4.89	3.52	18.9											Flow from Basins H and I combine at DP9.1 and contunie to flow in Cottonwood creek, Emergancy Spillway flows are accouted for in 9.1
	10	J	2.90	0.36	25.7	1.04	4.56	4.7															Runoff from Basin J, overland flows south and enters the site at DP10
	10.1								28.7	22.89	4.28	97.9											Flows from Basins J and DP B4 combine at DP10.1 and enters the adjacent proporerty
	B4	OSB4	52.02	0.42	28.7	21.85	4.11	89.8															Off-site basin OSB4 Values from Sliver Pond FDR (Bains OS1- B4 & DP8)
	I4	OSI4	27.16	0.40	29.2	10.86	4.07	44.2															Off-site Basin OSI4 Values from Sliver Pond FDR (Bains I4 & DP21)

Notes:
Street and Pipe C*A values are determined by Q/i using the catchment's intensity value.

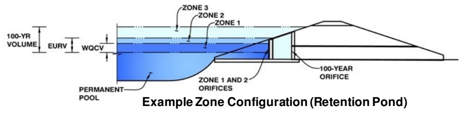
Appendix C
Hydraulic Calculations

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)

Project: **SCHMIDT PARCEL**

Basin ID: **Custom Sediment Basin**



Example Zone Configuration (Retention Pond)

Sediment Basin not an EDB

72hr drain time, per MHFD SC-07

Per MHFD SC-07, 3,600 CF of volume per acre:
70.2 AC* 3,600CF* (1acre-ft/43559.9 CF)= 5.80 Acre-Ft

Watershed Information

Selected BMP Type =	**EDB**		
Watershed Area =	70.20	acres	
Watershed Length =	3,434	ft	
Watershed Length to Centroid =	1,103	ft	
Watershed Slope =	0.014	ft/ft	
Watershed Imperviousness =	2.90%	percent	
Percentage Hydrologic Soil Group A =	100.0%	percent	
Percentage Hydrologic Soil Group B =	0.0%	percent	
Percentage Hydrologic Soil Groups C/D =	0.0%	percent	
Target WQCV Drain Time =	72.0	hours	**Drain Time Too Long**
Location for 1-hr Rainfall Depths =	User Input		

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

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	5.800	acre-feet	5.800	acre-feet
Excess Urban Runoff Volume (EURV) =	6.000	acre-feet	6.000	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.055	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.104	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.147	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.951	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	1.850	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	3.087	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 4 in.) =	10.624	acre-feet	4.00	inches
Approximate 2-yr Detention Volume =	0.060	acre-feet		
Approximate 5-yr Detention Volume =	0.085	acre-feet		
Approximate 10-yr Detention Volume =	0.119	acre-feet		
Approximate 25-yr Detention Volume =	0.174	acre-feet		
Approximate 50-yr Detention Volume =	0.353	acre-feet		
Approximate 100-yr Detention Volume =	0.873	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	5.800	acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	5.800	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = ft

	Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
6982	**Top of Micropool**	--	0.00	--	--	--	4,184	0.096		
	6983	--	1.00	--	--	--	16,813	0.386	10,499	0.241
	6984	--	2.00	--	--	--	37,163	0.853	37,487	0.861
	6985	--	3.00	--	--	--	64,907	1.490	88,522	2.032
	6986	--	4.00	--	--	--	84,578	1.942	163,265	3.748
	6987	--	5.00	--	--	--	96,770	2.222	253,939	5.830
	6988	--	6.00	--	--	--	108,418	2.489	356,533	8.185
	6989	--	7.00	--	--	--	121,287	2.784	471,385	10.822
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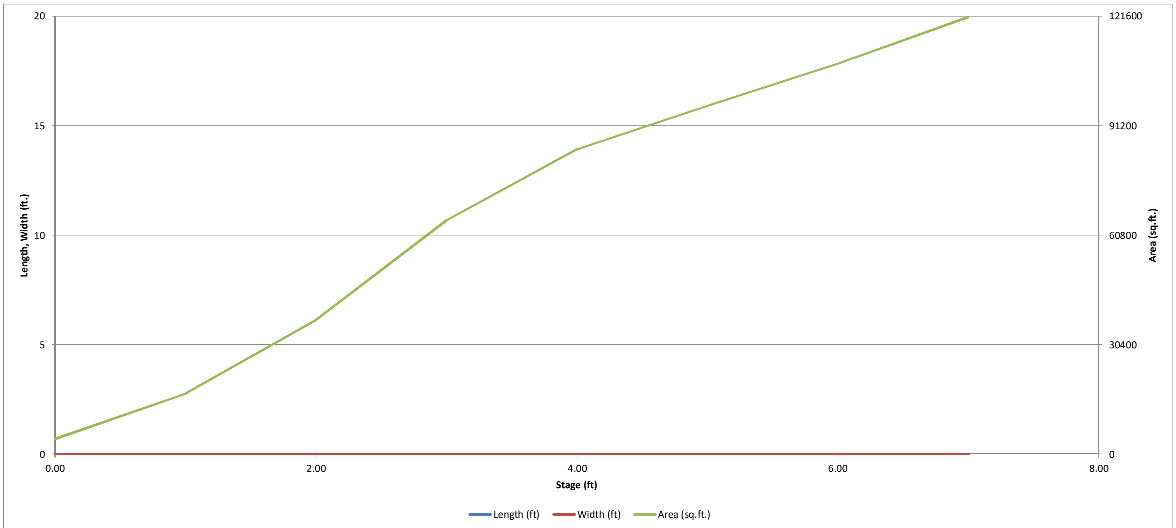
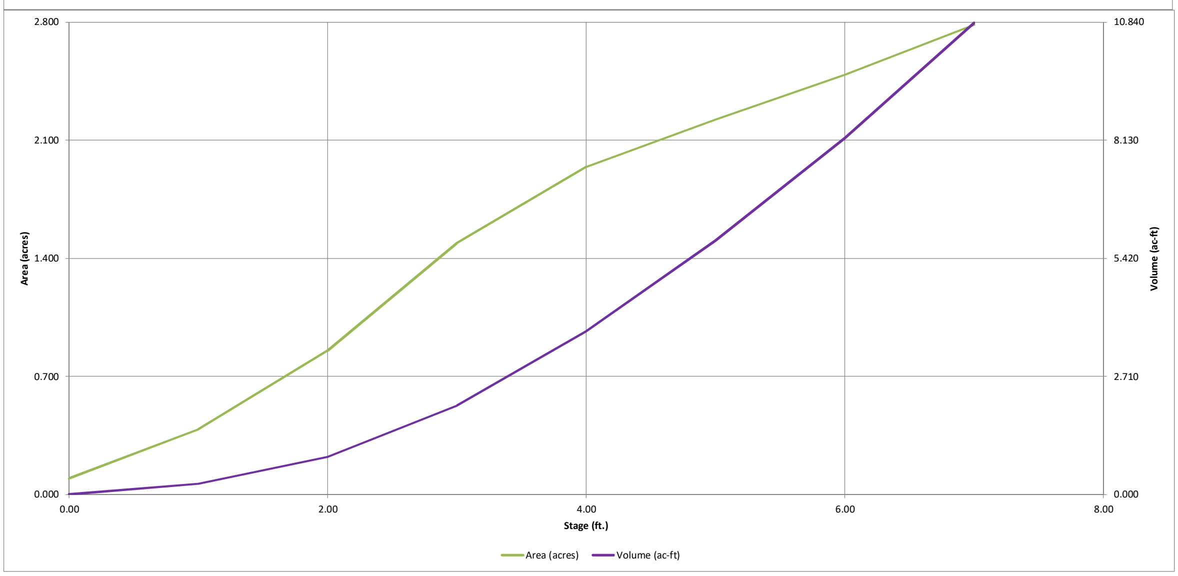
DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.05 (January 2022)



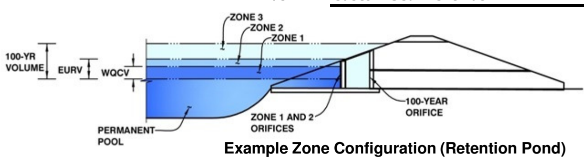


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

Project: SCHMIDT PARCEL

Basin ID: Custom Sediment Basin



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	4.99	5.800	Orifice Plate
Zone 2			
Zone 3			
Total (all zones)		5.800	

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

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

Calculated Parameters for Underdrain

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

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

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	5.61	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	N/A	inches
Orifice Plate: Orifice Area per Row =	6.07	sq. inches (use rectangular openings)

Calculated Parameters for Plate

WQ Orifice Area per Row =	4.215E-02	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

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

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	1.25	1.55	1.85	2.15	2.45		
Orifice Area (sq. inches)	6.07	6.07	6.07	6.07	6.07	6.07		

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

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =			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

	Not Selected	Not Selected	
Vertical Orifice Area =			ft^2
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)

	Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =			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

	Not Selected	Not Selected	
Height of Grate Upper Edge, H_t =			feet
Overflow Weir Slope Length =			feet
Grate Open Area / 100-yr Orifice Area =			
Overflow Grate Open Area w/o Debris =			ft^2
Overflow Grate Open Area w/ Debris =			ft^2

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

	Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =			ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =			inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

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

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.10	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	40.00	feet
Spillway End Slopes =	4.00	H:V
Freeboard above Max Water Surface =	1.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.43	feet
Stage at Top of Freeboard =	6.53	feet
Basin Area at Top of Freeboard =	2.64	acres
Basin Volume at Top of Freeboard =	9.52	acre-ft

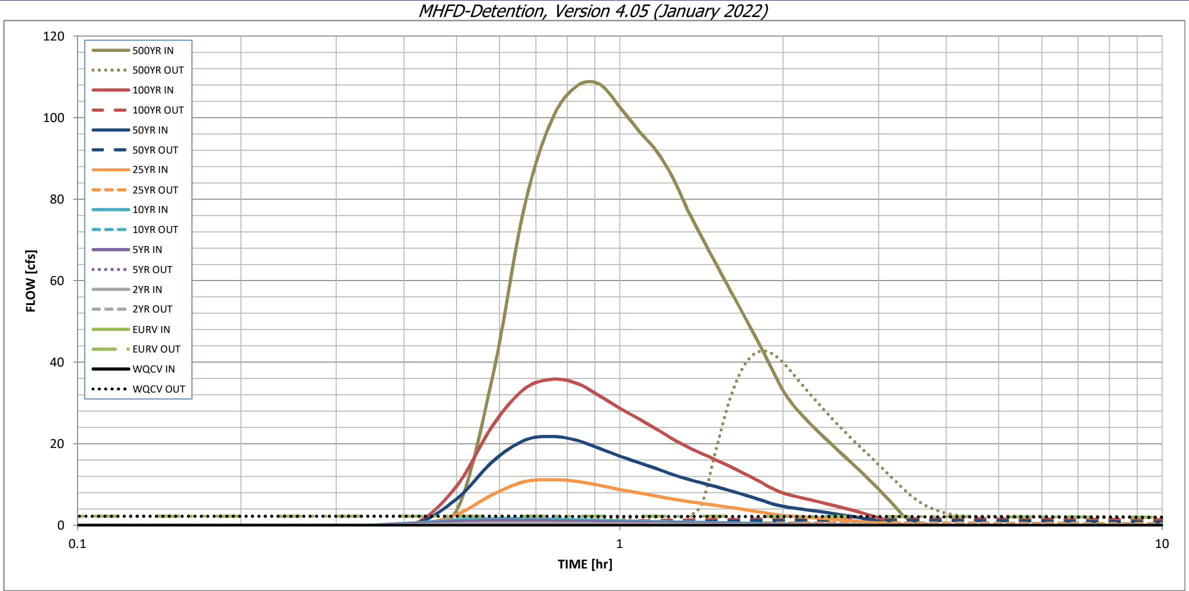
Routed Hydrograph Results

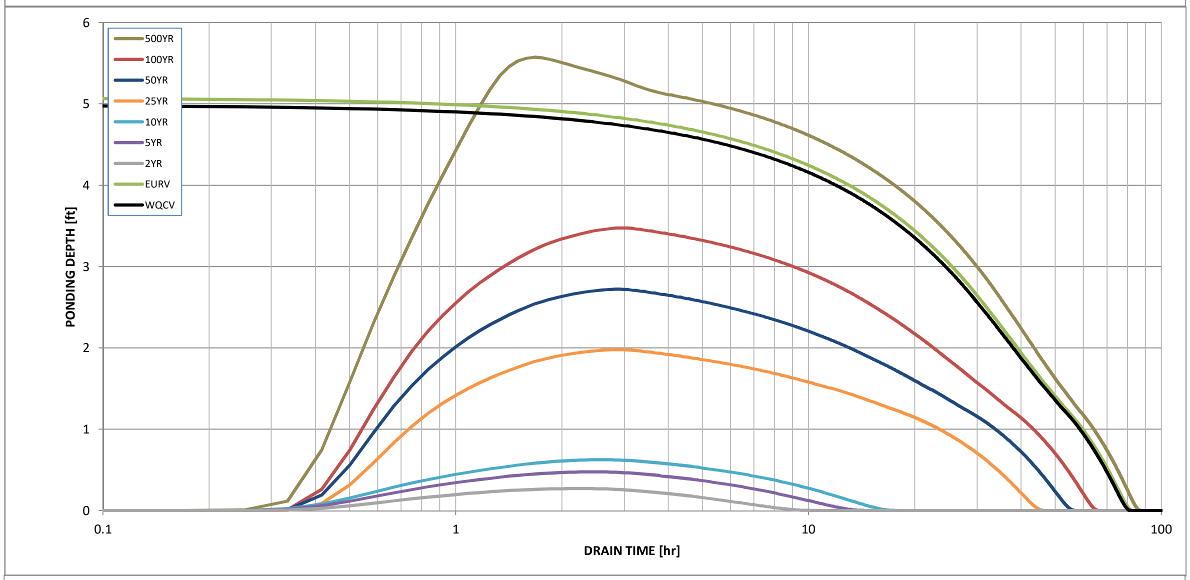
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

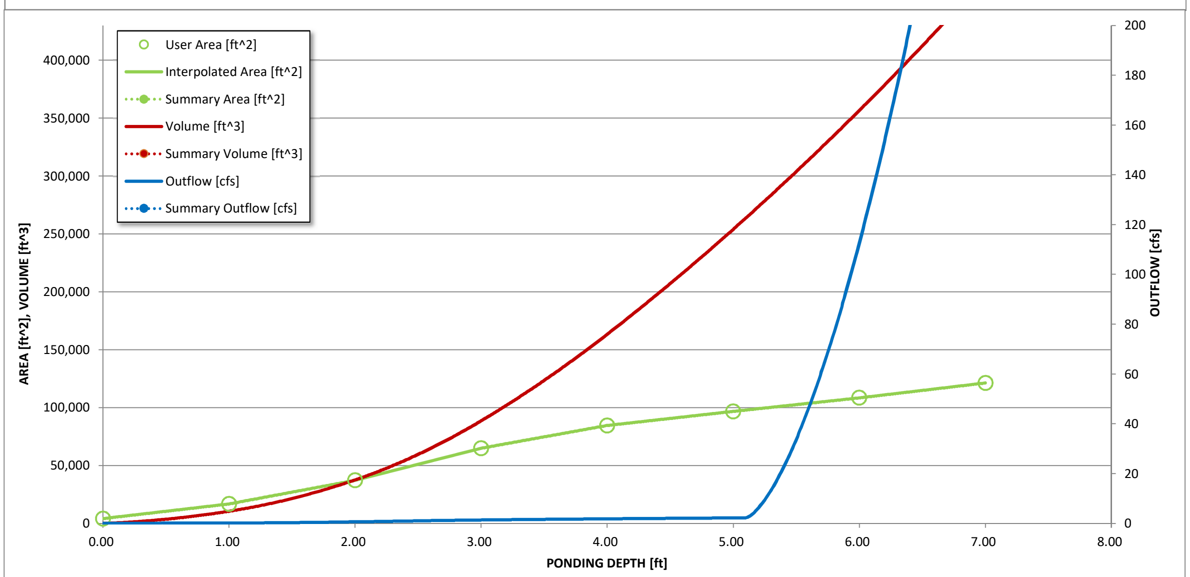
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A								
CUHP Runoff Volume (acre-ft) =	5.800	6.00							
Inflow Hydrograph Volume (acre-ft) =	N/A								
CUHP Predevelopment Peak Q (cfs) =	N/A								
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A								
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A								
Peak Inflow Q (cfs) =	N/A								
Peak Outflow Q (cfs) =	2.2								
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A						
Structure Controlling Flow =	Plate								
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	63								
Time to Drain 99% of Inflow Volume (hours) =	**72**								
Maximum Ponding Depth (ft) =	4.99								
Area at Maximum Ponding Depth (acres) =	2.22								
Maximum Volume Stored (acre-ft) =	5.807								

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

Time Interval	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
	TIME	WQCV [cfs]	EURV [cfs]	2 Year [cfs]	5 Year [cfs]	10 Year [cfs]	25 Year [cfs]	50 Year [cfs]	100 Year [cfs]	500 Year [cfs]
5.00 min	0:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0:15:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.02
	0:20:00	0.00	0.00	0.02	0.03	0.03	0.02	0.02	0.02	0.14
	0:25:00	0.00	0.00	0.18	0.42	0.63	0.13	0.25	0.32	3.71
	0:30:00	0.00	0.00	0.46	0.97	1.37	2.68	6.52	9.69	37.01
	0:35:00	0.00	0.00	0.61	1.19	1.66	7.65	15.76	24.64	78.24
	0:40:00	0.00	0.00	0.61	1.19	1.66	10.74	20.88	33.49	99.70
	0:45:00	0.00	0.00	0.58	1.12	1.56	11.23	21.85	35.86	107.80
	0:50:00	0.00	0.00	0.53	1.00	1.40	10.79	20.86	34.85	108.26
	0:55:00	0.00	0.00	0.47	0.90	1.26	9.83	18.89	31.81	102.61
	1:00:00	0.00	0.00	0.43	0.82	1.15	8.79	16.99	28.72	96.77
	1:05:00	0.00	0.00	0.40	0.75	1.04	7.98	15.41	26.14	91.95
	1:10:00	0.00	0.00	0.36	0.67	0.94	7.23	13.95	23.68	85.45
	1:15:00	0.00	0.00	0.33	0.62	0.88	6.48	12.49	21.23	77.41
	1:20:00	0.00	0.00	0.31	0.57	0.82	5.86	11.35	19.25	70.62
	1:25:00	0.00	0.00	0.28	0.53	0.76	5.39	10.41	17.64	64.45
	1:30:00	0.00	0.00	0.26	0.48	0.70	4.94	9.54	16.14	58.62
	1:35:00	0.00	0.00	0.24	0.44	0.63	4.50	8.67	14.68	53.21
	1:40:00	0.00	0.00	0.21	0.39	0.56	4.06	7.81	13.24	47.98
	1:45:00	0.00	0.00	0.19	0.35	0.50	3.62	6.95	11.80	42.84
	1:50:00	0.00	0.00	0.17	0.30	0.43	3.18	6.09	10.36	37.81
	1:55:00	0.00	0.00	0.15	0.28	0.39	2.74	5.25	8.94	33.04
	2:00:00	0.00	0.00	0.14	0.26	0.37	2.42	4.68	7.94	29.68
	2:05:00	0.00	0.00	0.13	0.24	0.34	2.24	4.31	7.29	27.08
	2:10:00	0.00	0.00	0.12	0.22	0.32	2.08	4.00	6.74	24.79
	2:15:00	0.00	0.00	0.11	0.20	0.29	1.92	3.70	6.24	22.72
	2:20:00	0.00	0.00	0.10	0.19	0.27	1.77	3.41	5.75	20.78
	2:25:00	0.00	0.00	0.09	0.17	0.24	1.62	3.12	5.26	18.93
	2:30:00	0.00	0.00	0.08	0.15	0.21	1.47	2.83	4.77	17.17
	2:35:00	0.00	0.00	0.07	0.13	0.19	1.32	2.54	4.29	15.51
	2:40:00	0.00	0.00	0.07	0.12	0.17	1.17	2.25	3.82	13.85
	2:45:00	0.00	0.00	0.06	0.10	0.14	1.03	1.96	3.34	12.20
	2:50:00	0.00	0.00	0.05	0.08	0.12	0.88	1.67	2.86	10.55
	2:55:00	0.00	0.00	0.04	0.07	0.09	0.73	1.39	2.38	8.90
	3:00:00	0.00	0.00	0.03	0.05	0.07	0.58	1.10	1.90	7.25
	3:05:00	0.00	0.00	0.02	0.03	0.05	0.43	0.81	1.42	5.61
	3:10:00	0.00	0.00	0.01	0.02	0.03	0.29	0.53	0.94	3.96
	3:15:00	0.00	0.00	0.01	0.01	0.01	0.14	0.24	0.47	2.38
	3:20:00	0.00	0.00	0.01	0.01	0.01	0.05	0.08	0.18	1.43
	3:25:00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.07	0.90
	3:30:00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.03	0.57
	3:35:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.02	0.34
	3:40:00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.19
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.09
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01
	4:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	6:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.05 (January 2022)

<u>Summary Stage-Area-Volume-Discharge Relationships</u>

The user can create a summary S-A-V-D by entering the desired stage increments and the remainder of the table will populate automatically.
The user should graphically compare the summary S-A-V-D table to the full S-A-V-D table in the chart to confirm it captures all key transition points.

Stage - Storage Description	Stage [ft]	Area [ft^2]	Area [acres]	Volume [ft^3]	Volume [ac-ft]	Total Outflow [cfs]

For best results, include the stages of all grade slope changes (e.g. ISV and Floor) from the S-A-V table on Sheet 'Basin'.

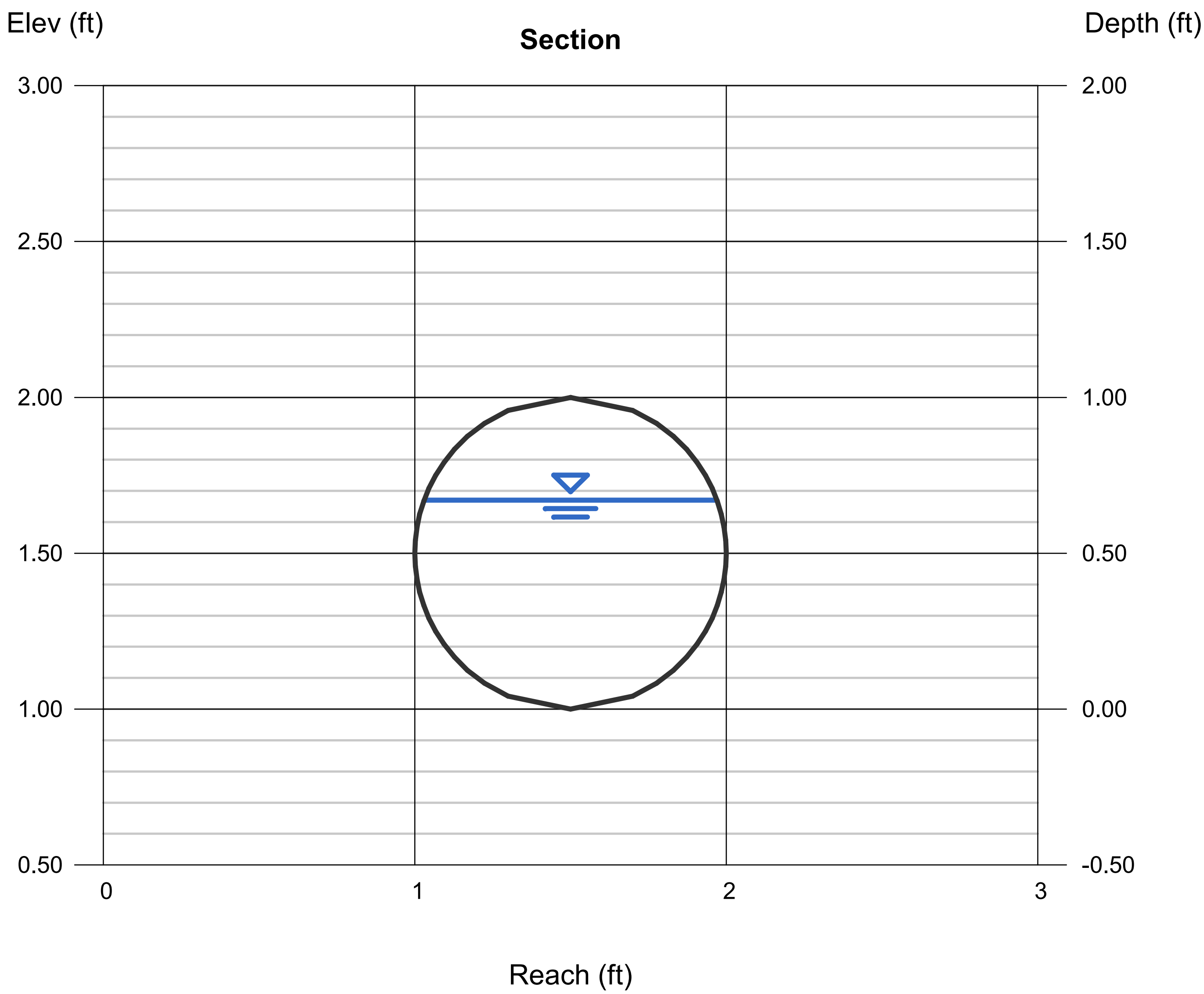
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Jul 19 2022

Sediment Basin Outlet Pipe

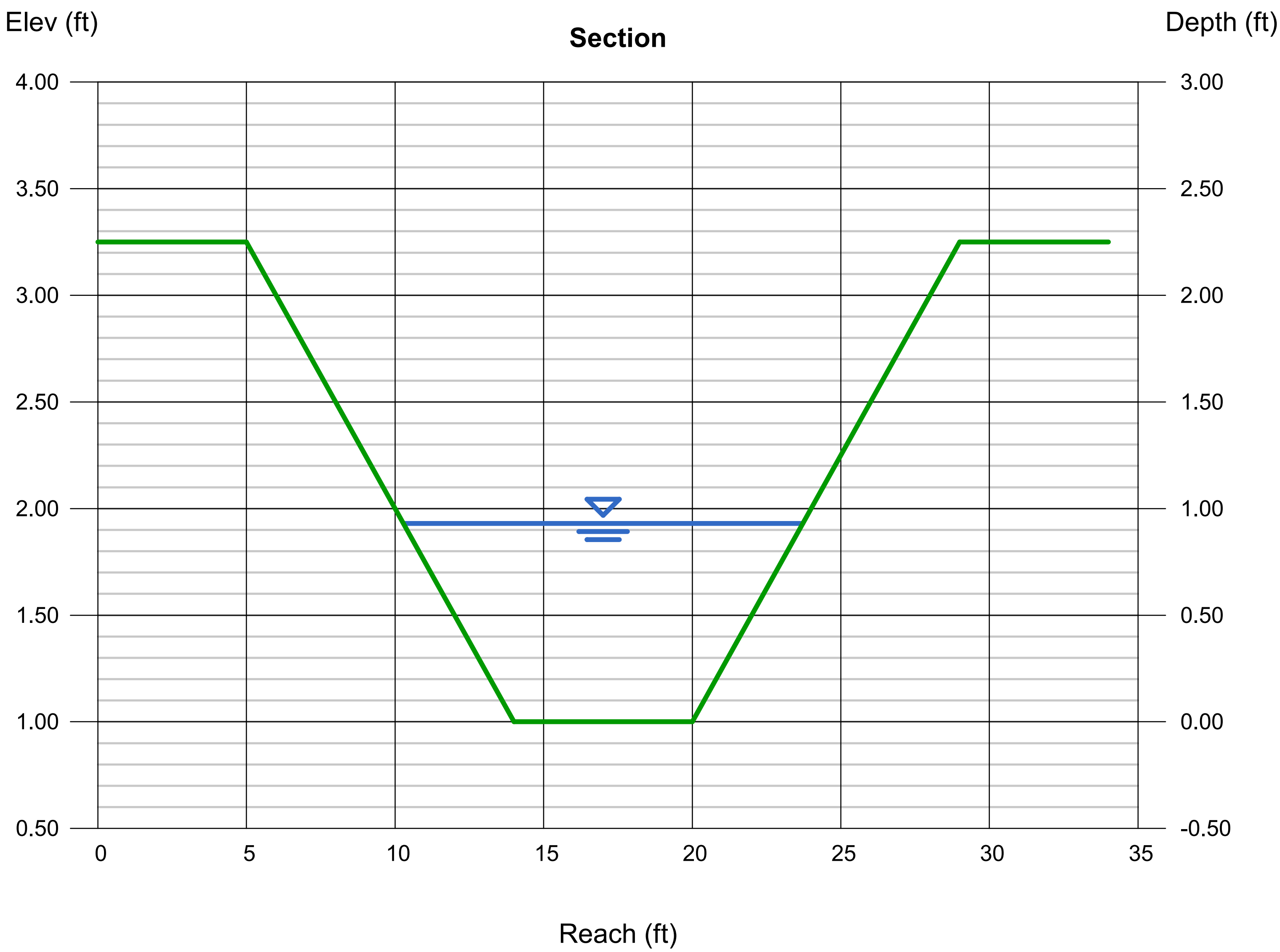
Circular		**Highlighted**	
Diameter (ft)	= 1.00	Depth (ft)	= 0.67
		Q (cfs)	= 2.840
		Area (sqft)	= 0.56
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 5.07
Slope (%)	= 0.50	Wetted Perim (ft)	= 1.92
N-Value	= 0.009	Crit Depth, Yc (ft)	= 0.73
		Top Width (ft)	= 0.94
Calculations		EGL (ft)	= 1.07
Compute by:	Known Q		
Known Q (cfs)	= 2.84		



Channel Report

EAST SWALE B-B (B1)

Trapezoidal		**Highlighted**	
Bottom Width (ft)	= 6.00	Depth (ft)	= 0.93
Side Slopes (z:1)	= 4.00, 4.00	Q (cfs)	= 38.50
Total Depth (ft)	= 2.25	Area (sqft)	= 9.04
Invert Elev (ft)	= 1.00	Velocity (ft/s)	= 4.26
Slope (%)	= 1.80	Wetted Perim (ft)	= 13.67
N-Value	= 0.035	Crit Depth, Yc (ft)	= 0.89
		Top Width (ft)	= 13.44
Calculations		EGL (ft)	= 1.21
Compute by:	Known Q		
Known Q (cfs)	= 38.50		

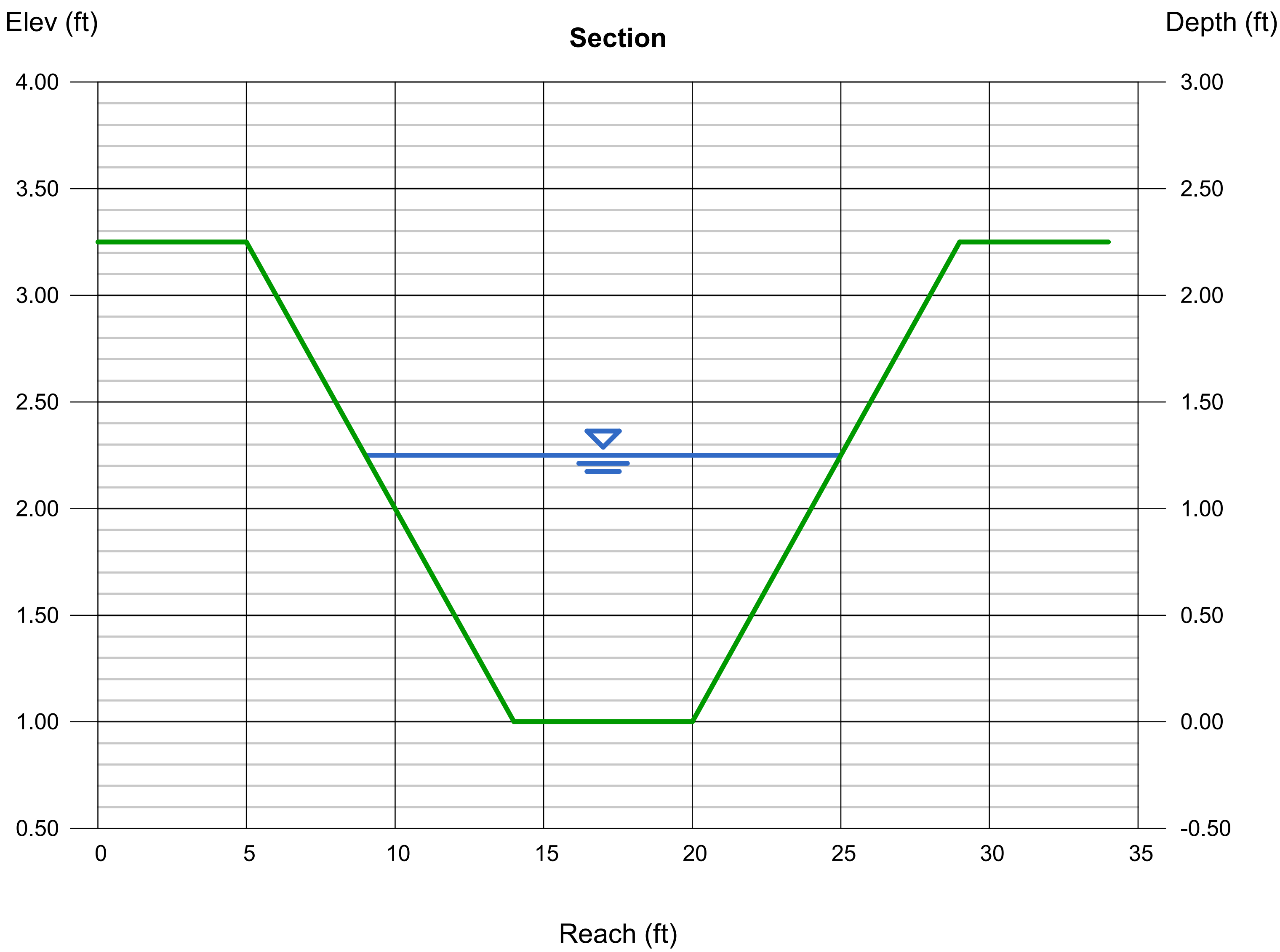


Channel Report

NORTH SWALE B-B (B2)

Trapezoidal	
Bottom Width (ft)	= 6.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 2.25
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.035
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 36.40

Highlighted	
Depth (ft)	= 1.25
Q (cfs)	= 36.40
Area (sqft)	= 13.75
Velocity (ft/s)	= 2.65
Wetted Perim (ft)	= 16.31
Crit Depth, Yc (ft)	= 0.86
Top Width (ft)	= 16.00
EGL (ft)	= 1.36



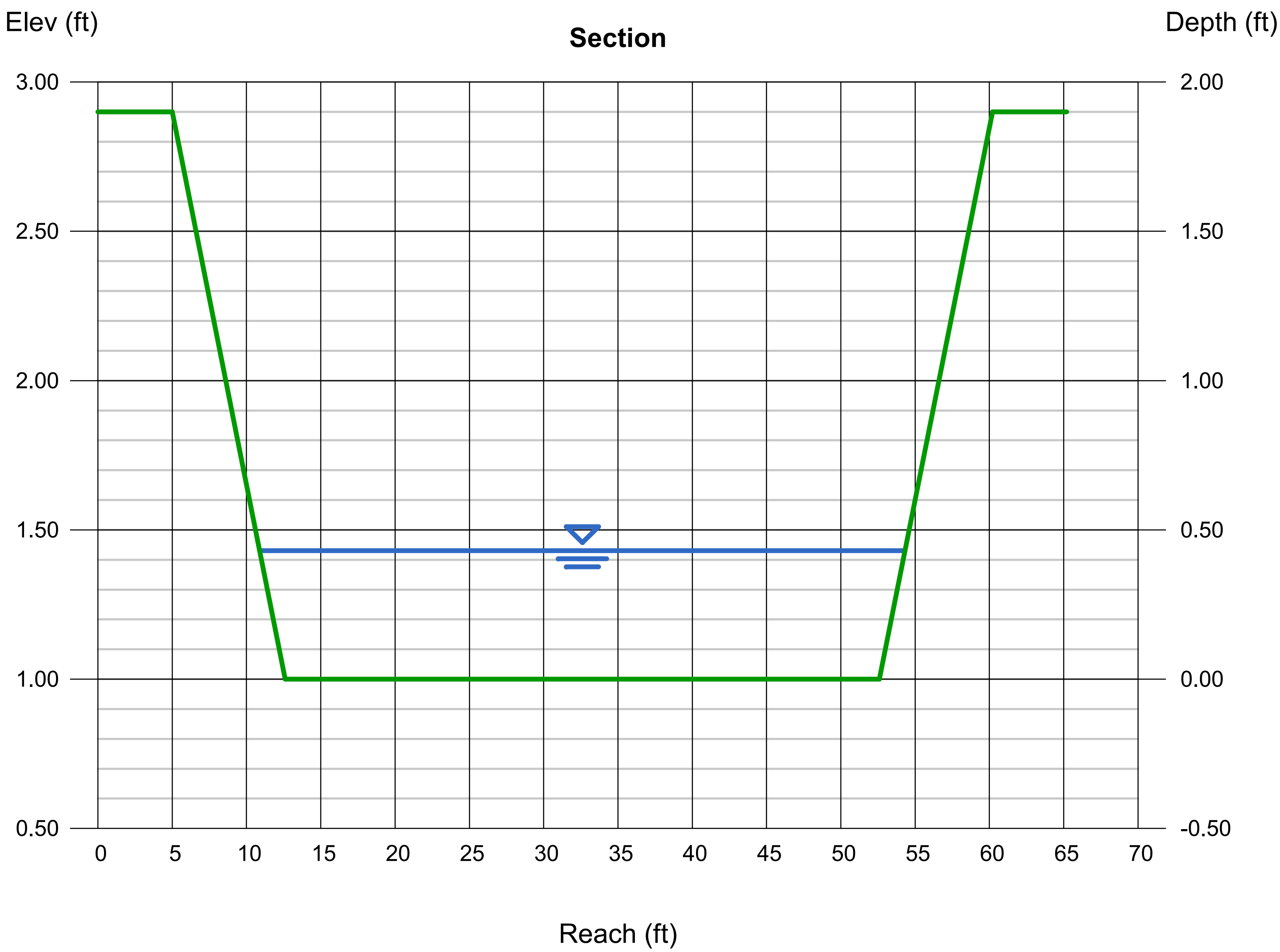
Channel Report

Spillway C-C

Trapezoidal
Bottom Width (ft) = 40.00
Side Slopes (z:1) = 4.00, 4.00
Total Depth (ft) = 1.90
Invert Elev (ft) = 1.00
Slope (%) = 1.80
N-Value = 0.035

Calculations
Compute by: Known Depth
Known Depth (ft) = 0.43

Highlighted
Depth (ft) = 0.43
Q (cfs) = 56.56
Area (sqft) = 17.94
Velocity (ft/s) = 3.15
Wetted Perim (ft) = 43.55
Crit Depth, Yc (ft) = 0.40
Top Width (ft) = 43.44
EGL (ft) = 0.58



Appendix D
Reference Material

SILVER PONDS SUBDIVISION FILING NO. 1

FINAL DRAINAGE REPORT

February 2, 1995
Revised May 5, 1996
Project No. 60572

PREPARED FOR:

The Campbell Corporation
4975 Austin Bluffs Parkway
Colorado Springs, CO 80918

PREPARED BY:

M.V.E., Inc.
1911 Lelaray St.
Colorado Springs, CO 80909

Table 3.1 - Developed Condition Hydrologic Data

5-year and 100-Year

Design Point	Included Basins	Cumulative Drainage Area (Ac)	5-yr Discharge (cfs)	100-yr Discharge (cfs)
1	OSA1	18.14	13.1	30.4
2	OSA2	8.72	7.0	16.3
3	OSA1 thru A3	29.05	20.5	47.7
4	OSA1 thru A4	31.04	24.3	53.6
5	OSB1	39.26	29.8	69.3
6	OSB1 thru B2	44.66	25.9	60.3
7	OSB1 thru B3	50.03	35.7	83.1
8	OSB1 thru B4	52.02	39.2	89.8
9	OSD1	8.26	7.9	18.4
10	OSD1 thru D2	19.95	24.1	52.9
11	D3	3.41	4.5	9.9
12	E1	4.24	5.5	12.1
13	F1	4.26	6.6	14.4
14	OSG1	6.66	7.0	16.4
15	OSG1 thru G2	9.22	10.5	24.0
16	OSH1	17.22	17.5	38.4
17	OSH1 thru H2	28.28	27.9	61.3
18	OSI1	3.67	3.3	7.8
19	OSI1 thru I2	11.05	7.9	18.4
20	I3	8.01	6.3	14.6
21	OSI1 thru I4	27.16	19.0	44.2
22	J1	4.19	3.0	6.9

M.V.E., Inc.
Colorado Springs, Colorado

Proj. No.: 60572 Project: SILVER PONDS Date: 1-31-96

DEVELOPED DISCHARGES
RAINFALL/RUNOFF ANALYSIS - RATIONAL METHOD

Design Point	Area (Ac)	C5	C100	Tc (min)	i5 (in/hr)	i100 (in/hr)	Q5 (cfs)	Q100 (cfs)
1	18.14	0.30	0.40	27.7	2.40	4.20	13.1	30.4
2	8.72	0.30	0.40	22.9	2.68	4.68	7.0	16.3
5	39.26	0.30	0.40	25.4	2.53	4.41	29.8	69.3
9	8.26	0.30	0.40	16.5	3.19	5.57	7.9	18.4
14	6.66	0.30	0.40	13.5	3.52	6.15	7.0	16.4
16	17.22	0.39	0.49	24.1	2.60	4.55	17.5	38.4
18	3.67	0.30	0.40	18.2	3.03	5.30	3.3	7.8
3	29.05	0.30	0.40	28.7	2.35	4.11	20.5	47.7
4	31.04	0.34	0.43	29.8	2.30	4.02	24.3	53.6
6	44.66	0.30	0.40	39.5	1.93	3.38	25.9	60.3
B3	5.37	0.30	0.40	26.7	2.45	4.29	4.0	9.2
7	50.03	0.30	0.40	28.2	2.38	4.15	35.7	83.1
8	52.02	0.32	0.42	28.7	2.35	4.11	39.2	89.8
D2	11.69	0.39	0.49	17.6	3.09	5.39	14.1	30.9
10	19.95	0.39	0.49	17.5	3.10	5.41	24.1	52.9
11	3.41	0.39	0.49	14.5	3.40	5.94	4.5	9.9
12	4.24	0.39	0.49	15.0	3.35	5.85	5.5	12.1
13	4.26	0.39	0.49	10.5	3.94	6.89	6.6	14.4
G2	2.56	0.39	0.49	13.1	3.57	6.24	3.6	7.8
15	9.22	0.33	0.43	14.0	3.46	6.04	10.5	24.0
H2	11.06	0.39	0.49	17.5	3.10	5.41	13.4	29.3
17	28.28	0.39	0.49	25.3	2.53	4.42	27.9	61.3
19	11.05	0.30	0.40	28.0	2.39	4.17	7.9	18.4
20	8.01	0.30	0.40	23.9	2.62	4.57	6.3	14.6
I4	8.10	0.30	0.40	23.1	2.67	4.66	6.5	15.1
21	27.16	0.30	0.40	29.2	2.33	4.07	19.0	44.2
22	4.19	0.30	0.40	28.8	2.35	4.10	3.0	6.9

LEGEND

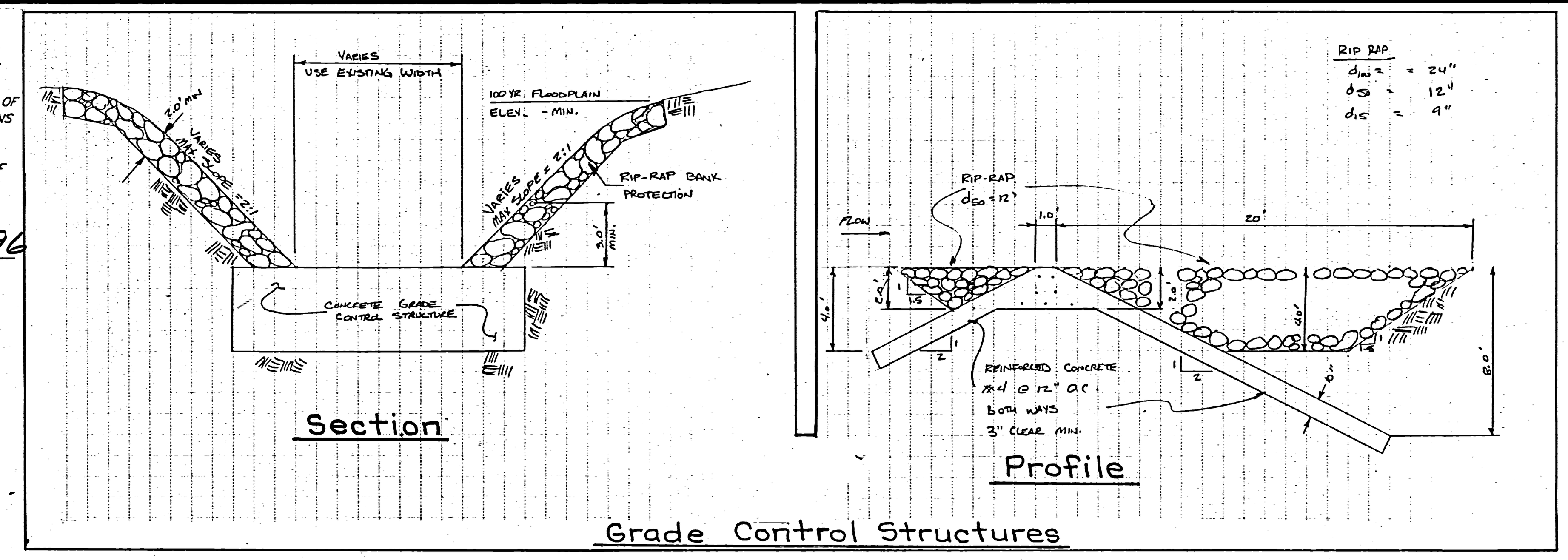
- EXISTING INDEX CONTOUR (7430)
- EXISTING INTERMEDIATE CONTOUR
- DRAINAGE BASIN BOUNDARY LINE
- SUBDIVISION BOUNDARY LINE
- SILT FENCE
- DRAINAGE DIRECTION ARROW
- DESIGN POINT DESIGNATION (5)
- PROPOSED STORM DRAIN CULVERT
- DRAINAGE BASIN DESIGNATION / DRAINAGE BASIN AREA (E / 0.40)

THESE DETAILED PLANS AND SPECIFICATIONS WERE PREPARED UNDER MY DIRECTION AND SUPERVISION. SAID DETAILED PLANS AND SPECIFICATIONS HAVE BEEN PREPARED ACCORDING TO THE CRITERIA ESTABLISHED BY THE COUNTY FOR DETAILED PLANS AND SPECIFICATIONS, AND SAID DETAILED PLANS AND SPECIFICATIONS ARE IN CONFORMITY WITH THE MASTER PLAN OF THE DRAINAGE BASIN. SAID DETAILED DRAINAGE PLANS AND SPECIFICATIONS MEET THE PURPOSES FOR WHICH THE PARTICULAR DRAINAGE FACILITY IS DESIGNED. I ACCEPT RESPONSIBILITY FOR ANY LIABILITY CAUSED BY ANY NEGLIGENT ACTS, ERRORS OR OMISSIONS ON MY PART IN PREPARATION OF THE DETAILED DRAINAGE PLANS AND SPECIFICATIONS.

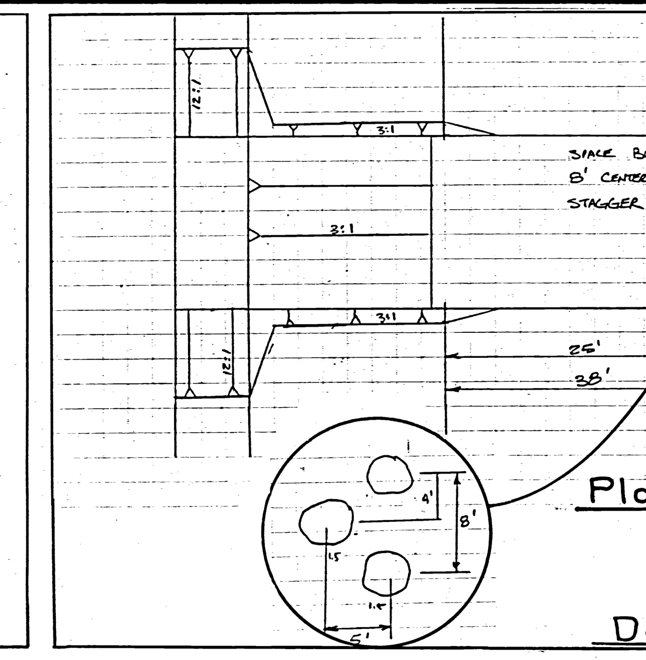
Charles C. Crum, P.E. 5-6-96

CHARLES C. CRUM, P.E. COLORADO NO. 13348 DATE

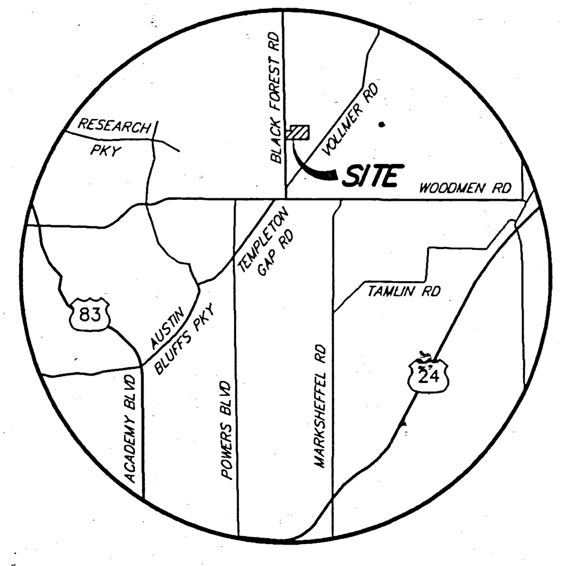
REGISTERED PROFESSIONAL ENGINEER 13348 STATE OF COLORADO



Grade Control Structures



Dam Spillways



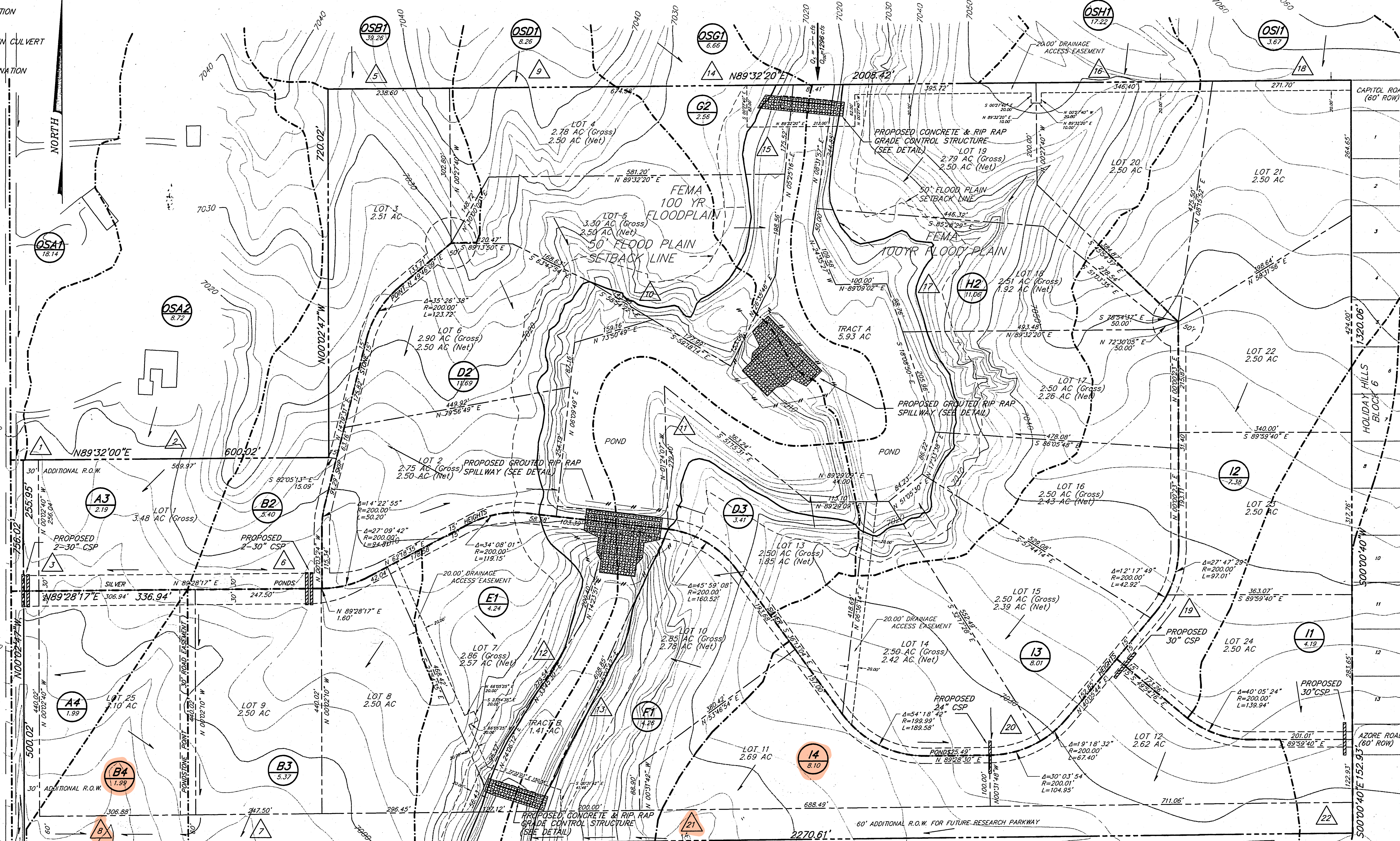
VICINITY MAP

SCALE

100' 50' 0 50' 100' 200'

75' 25'

1"=100' 1:1200



SITE HYDROLOGY DATA

DESIGN POINT	INCL. BASINS	AREA (Ac)	Q_5 (cfs)	Q_{100} (cfs)
1	OSA1	18.14	13.1	30.4
2	OSA2	8.72	7.0	16.3
3	OSA1–A3	29.05	20.5	47.7
4	OSA1–A4	31.04	24.3	53.6
5	OSB1	39.26	29.8	69.3
6	OSB1–B2	44.66	25.9	60.3
7	OSB1–B3	50.03	35.7	83.1
8	OSB1–B4	52.02	39.2	89.8
9	OSD1	8.26	7.9	18.4
10	OSD1–D2	19.95	24.1	52.9
11	D3	3.41	4.5	9.9
12	E1	4.24	5.5	12.1
13	F1	4.26	6.6	14.4
14	OSG1	6.66	7.0	16.4
15	OSG1–G2	9.22	10.5	24.0
16	OSH1	17.22	17.5	38.4
17	OSH1–H2	28.28	27.9	61.3
18	OSI1	3.67	3.3	7.8
19	OSI1–I2	11.05	7.9	18.4
20	I3	8.01	6.3	14.6
21	OSI1–I4	27.16	19.0	44.2
22	J1	4.19	3.0	6.9

NOTE: SEE OFFSITE DRAINAGE BASIN MAP FOR OFFSITE BASINS (OS__)

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

Murray D. Stewart Jr. 5/9/96

MURRAY D. STEWART, JR., P.E.
COUNTY ENGINEER

PLANNING
KEVIN J. WALKER & ASSOCIATES

PROJECT: SILVER PONDS SUBDIVISION FILING NO. 1

TITLE: DRAINAGE IMPROVEMENT DETAILS

MONUMENT VALLEY ENGINEERS INC.
ENGINEERS • SURVEYORS
1911 LELARAY STREET
COLORADO SPRINGS, COLORADO 80909
PHONE (719) 635-5736

PROJ. NO. 60572
DRAWN: DRG
ENGINEER: DRG
CHECKED: CCC
SCALE: 1" = 100'
DATE: 3/18/96

REVISIONS:

NO.:	DATE:	ITEM
1	5/1/96	ADD ESMTS, SILT FENCE & DETAIL

SHEET 1 OF 1

DRAWING NO. 60572008

DISK NO. 1516

SILVER PONDS FIL. 1

TRAILS AT FOREST MEADOWS
FILING NO. 3
FINAL DRAINAGE REPORT

AMENDMENT TO:
MASTER DEVELOPMENT DRAINAGE PLAN UPDATE FOR WOODMEN HEIGHTS AND FINAL DRAINAGE REPORT FOR FOREST MEADOWS FILING NO.1AND NO.4

August 2015

Prepared for:

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Prepared by:

M&S
CIVIL CONSULTANTS, INC.
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(719) 955-5485

Project #08-029

OFFICE COPY

Basin U is located in the easterly portion of the site and contains 1.23 acres of Vollmer Road asphalt and curb and gutter. Basin U has proposed design flows of 4.3 cfs for the minor storm event (5-Year) and 8.1 cfs for the major storm event (100-Year). Runoff from Basin U will flow, via curb and gutter to Design Point E3, an existing 20' D-10-R inlet, in an at-grade condition. The inlet at Design Point E3 has been sized to accept flows from Basin T, U and portions of historic flows from Basins EX1 and EX2 (capacity of ~ 30 cfs). Collected flows from Design Point E3 will be conveyed in an existing 30" RCP (pipe 10) to pipe 11, an existing 48" RCP. Combined flows in 9, 10 and 11 have been sized to accept these developed flows and do not exceed the pipe design flows in FDR2. Additional discussion the runoff reaching Design Point 3 is discussed in upcoming paragraphs.

Basin OS2 is located off-site, in the northerly portion of the site and contains 1.22 acres of undeveloped land. Basin OS2 has undeveloped flows of 0.8 cfs for the minor storm event (5-Year) and 3.6 cfs for the major storm event (100-Year). Runoff from Basin OS2 will be directed around Basin Q, via the proposed perimeter berm to Design Point 9 (accumulated flows 10.2 cfs-5 year, 22.4 cfs-100 year) and a proposed diversion swale. The diversion swale will route flows to an existing 48" RCP (pipe 14). Pipe 14 and 3 have been sized to accept these developed flows and do not exceed the pipe design flows in FDR2. *Any increase in flows due to future development of Basin OS1/OS2 will require the construction of a proposed detention facility*, as per the Sand Creek DBPS.

Basin OS3 is located off-site, in the northerly portion of the site and contains 0.34 acres of undeveloped land. Basin OS3 has undeveloped flows of 0.2 cfs for the minor storm event (5-Year) and 1.0 cfs for the major storm event (100-Year). Runoff from Basin OS3 will be directed westward via the proposed perimeter berm to Design Point 9 (accumulated flows 10.2 cfs-5 year, 22.4 cfs-100 year) and a proposed diversion swale. The aforementioned diversion swale will route flows to an existing 48" RCP (pipe 14).

Flows reaching **Design Point E3** are historic and tributary to Vollmer Road (EX1, EX2 and EX3, see Historic drainage map DP-1). A portion of these Historic (EX1 and EX2) and proposed flows (Basin T and U), will be routed into the existing Vollmer Road infrastructure at the north end of the Dry Needle Place/Vollmer Road intersection and the northerly boundary of Filing No. 2. If sufficient conveyance capacity were to exist within the Vollmer ROW to convey runoff from the historic upstream watersheds, flows rates as high as 87.8 cfs for the minor storm event (5- Year) and 388.7 cfs for the major storm event (100-Year) could be expected to reach Design Point E3. These calculated flows differ by 2 cfs in the 5-year event and 1 cfs in the 100- year event from those estimated within the FDR2 report. A field inspection of the existing roadside ditch and roadway was conducted by M&S Civil Consultants in the Early Summer of 2015 and the estimated conveyance capacity was determined using Bentley's FlowMaster program. Based upon the observed longitudinal slope and geometry, the capacity of the street/ditch section at the northern boundary was found to be as high as approximately 135 cfs, thereby limiting the maximum amount of upstream runoff which is able to reach the subject site and Design Point 3. Runoff upstream of the site, in excess of ditch capacity, is believed to intermittently overtop Vollmer Road continue east toward Sand Creek. Recent storms during the summer months of 2015 (June & July) have aided in additional sediment transport in the area, thus likely further decreasing the available conveyance capacity. In the proposed condition grading will occur along portions of the west side of Vollmer Road to add width to the existing roadway and a vertical curb and gutter section along the west side of the street. A proposed cross section was analyzed upstream of Design Point 3 which indicates an estimated street conveyance capacity of 131 cfs for the west side of Vollmer Road when ponding reaches a depth of 1' at the flowline.

A temporary radial asphalt curb with a riprap transition will be constructed at the confluence of the roadway section and the existing ditch, at the north end of the subdivision, to aid in directing runoff from the existing ditch to the proposed curb and guttered street section. The proposed improvements will be detailed in the street improvement plans for Trails at Forest Meadows Filing No. 3. The proposed improvements will be constructed within the right of way in a manner so that they do not impact lots or offsite property.

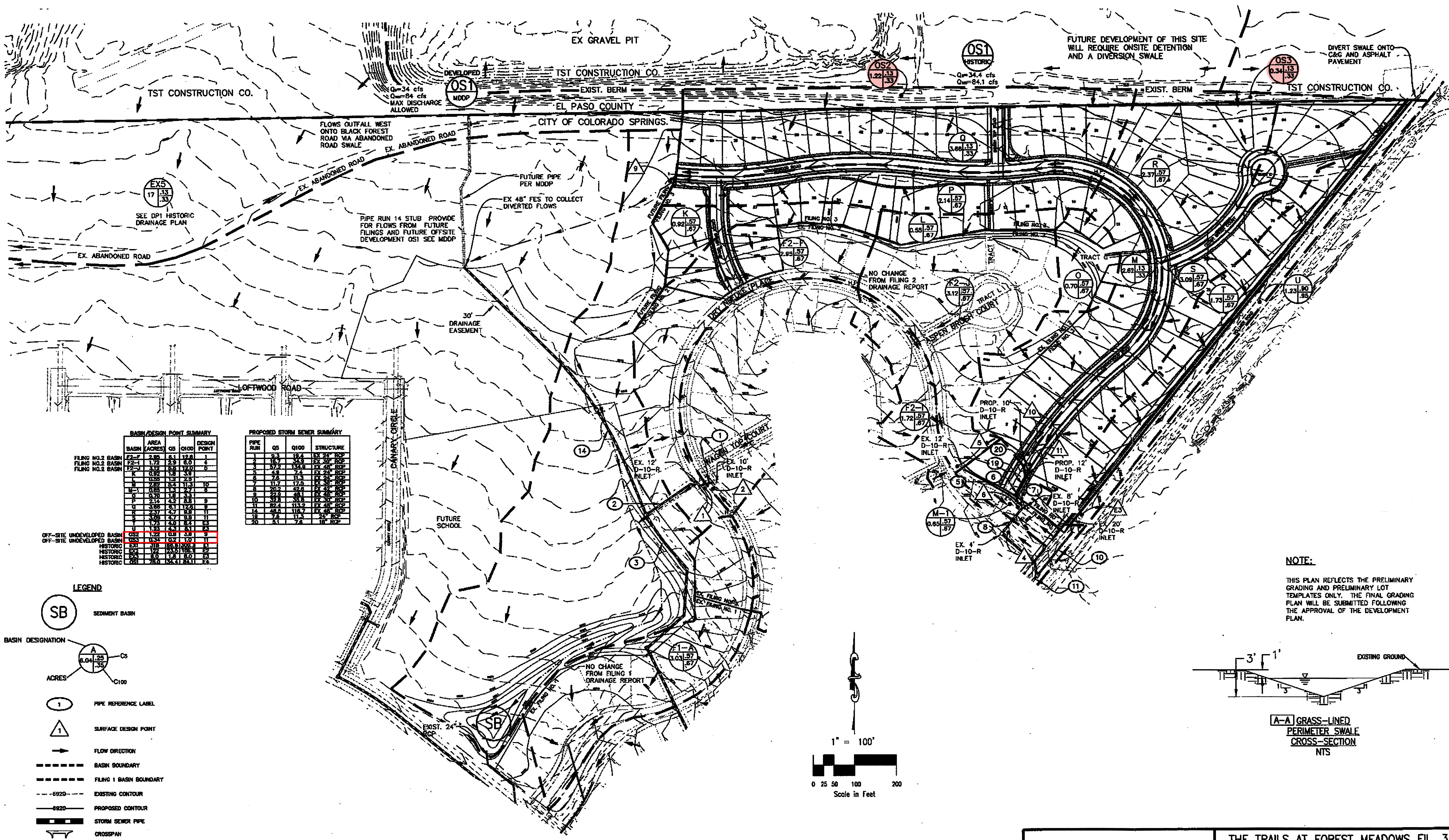
It should be noted that based upon the Preliminary Drainage Report of Sterling Ranch Phase 1, dated March 2015 by M&S Consultants, the construction of the Sterling Ranch Subdivision and Marksheffel Road will

TRAILS AT FOREST MEADOWS FILING NO. 3
FINAL DRAINAGE REPORT
(Area Drainage Summary)

From Composite Runoff Coefficient Summary				OVERLAND				STREET / CHANNEL FLOW				Time of Travel (T_t)	INTENSITY *		TOTAL FLOWS				
BASIN	AREA TOTAL (Acres)	C_5 (From DCM Table 5-1)	C_{100}	C_5	Length (ft)	Height (ft)	Tc (min)	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)	CA_5	Basin	CA_{100}
F2-F FILING 2	2.95	0.57	0.67	0.25	117	5	10.6	842	1.8%	4.7	3.0	13.7	3.6	6.4	6.1	12.8	1.69	F2-F	1.99
F2-I FILING 2	1.72	0.57	0.67	0.25	194	3.2	18.8	714	1.9%	4.9	2.4	21.2	2.9	5.2	2.9	6.0	0.99	F2-I	1.16
F2-J FILING 2	3.12	0.57	0.67	0.25	164	4	15.2	623	1.9%	4.8	2.2	17.3	3.2	5.8	5.8	12.0	1.78	F2-J	2.09
K	0.92	0.57	0.67	0.25	131	2.6	14.5	0	1.0%	3.5	0.0	14.5	3.5	6.3	1.8	3.9	0.52	K	0.62
L	0.55	0.57	0.67	0.25	80	1.5	11.6	0	1.0%	3.5	0.0	11.6	3.9	6.9	1.2	2.5	0.31	L	0.37
M	2.62	0.57	0.67	0.25	76	1.5	11.1	843	2.5%	5.5	2.6	13.6	3.6	6.4	5.4	11.3	1.49	M	1.76
M-1	0.65	0.57	0.67	0.25	118	2.4	13.7	170	1.0%	3.5	0.8	14.5	3.5	6.3	1.3	2.7	0.37	M-1	0.44
O	0.70	0.57	0.67	0.25	155	10	10.7	0	2.5%	5.6	0.0	10.7	4.0	7.1	1.6	3.3	0.40	O	0.47
P	2.14	0.57	0.67	0.25	76	1.5	11.1	920	1.1%	3.7	4.2	15.2	3.4	6.1	4.2	8.8	1.22	P	1.43
Q	3.66	0.57	0.67	0.25	170	3.4	16.5	1016	1.1%	3.7	4.6	21.1	2.9	5.2	6.1	12.8	2.09	Q	2.45
R	2.37	0.57	0.67	0.25	112	2.2	13.5	369	1.9%	4.8	1.3	14.7	3.5	6.2	4.7	9.9	1.35	R	1.59
S	3.09	0.57	0.67	0.25	298	6	21.8	1015	2.5%	5.5	3.1	24.8	2.7	4.8	4.7	9.9	1.76	S	2.07
T	1.73	0.57	0.67	0.25	62	1.2	10.1	0	2.5%	5.6	0.0	10.1	4.1	7.3	4.0	8.4	0.99	T	1.16
U	1.23	0.90	0.95	0.25	34	0.7	7.3	1284	2.3%	5.3	4.0	11.3	3.9	7.0	4.3	8.1	1.11	U	1.17
OS2	1.22	0.13	0.33	0.13	52	8	5.3	0	2.5%	5.6	0.0	5.3	5.0	8.9	0.8	3.6	0.16	OS2	0.40
OS3	0.34	0.13	0.33	0.13	40	8	4.3	0	2.5%	5.6	0.0	5.0	5.1	9.1	0.2	1.0	0.04	OS3	0.11

* Intensity equations assume a minimum travel time of 5 minutes.

Calculated by: ET
Date: 5/26/2015
Checked by:



	BASIN	AREA (ACRES)	Q5	Q100	DESIGN POINT
FILING NO.2 BASIN	F2–F	2.85	6.1	12.8	1
FILING NO.2 BASIN	F2–I	1.72	2.9	6.0	4
FILING NO.2 BASIN	F2–J	3.12	5.8	12.0	5
	K	0.92	1.8	3.9	
	L	0.55	1.2	2.5	
	M	2.62	5.4	11.3	10
	M–1	0.65	1.3	2.7	8
	O	0.70	1.6	3.3	
	P	2.14	4.2	8.8	9
	Q	3.66	6.1	12.8	9
	R	2.37	4.7	9.9	11
	S	3.09	4.7	9.9	11
	T	1.73	4.0	8.4	E3
	U	1.23	4.3	8.1	E3
OFF–SITE UNDEVELOPED BASIN	OS2	1.22	0.8	3.6	9
OFF–SITE UNDEVELOPED BASIN	OS3	0.34	0.2	1.0	11
HISTORIC	EX1	318	88.6	300.7	E1
HISTORIC	EX2	122	23.5	106.1	E2
HISTORIC	EX3	6.0	1.8	8.0	E3
HISTORIC	OS1	78.0	34.4	84.1	E4

BASIN/DESIGN POINT SUMMARY

PIPE RUN	Q5	Q100	STRUCTURE
1	9.3	19.4	EX 24" RCP
2	16.7	34.9	EX 30" RCP
3	57.2	134.8	EX 48" RCP
5	4.8	7.4	EX 24" RCP
6	7.6	11.3	EX 24" RCP
7	11.7	17.5	EX 36" RCP
8	20.2	42.6	EX 42" RCP
9	22.9	48.1	EX 48" RCP
10	32.3	35.8	EX 30" RCP
11	82.4	113.2	EX 48" RCP
14	48.5	116.7	EX 48" RCP
19	7.6	11.3	24" RCP
20	5.1	7.6	18" RCP

PROPOSED STORM SEWER SUMMARY

LEGEND

- SB — SEDIMENT BASIN
- BASIN DESIGNATION (A, 6.04 ACRES, .25 C5, .35 C100)
- PIPE REFERENCE LABEL
- SURFACE DESIGN POINT
- FLOW DIRECTION
- BASIN BOUNDARY
- FILING 1 BASIN BOUNDARY
- EXISTING CONTOUR (6920)
- PROPOSED CONTOUR (6920)
- STORM SEWER PIPE
- CROSSPAN
- PERIMETER SWALE
- FILING LINE
- H.P. — HIGH POINT
- L.P. — LOW POINT
- INLET

1" = 100'

0 25 50 100 200

Scale in Feet

NOTE:

THIS PLAN REFLECTS THE PRELIMINARY GRADING AND PRELIMINARY LOT TEMPLATES ONLY. THE FINAL GRADING PLAN WILL BE SUBMITTED FOLLOWING THE APPROVAL OF THE DEVELOPMENT PLAN.

A–A GRASS–LINED PERIMETER SWALE CROSS–SECTION

NTS

M&S CIVIL CONSULTANTS, INC.

THE TRAILS AT FOREST MEADOWS FIL. 3			
FILING 3 DRAINAGE PLAN			
PROJECT NO. 08–025	FILE: *\dwg\Dev. Plan\ 08025 – DRAINAGE		
DESIGNED BY: VAS DRAWN BY: BLB CHECKED BY: VAS	SCALE HORIZ: 1"=100' VERT: N/A	DATE: 04/09/2014 SHEET 2 OF 2	DP2

TRAILS AT FOREST MEADOWS
FILING NO. 4
FINAL DRAINAGE REPORT

AMENDMENT TO:
MASTER DEVELOPMENT DRAINAGE PLAN UPDATE FOR WOODMEN HEIGHTS AND FINAL DRAINAGE REPORT FOR FOREST MEADOWS FILING NO.1AND NO.4

April 2016

Prepared for:

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Prepared by:

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Project #08-032

Filing No.3 - Basins **OS2, **P, **Q are located to the northeast of the subject site, in the north portions of the Filing 3 site. The flows from these basins were previously analyzed as part of "The Trails at Forest Meadows Filing No. 3 Preliminary/Final Drainage Report" (TRM 3 FDR). Runoff produced within Basins **OS2 (0.8 cfs/3.6 cfs), **P (4.2 cfs/8.8 cfs), and **Q (6.1 cfs/12.8 cfs) flows have been accounted for and are included in this Final Drainage Report.

Basin V is located in the northerly portion of the site, north of Vanderwood Road, and contains 2.48 acres of single family residential lots and streets. Basin V has proposed design flows of 3.2 cfs for the minor storm event (5-Year) and 7.6 cfs for the major storm event (100-Year). Runoff from Basin V will flow, overland via side lot swales, to the curb and gutter of proposed Vanderwood Road. These flows will combine with flows from Basin **Q and be conveyed west via curb and gutter to Design Point 11 (11.0 cfs/25.2 cfs), a proposed 8' D-10-R inlet in a sump condition. Design Point 11 (11.0 cfs/25.2 cfs) cumulative flows include Basin X. The inlet at Design Point 11 has been sized to accept flows in the developed condition. Collected flows from Design Point 11 will be conveyed in a 48" RCP (Pipe 2) to Design Point 12, a proposed 10' D-10-R inlet in the sump condition. In the event of clogging or total inlet failure, flows from Design Point 11 will overtop crown/curb and flow southeast over Tract I to a temporary sediment basin located in the Trails at Forest Meadows Filing No. 1.

Basin W is located in the northerly portion of the site, south of Vanderwood Road, and contains 2.2 acres of single family residential lots and streets. Basin W has proposed design flows of 3.1 cfs for the minor storm event (5-Year) and 7.1 cfs for the major storm event (100-Year). Runoff from Basin W will flow, overland via side lot swales, to the curb and gutter of proposed Vanderwood Road. These flows will combine with flows from Basin **P and be conveyed west via curb and gutter to Design Point 12 (7.5 cfs/16.8 cfs), a proposed 10' D-10-R inlet in a sump condition. Design Point 12 (7.5 cfs/16.8 cfs) cumulative flows include Basin Y. The inlet at Design Point 12 has been sized to accept flows in the developed condition. Collected flows from Design Point 12 will be conveyed in an existing 48" RCP (Pipe 3). In the event of clogging or total inlet failure, flows from Design Point 12 will overtop curb and flow southeast over Tract I to a temporary sediment basin located in the Trails at Forest Meadows Filing No. 1.

Basin X is located in the northerly portion of the site, north of Vanderwood Road, and contains 2.03 acres of single family residential lots and streets. Basin X has proposed design flows of 2.7 cfs for the minor storm event (5-Year) and 6.4 cfs for the major storm event (100-Year). Runoff from Basin X will flow, overland via side lot swales, to the curb and gutter of proposed Vanderwood Road. These flows will be conveyed east via curb and gutter and be combined with flows from Basin **Q and Basin V to Design Point 11 (11.0 cfs/25.2 cfs), a proposed 8' D-10-R inlet in a sump condition. The inlet at Design Point 11 has been sized to accept flows in the developed condition. Collected flows from Design Point 11 will be conveyed in a 48" RCP (Pipe 2) to Design Point 12, a proposed 10' D-10-R inlet in the sump condition.. In the event of clogging or total inlet failure, flows from Design Point 11 will overtop crown/curb and flow southeast over Tract I to a temporary sediment basin located in the Trails at Forest Meadows Filing No. 1.

Basin Y is located in the northerly portion of the site, south of Vanderwood Road, and contains 0.78 acres of single family residential lots and streets. Basin Y has proposed design flows of 1.2 cfs for the minor storm event (5-Year) and 2.8 cfs for the major storm event (100-Year). Runoff from Basin Y will flow, overland via side lot swales, to the curb and gutter of proposed Vanderwood Road. These flows will be conveyed east via curb and gutter and be combined with flows from Basin **P and Basin W to Design Point 12 (7.5 cfs/16.8 cfs), a proposed 10' D-10-R inlet in a sump condition. The inlet at Design Point 12 has been sized to accept flows in the developed condition. Collected flows from Design Point 12 will be conveyed in an existing 48" RCP (Pipe 3). In the event of clogging or total inlet failure, flows from Design Point 12 will overtop curb and flow southeast over Tract I to a temporary sediment basin located in the Trails at Forest Meadows Filing No. 1.

Basin Z is located in the northerly portion of the site, south of Leaf Wood Court, and contains 1.2 acres of

(30.5 cfs/63.9 cfs). Hence flows to this Design Point are less and will not adversely affect the existing subdivision or storm infrastructure.

Basin OS4 is located north of the site and contains 0.83 acres of offsite undeveloped land. In the interim, Basin OS4 has existing design flows of 0.4 cfs for the minor storm event (5-Year) and 1.8 cfs for the major storm event (100-Year). Runoff from Basin OS4 will sheet flow overland to a proposed swale/berm along the north property line. These flows will be conveyed west and combine with flows from Basins **OS2 (0.8 cfs/3.6 cfs) to Design Point 10 (1.0 cfs/4.7 cfs). These flows will be routed to a riprap lined depression and a 48" PP storm sewer with FES (Pipe Run 1). Pipe 1, 2 and 3 have been sized to accept these developed flows and do not exceed the pipe design flows in the Trails at Forest Meadows Filing No. 2 Final Drainage Report. In the event of clogging and/or failure, an overflow route will be graded in between lots 39 and 40 to design point 11 and will be limited to historic flows (Q100=84 cfs). *Any increase in flows due to future development of Basin OS1 MDDP will require the construction of a proposed detention facility*, as per the Sand Creek DBPS. Upon development of Basin OS1 the riprap depression will be filled in and the storm sewer system will be routed to the north to collect the developed flows.

Basin OS5 is located to the north of the site and contains 4.46 acres of offsite undeveloped land. In the interim, Basin OS5 has existing design flows of 2.1 cfs for the minor storm event (5-Year) and 9.0 cfs for the major storm event (100-Year). Runoff from Basin OS5 will sheet flow overland to a proposed swale/berm along the north property line and existing Black Forest Road. These flows will be conveyed south and combine with flows from Basins DD and OS6 to Design Point 17 (4.2 cfs/14.5 cfs). These flows donot exceed the 100 year flows at Design Point EX1 (3.7 cfs/16.7 cfs), see Existing Drainage Plan DP-1. *Any increase in flows due to future development of Basin OS5 will require the construction of a proposed detention facility.*

Basin OS6 is located to the north of the site and contains 0.45 acres of offsite undeveloped land. In the interim, Basin OS6 has existing design flows of 0.1 cfs for the minor storm event (5-Year) and 0.6 cfs for the major storm event (100-Year). Runoff from Basin OS6 will sheet flow overland to a proposed swale/berm along the north property line and existing Black Forest Road. These flows will be conveyed south and combine with flows from Basins DD and OS5 to Design Point 17 (4.2 cfs/14.5 cfs). These flows donot exceed the 100 year flows at Design Point EX1 (3.7 cfs/16.7 cfs), see Existing Drainage Plan DP-1. Basin OS6 (see Existing Drainage Plan DP-1) is tributary to the Cottonwood Creek Basin. In the interim, conveyance of flows from OS6 will be tributary to the Sand Creek Basin. *Upon future development of Basin OS6 all runoff will required to be routed to the Cottonwood Creek Basin.*

Basin OS1 MDDP is located off-site, in the northerly portion of the site and contains 78.0 acres of undeveloped land. Basin OS1 is composed of Basins OS2, OS4, OS5 and OS6. Upon development of Basin OS1, flows of 34.4 cfs for the minor storm event (5-Year) and 84.1 cfs for the major storm event (100-Year) will be routed, via a storm sewer, to the proposed 48" RCP (Pipe Run 1(34.4 cfs/84.1 cfs)) storm sewer within the property site. Pipe Run 1 will route flows to and combine with flows at Pipe Run 2 (41.3 cfs/100.0 cfs), a proposed 48" RCP storm sewer. Pipe Run 2 will route flows to and combine with flows at Pipe Run 3 (45.8 cfs/110.0 cfs), an existing 48" RCP storm sewer. These flows donot exceed the flows designed for the north future filings (48.8 cfs/118.2 cfs), as noted in the Trails at Forest Meadows Filing No. 2 report. Basin OS1 will be conveyed through and combined with the flows of Trails at Forest Meadows Filings to Sand Creek Regional Detention Facility No. 6. See the Trails at Forest Meadows Filing No.2 for historic drainage map and calculations. Any increase in flows due to future development of Basin OS1 will require the construction of a proposed detention facility, as per the Sand Creek DBPS.

EROSION CONTROL

It is the policy of the City of Colorado Springs that we submit an erosion control plan with the drainage report. At this time we respectfully request that the erosion control plan be submitted in conjunction with the final grading plan. Proposed straw bale check dams, silt fence, vehicle traffic control, and reseeding are proposed as erosion control measures. The proposed 90 single family lots will not adversely impact the existing surrounding residential infrastructure. The proposed BMP's in the plan and report shall be installed and maintained to accomplish this task.

TRAILS AT FOREST MEADOWS FILING NO. 4
PRELIMINARY DRAINAGE REPORT
(Area Drainage Summary)

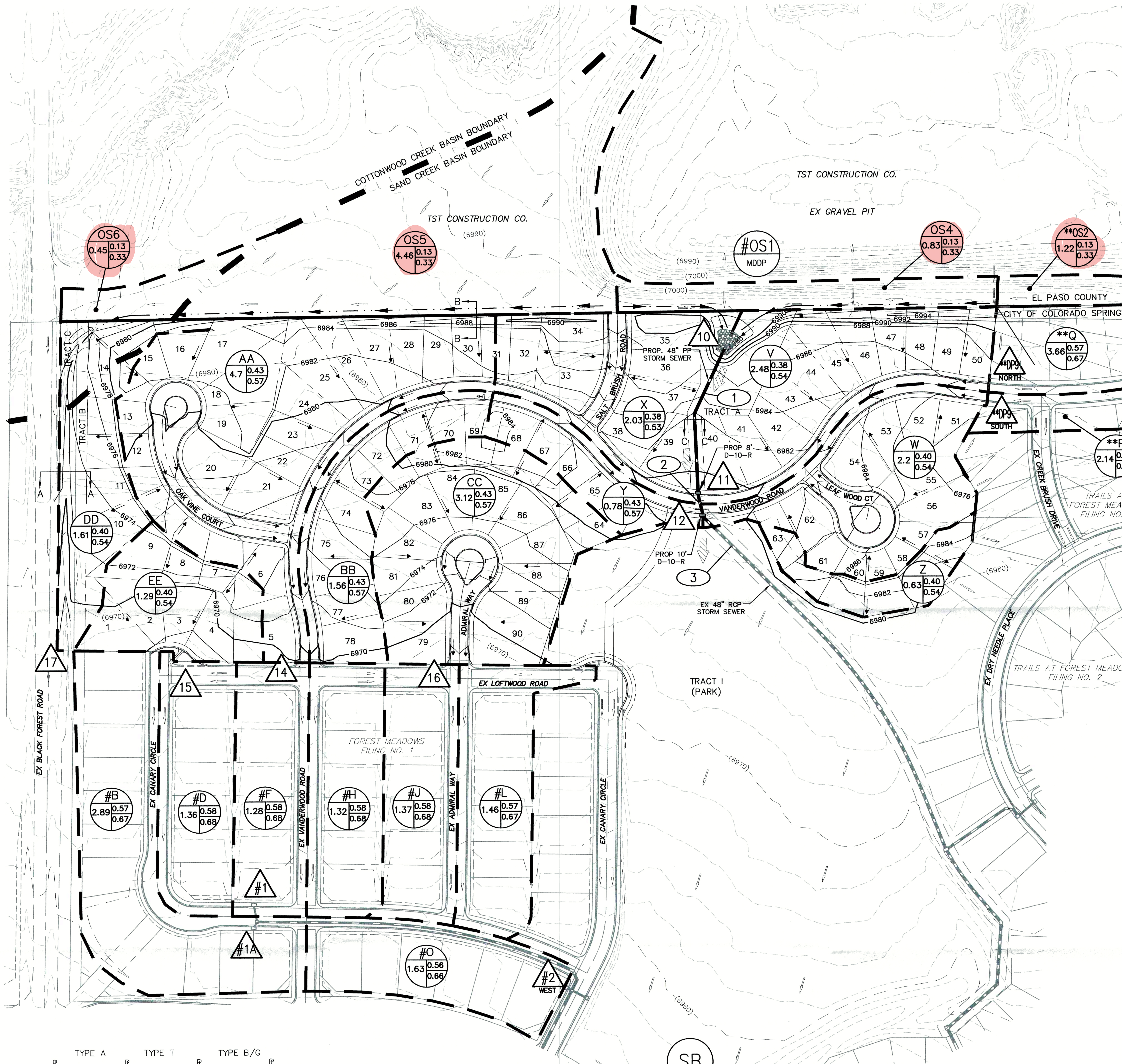
From Area Runoff Coefficient Summary				OVERLAND				STREET / CHANNEL FLOW				of Travel	INTENSITY *		TOTAL FLOWS		#REF!		#REF!
BASIN	AREA TOTAL (Acres)	C_5 (From DCM Table 5-1)	C_{100}	C_5	Length (ft)	Height (ft)	T_C (min)	Length (ft)	Slope (%)	Velocity (fps)	T_t (min)	TOTAL (min)	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (c.f.s.)	Q_{100} (c.f.s.)	CA_5	Basin	CA_{100}
Existing Area Drainage Summary																			
#OS1 Historic	78	0.24	0.33									47.6			34.4	84.1	18.72	#OS1 Historic	25.74
**OS2	1.22	0.13	0.33									5.3			0.8	3.6	0.16	**OS2	0.40
OS4	0.83	0.13	0.33	0.13	48	12	4.5	950	1.3%	2.3	7.0	11.4	3.9	6.6	0.4	1.8	0.11	OS4	0.27
OS5	4.46	0.13	0.33	0.13	64	12	5.7	1138	1.9%	2.3	8.3	14.0	3.6	6.1	2.1	9.0	0.58	OS5	1.47
OS6	0.45	0.13	0.33	0.13	200	2	28.1	232	4.3%	3.0	1.3	29.4	2.5	4.2	0.1	0.6	0.06	OS6	0.15
EX5	6.47	0.13	0.33	0.13	26	2	5.2	1545	1.3%	0.8	34.0	39.1	2.1	3.5	1.8	7.5	0.84	EX5	2.14
EX6	0.38	0.13	0.33	0.13	95	1	19.0	91	11.0%	1.1	1.4	20.5	3.1	5.1	0.2	0.6	0.05	EX6	0.13
EX7	0.72	0.13	0.33	0.13	127	2	19.3	215	1.9%	0.8	4.7	24.0	2.8	4.7	0.3	1.1	0.09	EX7	0.24
EX8	9.1	0.13	0.33	0.13	128	4	15.4	530	2.6%	0.8	11.6	27.1	2.6	4.4	3.1	13.3	1.18	EX8	3.00
EX9	6.3	0.13	0.33	0.13	165	7	15.8	1017	2.1%	0.8	22.4	38.2	2.1	3.6	1.7	7.4	0.82	EX9	2.08
EX10	4.9	0.13	0.33	0.13	216	4	23.8	382	2.1%	0.8	8.4	32.2	2.4	4.0	1.5	6.4	0.64	EX10	1.62
EX11	6.8	0.13	0.33	0.13	204	4	22.7	1310	2.0%	0.8	28.8	51.5	1.7	2.8	1.5	6.3	0.88	EX11	2.24
**P	2.14	0.57	0.67									15.2			4.2	8.8	1.22	**P	1.43
**Q	3.66	0.57	0.67									21.1			6.1	12.8	2.09	**Q	2.45
#B	2.89	0.57	0.67									11.4			6.4	13.4	1.65	#B	1.94
#D	1.36	0.58	0.68									9.2			3.3	7.0	0.79	#D	0.92
#F	1.28	0.58	0.68									10.2			3.0	6.3	0.74	#F	0.87
#H	1.32	0.58	0.68									10.2			3.1	6.5	0.77	#H	0.90
#J	1.37	0.58	0.68									10.1			3.2	6.8	0.79	#J	0.93
#L	1.46	0.57	0.67									10.3			3.4	7.0	0.83	#L	0.98
#O	1.63	0.56	0.66									10.7			3.6	7.6	0.91	#O	1.08
Proposed Area Drainage Summary																			
V	2.48	0.38	0.54	0.38	139	2.78	13.1	604	1.5%	3.0	3.3	16.4	3.4	5.7	3.2	7.6	0.94	V	1.34
W	2.2	0.40	0.54	0.40	112	2.24	11.2	604	1.5%	3.0	3.3	14.6	3.6	6.0	3.1	7.1	0.88	W	1.19
X	2.03	0.38	0.53	0.38	128	2.56	12.5	427	1.3%	3.0	2.3	14.8	3.5	5.9	2.7	6.4	0.77	X	1.07
Y	0.78	0.43	0.57	0.43	115	2.3	10.9	427	1.3%	3.0	2.3	13.3	3.7	6.2	1.2	2.8	0.34	Y	0.44
Z	0.63	0.40	0.54	0.40	56	2.2	6.4	0	1.3%	2.3	0.0	6.4	4.8	8.1	1.2	2.7	0.25	Z	0.34
AA	4.7	0.43	0.57	0.43	111	2.2	10.8	732	2.0%	3.0	4.0	14.8	3.5	5.9	7.2	15.9	2.02	AA	2.68
BB	1.56	0.43	0.57	0.43	107	2.1	10.6	732	2.0%	3.0	4.0	14.6	3.6	6.0	2.4	5.3	0.67	BB	0.89
CC	3.12	0.43	0.57	0.43	118	2.36	11.1	261	4.0%	3.0	1.4	12.5	3.8	6.4	5.1	11.3	1.34	CC	1.78
DD	1.61	0.40	0.54	0.40	83	4.9	6.8	590	1.1%	2.3	4.3	11.1	4.0	6.7	2.6	5.8	0.64	DD	0.87
EE	1.29	0.40	0.54	0.40	68	2.7	7.0	111	2.0%	2.3	0.8	7.8	4.5	7.6	2.3	5.3	0.52	EE	0.70

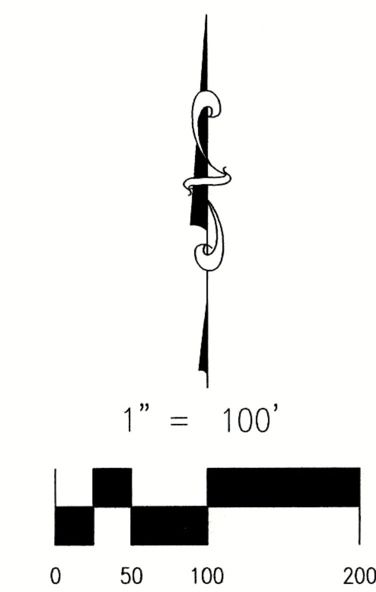
* Intensity equations assume a minimum travel time of 5 minutes.

** Data from Trails at Forest Meadows Filing No. 3 Final Drainage Report (TFM 3 FDR).

\# Data from Master Development Drainage Plan Update for Woodmen Heights and Final Drainage Report for Forest Meadows Filing No.1 & No.4 (MDDP)

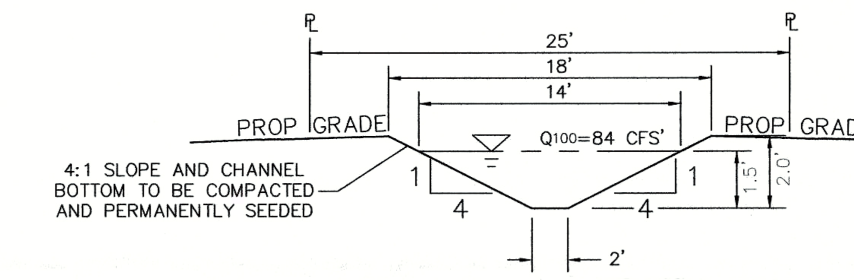
Calculated by: ET
Date: 12/9/2015
Checked by: VAS





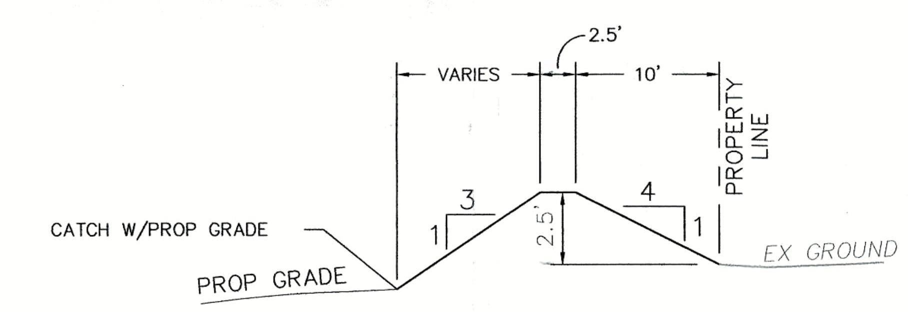
LEGEND

SB	SEDIMENT BASIN	BASIN DESIGNATION / ACRES / C5 / C100	
200	PIPE RUN REFERENCE LABEL		
2A	SURFACE DESIGN POINT		EXISTING FLOW DIRECTION ARROW
			EMERGENCY OVERFLOW DIRECTION
	BASIN BOUNDARY		FLOW DIRECTION
(6920)	EXISTING CONTOUR		FLARED END SECTION
6920	PROPOSED CONTOUR		PERIMETER SWALE
	STORM SEWER PIPE		FILING LINE
	CROSSPAN	11	LOT NUMBER
	INLET	2.5%	STREET GRADE W/DIRECTION
		H.P.	HIGH POINT
		L.P.	LOW POINT



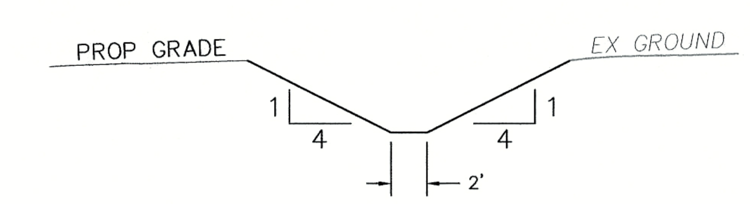
SECTION "C-C" OVERFLOW SWALE

NOT TO SCALE



SECTION "B-B" BERM

NOT TO SCALE



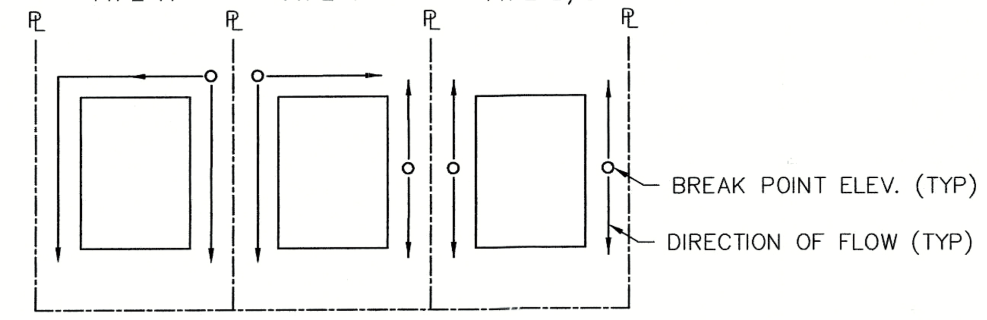
SECTION "A-A" SWALE

NOT TO SCALE

BASIN SUMMARY			
BASIN	AREA (ACRES)	Q5	Q100
V	2.48	3.2	7.6
W	2.20	3.1	7.1
X	2.03	2.7	6.4
Y	0.78	1.2	2.8
Z	0.63	1.2	2.7
AA	4.70	7.2	15.9
BB	1.56	2.4	5.3
CC	3.12	5.1	11.3
DD	1.61	2.6	5.8
EE	1.29	2.3	5.3
OS4	0.83	0.4	1.8
OS5	4.46	2.1	9.0
OS6	0.45	0.1	0.6
#OS1	78.0	34.4	84.1
**OS2	1.22	0.8	3.6
**P	2.14	4.2	8.8
**Q	3.66	6.1	12.8
#B	2.89	6.4	13.4
#D	1.36	3.3	7.0
#F	1.28	3.0	6.3
#H	1.32	3.1	6.5
#J	1.37	3.2	6.8
#L	1.48	3.4	7.0
#O	1.63	3.6	7.6

DESIGN POINT SUMMARY			
DESIGN POINT	Q5	Q100	BASIN
**DP9 NORTH	6.1	12.8	**DP9Q
**DP9 SOUTH	3.6	7.5	**DP9P
10	1.0	4.7	OS4,**OS2
11	11.0	25.2	**DP9Q,V,X
12	7.5	16.8	**DP9P,W,Y
11-12	18.1	41.1	**DP9Q,**DP9P,V,X,W,Y
14	9.4	22.1	AA,BB
15	2.3	5.3	EE
#1&#1A	22.9	50.7	AA,BB,EE,#B,#D,#F,#H
16	5.0	11.9	CC
#2 WEST	12.9	28.2	CC,#J,#L,#O
17	4.2	14.5	OS5,OS6,DD

STORM SEWER SUMMARY			
PIPE RUN	Q5	Q100	PIPE SIZE
1	34.4	84.1	48" PP
2	41.3	100.0	48" PP
3	45.8	110.0	EX 48" RCP



LOT DRAINAGE TYPES AND SWALE DIRECTION

NOT TO SCALE

M&S CIVIL CONSULTANTS, INC.
20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485

TRAILS AT FOREST MEADOWS FILING NO. 4

PROPOSED DRAINAGE PLAN

PROJECT NO. 08-032	FILE: \dwg\Eng Exhibits\DP2.dwg		
DESIGNED BY: ET DRAWN BY: BB CHECKED BY: ET	SCALE HORIZ: 1"=100' VERT: N/A	DATE: 3/28/16 SHEET 2 OF 2	DP2

COTTONWOOD CREEK DRAINAGE BASIN PLANNING STUDY

FINAL REPORT
JULY 2019

Prepared for:

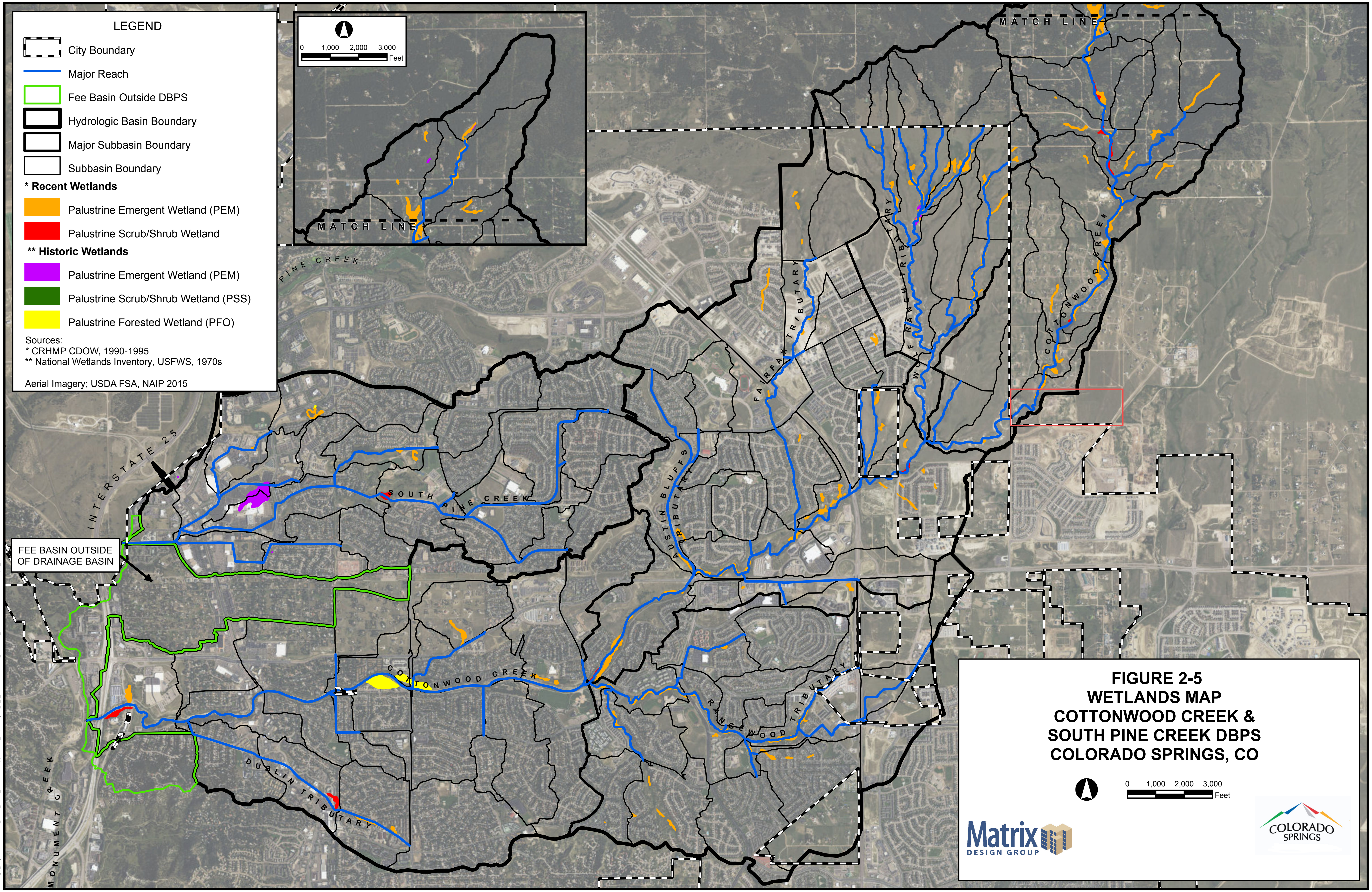
COLORADO SPRINGS

Department of Public Works
Water Resources Engineering

City of Colorado Springs
30 S. Nevada Ave
Colorado Springs, CO 80903

Prepared by:

Matrix DESIGN GROUP
AN EMPLOYEE-OWNED COMPANY


LEGEND
City Boundary
Major Reach
Fee Basin Outside DBPS
Hydrologic Basin Boundary
Major Subbasin Boundary
Subbasin Boundary
* Recent Wetlands
Palustrine Emergent Wetland (PEM)
Palustrine Scrub/Shrub Wetland
** Historic Wetlands
Palustrine Emergent Wetland (PEM)
Palustrine Scrub/Shrub Wetland (PSS)
Palustrine Forested Wetland (PFO)
Sources:
* CRHMP CDOW, 1990-1995
** National Wetlands Inventory, USFWS, 1970s
Aerial Imagery; USDA FSA, NAIP 2015
0 1,000 2,000 3,000 Feet
MATCH LINE
PINE CREEK
INTERSTATE 25
FEE BASIN OUTSIDE OF DRAINAGE BASIN
SOUTH PINE CREEK
COTTONWOOD CREEK
DUBLIN TRIBUTARY
MONUMENT CREEK
AUSTIN BLUFFS TRIBUTARY
FAIRFAX TRIBUTARY
WOLF RANCH TRIBUTARY
RANGEWOOD TRIBUTARY
FIGURE 2-5
WETLANDS MAP
COTTONWOOD CREEK &
SOUTH PINE CREEK DBPS
COLORADO SPRINGS, CO
Matrix DESIGN GROUP
COLORADO SPRINGS

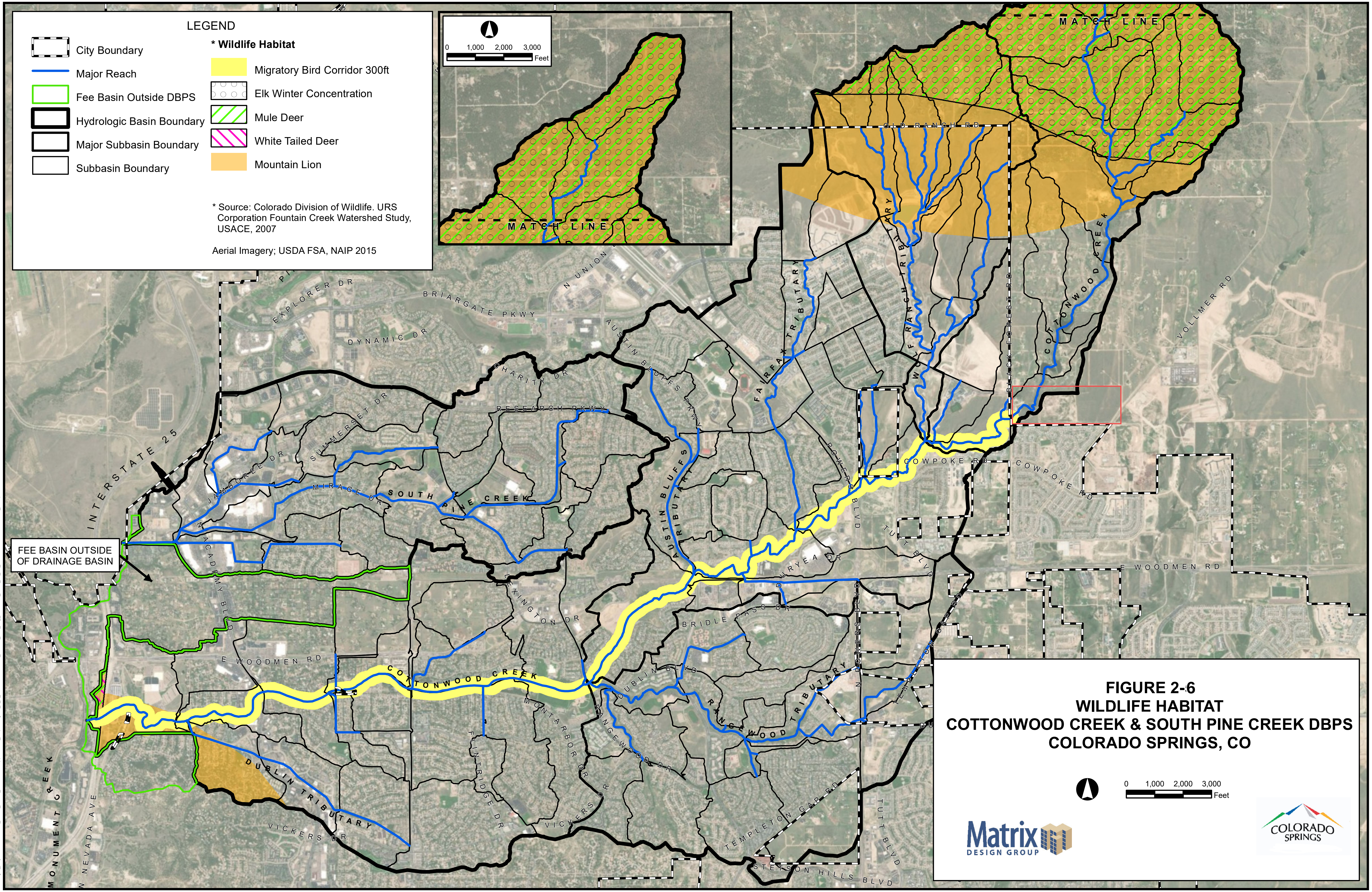
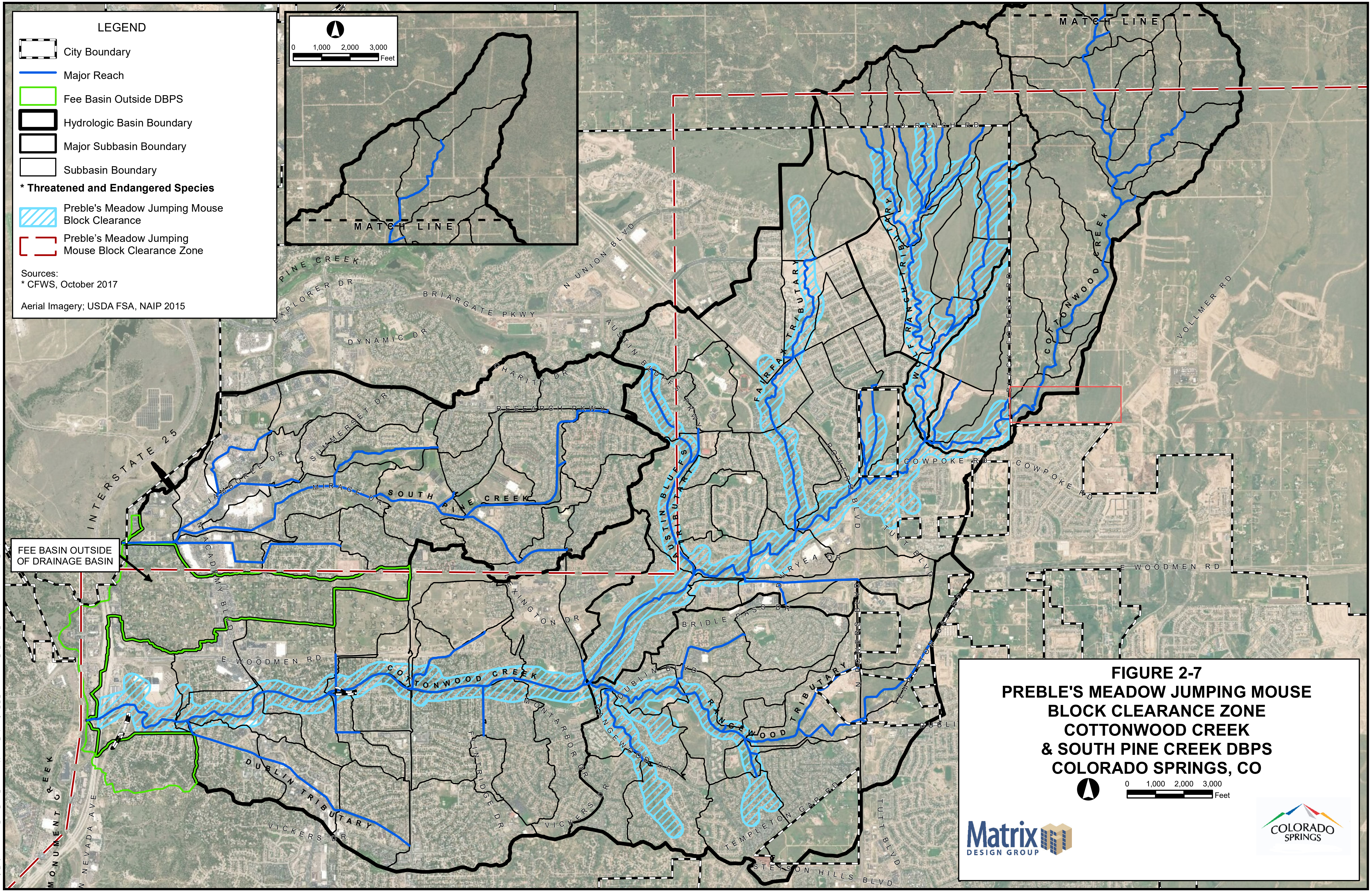


FIGURE 2-6
WILDLIFE HABITAT
COTTONWOOD CREEK & SOUTH PINE CREEK DBPS
COLORADO SPRINGS, CO



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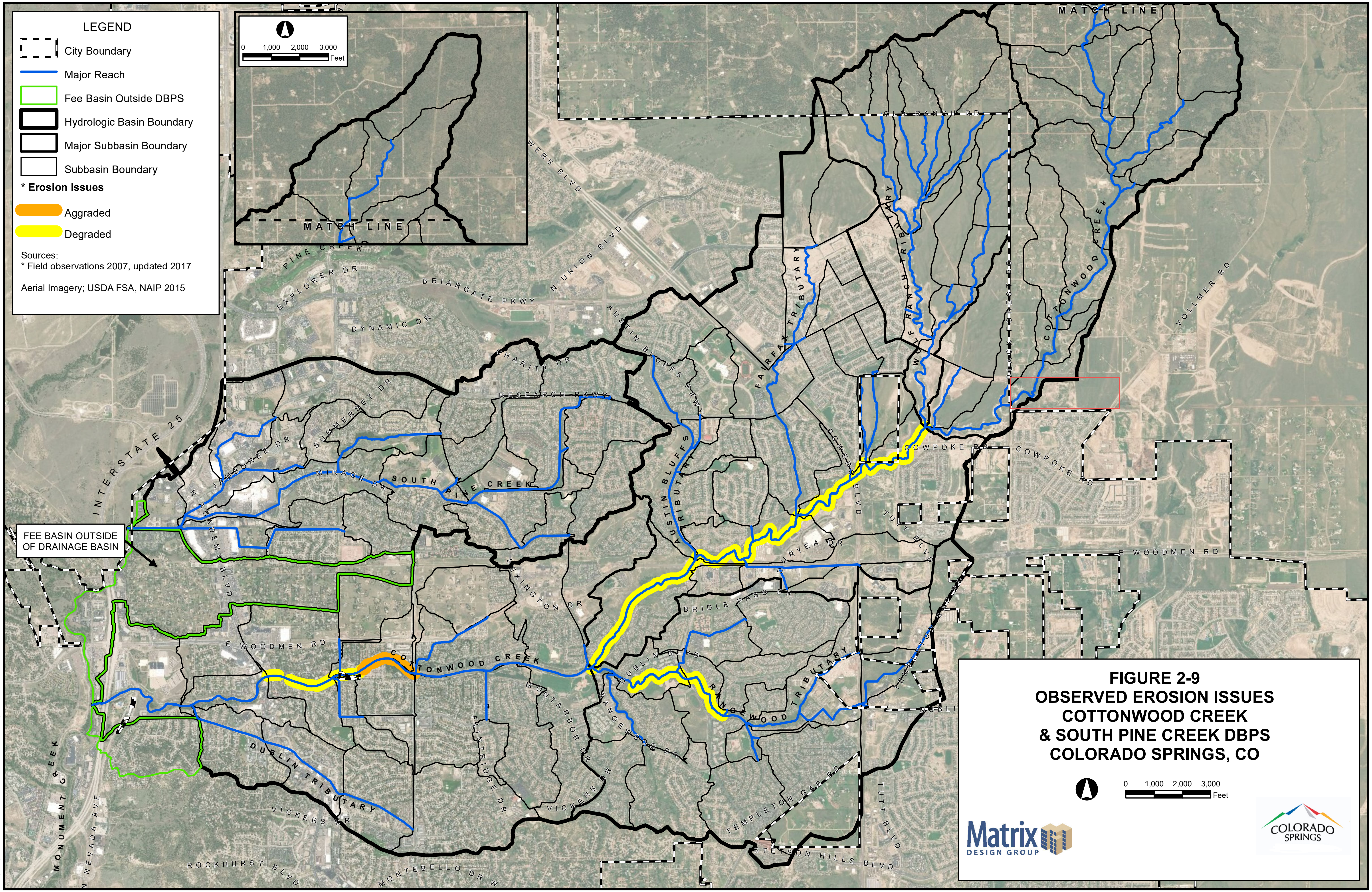
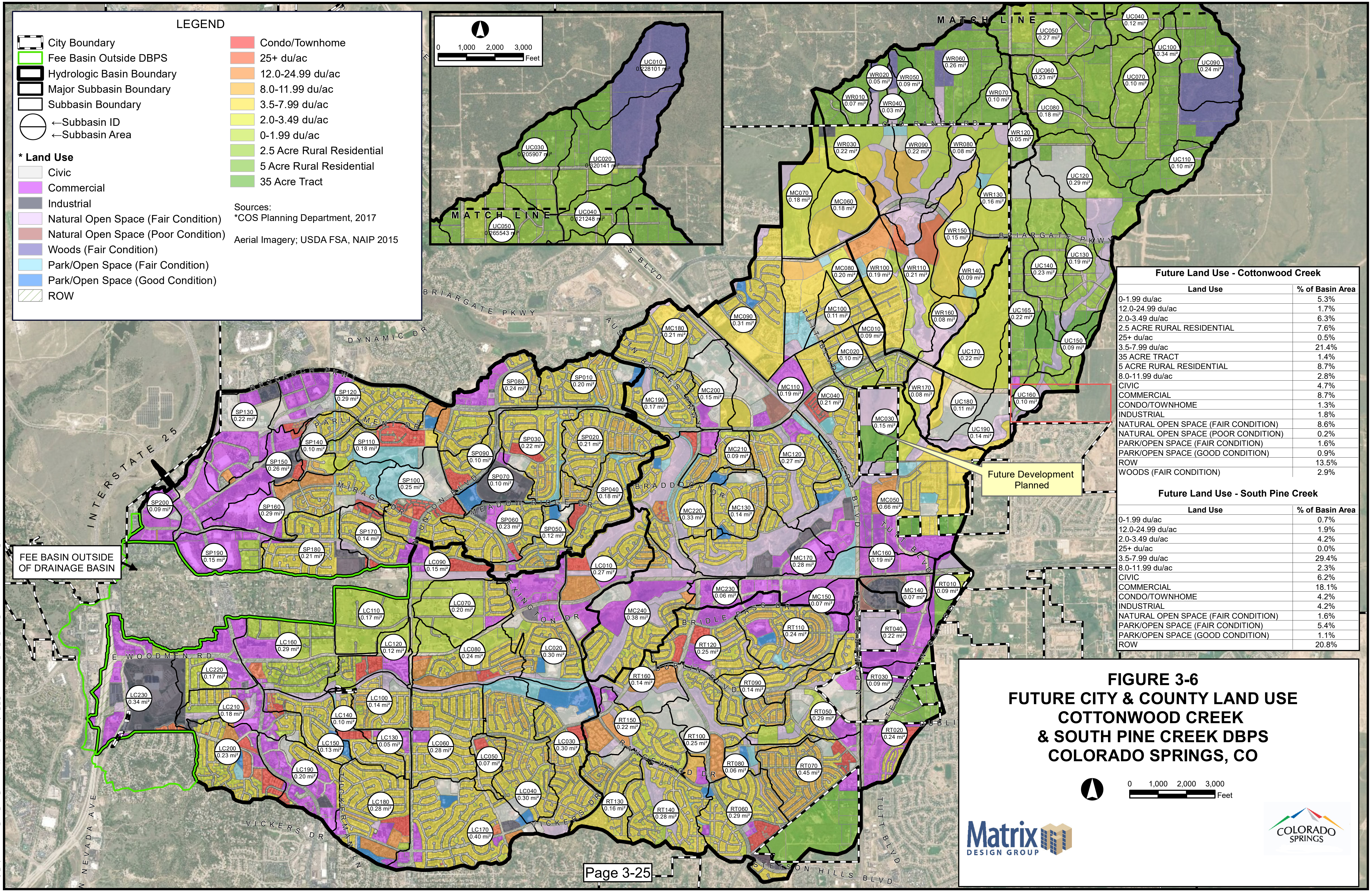


FIGURE 2-9
OBSERVED EROSION ISSUES
COTTONWOOD CREEK
& SOUTH PINE CREEK DBPS
COLORADO SPRINGS, CO



Future Land Use - Cottonwood Creek

Land Use	% of Basin Area
0-1.99 du/ac	5.3%
12.0-24.99 du/ac	1.7%
2.0-3.49 du/ac	6.3%
2.5 ACRE RURAL RESIDENTIAL	7.6%
25+ du/ac	0.5%
3.5-7.99 du/ac	21.4%
35 ACRE TRACT	1.4%
5 ACRE RURAL RESIDENTIAL	8.7%
8.0-11.99 du/ac	2.8%
CIVIC	4.7%
COMMERCIAL	8.7%
CONDO/TOWNHOME	1.3%
INDUSTRIAL	1.8%
NATURAL OPEN SPACE (FAIR CONDITION)	8.6%
NATURAL OPEN SPACE (POOR CONDITION)	0.2%
PARK/OPEN SPACE (FAIR CONDITION)	1.6%
PARK/OPEN SPACE (GOOD CONDITION)	0.9%
ROW	13.5%
WOODS (FAIR CONDITION)	2.9%

Future Land Use - South Pine Creek

Land Use	% of Basin Area
0-1.99 du/ac	0.7%
12.0-24.99 du/ac	1.9%
2.0-3.49 du/ac	4.2%
25+ du/ac	0.0%
3.5-7.99 du/ac	29.4%
8.0-11.99 du/ac	2.3%
CIVIC	6.2%
COMMERCIAL	18.1%
CONDO/TOWNHOME	4.2%
INDUSTRIAL	4.2%
NATURAL OPEN SPACE (FAIR CONDITION)	1.6%
PARK/OPEN SPACE (FAIR CONDITION)	5.4%
PARK/OPEN SPACE (GOOD CONDITION)	1.1%
ROW	20.8%

FIGURE 3-6
FUTURE CITY & COUNTY LAND USE COTTONWOOD CREEK & SOUTH PINE CREEK DBPS COLORADO SPRINGS, CO

0 1,000 2,000 3,000 Feet

Matrix DESIGN GROUP

COLORADO SPRINGS

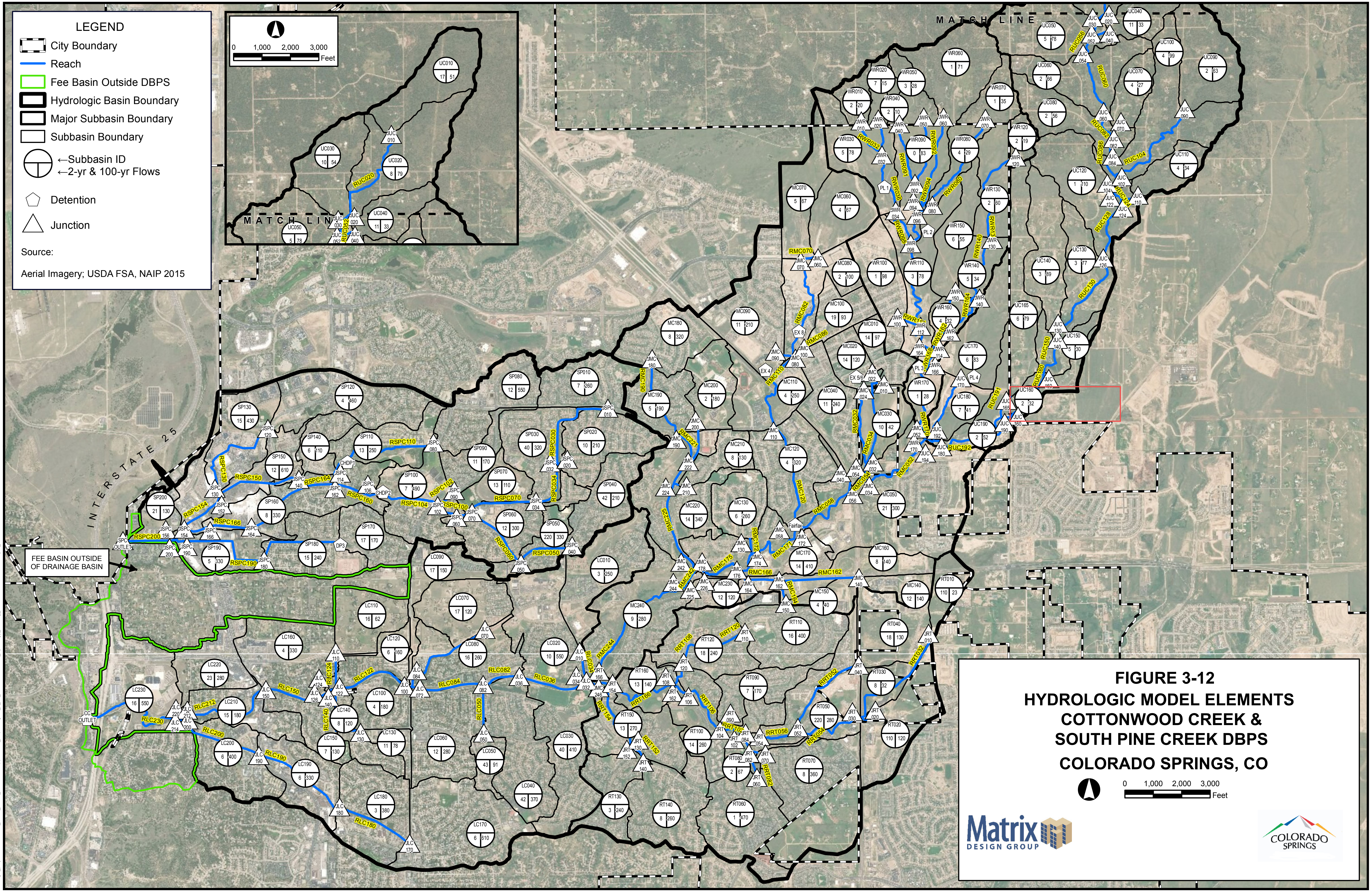
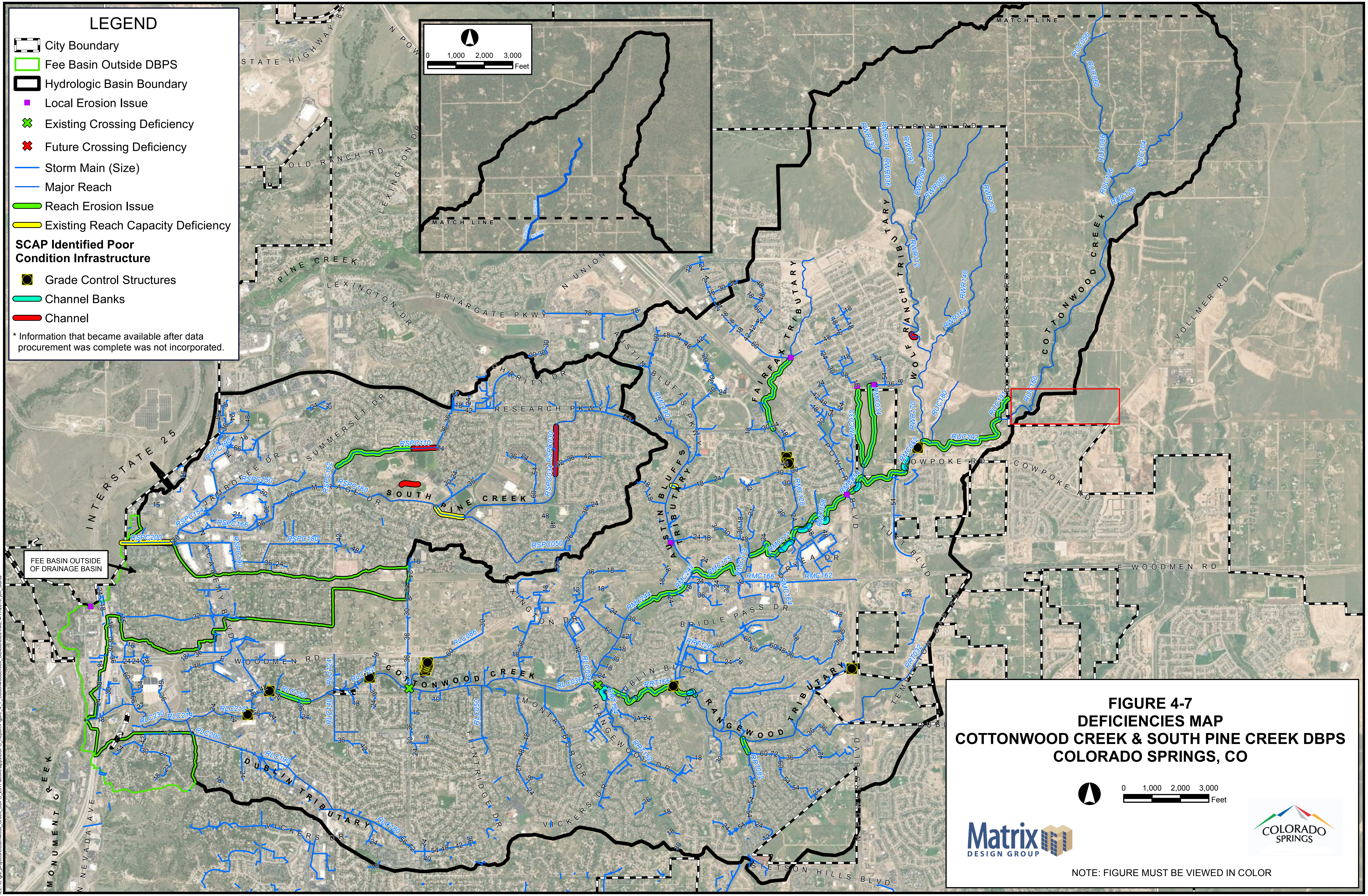


FIGURE 3-12
HYDROLOGIC MODEL ELEMENTS
COTTONWOOD CREEK &
SOUTH PINE CREEK DBPS
COLORADO SPRINGS, CO


LEGEND
City Boundary
Fee Basin Outside DBPS
Hydrologic Basin Boundary
Local Erosion Issue
Existing Crossing Deficiency
Future Crossing Deficiency
Storm Main (Size)
Major Reach
Reach Erosion Issue
Existing Reach Capacity Deficiency
SCAP Identified Poor Condition Infrastructure
Grade Control Structures
Channel Banks
Channel
* Information that became available after data procurement was complete was not incorporated.
FEE BASIN OUTSIDE OF DRAINAGE BASIN
MATCH LINE
0 1,000 2,000 3,000 Feet
INTERSTATE 25
PINE CREEK
SOUTH PINE CREEK
COTTONWOOD CREEK
DUBLIN TRIBUTARY
RANGEWOOD TRIBUTARY
AUSTIN BLUFFS TRIBUTARY
FAIRFAX TRIBUTARY
WOLF RANCH TRIBUTARY
BRIARGATE PKWY
RESEARCH PKWY
E WOODMEN RD
BRIDLE PASS DR
VOLLMER RD
COWPOKE RD
STETSON HILLS BLVD
VICKERS DR
FIGURE 4-7
DEFICIENCIES MAP
COTTONWOOD CREEK & SOUTH PINE CREEK DBPS
COLORADO SPRINGS, CO
Matrix DESIGN GROUP
COLORADO SPRINGS
NOTE: FIGURE MUST BE VIEWED IN COLOR

SAND CREEK DRAINAGE BASIN PLANNING STUDY

FINAL REPORT
JANUARY 2021

Prepared for:

COLORADO SPRINGS
OLYMPIC CITY USA

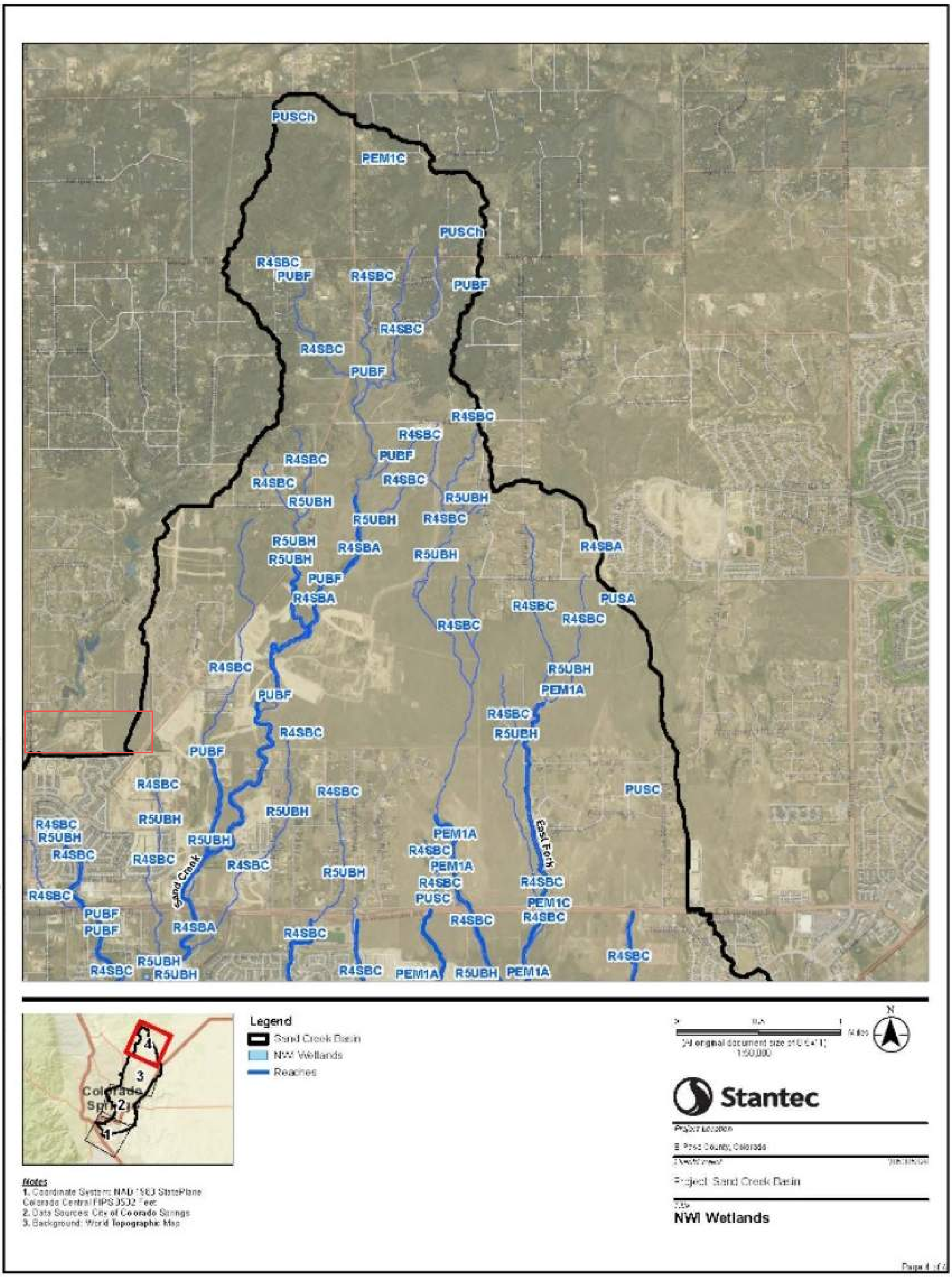
STORMWATER ENTERPRISE

Prepared by:

Stantec

HDR

Dewberry®



Disclaimer: This document has been prepared based on information provided by others as cited in the Notes section. Stantec has not verified the accuracy and/or completeness of this information and shall not be responsible for any errors or omissions which may be incorporated herein as a result. Stantec assumes no responsibility for data supplied in electronic format, and the recipient accepts full responsibility for verifying the accuracy and completeness of the data.

Figure 2-7: NWI Wetlands Located in Sand Creek Drainage Basin (Page 4)

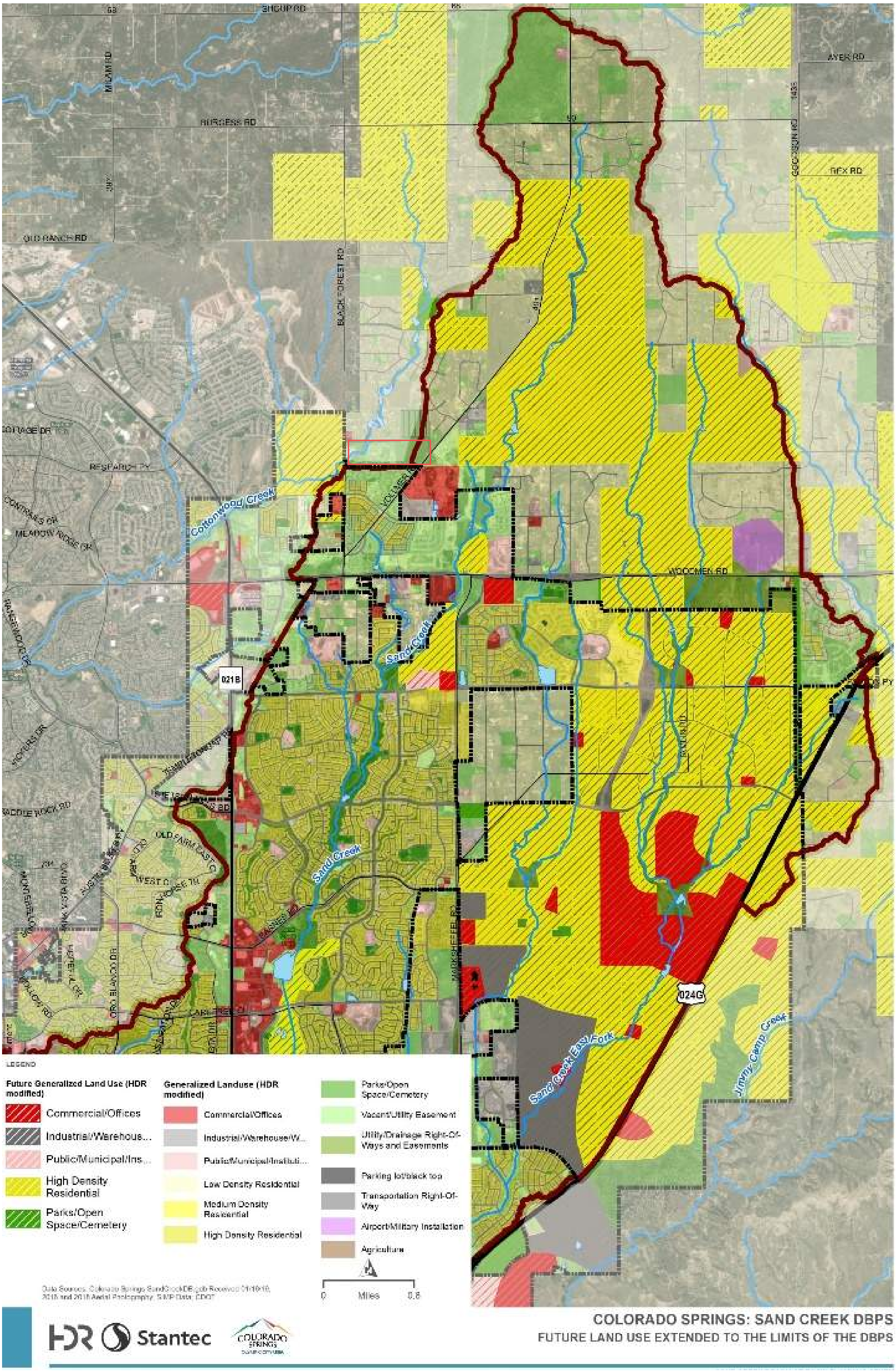


Figure 3-15. **Future Land Use MapFuture Condition Model Results**

Appendix E
Maps

SCHIMIDT PARCEL
EXISTING DRAINAGE MAP

BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EX1	15.60	2%	0.09	0.36	41.6	2.8	18.8
EX2	22.90	2%	0.09	0.36	58.1	3.1	20.6
EX3	2.50	2%	0.09	0.36	40.6	0.5	3.1
EX4	33.10	2%	0.09	0.36	28.7	7.6	51.0
EX5	8.00	2%	0.09	0.36	20.5	2.2	14.7
EX6	3.40	2%	0.09	0.36	20.0	0.9	6.3
EX7	2.90	2%	0.09	0.36	17.6	0.9	5.7
EX8	6.40	2%	0.09	0.36	36.0	1.3	8.5
EX9	2.40	2%	0.09	0.36	10.0	0.9	6.0
OS1	0.61	2%	0.09	0.36	10.0	0.2	1.5
OS2	0.22	2%	0.09	0.36	10.0	0.1	0.6
OSI4	27.16		0.30	0.40	29.20	19.0	44.2
OSB4	52.02		0.32	0.42	28.70	39.1	89.8

DESIGN POINT SUMMARY TABLE

DP#	$Q_{5\text{-YR}}$	$Q_{100\text{-YR}}$
1	2.8	18.8
1.1	2.8	19.0
2	3.1	20.6
2.1	3.2	21.1
3	0.5	3.1
3.1	17.0	40.0
4	7.6	51.0
4.1	7.6	50.9
5	2.2	14.7
6	0.9	6.3
6.1	3.1	21.0
7	0.9	5.7
7.1	43.1	97.9
8	1.3	8.5
9	0.9	6.0
10	0.2	1.5
11	0.1	0.6
B4	39.1	89.8
I4	19.0	44.2

LEGEND:

- —6000— EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- DRAINAGE BASIN
- MAJOR DRAINAGE BASIN
- A = BASIN DESIGNATION, B = AREA IN ACRES
- DESIGN POINT
- EXISTING DRAINAGE ARROW

150 75 0 150 300
ORIGINAL SCALE: 1" = 150'

PCD FILE NO: CDR-22-007

EXISTING DRAINAGE MAP
SCHMIDT PARCEL
JOB NO. 25188.13
09/02/2022
SHEET 1 OF 1

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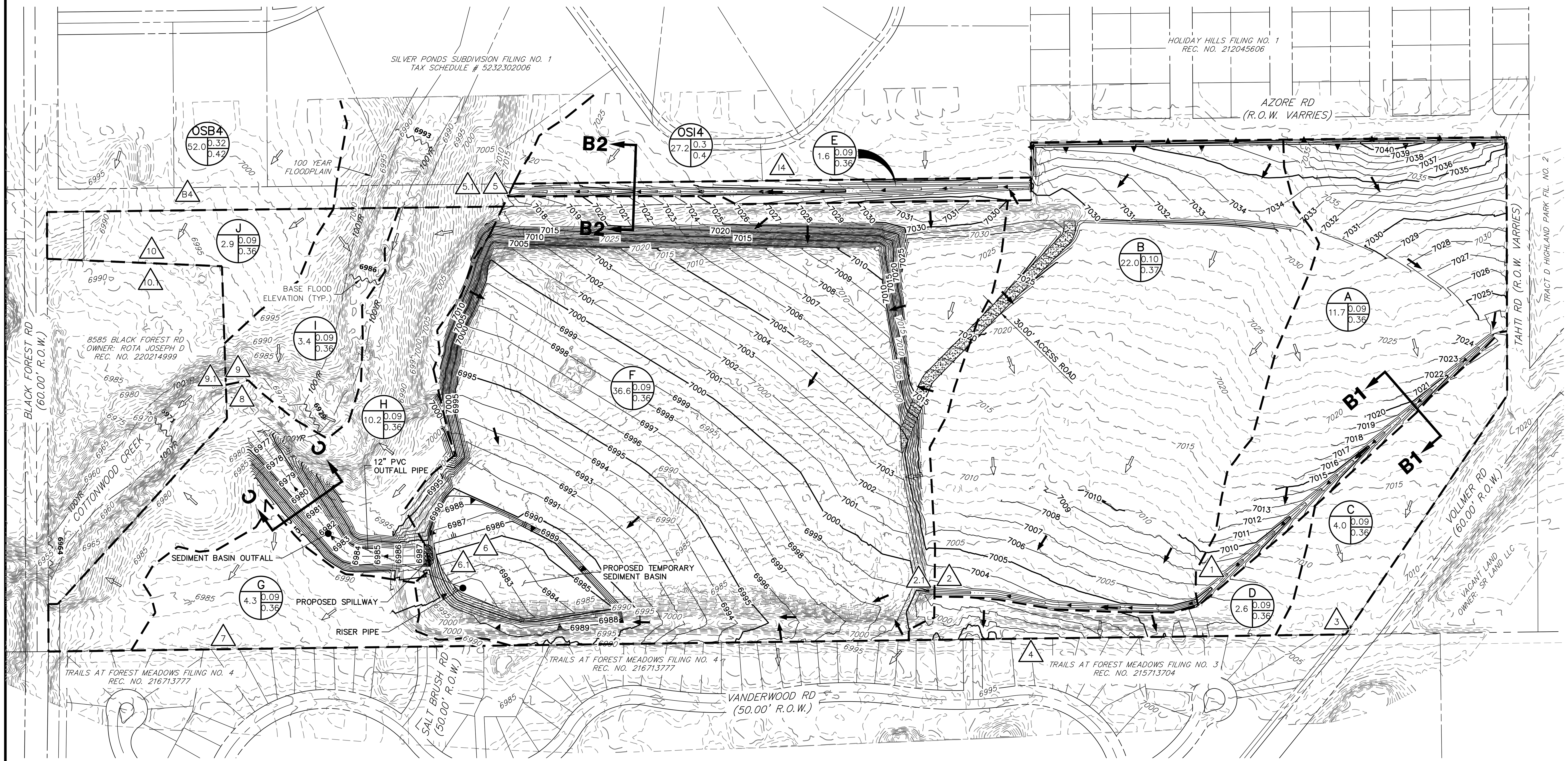
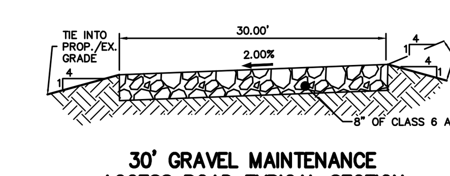
Fort Collins 970-491-9888 • www.jrengineering.com

SCHMIDT PARCEL
PROPOSED DRAINAGE MAP



BASIN SUMMARY TABLE							
Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
A	11.70	2%	0.09	0.36	46.2	1.9	13.0
B	22.00	4%	0.10	0.37	48.6	3.5	23.8
C	4.00	2%	0.09	0.36	34.6	0.8	5.5
D	2.60	2%	0.09	0.36	25.7	0.6	4.3
E	1.60	2%	0.09	0.36	53.2	0.2	1.6
F	36.60	3%	0.09	0.36	53.9	5.3	35.7
G	4.30	2%	0.09	0.36	25.7	1.1	7.1
H	10.20	2%	0.09	0.36	38.8	1.9	12.9
I	3.40	2%	0.09	0.36	38.7	0.6	4.3
J	2.90	2%	0.09	0.36	25.7	0.7	4.7
OSI4	27.16		0.30	0.40	29.2	19.0	44.2
OSB4	52.02		0.32	0.42	28.7	39.1	89.8

DESIGN POINT SUMMARY TABLE		
DP#	$Q_{5\text{-YR}}$	$Q_{100\text{-YR}}$
1	1.9	13.0
2	3.5	23.8
2.1	5.3	36.2
3	0.8	5.5
4	0.6	4.3
5	0.2	1.5
5.1	13.2	30.5
6	5.3	35.7
6.1	10.1	68.7
7	1.0	7.0
8	1.9	12.7
9	0.6	4.2
9.1	2.6	18.7
10	0.7	4.7
10.1	43.1	97.9
B4	39.1	89.8
I4	19.0	44.2

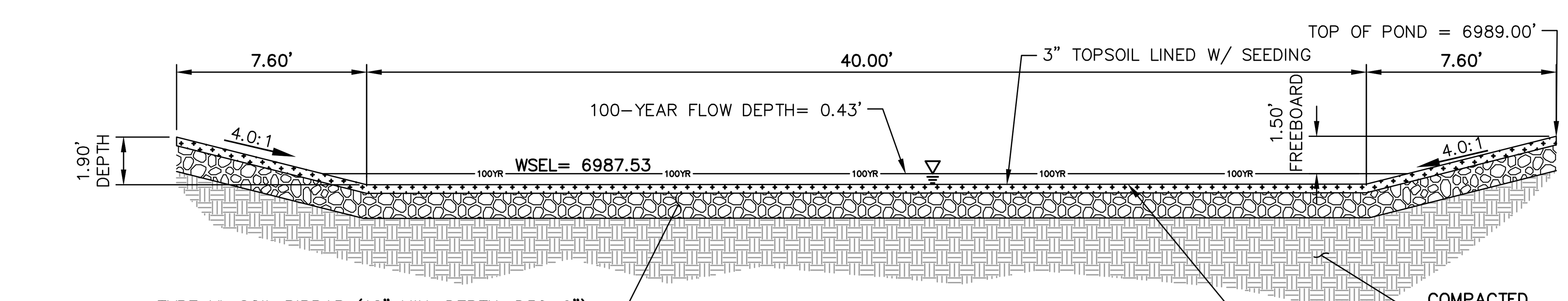


30' GRAVEL MAINTENANCE ACCESS ROAD TYPICAL SECTION

N.T.S.

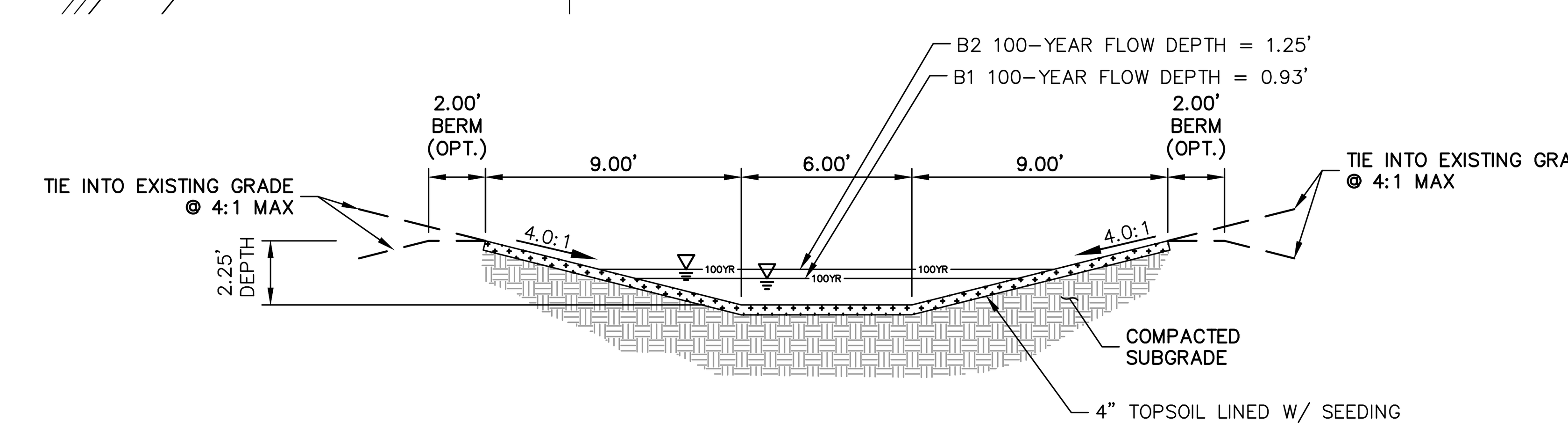
LEGEND:

- 6000 — PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- 6000 — EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- DRAINAGE BASIN
- PROPOSED SWALE
- PROPOSED TOP OF SLOPE/BERM
- A = BASIN DESIGNATION; B = AREA IN ACRES; C = 5-YR RUNOFF COEFFICIENT; D = 100-YR RUNOFF COEFFICIENT
- 1 — DESIGN POINT
- DRAINAGE ARROW
- EXISTING DRAINAGE ARROW



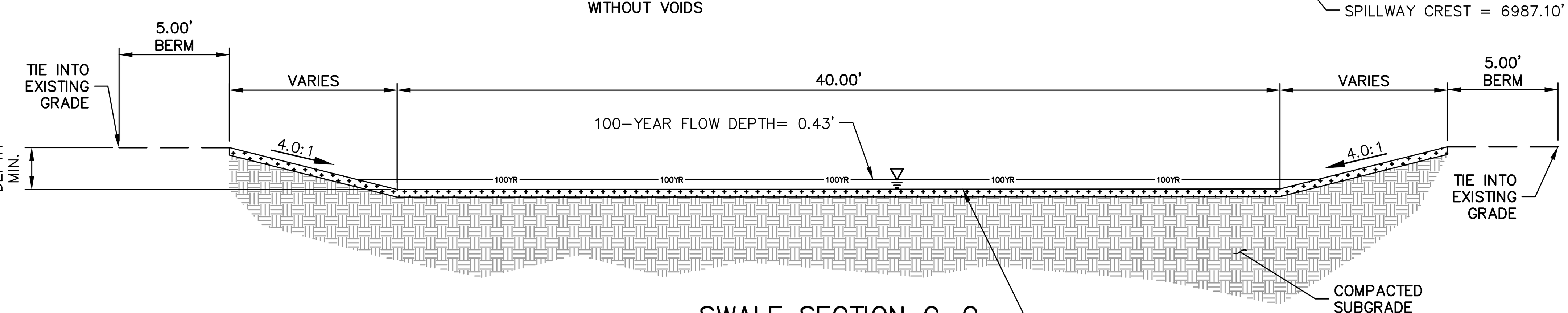
SPILLWAY SECTION

SCALE: 1"=5'



SWALE SECTION B-B

SCALE: 1"=5'



SWALE SECTION C-C

SCALE: 1"=5'

150 75 0 150 300

ORIGINAL SCALE: 1" = 150'

PCD FILE NO: CDR-22-007

PROPOSED DRAINAGE MAP
SCHMIDT PARCEL
JOB NO. 25188.13
09/02/2022
SHEET 1 OF 1

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