FINAL DRAINAGE REPORT
FOR
URBAN COLLECTION AT PALMER VILLAGE

Prepared For:

MDC Holdings – Richmond American Homes
4350 South Monaco Street
Denver, CO 80237
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PCD Filing No.:
SF-20-028

April 23, 2021
Project No. 25149.01

Prepared By:

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FINAL DRAINAGE REPORT FOR
URBAN COLLECTION AT PALMER VILLAGE April 2021

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.

COLORADO LICENSED GLENN DEAN ELLIS 38861 4/28/21 PROFESSIONAL ENGINEER

Glenn D. Ellis, Colorado P.E. 38861
For and On Behalf of JR Engineering, LLC

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: MDC Holdings – Richmond American Homes

By: Jason J.W. Pack

Title: VP of Land Acquisition & Entitlements

Address: 4350 South Monaco Street
Denver, CO 80237

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
by Jeff Rice
El Paso County Planning and Community Development
on behalf of Elizabeth Nijkamp, Engineering Review Manager
09/07/2021 10:32:14 AM

Jennifer Irvine, P.E.
County Engineer/ ECM Administrator

Date

Conditions:

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APPENDIX

PURPOSE

This document is the Final Drainage Report for Urban Collection at Palmer Village. The purpose of this report is to identify on-site and off-site drainage patterns, storm sewer, culvert and inlet locations, areas tributary to the site, and to safely route developed storm water to adequate outfall facilities.

GENERAL SITE DESCRIPTION

GENERAL LOCATION

Urban Collection at Palmer Village is a proposed development within the Urban Collection at Palmer Village subdivision with a total area of 23.1 acres. The site is located in the northeast quarter of Section 5, Township 14 South, Range 65 West of the Sixth Principal Meridian in the County of El Paso, State of Colorado. The site is located immediately south of Constitution Avenue on the west and east side of Hannah Ridge Drive, extending to the east to Marksheffel Road. The site is bounded by Constitution Avenue to the north, Marksheffel Road to the east, Jessica Heights Filing No. 1 to the south, and the Cherokee Park Townhomes to the west. Refer to the vicinity map in Appendix A.

DESCRIPTION OF PROPERTY

A 100-unit residential development is proposed on lots 1 through 100 and Tracts A through L within the subdivision (hereby referred to as the "site") per the corresponding approved Final Plat. The area of the site totals 10.83 acres. The two tracts (M and N) along Constitution Avenue, east to Marksheffel Road will not be developed at this time. They are referenced in this report only in the context of being included in the plat of the proposed development. Any development of these two tracts shall require separate drainage analysis and drainage reports. The site is currently undeveloped other than a sanitary sewer easement that follows the eastern border of the site on the east side of Hannah Ridge Drive. The proposed development site is comprised of variable sloping grasslands that generally slope east at approximately 3% on the east side of Hannah Ridge Drive. On the west side of Hannah Ridge Drive the land slopes at about 1% to the east, draining into the curb and gutter in Hannah Ridge Drive.

Soil characteristics are comprised of Blakeland loamy sand. NRCS rates this soil designation as Hydrologic Group A. Group A soils exhibit a high infiltration rate when thoroughly wet and consist chiefly of deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a high rate of water transmission. Refer to the soil survey mapping in Appendix A.

There are no major drainageways on the proposed development site, although a tributary to the East Fork Sand Creek is immediately to the east of the site, within the undeveloped tracts.

There are no known irrigation facilities located on the project site. A 12" PVC sanitary sewer runs along the eastern side of the site within an easement.

FLOODPLAIN STATEMENT

Based on the FEMA Firm Map Number 08041C0752G, revised December 7, 2018, the entire 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. 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 Drainage Basin based on the "Sand Creek Drainage Basin Planning Study" completed by Kiowa Engineering Corporation in January 1993. The Sand Creek Drainage Basin covers approximately 54 square miles and is divided into five major sub-basins: Sand Creek Mainstem, East Fork Sand Creek, Central Tributary to East Fork, West Fork, and East Fork Subtributary. The site is within the East Fork Sand Creek sub-basin, as shown in Appendix E. The Sand Creek Basin discharges into Fountain Creek approximately 1.5 miles upstream of Academy Boulevard Bridge over Fountain Creek.

As development occurred within the basin, the site was analyzed with the "Jessica Heights Filing No. 1 Final Drainage Report" completed by M.V.E. Inc. in April 2005. The portion of the site west of Hannah Ridge Drive was identified as Basin C1 and the portion of the site east of Hannah Ridge Drive was identified as Basin A2. Basin C1 contributes existing flows of Q_5 = 2.8 cfs and Q_{100} = 6.8 cfs. Basin A2 contributes existing flows of Q_5 = 3.2 cfs and Q_{100} = 7.6 cfs. Runoff from both basins flows east. Basin C1 is captured in Hannah Ridge Drive curb and gutter and is conveyed to Constitution Avenue, while Basin A2 sheet flows off site to the adjacent parcel to the east.

Most recently, the site was analyzed within the "Hannah Ridge at Feathergrass Master Drainage Development Plan" completed by M.V.E. Inc in November 2007. The site was identified as Basin OSA14 with existing flows of Q_5=14 and Q_{100}=27 cfs flowing easterly to Tributary to Sand Creek – East Fork Reach No. 6.

As previously stated, there are no known irrigation facilities within the site that would impact drainage. An existing 12" PVC sanitary sewer runs along the eastern boundary of the site and is contained within a dedicated easement.

EXISTING SUB-BASIN DRAINAGE

The site is bisected by Hannah Ridge Drive, dividing the site into east and west parcels. The east side drains directly into a tributary to the East Fork Sand Creek (Tributary to Sand Creek – East Fork Reach No. 6). Runoff from the west site sheet flows across the site and is collected in Hannah Ridge Drive curb and gutter and is conveyed either north to Constitution Avenue or south to the Jessica Heights Subdivision. The west site is comprised of existing Basins EX3 and EX4. The east site is comprised of Basin EX6. Basins EX1 and EX2 are offsite basins that sheet flow onto Basins EX3 and EX4, respectively. Basin EX5 flows offsite to Constitution Avenue. The basins shown in the "Jessica Heights Filing No. 1 Final Drainage Report" created by M.V.E., Inc. in April, 2005 correspond to the existing basins in this report in the following manner: OSA = EX1, OSB = EX2, C1 = EX3 and EX4, A4 = EX5, A2 = EX6.

Existing Basin EX1 is approximately 0.15 acres and is consistent with the Jessica Heights Filing No. 1 Final Drainage Report Basin OSA. Flow from this basin sheet flows onto the site to Basin EX3 at Design Point (DP) 1 (Q_5=0.04 cfs, Q_{100} =0.4 cfs), eventually reaching DP3, a local depression.

Existing Basin EX2 is approximately 0.46 acres and is consistent with the Jessica Heights Filing No. 1 Final Drainage Report Basin OSB. Flow from this basin (Q_5=0.2 cfs, Q_{100} =1.2 cfs) sheet flows onto the site to Basin EX4 at DP2, eventually reaching Hannah Ridge Drive at DP4.

Existing Basin EX3 is approximately 4.27 acres and consists of prairie grasses. Flow from this basin (Q_5 =1.2 cfs, Q_{100} =9.0 cfs) sheet flows to the local depression at DP3. According to the available contour data, once the local depression has filled, the overtopping flow travels to the northeast. The flow then is conveyed to the curb and gutter along the south side of Constitution Avenue, where it is conveyed to an existing Type R inlet approximately 670 feet east of Hannah Ridge Drive. The flow that enters the existing inlet is routed into the existing double 10' x 6' concrete box culvert that conveys the tributary to the East Fork Sand Creek under Constitution Avenue.

Existing Basin EX4 is approximately 1.62 acres and consists of prairie grasses and a portion of Hannah Ridge Drive. Flow from this basin (Q_5=1.1 cfs, Q_{100} =4.0 cfs) sheet flows to the curb and gutter in Hannah Ridge Drive at DP4. The flow then is conveyed south via the Jessica Heights Subdivision storm sewer system, eventually discharging into a tributary to the East Fork Sand Creek.

Existing Basin EX5 is approximately 0.37 acres and consists of a portion of Hannah Ridge Drive and prairie grasses. Flow from this basin (Q_5=1.4 cfs, Q_{100} =2.7 cfs) flows north along the Hannah Ridge Drive curb and gutter until it reaches the curb and gutter on the south side of Constitution Avenue at DP5. From there, the flow follows the same path as the flow that overtops the local depression in Basin EX3.

Existing Basin EX6 is approximately 5.25 acres and consists of prairie grasses. Flow from this basin (Q_5=1.5 cfs, Q_{100} =11.1 cfs) sheet flows to the eastern property line at DP6 and enters a tributary to the East Fork Sand Creek.

As stated previously, the undeveloped tracts east of the site have not been analyzed in their existing conditions as part of this report. Future development of these tracts will require a separate drainage report.

PROPOSED DRAINAGE CONDITIONS

PROPOSED SUB-BASIN DRAINAGE

The site was broken into two major proposed basins: Basin A (west parcel) and Basin B (east parcel). The proposed basin (and sub-basin) delineation is shown on the drainage basin map and is described as follows:

Basin EX1 is approximately 0.15 acres and is consistent with the Jessica Heights Filing No. 1 Final Drainage Report Basin OSA. Flow from this basin sheet flows onto the site to Basin A1 at Design Point (DP) EX1 (Q_5=0.04 cfs, Q_{100} =0.4 cfs). The flow is combined with runoff from Basin A1 at DP1.

Basin A1 consists of approximately 0.78 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=2.6 cfs and Q_{100}=5.1 cfs) will be collected and conveyed in the centerline of Vanhoutte View to DP1. At DP1 (Q_5=2.3 cfs and Q_{100}=4.9 cfs), flow combines with runoff from Basin EX1 and enters EPC Type A curb and gutter. The curb and gutter conveys the flow east to a sump Double Denver Type 16 Combination Inlet (Double Type 16 inlet) at DP3, where it combines with Basin A2 flow.

Basin A2 consists of approximately 0.22 acres and includes walks, drives, and landscape areas. Flow from this basin (Q_5=0.6 cfs and Q_{100}=1.3 cfs) will be collected and conveyed in EPC Type A curb and gutter on the north side of Wayfaring Tree Heights to a sump Double Type 16 inlet at DP3, where it combines with the flow from DP1.

Total flows at DP3 are Q_5=3.0 cfs and Q_{100}=6.2 cfs. The sump Double Type 16 inlet captures all flow in the 5-year and 100-year events. DP3 flow combine with DP4 flow at DP4.1. In the event that the inlet becomes clogged, the flow will follow the curb flowline to the east to the on-grade Double Type 16 inlet at DP5.

Basin A3 consists of approximately 0.11 acres and includes walks, drives, and landscape areas. Flow from this basin (Q_5=0.3 cfs and Q_{100}=0.7 cfs) will be collected and conveyed in EPC Type A curb

and gutter on the south side of Wayfaring Tree Heights to an on-grade Double Type 16 inlet at DP4, where it combines with Basin A4 flow.

Basin A4 consists of approximately 0.62 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=2.0 cfs and Q_{100}=4.0 cfs) will be collected and conveyed in the centerline of Vanhoutte View to DP2. At DP2, flow enters EPC Type A curb and gutter and is conveyed east to an on-grade Double Type 16 inlet at DP4, where it combines with Basin A3 flow.

Total flows at DP4 are Q_5=2.4 cfs and Q_{100}=5.7 cfs. The on-grade Double Type 16 inlet captures 1.9 cfs in the 5-year and 3.4 cfs in the 100-year event. DP4 flow-by of Q_5=0.5 cfs and Q_{100}=2.3 cfs continues east via curb and gutter to DP6 where it combines with Basin A7 flow. DP4 captured flow is piped in 18" RCP to DP4.1, where it combines with flow from DP3.

Total flows at DP4.1 are Q_5=4.8 cfs and Q_{100}=9.4 cfs. The flow is conveyed via 18" and 24" RCP to DP5.1, where it combines with flow from DP5.

Basin A5 consists of approximately 0.83 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=2.0 cfs and Q_{100}=4.2 cfs) will be collected and conveyed in the centerline of Serviceberry Grove and the EPC Type A curb and gutter on the north side of Wayfaring Tree Heights to an on-grade Double Type 16 inlet at DP5. The on-grade Double Type 16 inlet captures 1.6 cfs in the 5-year and 2.7 cfs in the 100-year event. DP5 flow-by of Q_5=0.4 cfs and Q_{100}=1.5 cfs continues east via curb and gutter to DP8 where it combines with Basin A6 and DP7 flow. DP5 captured flow combines with DP4.1 flow at DP5.1.

Total flows at DP5.1 are Q_5=6.7 cfs and Q_{100}=13.5 cfs. The flow is conveyed via 30" RCP to DP8.1, where it combines with flow from DP8.

Basin A6 consists of approximately 0.18 acres and includes walks, drives, and landscape areas. Flow from this basin (Q_5=0.6 cfs and Q_{100}=1.1 cfs) will be collected and conveyed in EPC Type A curb and gutter in Wayfaring Tree Heights to a sump Triple Type 16 inlet at DP8, where it combines with flow from DP7 and DP5 flow-by.

Basin A7 consists of approximately 0.46 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=1.3 cfs and Q_{100}=2.7 cfs) will be collected and conveyed in the centerline of Serviceberry Grove to DP6. At DP6, flow enters EPC Type A curb and gutter and combines with DP4 flow-by. The combined flow is conveyed to a sump Triple Type 16 inlet at DP9, where it combines with Basin A9 flow.

Total flows at DP6 are Q_5=1.8 cfs and Q_{100}=4.8 cfs. The flow is conveyed east via curb and gutter to DP9, where it combines with flow from Basin A9 and DP8 flow-by.

Basin A8 consists of approximately 0.75 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=1.5 cfs and Q_{100}=3.5 cfs) will be collected and conveyed in the centerline of Fountain Grass Grove to DP7. At DP7, flow enters EPC Type A curb and gutter and is conveyed west to a sump Triple Type 16 inlet at DP8 where it combines with DP5 flow-by and Basin A6 flow.

Total flows at DP8 are Q_5=2.4 cfs and Q_{100}=5.9 cfs. The sump Triple Type 16 inlet captures all flows in the 5-year and 4.3 cfs in the 100-year event. DP8 flow-by of Q_{100}=1.6 cfs overtops the centerline crown of the road south to DP9 where it combines with Basin A9 and DP6 flow. DP8 captured flow combines with DP5.1 flow at DP8.1.

Total flows at DP8.1 are Q_5=8.8 cfs and Q_{100}=15.0 cfs. All flow at DP8.1 is conveyed via 30" RCP to DP9.1, where it combines with flow from DP9.

Basin A9 consists of approximately 0.57 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=1.8 cfs and Q_{100}=3.5 cfs) will be collected and conveyed in EPC Type A curb and gutter on the west side of Fountain Grass Grove to a sump Triple Type 16 inlet at DP9, where it combines with flow from DP6 and DP8 flow-by.

The total combined flow at DP9 from DP6, DP8 flow-by, and Basin A9 is Q_5=3.4 cfs and Q_{100}=9.2 cfs. All flow at DP9 is captured and combines with flow from DP8.1 at DP9.1. If the sump inlet at DP9 were to become clogged, flow would overtop the curb to the south and discharge directly into Pond A.

Total flows at DP9.1 are Q_5=11.8 cfs and Q_{100}=23.9 cfs. All flow at DP9.1 is conveyed via 30" RCP to Pond A at DP10, where it combines with flow from Basin A10.

Basin A10 consists of approximately 0.78 acres of sidewalk, landscaped areas, and contains Full Spectrum Water Quality and Detention Pond A. Flow from this basin (Q_5=0.4 cfs and Q_{100}=2.1 cfs) is captured in a grass-lined swale that discharges directly into Pond A where it combines with flow from DP9.1. A detailed discussion of Full-Spectrum Water Quality and Detention Pond A is presented in the Water Quality section later in this report.

Total flows at DP10 are Q_5=12.1 cfs and Q_{100}=25.7 cfs. All flow at DP10 is routed through the Pond A outlet structure and proposed RCP (various sizes) before discharging into the existing double 10'x6' concrete box culvert that conveys a tributary to the East Fork Sand Creek.

Basin A11 consists of approximately 0.16 acres and includes walks, drives, and landscape areas. Due to topographical constraints, Basin A11 (Q_5=0.3 cfs and Q_{100}=0.6 cfs) flow drains overland to the existing curb and gutter on the south side of Constitution Avenue, which conveys it east to an existing Type R inlet at DP11.

Basin A12 consists of approximately 0.13 acres and includes landscaped area and sidewalk. Due to topographical constraints, Basin A12 (Q_5=0.2 cfs and Q_{100}=0.6 cfs) flow drains overland to the existing curb and gutter on the south side of Constitution Avenue, which conveys it east to the existing Hannah Ridge Drive cross pan at DP12.

Basin B1 consists of approximately 0.61 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=1.4 cfs and Q_{100}=3.2 cfs) will be collected and conveyed in the centerline of Fountain Grass Grove to DP15. At DP15, flow enters EPC Type A curb and gutter and is conveyed east to an on-grade Double Type 16 inlet at DP17, where it combines with Basin B2 flow.

Basin B2 consists of approximately 0.08 acres and includes walks and drives. Flow from this basin (Q_5=0.4 cfs and Q_{100}=0.6 cfs) will be collected and conveyed in EPC Type A curb and gutter in Blue Avena View to an on-grade Double Type 16 inlet at DP17, where it combines with flow from DP15.

Total flows at DP17 are Q_5=1.7 cfs and Q_{100}=3.6 cfs. The on-grade Double Type 16 inlet captures 1.4 cfs in the 5-year event and 2.3 cfs in the 100-year event. DP17 flow-by of Q_5=0.3 cfs and Q_{100}=1.3 cfs continues east in curb and gutter to an on-grade Single Type 16 inlet at DP19 where it combines with Basin B5 flow. DP17 captured flows are piped in 18” RCP to DP18.1, where it combines with flow from DP18.

Basin B3 consists of approximately 0.12 acres and includes walks, drives, and landscape areas. Flow from this basin (Q_5=0.5 cfs and Q_{100}=0.9 cfs) will be collected and conveyed in EPC Type A curb and gutter in Blue Avena View to an on-grade Double Type 16 inlet at DP18, where it combines with flow from DP16.

Basin B4 consists of approximately 0.76 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=2.5 cfs and Q_{100}=4.9 cfs) will be collected and conveyed in the centerline of Fountain Grass Grove to DP16. At DP16, flow enters EPC Type A curb and gutter and is conveyed east to a sump Double Type 16 inlet at DP18, where it combines with Basin B3 flow.

Total flows at DP18 from DP16 and Basin B3 are Q_5=2.8 cfs and Q_{100}=5.4 cfs. The sump Double Type 16 inlet captures all flow in the 5-year and 100-year events. DP18 flow combines with DP17 flow at DP18.1. In the event that the inlet at DP18 becomes clogged, flow will follow the flowline east to the sump Double Type 16 inlet at DP23.

Total flows at DP18.1 are Q_5=4.2 cfs and Q_{100}=7.8 cfs. The flow is conveyed via 18” RCP to DP23.1, where it combines with flow from DP23.

Basin B5 consists of approximately 0.66 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=1.6 cfs and Q_{100}=3.5 cfs) will be collected and conveyed in the centerline

of Purple Fountain Point to an on-grade Single Type 16 inlet at DP19, where it combines with DP17 flow-by.

Total flows at DP19 from Basin B5 and DP17 flow-by are Q_5=1.9 cfs and Q_{100}=4.8 cfs. The on-grade Single Type 16 inlet captures 1.2 cfs in the 5-year and 2.1 cfs in the 100-year event. DP19 flow-by of Q_5=0.7 cfs and Q_{100}=2.7 cfs continues east via curb and gutter to a sump Triple Type 16 inlet at DP24 where it combines with Basin B6 flow. DP19 captured flow is conveyed via 18" RCP to DP24.1, where it combines with DP24 flow.

Basin B6 consists of approximately 0.08 acres and includes walks, drives and landscape areas. Flow from this basin (Q_5=0.3 cfs and Q_{100}=0.6 cfs) will be collected and conveyed in EPC Type A curb and gutter in Blue Avena View to a sump Triple Type 16 inlet at DP24, where it combines with DP19 flow-by.

Total flows at DP24 from DP19 flow-by and Basin B6 are Q_5=1.0 cfs and Q_{100}=3.2 cfs. All flow at DP24 is captured by a sump Triple Type 16 inlet and combines with flow from DP19 and DP23.1 at DP24.1. In the event that the inlet at DP24 becomes clogged, flow will overtop the curb to the north and enter Pond B.

Basin B7 consists of approximately 0.13 acres and includes walks, drives, and landscape areas. Flow from this basin (Q_5=0.5 cfs and Q_{100}=1.0 cfs) will be collected and conveyed in EPC Type A curb and gutter in Blue Avena View to a sump Double Type 16 inlet at DP23, where it combines with flow from DP20 and DP22 flow-by.

Basin B8 consists of approximately 0.72 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=2.2 cfs and Q_{100}=4.4 cfs) will be collected and conveyed in the centerline of Purple Fountain Point to DP20. The flow is conveyed east to a sump Double Type 16 inlet at DP23, where it combines with Basin B7 flow and DP22 flow-by.

Basin B9 consists of approximately 0.31 acres of landscaped areas and sidewalk. Flow from this basin (Q_5=0.1 cfs and Q_{100}=0.9 cfs) is conveyed in a grass-lined swale to a sump Type C Inlet at DP21. All Basin B9 flow is captured at DP21 and is piped via 18" RCP to DP22.1, where it combines with flows from DP22. In the event that the inlet at DP21 becomes clogged, the flow will overtop the one-foot depression and continue to flow east to DP30 via a grass-lined swale.

Basin B10 consists of approximately 0.55 acres and includes walks, drives, roofs and landscape areas. Flow from this basin (Q_5=1.6 cfs and Q_{100}=3.2 cfs) will be collected and conveyed in EPC Type A curb and gutter on the west side of Foerster Grass View to a sump Double Type 16 inlet at DP22. All captured flow at DP22 (Q_5=1.4 cfs and Q_{100}=2.6 cfs) is piped via 18" RCP to DP22.1, where it combines with flow from DP21. DP22 flow-by (Q_{100}=0.6 cfs) will follow the curb flowline

north to the sump Double Type 16 inlet at DP23. In the event that the inlet at DP22 becomes clogged, the flow would follow the curb flowline north to the sump Double Type 16 inlet at DP23.

The total combined flow at DP23 from Basin B7, DP20, and DP22 flow-by is Q_5=2.6 cfs and Q_{100}=5.6 cfs. All flow at DP23 is captured and combines with flow from DP18.1 at DP23.1. In the event the inlet at DP23 becomes clogged, the flow will overtop the road crown to the north and enter the sump Triple Type 16 inlet at DP24.

Total flows at DP22.1 are Q_5=1.7 cfs and Q_{100}=3.5 cfs. The flow is conveyed via 18" RCP to DP23.1, where it combines with flow from DP23.

Total flows at DP23.1 from DP18.1, DP22.1, and DP23 are Q_5=8.2 cfs and Q_{100}=16.5 cfs. The flow is conveyed via 24" RCP to DP24.1, where it combines with flow from DP19 and DP24.

Total flows at DP24.1 are Q_5=10.2 cfs and Q_{100}=21.5 cfs. The flow is conveyed via 30" RCP to Pond B at DP25, where it combines with flow from Basin B11.

Basin B11 consists of approximately 0.55 acres of walks and landscaped areas and contains Full-Spectrum Water Quality and Detention Pond B. Flow from this basin (Q_5=0.3 cfs and Q_{100}=1.7 cfs) sheet flows directly into Pond B where it combines with flow from DP24.1 at DP25. A detailed discussion of Full-Spectrum Water Quality and Detention Pond B is presented in the Water Quality section later in this report.

Total flows at DP25 are Q_5=10.4 cfs and Q_{100}=22.9 cfs. All flow at DP25 is routed through the Pond B outlet structure and proposed RCP (various sizes) before discharging into the existing double 10'x6' concrete box culvert that conveys a tributary to the East Fork Sand Creek.

Basin B12 consists of approximately 0.06 acres of landscaped areas and sidewalk. Due to topographical constraints, flow from this basin (Q_5=0.1 cfs and Q_{100}=0.3 cfs) will discharge directly into Constitution Avenue curb and gutter at DP26, which conveys the flow east to an existing Type R inlet about 670 feet east of Hannah Ridge Drive.

Basin B13 consists of approximately 0.18 acres of landscaped areas and sidewalk. Due to topographical constraints, flow from this basin (Q_5=0.3 cfs and Q_{100}=0.9 cfs) will discharge directly into Constitution Avenue curb and gutter at DP27, and will follow the same flow path as Basin B12.

Basin B14 consists of approximately 0.17 acres of landscaped areas and contains approximately 1,870 square feet of asphalt roadway. Flow from this basin (Q_5=0.2 cfs and Q_{100}=0.7 cfs) follows historic drainage patterns and sheet flows offsite at DP28, along the eastern site boundary, eventually flowing directly into the Tributary to Sand Creek – East Fork Reach No. 6.

Basin B15 consists of approximately 0.17 acres of walks and landscaped areas. Flow from this basin (Q_5=0.2 cfs and Q_{100}=0.6 cfs) follows historic drainage patterns and sheet flows easterly offsite at DP29 to Tributary to Sand Creek – East Fork Reach No. 6.

Basin B16 consists of approximately 0.11 acres of landscaped areas and will remain undeveloped. Flow from this basin (Q_5=0.1 cfs and Q_{100}=0.3 cfs) is conveyed in a grass-lined swale onsite before discharging to the east property line at DP30. From here, the flow follows historic drainage patterns to the Tributary to Sand Creek – East Fork Reach No. 6.

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 2 - 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 UD-Detention v4.04 spreadsheet was utilized for evaluating proposed detention and water quality pond. Sump and on-grade inlets were sized using UDFCD UD-Inlet v4.05. Manning's equation was used to size the proposed pipes in this report and StormCAD was used to model the proposed storm sewer system and to analyze the

proposed HGL calculations for the Construction Drawings. See Appendix C for the HGL calculations.

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.

Step 1 – Reducing Runoff Volumes: The Urban Collection at Palmer Village development project consists of 50 duplex structures with open spaces and lawn areas interspersed within the development which helps disconnect impervious areas and reduce runoff volumes. Roof drains from the structures will discharge to lawn areas, where feasible, to allow for infiltration and runoff volume reduction.

Step 2 – Stabilize Drainageways: The site lies within the Sand Creek Drainage Basin. Basin and bridge fees will be paid at time of platting. These funds will be used on future projects within the basin to stabilize drainageways. The site does not discharge directly into the open drainageway of Sand Creek, therefore no downstream stabilization will be accomplished with this project.

Step 3 – Treat the WQCV: Water Quality treatment for this site is provided in two proposed full-spectrum water quality detention ponds: Pond A and Pond B. The runoff from this site will be collected within inlets and conveyed to the proposed ponds via storm sewer. Upon entrance to the ponds, flows will be captured in a forebay designed to promote settlement of suspended solids. A trickle channel is also incorporated into the ponds to minimize the amount of standing water. The outlet structure has been designed to detain the water quality capture volume (WQCV) for 40 hours, and the extended urban runoff volume (EURV) for 72 hours. All flows released from the ponds will be reduced to less than historic rates.

Step 4 – Consider Need for Industrial and Commercial BMPs: Step 4 does not apply to this project since the site is not an industrial or commercial site.

WATER QUALITY

The site is split by Hannah Ridge Drive, therefore, a full-spectrum water quality and detention pond is provided on both sides. Basins EX1, EX2, and A1-A10, located west of Hannah Ridge Drive, will discharge to Pond A. Basins B1-B11, located east of Hannah Ridge Drive, will discharge to Pond B. Both ponds have been designed per Section 13.3.2.1 of Resolution 15-042 of the El Paso County Drainage Criteria Manual.

Full-Spectrum Water Quality and Detention Pond A is designed for a total contributing acreage of 5.92 acres at 50.5% impervious from Basins EX1, EX2, and A1-A10. The total WQCV is 0.102 ac-ft, the excess urban runoff volume (EURV) is 0.346 ac-ft, and the total required detention volume is 0.548 ac-ft. The WQCV is released over 41 hours, the EURV is released over 72 hours, and the 100-year volume is released over 80 hours. The 100-year discharge of 2.4 cfs is less than 90% of predevelopment rates. An emergency inlet is provided that conveys the full undetained, peak 100-year flow of 25.7 cfs with a 1.0' freeboard.

Pond A's outlet structure outfalls into a 30" RCP that flows along the site's southern property line before discharging into the existing double 10'x6' RCBC located in the adjacent parcel, east of the eastern parcel. A drainage easement is provided for both the onsite and offsite portions of this pond outfall. The ultimate discharge of the double 10'x6' RCBC is the "Tributary to Sand Creek – East Fork Reach No. 6". A drainage map including Pond A and its outfall has been presented in Appendix F. Due to the fact that there are no upstream regional detention facilities, an "emergency conditions" scenario was not analyzed for Pond A.

Pond B is designed for a total contributing acreage of 4.57 acres at 54.3% impervious from Basins B1-B11. The total WQCV is 0.083 ac-ft, the excess urban runoff volume (EURV) is 0.293 ac-ft and the total required detention volume is 0.456 ac-ft. The WQCV is released over 42 hours, the EURV is released over 72 hours and the 100-year volume is released over 78 hours. The 100-year discharge of 1.8 cfs is less than 90% of predevelopment rates. A riprap spillway is provided that conveys the full undetained, peak 100-year flow of 22.9 cfs with a 1.0' freeboard. The spillway has a crest length of 20' and a total depth of 1.50'. Additionally, emergency overflow inlets are included to capture emergency flows.

The pond outfalls into a 30" RCP that flows east and south, connecting to the Pond A outfall. A drainage easement will be provided for both the onsite and offsite portions of this pond outfall. The ultimate discharge of the double 10' x 6' RCBC is the" Tributary to Sand Creek – East Fork Reach No. 6". A drainage map including Pond B and it's outfall has been presented in Appendix F. Due to the fact that there are no upstream regional detention facilities, an "emergency conditions" scenario was not analyzed for Pond B.

EROSION CONTROL PLAN

The Erosion Control Plan and Cost Estimate have been submitted for review in conjunction with the grading and erosion control plan and construction assurances will be posted prior to issuance of a building 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. Access is provided from onsite facilities and easements for proposed infrastructure located offsite. 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 Sand Creek Drainage Basin. Anticipated drainage and bridge fees are presented below, based on Resolution No. 19-441, and will be paid at time of platting. Fees could change, and are dependent on the timing of the plat.

2020 DRAINAGE AND BRIDGE FEES - URBAN COLLECTION AT PALMER VILLAGE				
Impervious Acres	Drainage Fee (Per Imp. Acre)	Bridge Fee (Per Imp. Acre)	Urban Collection at Palmer Village Drainage Fee	Urban Collection at Palmer Village Bridge Fee
5.67	$19,698	$8,057	$111,688	$45,683

SUMMARY

The proposed Urban Collection at Palmer Village development drainage improvements, including storm sewer and two full-spectrum water quality and detention ponds were designed to meet or exceed the El Paso County Drainage Criteria. The proposed development will not adversely affect the offsite drainageways or surrounding development. This report is in conformance and meets the latest El Paso County Storm Drainage Criteria requirements for this site.

REFERENCES

1. City of Colorado Springs Drainage Criteria Manual (Volumes I & II), City of Colorado Springs, Colorado, Updated May, 2014.

2. Urban Storm Drainage Criteria Manual (Volumes 1, 2, and 3), Urban Drainage and Flood Control District, June 2001.

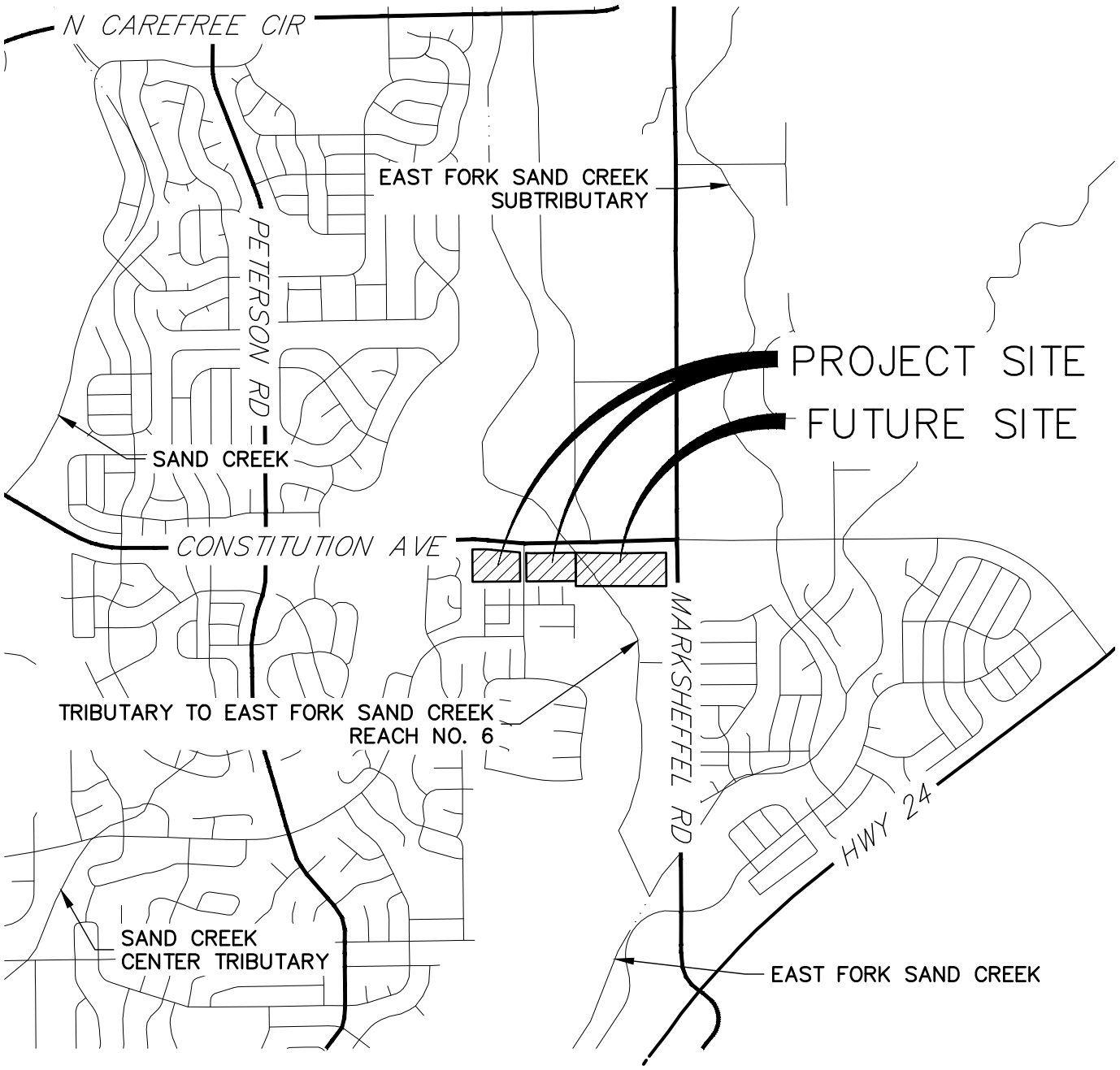
3. Sand Creek Drainage Basin Planning Study, prepared Kiowa Engineering Corporation, January, 1993.

4. Jessica Heights Filing No. 1 Final Drainage Report, prepared by M.V.E., Inc, April, 2005.

5. Hannah Ridge at Feathergrass Master Drainage Development Plan, prepared by M.V.E., Inc., November 15, 2007.

6. Preliminary Drainage Report for Urban Collection at Palmer Village, prepared by JR Engineering, LLC, July, 2020.

Appendix A
Vicinity Map, Soil Descriptions, FEMA Floodplain Map



N

2000 1000 0 2000

ORIGINAL SCALE: 1" = 2000'

APPENDIX A: VICINITY MAP
URBAN COLLECTION AT
PALMER VILLAGE
JOB NO. 25149.01
06/01/2020
SHEET 1 OF 1

J·R ENGINEERING
A Westrian Company

Centennial 303-740-9393 • Colorado Springs 719-593-2593
Fort Collins 970-491-9888 • www.jrengineering.com

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.

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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.

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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.

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

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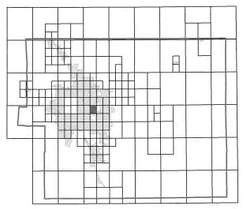
El Paso County Vertical Datum Offset Table

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



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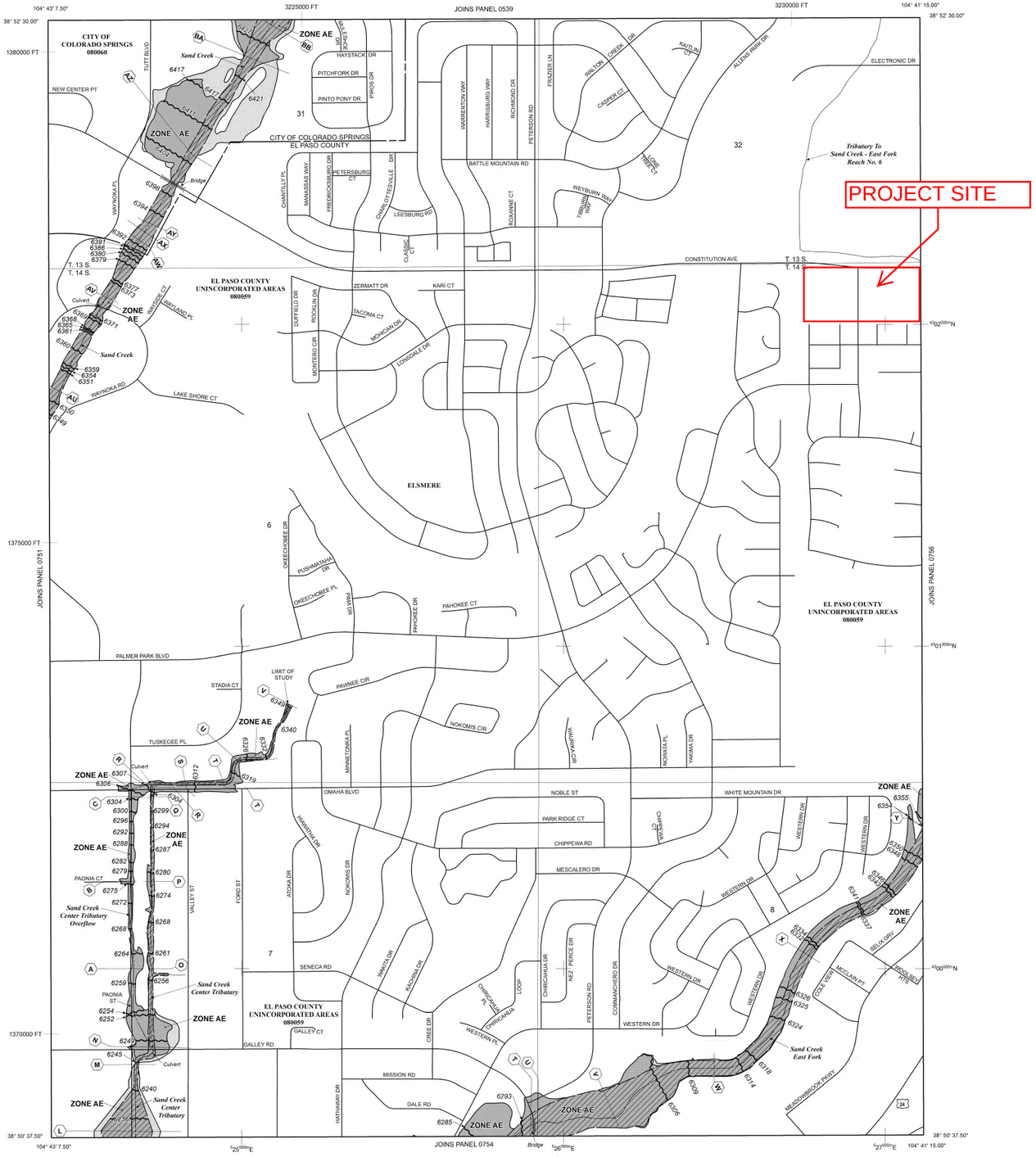

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 13 SOUTH, RANGE 65 WEST, AND TOWNSHIP 14 SOUTH, RANGE 65 WEST.

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.
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- (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
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- 4275000mN — 1000-meter Universal Transverse Mercator grid ticks, zone 13
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MARCH 17, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
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MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

PANEL 0752G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 752 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0752	G
EL PASO COUNTY	080059	0752	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
08041C0752G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency

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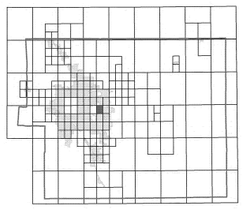

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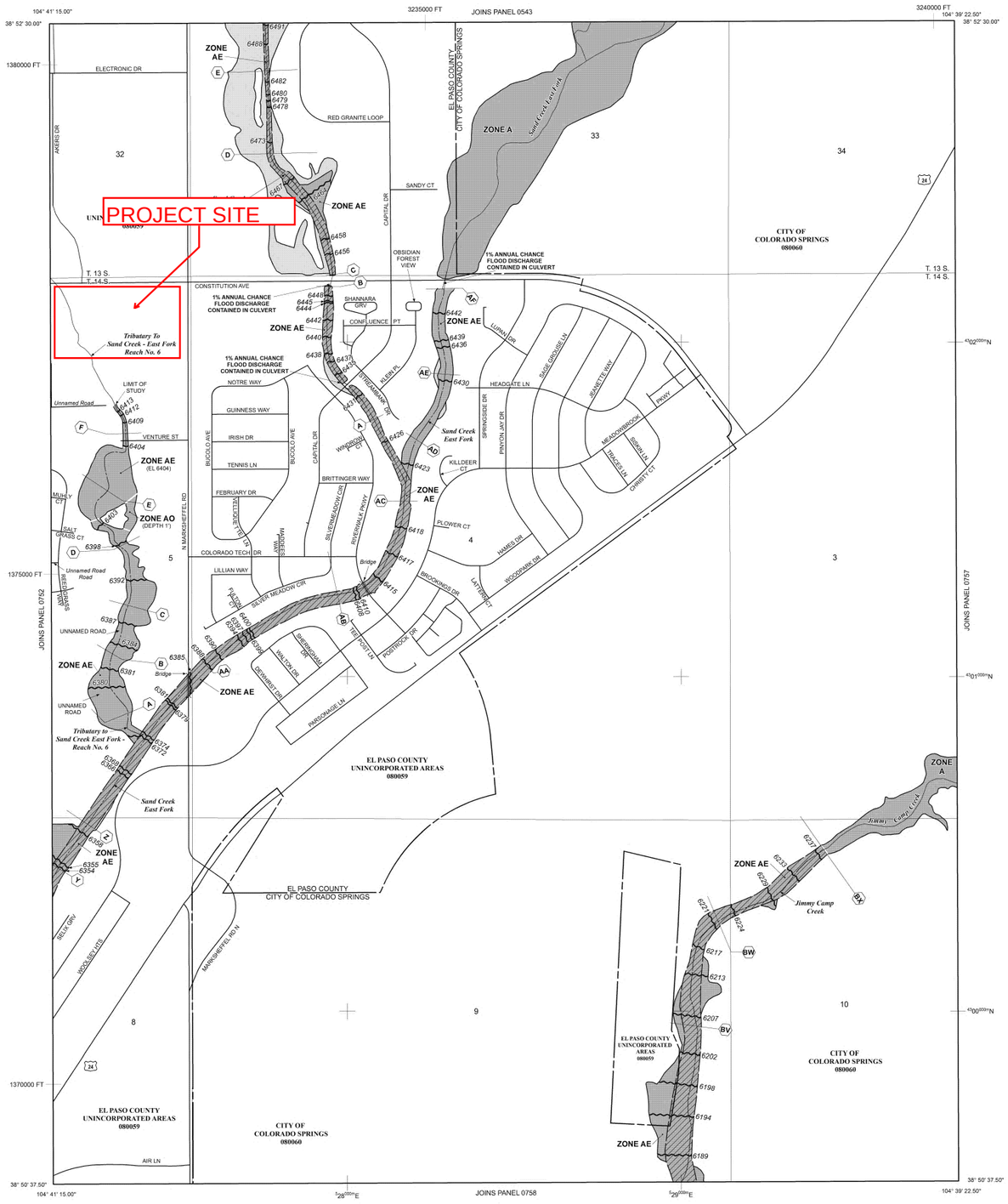

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- M1.5 — River Mile

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

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
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NFIP

PANEL 0756G

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 756 OF 1300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLORADO SPRINGS, CITY OF	080060	0756	G
EL PASO COUNTY	080059	0756	G

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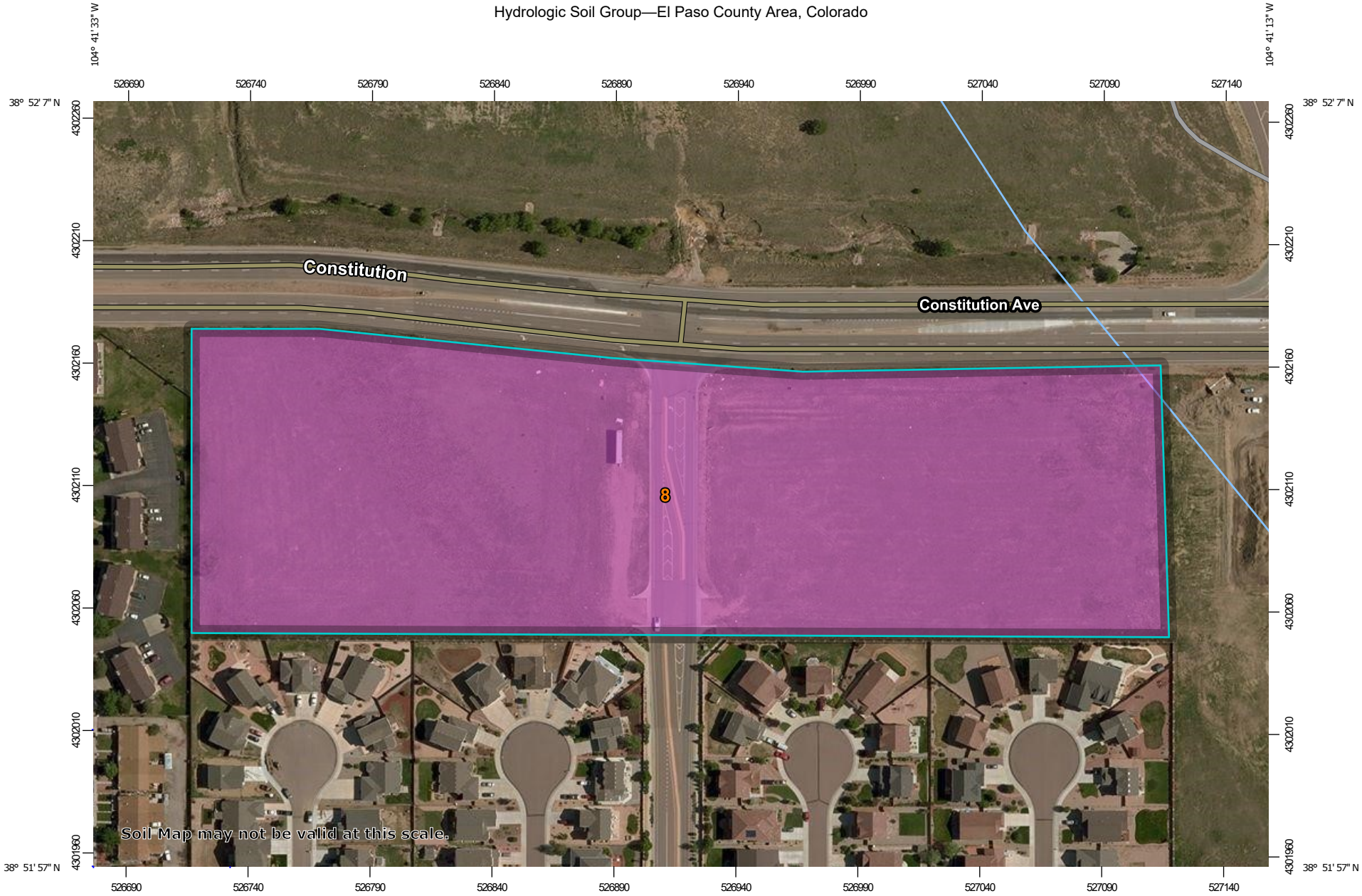
MAP NUMBER
08041C0756G

MAP REVISED
DECEMBER 7, 2018

Federal Emergency Management Agency



Map Scale: 1:2,200 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 30 60 120 180

Feet
0 100 200 400 600

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 17, Sep 13, 2019

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

Date(s) aerial images were photographed: Apr 15, 2011—Jun 17, 2014

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	11.3	100.0%
Totals for Area of Interest			**11.3**	**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

Appendix B
Hydrologic Calculations

PALMER VILLAGE - EXISTING DRAINAGE SUMMARY

EXISTING BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EX1	0.15	2%	0.08	0.35	7.9	0.04	0.4
EX2	0.46	2%	0.08	0.35	8.1	0.2	1.2
EX3	4.27	2%	0.08	0.35	14.2	1.2	9.0
EX4	1.62	19%	0.22	0.45	17.9	1.1	4.0
EX5	0.37	82%	0.75	0.85	5.0	1.4	2.7
EX6	5.25	2%	0.08	0.35	14.4	1.5	11.1

EXISTING DESIGN POINT SUMMARY TABLE

DP	Q_5	Q_{100}
1	0.04	0.4
2	0.2	1.2
3	1.3	9.3
4	1.3	4.9
5	1.4	2.7
6	1.5	11.1

% IMPERVIOUS & COMPOSITE RUNOFF COEFFICIENT C

Subdivision:	PALMER VILLAGE	PALMER VILLAGE
Location:	Colorado Springs	2000-5149.01
		RPD
		NQJ
		1/30/20

Basin ID	Total Area (ac)	PAVED STREETS			UNDEVELOPED MEADOW			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
EX1	0.15	100%	0.00	0.0%	2%	0.15	2.0%	2.0%
EX2	0.46	100%	0.00	0.0%	2%	0.46	2.0%	2.0%
EX3	4.27	100%	0.00	0.0%	2%	4.27	2.0%	2.0%
EX4	1.62	100%	0.27	17.0%	2%	1.35	1.7%	18.6%
EX5	0.37	100%	0.30	81.8%	2%	0.07	0.4%	82.1%
EX6	5.25	100%	0.00	0.0%	2%	5.25	2.0%	2.0%
TOTAL	12.12							6.7%

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

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

COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: PALMER VILLAGE
Location: Colorado Springs

Project Name: PALMER VILLAGE
Project No.: 2000-5149.01
Calculated By: RPD
Checked By: NQJ
Date: 1/30/20

Basin ID	Total Area (ac)	Basins Total Weighted % Imp.	Hydrologic Soil Group			Land Use		Minor Coefficients		Major Coefficients		Basins Total Weighted C_5	Basins Total Weighted C_{100}
			Area A (ac)	Area B (ac)	Area C/D (ac)	Area Paved Streets (ac)	Area Undeveloped Meadow (ac)	$C_{5,A,PAVED\ STREETS}$	$C_{5,A,UNDEVELOPED\ MEADOW}$	$C_{100,A,PAVED\ STREETS}$	$C_{100,A,UNDEVELOPED\ MEADOW}$		
EX1	0.15	2.0%	0.15	0.00	0.00	0.00	0.15	0.90	0.08	0.96	0.35	0.08	0.35
EX2	0.46	2.0%	0.46	0.00	0.00	0.00	0.46	0.90	0.08	0.96	0.35	0.08	0.35
EX3	4.27	2.0%	4.27	0.00	0.00	0.00	4.27	0.90	0.08	0.96	0.35	0.08	0.35
EX4	1.62	18.6%	1.62	0.00	0.00	0.27	1.35	0.90	0.08	0.96	0.35	0.22	0.45
EX5	0.37	82.1%	0.37	0.00	0.00	0.30	0.07	0.90	0.08	0.96	0.35	0.75	0.85
EX6	5.25	2.0%	5.25	0.00	0.00	0.00	5.25	0.90	0.08	0.96	0.35	0.08	0.35
TOTAL	12.12	6.7%	12.12	0.00	0.00	5%	95%	---	---	---	---	0.12	0.38

Table 6-6. Runoff Coefficients for Rational Method
(Source: UDFCD 2001)

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

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: PALMER VILLAGE
Location: Colorado Springs

Project Name: PALMER VILLAGE
Project No.: 2000-5149.01
Calculated By: RPD
Checked By: NQJ
Date: 1/30/20

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)
EX1	0.15	A	2%	0.08	0.35	50	5.0%	7.7	26	5.0%	10.0	2.2	0.2	7.9	76.0	25.9	7.9
EX2	0.46	A	2%	0.08	0.35	50	5.0%	7.7	56	5.0%	10.0	2.2	0.4	8.1	106.0	26.1	8.1
EX3	4.27	A	2%	0.08	0.35	50	7.8%	6.6	471	1.1%	10.0	1.0	7.6	14.2	521.0	33.9	14.2
EX4	1.62	A	19%	0.22	0.45	50	7.8%	5.7	643	0.8%	10.0	0.9	12.2	17.9	693.0	33.3	17.9
EX5	0.37	A	82%	0.75	0.85	0	N/A	N/A	189	0.5%	20.0	1.4	2.3	2.3	189.0	14.3	5.0
EX6	5.25	A	2%	0.08	0.35	50	3.0%	9.1	550	3.0%	10.0	1.7	5.3	14.4	600.0	31.4	14.4

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).

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

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

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

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

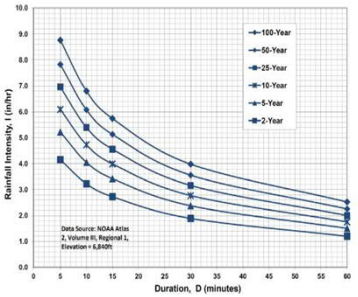
Subdivision: PALMER VILLAGE
Location: Colorado Springs
Design Storm: 5-Year

Project Name: PALMER VILLAGE
Project No.: 2000-5149.
Calculated By: RPD
Checked By: NQJ
Date: 1/30/20

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				OVERLAND			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)	$Q_{overland}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	EX1	0.15	0.08	7.9	0.01	4.49	0.04					0.04	0.01	1.90					468	1.4	5.7	BASIN EX1 FLOW AT DP1, OVERLAND FLOW TO DP3
	2	EX2	0.46	0.08	8.1	0.04	4.45	0.2					0.2	0.04	1.61					626	1.3	8.2	BASIN EX2 FLOW AT DP2, OVERLAND FLOW TO DP4
		EX3	4.27	0.08	14.2	0.34	3.60	1.2															BASIN EX3 FLOW AT DP3 (LOCAL DEPRESSION)
	3								14.2	0.35	3.60	1.3											COMBINED DP1 AND EX3 FLOW AT DP3 (LOCAL DEPRESSION)
		EX4	1.62	0.22	17.9	0.35	3.26	1.1															BASIN EX4 FLOW AT DP4, FLOWS SOUTH ALONG C&G
	4								17.9	0.39	3.26	1.3											COMBINED DP2 AND EX4 FLOW AT DP4
	5	EX5	0.37	0.75	5.0	0.28	5.17	1.4															BASIN EX5 FLOW AT DP5, FLOWS EAST ALONG C&G
	6	EX6	5.25	0.08	14.4	0.42	3.59	1.5															BASIN EX6 FLOW AT DP6

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

Figure 6-5. Colorado Springs Rainfall Intensity Duration Frequency



IDF Equations

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

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

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

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

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

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

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

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision: PALMER VILLAGE
Location: Colorado Springs
Design Storm: 100-Year

Project Name: PALMER VILLAGE
Project No.: 2000-5149.
Calculated By: RPD
Checked By: NQJ
Date: 1/30/20

Description	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				OVERLAND			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)	$Q_{overland}$ (cfs)	C*A (ac)	Slope (%)	Q_{pipe} (cfs)	C*A (ac)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	t_t (min)	
	1	EX1	0.15	0.35	7.9	0.05	7.54	0.4					0.4	0.05	1.90					468	1.4	5.7	BASIN EX1 FLOW AT DP1, OVERLAND FLOW TO DP3
	2	EX2	0.46	0.35	8.1	0.16	7.47	1.2					1.2	0.16	1.61					626	1.3	8.2	BASIN EX2 FLOW AT DP2, OVERLAND FLOW TO DP4
		EX3	4.27	0.35	14.2	1.49	6.04	9.0															BASIN EX3 FLOW AT DP3 (LOCAL DEPRESSION)
	3								14.2	1.54	6.04	9.3											COMBINED DP1 AND EX3 FLOW AT DP3 (LOCAL DEPRESSION)
		EX4	1.62	0.45	17.9	0.73	5.47	4.0															BASIN EX4 FLOW AT DP4, FLOWS SOUTH ALONG C&G
	4								17.9	0.89	5.47	4.9											COMBINED DP2 AND EX4 FLOW AT DP4
	5	EX5	0.37	0.85	5.0	0.31	8.68	2.7															BASIN EX5 FLOW AT DP5, FLOWS EAST ALONG C&G
	6	EX6	5.25	0.35	14.4	1.84	6.02	11.1															BASIN EX6 FLOW AT DP6

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

PALRMER VILLAGE - PROPOSED DRAINAGE
SUMMARY

BASIN 'A' SUMMARY TABLE							
Tributary	Area	Percent			t_c	Q_5	Q_{100}
Sub-basin	(acres)	Impervious	C_5	C_{100}	(min)	(cfs)	(cfs)
EX1	0.15	0%	0.08	0.35	7.9	0.0	0.2
EX2	0.46	0%	0.08	0.35	8.1	0.2	0.7
A1	0.78	75%	0.65	0.77	5.5	2.6	5.1
A2	0.22	67%	0.63	0.76	7.8	0.6	1.3
A3	0.11	63%	0.60	0.74	6.2	0.3	0.7
A4	0.62	75%	0.65	0.76	5.2	2.0	4.0
A5	0.83	55%	0.50	0.65	7.0	2.0	4.2
A6	0.18	84%	0.74	0.84	7.9	0.6	1.1
A7	0.46	67%	0.60	0.73	5.8	1.3	2.7
A8	0.75	48%	0.44	0.61	7.8	1.5	3.5
A9	0.57	72%	0.66	0.77	6.9	1.8	3.5
A10	0.78	5%	0.12	0.38	9.4	0.4	2.1
A11	0.16	40%	0.41	0.60	9.8	0.3	0.6
A12	0.13	39%	0.40	0.59	7.8	0.2	0.6

DESIGN POINT SUMMARY TABLE		
Design Point	Q_5 (cfs)	Q_{100} (cfs)
EX1	0.04	0.2
EX2	0.2	0.7
1	2.3	4.9
2	2.0	4.7
3	3.0	6.2
4	2.4	5.7
4.1	4.8	9.4
5	2.0	4.2
5.1	6.7	13.5
6	1.8	4.8
7	1.5	3.5
8	2.4	5.9
8.1	8.8	15.0
9	3.4	9.2
9.1	11.9	23.9
10	12.1	25.7
11	0.3	0.6
12	0.2	0.6

BASIN 'B' SUMMARY TABLE							
Tributary	Area	Percent			t_c	Q_5	Q_{100}
Sub-basin	(acres)	Impervious	C_5	C_{100}	(min)	(cfs)	(cfs)
B1	0.61	55%	0.50	0.65	6.3	1.4	3.2
B2	0.08	100%	0.90	0.96	5.0	0.4	0.6
B3	0.12	87%	0.79	0.88	5.0	0.5	0.9
B4	0.76	75%	0.66	0.77	5.9	2.5	4.9
B5	0.66	53%	0.49	0.64	6.2	1.6	3.5
B6	0.08	84%	0.77	0.87	5.0	0.3	0.6
B7	0.13	88%	0.80	0.89	5.0	0.5	1.0
B8	0.72	68%	0.60	0.72	5.5	2.2	4.4
B9	0.31	2%	0.10	0.36	5.6	0.1	0.9
B10	0.55	65%	0.59	0.72	6.4	1.6	3.2
B11	0.55	3%	0.10	0.37	5.6	0.3	1.7
B12	0.06	36%	0.37	0.57	5.0	0.1	0.3
B13	0.18	39%	0.40	0.59	7.0	0.3	0.9
B14	0.17	21%	0.25	0.48	5.6	0.2	0.7
B15	0.17	11%	0.17	0.42	5.0	0.2	0.6
B16	0.11	0%	0.08	0.35	5.0	0.1	0.3

DESIGN POINT SUMMARY TABLE		
Design Point	Q_5 (cfs)	Q_{100} (cfs)
15	1.4	3.2
16	2.5	4.9
17	1.7	3.6
18	2.8	5.4
18.1	4.2	7.8
19	1.9	4.8
20	2.2	4.4
21	0.1	0.9
22	1.6	3.2
22.1	1.7	3.5
23	2.6	5.6
23.1	8.2	16.5
24	1.0	3.2
24.1	10.2	21.5
25	10.4	22.9
26	0.3	1.7
27	0.1	0.3
28	0.3	0.9
29	0.2	0.7
30	0.1	0.3

2020 DRAINAGE AND BRIDGE FEES - PALMER VILLAGE				
Impervious Acres (ac)	Drainage Fee (Per Imp. Acre)	Bridge Fee (Per Imp. Acre)	Feathergrass Drainage Fee	Feathergrass Bridge Fee
5.67	$19,698	$8,057	$111,688	$45,683

COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: PALMER VILLAGE
Location: Colorado Springs

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: RPD
Checked By:
Date: 1/27/21

Basin ID	Total Area (ac)	Drives/Walks			Roofs			Lawns			Basins Total
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	Weighted % Imp.
EX1	0.15	100%	0.00	0.0%	90%	0.00	0.0%	0%	0.15	0.0%	0.0%
EX2	0.46	100%	0.00	0.0%	90%	0.00	0.0%	0%	0.46	0.0%	0.0%
A1	0.78	100%	0.28	36.2%	90%	0.33	38.3%	0%	0.17	0.0%	74.5%
A2	0.22	100%	0.15	67.3%	90%	0.00	0.0%	0%	0.07	0.0%	67.3%
A3	0.11	100%	0.07	63.3%	90%	0.00	0.0%	0%	0.04	0.0%	63.3%
A4	0.62	100%	0.16	26.6%	90%	0.33	48.3%	0%	0.12	0.0%	74.8%
A5	0.83	100%	0.21	24.8%	90%	0.28	29.9%	0%	0.35	0.0%	54.7%
A6	0.18	100%	0.11	59.4%	90%	0.05	24.5%	0%	0.02	0.0%	83.9%
A7	0.46	100%	0.16	34.5%	90%	0.17	32.7%	0%	0.13	0.0%	67.1%
A8	0.75	100%	0.16	20.9%	90%	0.22	26.6%	0%	0.37	0.0%	47.5%
A9	0.57	100%	0.32	54.9%	90%	0.11	17.4%	0%	0.15	0.0%	72.3%
A10	0.78	100%	0.04	5.2%	90%	0.00	0.0%	0%	0.74	0.0%	5.2%
A11	0.16	100%	0.06	40.5%	90%	0.00	0.0%	0%	0.09	0.0%	40.5%
A12	0.13	100%	0.05	38.9%	90%	0.00	0.0%	0%	0.08	0.0%	38.9%
B1	0.61	100%	0.13	21.6%	90%	0.22	33.0%	0%	0.25	0.0%	54.6%
B2	0.08	100%	0.08	100.0%	90%	0.00	0.0%	0%	0.00	0.0%	100.0%
B3	0.12	100%	0.10	87.0%	90%	0.00	0.0%	0%	0.02	0.0%	87.0%
B4	0.76	100%	0.27	35.8%	90%	0.33	39.2%	0%	0.16	0.0%	75.0%
B5	0.66	100%	0.15	23.0%	90%	0.22	30.0%	0%	0.29	0.0%	53.0%
B6	0.08	100%	0.07	84.4%	90%	0.00	0.0%	0%	0.01	0.0%	84.4%
B7	0.13	100%	0.11	87.9%	90%	0.00	0.0%	0%	0.02	0.0%	87.9%
B8	0.72	100%	0.19	26.4%	90%	0.33	41.6%	0%	0.20	0.0%	68.0%
B9	0.31	100%	0.01	2.2%	90%	0.00	0.0%	0%	0.30	0.0%	2.2%
B10	0.55	100%	0.21	38.0%	90%	0.17	27.0%	0%	0.18	0.0%	65.0%
B11	0.55	100%	0.02	2.8%	90%	0.00	0.0%	0%	0.54	0.0%	2.8%
B12	0.06	100%	0.02	36.0%	90%	0.00	0.0%	0%	0.04	0.0%	36.0%
B13	0.18	100%	0.07	39.3%	90%	0.00	0.0%	0%	0.11	0.0%	39.3%
B14	0.17	100%	0.04	20.7%	90%	0.00	0.0%	0%	0.14	0.0%	20.7%
B15	0.17	100%	0.02	11.0%	90%	0.00	0.0%	0%	0.15	0.0%	11.0%
B16	0.11	100%	0.00	0.0%	90%	0.00	0.0%	0%	0.11	0.0%	0.0%
SITE TOTAL	11.46									SITE	50.0%
WEST POND	5.92									WEST POND	50.5%
EAST POND	4.57									EAST POND	54.3%

COMPOSITE RUNOFF COEFFICIENT CALCULATIONS

Subdivision: PALMER VILLAGE
Location: Colorado Springs

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: RPD
Checked By:
Date: 1/27/21

Basin ID	Total Area (ac)	Basins Total Weighted % Imp.	Hydrologic Soil Group			Land Use			Minor Coefficients			Major Coefficients			Basins Total Weighted C_5	Basins Total Weighted C_{100}
			Area A (ac)	Area B (ac)	Area C/D (ac)	Area Walks & Drives (ac)	Area Roofs (ac)	Area Lawns (ac)	$C_{5,A,WALKS\ \&\ DRIVES}$	$C_{5,A,ROOFS}$	$C_{5,A,LAWNS}$	$C_{100,A,WALKS\ \&\ DRIVES}$	$C_{100,A,ROOFS}$	$C_{100,A,LAWNS}$		
EX1	0.15	0%	0.15	0.00	0.00	0.00	0.00	0.15	0.90	0.73	0.08	0.96	0.81	0.35	0.08	0.35
EX2	0.46	0%	0.46	0.00	0.00	0.00	0.00	0.46	0.90	0.73	0.08	0.96	0.81	0.35	0.08	0.35
A1	0.78	75%	0.78	0.00	0.00	0.28	0.33	0.17	0.90	0.73	0.08	0.96	0.81	0.35	0.65	0.77
A2	0.22	67%	0.22	0.00	0.00	0.15	0.00	0.07	0.90	0.73	0.08	0.96	0.81	0.35	0.63	0.76
A3	0.11	63%	0.11	0.00	0.00	0.07	0.00	0.04	0.90	0.73	0.08	0.96	0.81	0.35	0.60	0.74
A4	0.62	75%	0.62	0.00	0.00	0.16	0.33	0.12	0.90	0.73	0.08	0.96	0.81	0.35	0.65	0.76
A5	0.83	55%	0.83	0.00	0.00	0.21	0.28	0.35	0.90	0.73	0.08	0.96	0.81	0.35	0.50	0.65
A6	0.18	84%	0.18	0.00	0.00	0.11	0.05	0.02	0.90	0.73	0.08	0.96	0.81	0.35	0.74	0.84
A7	0.46	67%	0.46	0.00	0.00	0.16	0.17	0.13	0.90	0.73	0.08	0.96	0.81	0.35	0.60	0.73
A8	0.75	48%	0.75	0.00	0.00	0.16	0.22	0.37	0.90	0.73	0.08	0.96	0.81	0.35	0.44	0.61
A9	0.57	72%	0.57	0.00	0.00	0.32	0.11	0.15	0.90	0.73	0.08	0.96	0.81	0.35	0.66	0.77
A10	0.78	5%	0.78	0.00	0.00	0.04	0.00	0.74	0.90	0.73	0.08	0.96	0.81	0.35	0.12	0.38
A11	0.16	40%	0.16	0.00	0.00	0.06	0.00	0.09	0.90	0.73	0.08	0.96	0.81	0.35	0.41	0.60
A12	0.13	39%	0.13	0.00	0.00	0.05	0.00	0.08	0.90	0.73	0.08	0.96	0.81	0.35	0.40	0.59
B1	0.61	55%	0.61	0.00	0.00	0.13	0.22	0.25	0.90	0.73	0.08	0.96	0.81	0.35	0.50	0.65
B2	0.08	100%	0.08	0.00	0.00	0.08	0.00	0.00	0.90	0.73	0.08	0.96	0.81	0.35	0.90	0.96
B3	0.12	87%	0.12	0.00	0.00	0.10	0.00	0.02	0.90	0.73	0.08	0.96	0.81	0.35	0.79	0.88
B4	0.76	75%	0.76	0.00	0.00	0.27	0.33	0.16	0.90	0.73	0.08	0.96	0.81	0.35	0.66	0.77
B5	0.66	53%	0.66	0.00	0.00	0.15	0.22	0.29	0.90	0.73	0.08	0.96	0.81	0.35	0.49	0.64
B6	0.08	84%	0.08	0.00	0.00	0.07	0.00	0.01	0.90	0.73	0.08	0.96	0.81	0.35	0.77	0.87
B7	0.13	88%	0.13	0.00	0.00	0.11	0.00	0.02	0.90	0.73	0.08	0.96	0.81	0.35	0.80	0.89
B8	0.72	68%	0.72	0.00	0.00	0.19	0.33	0.20	0.90	0.73	0.08	0.96	0.81	0.35	0.60	0.72
B9	0.31	2%	0.31	0.00	0.00	0.01	0.00	0.30	0.90	0.73	0.08	0.96	0.81	0.35	0.10	0.36
B10	0.55	65%	0.55	0.00	0.00	0.21	0.17	0.18	0.90	0.73	0.08	0.96	0.81	0.35	0.59	0.72
B11	0.55	3%	0.55	0.00	0.00	0.02	0.00	0.54	0.90	0.73	0.08	0.96	0.81	0.35	0.10	0.37
B12	0.06	36%	0.06	0.00	0.00	0.02	0.00	0.04	0.90	0.73	0.08	0.96	0.81	0.35	0.37	0.57
B13	0.18	39%	0.18	0.00	0.00	0.07	0.00	0.11	0.90	0.73	0.08	0.96	0.81	0.35	0.40	0.59
B14	0.17	21%	0.17	0.00	0.00	0.04	0.00	0.14	0.90	0.73	0.08	0.96	0.81	0.35	0.25	0.48
B15	0.17	11%	0.17	0.00	0.00	0.02	0.00	0.15	0.90	0.73	0.08	0.96	0.81	0.35	0.17	0.42
B16	0.11	0%	0.11	0.00	0.00	0.00	0.00	0.11	0.90	0.73	0.08	0.96	0.81	0.35	0.08	0.35
TOTAL	11.46	50.0%	11.46	0.00	0.00	3.24	2.76	5.45	---	---	---	---	---	---	0.47	0.63

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: PALMER VILLAGE
Location: Colorado Springs

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: RPD
Checked By:
Date: 1/27/21

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)
EX1	0.15	A	0%	0.08	0.35	50	5.0%	7.7	26	5.0%	10.0	2.2	0.2	7.9	76.0	26.2	7.9
EX2	0.46	A	0%	0.08	0.35	50	5.0%	7.7	56	5.0%	10.0	2.2	0.4	8.1	106.0	26.5	8.1
A1	0.78	A	75%	0.65	0.77	87	5.0%	4.4	155	1.4%	20.0	2.4	1.1	5.5	242.0	14.4	5.5
A2	0.22	A	67%	0.63	0.76	87	2.0%	6.3	180	1.0%	20.0	2.0	1.5	7.8	267.0	16.2	7.8
A3	0.11	A	63%	0.60	0.74	87	6.0%	4.7	180	1.0%	20.0	2.0	1.5	6.2	267.0	16.9	6.2
A4	0.62	A	75%	0.65	0.76	87	6.0%	4.2	150	1.6%	20.0	2.5	1.0	5.2	237.0	14.3	5.2
A5	0.83	A	55%	0.50	0.65	87	5.0%	5.9	150	1.6%	20.0	2.5	1.0	7.0	237.0	17.9	7.0
A6	0.18	A	84%	0.74	0.84	99	1.0%	6.4	178	1.0%	20.0	2.0	1.5	7.9	277.0	13.2	7.9
A7	0.46	A	67%	0.60	0.73	87	5.5%	4.8	153	1.6%	20.0	2.5	1.0	5.8	240.0	15.7	5.8
A8	0.75	A	48%	0.44	0.61	90	4.5%	6.8	115	1.1%	20.0	2.1	0.9	7.8	205.0	19.1	7.8
A9	0.57	A	72%	0.66	0.77	87	3.0%	5.2	200	1.0%	20.0	2.0	1.7	6.9	287.0	15.5	6.9
A10	0.78	A	5%	0.12	0.38	50	15.0%	5.1	325	0.7%	15.0	1.3	4.3	9.4	375.0	31.8	9.4
A11	0.16	A	40%	0.41	0.60	90	2.0%	9.4	55	1.0%	20.0	2.0	0.5	9.8	145.0	19.7	9.8
A12	0.13	A	39%	0.40	0.59	20	2.0%	4.5	280	0.5%	20.0	1.4	3.3	7.8	300.0	24.0	7.8
B1	0.61	A	55%	0.50	0.65	97	8.0%	5.4	105	1.0%	20.0	2.0	0.9	6.3	202.0	17.8	6.3
B2	0.08	A	100%	0.90	0.96	12	2.0%	1.0	182	2.3%	20.0	3.1	1.0	2.0	194.0	9.9	5.0
B3	0.12	A	87%	0.79	0.88	12	2.0%	1.5	190	2.3%	20.0	3.0	1.0	2.6	202.0	12.2	5.0
B4	0.76	A	75%	0.66	0.77	120	6.0%	4.9	183	2.0%	20.0	2.8	1.1	5.9	303.0	14.4	5.9
B5	0.66	A	53%	0.49	0.64	97	8.0%	5.5	103	1.6%	20.0	2.5	0.7	6.2	200.0	17.8	6.2
B6	0.08	A	84%	0.77	0.87	12	2.0%	1.6	160	2.5%	20.0	3.2	0.8	2.5	172.0	12.5	5.0
B7	0.13	A	88%	0.80	0.89	12	2.0%	1.5	170	2.5%	20.0	3.2	0.9	2.4	182.0	11.9	5.0
B8	0.72	A	68%	0.60	0.72	97	9.0%	4.3	145	1.0%	20.0	2.0	1.2	5.5	242.0	15.7	5.5
B9	0.31	A	2%	0.10	0.36	15	10.0%	3.3	365	3.0%	15.0	2.6	2.3	5.6	380.0	29.4	5.6
B10	0.55	A	65%	0.59	0.72	87	5.0%	5.1	155	1.0%	20.0	2.0	1.3	6.4	242.0	16.4	6.4
B11	0.55	A	3%	0.10	0.37	15	2.0%	5.5	40	33.0%	15.0	8.6	0.1	5.6	55.0	25.6	5.6
B12	0.06	A	36%	0.37	0.57	20	2.0%	4.7	19	2.5%	20.0	3.2	0.1	4.8	39.0	20.0	5.0
B13	0.18	A	39%	0.40	0.59	20	2.0%	4.5	450	2.2%	20.0	3.0	2.5	7.0	470.0	22.8	7.0
B14	0.17	A	21%	0.25	0.48	20	2.0%	5.5	20	2.0%	20.0	2.8	0.1	5.6	40.0	22.7	5.6
B15	0.17	A	11%	0.17	0.42	20	25.0%	2.6	35	25.0%	15.0	7.5	0.1	2.7	55.0	24.2	5.0
B16	0.11	A	0%	0.08	0.35	15	10.0%	3.3	150	1.5%	15.0	1.9	1.3	4.7	165.0	28.2	5.0

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

ɔdivision: PALMER VILLAGE
Location: Colorado Springs
ɡn Storm: 5-Year

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: RPD
Checked By:
Date: 1/27/21

STREET	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			REMARKS
		Basin ID	Area (Ac)	Runoff Coeff.	t_i (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)	
	EX1	EX1	0.15	0.08	7.9	0.01	4.49	0.0															OFFSITE BASIN EX1 FLOW @ DPEX1, FLOW INTO BASIN A1 (ROUTED IN SF2)
	EX2	EX2	0.46	0.08	8.1	0.04	4.45	0.2															BASIN EX2 FLOW @ DPEX2, FLOW INTO BASIN A2 (ROUTED IN SF2)
	1	A1	0.78	0.65	5.5	0.51	5.03	2.6	7.9	0.52	4.49	2.3	2.3	0.52	1.13					170	2.1	1.3	BASIN A1 & DPEX1 FLOW @ DP1, C&G FLOW TO DP3
		A2	0.22	0.63	7.8	0.14	4.51	0.6															BASIN A2 FLOW @ DP3 (ROUTED IN SF2)
		A3	0.11	0.60	6.2	0.07	4.85	0.3															BASIN A3 FLOW @ DP4 (ROUTED IN SF2)
	2	A4	0.62	0.65	5.2	0.40	5.10	2.0	8.1	0.44	4.45	2.0	2.0	0.44	1.13					170	2.1	1.3	BASIN A4 & DPEX2 FLOW @ DP2, C&G TO DP4
	3								7.8	0.66	4.51	3.0				3.0	0.66	1.0	18	5	5.1	0.0	DP1 & BASIN A2 FLOW CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP4.1
	4								6.6	0.51	4.76	2.4	0.5	0.11	1.13	1.9	0.40	1.0	18	60 31	2.1 4.4	0.5 0.1	DP4 FLOW-BY, C&G FLOW TO DP6 BASIN A3 & DP2 FLOW CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET (ON-GRADE), PIPE TO DP4.1
	4.1								7.8	1.06	4.50	4.8				4.8	4.50	0.8	24	110	5.2	0.4	COMBINED DP3&DP4 CAPTURED FLOW, PIPE FLOW TO DP5.1
	5	A5	0.83	0.50	7.0	0.42	4.67	2.0	7.0	0.42	4.67	2.0	0.4	0.08	0.66	1.6	0.34	0.8	24	115 5	1.6 3.9	1.2 0.0	DP5 FLOW-BY, C&G FLOW TO DP8 BASIN A5 FLOW @ DP5, CAPTURED IN DBL DENVER TYPE 16 COMBO INLET (ON-GRADE), PIPE TO 5.1
	5.1								7.8	1.48	4.50	6.7				6.7	1.48	0.8	30	50	5.6	0.1	DP4.1 & DP5 FLOW @ DP5.1, PIPE FLOW TO DP8.1
		A6	0.18	0.74	7.9	0.14	4.49	0.6															BASIN A6 FLOW @ DP8 (ROUTED IN SF2)
	6	A7	0.46	0.60	5.8	0.27	4.94	1.3	7.0	0.38	4.66	1.8	1.8	0.38	1.13					130	2.1	1.0	BASIN A7 FLOW & DP4 FLOW-BY @ DP6, C&G FLOW TO DP9
	7	A8	0.75	0.44	7.8	0.33	4.51	1.5	7.8	0.33	4.50	1.5	1.5	0.33	1.00					100	2.0	0.8	BASIN A8 FLOW @ DP7, C&G FLOW TO DP8
	8								8.6	0.55	4.36	2.4				2.4	0.55	0.5	30	5	3.5	0.0	BASIN A6, DP5 & DP7 FLOW @ DP8, CAPTURED BY TRP DENVER TYPE 16 COMBO INLET (SUMP), PIPE FLOW TO DP8.1
	8.1								8.6	2.03	4.35	8.8				8.8	2.03	0.5	30	50	2.0	0.4	DP5.1 & DP8 FLOW @ DP8.1, PIPE FLOW TO DP9.1
	9	A9	0.57	0.66	6.9	0.38	4.69	1.8	8.1	0.76	4.45	3.4				3.4	0.76	1.3	30	5	5.5	0.0	DP6, DP8 FLOW-BY & BASIN A9 FLOW @ DP9, CAPTURED BY TRP. DENVER TYPE 16 COMBO INLET (SUMP), PIPE FLOW TO DP9.1
	9.1								9.0	2.79	4.28	11.9				11.9	2.79	1.3	30	18	7.9	0.0	DP8.1 & DP9 FLOW @ DP9.1, PIPE FLOW TO DP10 (POND A)
	10	A10	0.78	0.12	9.4	0.09	4.22	0.4	9.4	2.88	4.22	12.1											BASIN A1-10 FLOW @ DP10, TOTAL FLOW ENTERING POND A
	11	A11	0.16	0.41	9.8	0.07	4.15	0.3															BASIN A11 FLOW, FOLLOWS HISTORIC DRAINAGE PATTERNS TO CONSTITUTION AVENUE @ DP11
	12	A12	0.13	0.40	7.8	0.05	4.50	0.2															BASIN A12 FLOW, FOLLOWS HISTORIC DRAINAGE PATTERNS TO CONSTITUTION AVENUE @ DP12

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

bdivision: PALMER VILLAGE
Location: Colorado Springs
gn Storm: 5-Year

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: RPD
Checked By:
Date: 1/27/21

		DIRECT RUNOFF								TOTAL RUNOFF				STREET			PIPE				TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	t_i (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
														1.4	0.30	2.85					160	3.4	0.8	BASIN B1 FLOW @ DP15, C&G FLOW TO DP17
	15	B1	0.61	0.50	6.3	0.30	4.83	1.4		6.3	0.30	4.83	1.4											
														0.3	0.07	2.85					70	3.4	0.3	DP17 FLOW-BY, C&G FLOW TO DP19
	17	B2	0.08	0.90	5.0	0.07	5.17	0.4		7.1	0.37	4.65	1.7				1.4	0.30	1.0	18	32	4.1	0.1	BASIN B2 AND DP15 FLOW @ DP17, CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET (ON-GRADE), PIPE TO DP18.1
		B3	0.12	0.79	5.0	0.09	5.17	0.5																BASIN B3 FLOW @ DP18 (ROUTED IN SF2)
														2.5	0.50	2.85					185	3.4	0.9	BASIN B4 FLOW @ DP16, C&G FLOW TO DP18
	16	B4	0.76	0.66	5.9	0.50	4.91	2.5		5.9	0.50	4.91	2.5											
	18									6.8	0.59	4.70	2.8				2.8	0.59	1.4	18	5	5.5	0.0	BASIN B3 & DP16 FLOW @ DP18, CAPTURED BY DBL. DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP18.1
	18.1									6.9	0.89	4.69	4.2				4.2	0.89	1.4	18	165	6.2	0.4	DP17 & DP18 CAPTURED FLOW, PIPE FLOW TO DP22.1
														0.7	0.14	2.85					92	3.4	0.5	DP19 FLOW-BY, C&G FLOW TO DP24
	19	B5	0.66	0.49	6.2	0.32	4.85	1.6		6.2	0.39	4.85	1.9				1.2	0.25	0.9	18	92	3.7	0.4	BASIN B5 & DP17 FLOW-BY @ DP19, CAPTURED IN SINGLE DENVER TYPE 16 COMBO INLET (ON-GRADE), PIPE TO DP24.1
		B6	0.08	0.77	5.0	0.06	5.17	0.3																BASIN B6 FLOW AT DP24 (ROUTED IN SF2)
		B7	0.13	0.80	5.0	0.10	5.17	0.5																BASIN B7 FLOW AT DP23 (ROUTED IN SF2)
														2.2	0.43	2.85					125	3.4	0.6	BASIN B8 FLOW @ DP20, C&G FLOW TO DP23
	20	B8	0.72	0.60	5.5	0.43	5.02	2.2		5.5	0.43	5.02	2.2											
	21	B9	0.31	0.10	5.6	0.03	4.99	0.1		5.6	0.03	4.99	0.1				0.1	0.03	0.5	18	147	1.6	1.5	BASIN B9 FLOW @ DP21, CAPTURED IN TYPE C INLET (SUMP), PIPED TO DP22.1
	22	B10	0.55	0.59	6.4	0.33	4.80	1.6		6.4	0.33	4.80	1.6				1.6	0.33	1.0	18	20	4.2	0.1	BASIN B10 FLOW @ DP22, CAPTURED BY DBL DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP22.1
	22.1									7.1	0.36	4.64	1.7				1.7	0.36	0.5	18	25	3.3	0.1	COMBINED DP21 & DP22 CAPTURED FLOW, PIPE TO DP23.1
	23									6.2	0.53	4.86	2.6				2.6	0.53	0.5	18	5	3.8	0.0	BASIN B7 & DP20 FLOW @ DP23, CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP23.1
	23.1									7.3	1.78	4.60	8.2				8.2	1.78	0.5	24	32	5.1	0.1	DP23 CAPTURED FLOW & DP22.1 FLOW, PIPE TO DP24.1
	24									6.6	0.20	4.74	1.0				1.0	0.20	0.5	24	5	2.7	0.0	BASIN B6 & DP19 FLOW-BY @ DP24, CAPTURED IN TRIPLE DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP24.1
	24.1									7.4	2.23	4.58	10.2				10.2	2.23	0.5	30	47	5.4	0.1	COMBINED DP23.1 & DP24 FLOW, PIPE TO DP25
	25	B11	0.55	0.10	5.6	0.06	4.99	0.3		7.6	2.29	4.55	10.4											DP24.1 AND BASIN B11 FLOW, TOTAL FLOW @ DP25 (POND B)
	26	B12	0.06	0.37	5.0	0.02	5.17	0.1																BASIN B12 FLOW, FOLLOWS EX PATTERNS & FLOWS NORTH TO CONSTITUTION AVENUE @ DP26
	27	B13	0.18	0.40	7.0	0.07	4.66	0.3																BASIN B13 FLOW, FOLLOWS EX PATTERNS & FLOWS NORTH TO CONSTITUTION AVENUE @ DP27
	28	B14	0.17	0.25	5.6	0.04	5.00	0.2																BASIN B14 FLOW, FOLLOWS EX PATTERNS & FLOWS EAST OFF SITE @ DP28
	29	B15	0.17	0.17	5.0	0.03	5.17	0.2																BASIN B15 FLOW, FOLLOWS EX PATTERNS & FLOWS EAST OFF SITE @ DP29
	30	B16	0.11	0.08	5.0	0.01	5.17	0.1																BASIN B16 FLOW, SWALE CONVEYS FLOW OFFSITE EAST (FOLLLOWS HISTORIC PATTERNS) @ DP30

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

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

sion: PALMER VILLAGE
tion: Colorado Springs
orm: 100-Year

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: RPD
Checked By:
Date: 1/27/21

TREE	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)	
	EX1	EX1	0.15	0.35	7.9	0.05	4.49	0.2															OFFSITE BASIN EX1 FLOW @ DPEX1, FLOW INTO BASIN A1 (ROUTED IN SF2)
	EX2	EX2	0.46	0.35	8.1	0.16	4.45	0.7															BASIN EX2 FLOW @ DPEX2, FLOW INTO BASIN A2 (ROUTED IN SF2)
	1	A1	0.78	0.77	5.5	0.60	8.44	5.1	7.9	0.65	7.54	4.9	4.9	0.65	1.13					170	2.1	1.3	BASIN A1 & DPEX1 FLOW @ DP1, C&G FLOW TO DP3
		A2	0.22	0.76	7.8	0.17	7.57	1.3															BASIN A2 FLOW @ DP3 (ROUTED IN SF2)
		A3	0.11	0.74	6.2	0.08	8.15	0.7															BASIN A3 FLOW @ DP4 (ROUTED IN SF2)
	2	A4	0.62	0.76	5.2	0.47	8.56	4.0	8.1	0.63	7.47	4.7	4.7	0.63	1.13					170	2.1	1.3	BASIN A4 & DPEX2 FLOW @ DP2, C&G TO DP4
	3								7.8	0.82	7.57	6.2				6.2	0.82	1.0	18	5	6.2	0.0	0 DP1 & BASIN A2 FLOW CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP4.1
	4								6.6	0.71	7.99	5.7	2.3	0.28	1.13	3.4	0.43	1.0	18	60 31	2.1 5.3	0.5 0.1	DP4 FLOW-BY, C&G FLOW TO DP6 BASIN A3 & DP2 FLOW CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET (ON-GRADE), PIPE TO DP4.1
	4.1								7.8	1.25	7.56	9.4				9.4	7.56	0.8	24	110	6.2	0.3	COMBINED DP3&DP4 CAPTURED FLOW, PIPE FLOW TO DP5.1
	5	A5	0.83	0.65	7.0	0.54	7.85	4.2	7.0	0.54	7.85	4.2	1.5	0.20	0.66	2.7	0.34	0.8	24	115 5	1.6 4.4	1.2 0.0	DP5 FLOW-BY, C&G FLOW TO DP8 BASIN A5 FLOW @ DP5, CAPTURED IN DBL DENVER TYPE 16 COMBO INLET (ON-GRADE), PIPE TO 5.1
	5.1								7.8	1.79	7.56	13.5				13.5	1.79	0.8	30	50	6.9	0.1	DP4.1 & DP5 FLOW @ DP5.1, PIPE FLOW TO DP8.1
		A6	0.18	0.84	7.9	0.15	7.53	1.1															BASIN A6 FLOW @ DP8 (ROUTED IN SF2)
	6	A7	0.46	0.73	5.8	0.33	8.29	2.7	7.0	0.61	7.82	4.8	4.8	0.61	1.13					130	2.1	1.0	BASIN A7 FLOW & DP4 FLOW-BY @ DP6, C&G FLOW TO DP9
	7	A8	0.75	0.61	7.8	0.46	7.57	3.5	7.8	0.46	7.56	3.5	3.5	0.46	1.00					100	2.0	0.8	BASIN A8 FLOW @ DP7, C&G FLOW TO DP8
	8								8.6	0.81	7.32	5.9	1.6	0.22	2.00	4.3	0.59	0.5	30	60 5	2.8 4.2	0.4 0.0	DP8 FLOW-BY, OVERTOPS CROWN TO DP9 BASIN A6, DP5 & DP7 FLOW @ DP8, CAPTURED BY TRP DENVER TYPE 16 COMBO INLET (SUMP), PIPE FLOW TO DP8.1
	8.1								8.6	2.05	7.31	15.0				15.0	2.05	0.5	30	50	2.0	0.4	DP5.1 & DP8 FLOW @ DP8.1, PIPE FLOW TO DP9.1
	9	A9	0.57	0.77	6.9	0.44	7.88	3.5	8.9	1.27	7.22	9.2				9.2	1.27	1.3	30	5	7.3	0.0	DP6, DP8 FLOW-BY & BASIN A9 FLOW @ DP9, CAPTURED BY TRP. DENVER TYPE 16 COMBO INLET (SUMP), PIPE FLOW TO DP9.1
	9.1								9.0	3.32	7.19	23.9				23.9	3.32	1.3	30	18	9.6	0.0	DP8.1 & DP9 FLOW @ DP9.1, PIPE FLOW TO DP10 (POND A)
	10	A10	0.78	0.38	9.4	0.30	7.08	2.1	9.4	3.62	7.08	25.7											BASIN A1-10 FLOW @ DP10, TOTAL FLOW ENTERING POND A
	11	A11	0.16	0.60	9.8	0.09	6.97	0.6															BASIN A11 FLOW, FOLLOWS HISTORIC DRAINAGE PATTERNS TO CONSTITUTION AVENUE @ DP11
	12	A12	0.13	0.59	7.8	0.08	7.56	0.6															BASIN A12 FLOW, FOLLOWS HISTORIC DRAINAGE PATTERNS TO CONSTITUTION AVENUE @ DP12

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

sion: PALMER VILLAGE
tion: Colorado Springs
orm: 100-Year

Project Name: PALMER VILLAGE
Project No.: 2514901
Calculated By: RPD
Checked By:
Date: 1/27/21

TREE	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)	
	15	B1	0.61	0.65	6.3	0.39	8.10	3.2	6.3	0.39	8.10	3.2	3.2	0.39	2.85					160	3.4	0.8	BASIN B1 FLOW @ DP15, C&G FLOW TO DP17
	17	B2	0.08	0.96	5.0	0.07	8.68	0.6	7.1	0.46	7.80	3.6	1.3	0.17	2.85	2.3	0.29	1.0	18	70 32	3.4 4.7	0.3 0.1	DP17 FLOW-BY, C&G FLOW TO DP19 BASIN B2 AND DP15 FLOW @ DP17, CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET (ON-GRADE), PIPE TO DP18.1
		B3	0.12	0.88	5.0	0.10	8.68	0.9															BASIN B3 FLOW @ DP18 (ROUTED IN SF2)
	16	B4	0.76	0.77	5.9	0.59	8.25	4.9	5.9	0.59	8.25	4.9	4.9	0.59	2.85					185	3.4	0.9	BASIN B4 FLOW @ DP16, C&G FLOW TO DP18
	18								6.8	0.69	7.89	5.4				5.4	0.69	1.4	18	5	6.7	0.0	0 BASIN B3 & DP16 FLOW @ DP18, CAPTURED BY DBL. DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP18.1
	18.1								6.9	0.98	7.88	7.8				7.8	0.98	1.4	18	165	7.3	0.4	DP17 & DP18 CAPTURED FLOW, PIPE FLOW TO DP22.1
	19	B5	0.66	0.64	6.2	0.43	8.14	3.5	6.2	0.60	8.14	4.8	2.7	0.34	2.85	2.1	0.26	0.9	18	92 92	3.4 4.3	0.5 0.4	DP19 FLOW-BY, C&G FLOW TO DP24 BASIN B5 & DP17 FLOW-BY @ DP19, CAPTURED IN SINGLE DENVER TYPE 16 COMBO INLET (ON-GRADE), PIPE TO DP24.1
		B6	0.08	0.87	5.0	0.07	8.68	0.6															BASIN B6 FLOW AT DP24 (ROUTED IN SF2)
		B7	0.13	0.89	5.0	0.11	8.68	1.0															BASIN B7 FLOW AT DP23 (ROUTED IN SF2)
	20	B8	0.72	0.72	5.5	0.52	8.42	4.4	5.5	0.52	8.42	4.4	4.4	0.52	2.85					125	3.4	0.6	BASIN B8 FLOW @ DP20, C&G FLOW TO DP23
	21	B9	0.31	0.36	5.6	0.11	8.38	0.9	5.6	0.11	8.38	0.9				0.9	0.11	0.5	18	147	2.8	0.9	BASIN B9 FLOW @ DP21, CAPTURED IN TYPE C INLET (SUMP), PIPED TO DP22.1
	22	B10	0.55	0.72	6.4	0.40	8.07	3.2	6.4	0.40	8.07	3.2	0.6	0.08	1.00	2.6	0.32	1.0	18	65 20	2.0 4.9	0.5 0.1	DP22 FLOW-BY, C&G FLOW TO DP23 BASIN B10 FLOW @ DP22, CAPTURED BY DBL DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP22.1
	22.1								6.5	0.43	8.02	3.5				3.5	0.43	0.5	18	25	4.1	0.1	COMBINED DP21 & DP22 CAPTURED FLOW, PIPE TO DP23.1
	23								6.9	0.71	7.86	5.6				5.6	0.71	0.5	18	5	4.6	0.0	BASIN B7, DP20 FLOW & DP22 FLOW-BY@ DP23, CAPTURED IN DBL. DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP23.1
	23.1								7.2	2.12	7.75	16.5				16.5	2.12	0.5	24	32	5.8	0.1	DP23 CAPTURED FLOW & DP22.1 FLOW, PIPE TO DP24.1
	24								6.6	0.41	7.96	3.2				3.2	0.41	0.5	24	5	3.9	0.0	BASIN B6 & DP19 FLOW-BY @ DP24, CAPTURED IN TRIPLE DENVER TYPE 16 COMBO INLET (SUMP), PIPE TO DP24.1
	24.1								7.3	2.79	7.71	21.5				21.5	2.79	0.5	30	47	6.4	0.1	COMBINED DP23.1 & DP24 FLOW, PIPE TO DP25
	25	B11	0.55	0.37	5.6	0.20	8.38	1.7	7.5	2.99	7.67	22.9											DP24.1 AND BASIN B11 FLOW, TOTAL FLOW @ DP25 (POND B)
	26	B12	0.06	0.57	5.0	0.03	8.68	0.3															BASIN B12 FLOW, FOLLOWS EX PATTERNS & FLOWS NORTH TO CONSTITUTION AVENUE @ DP26
	27	B13	0.18	0.59	7.0	0.11	7.83	0.9															BASIN B13 FLOW, FOLLOWS EX PATTERNS & FLOWS NORTH TO CONSTITUTION AVENUE @ DP27
	28	B14	0.17	0.48	5.6	0.08	8.40	0.7															BASIN B14 FLOW, FOLLOWS EX PATTERNS & FLOWS EAST OFF SITE @ DP28
	29	B15	0.17	0.42	5.0	0.07	8.68	0.6															BASIN B15 FLOW, FOLLOWS EX PATTERNS & FLOWS EAST OFF SITE @ DP29
	30	B16	0.11	0.35	5.0	0.04	8.68	0.3															BASIN B16 FLOW, SWALE CONVEYS FLOW OFFSITE EAST (FOLLLOWS HISTORIC PATTERNS) @ DP30

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

Appendix C
Hydraulic Calculations

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Nov 11 2019

Alley Street Capacity - 1% CL - Allowable Spread - Edge of Pavement

User-defined

Invert Elev (ft)	= 0.36
Slope (%)	= 1.00
N-Value	= 0.016

Calculations

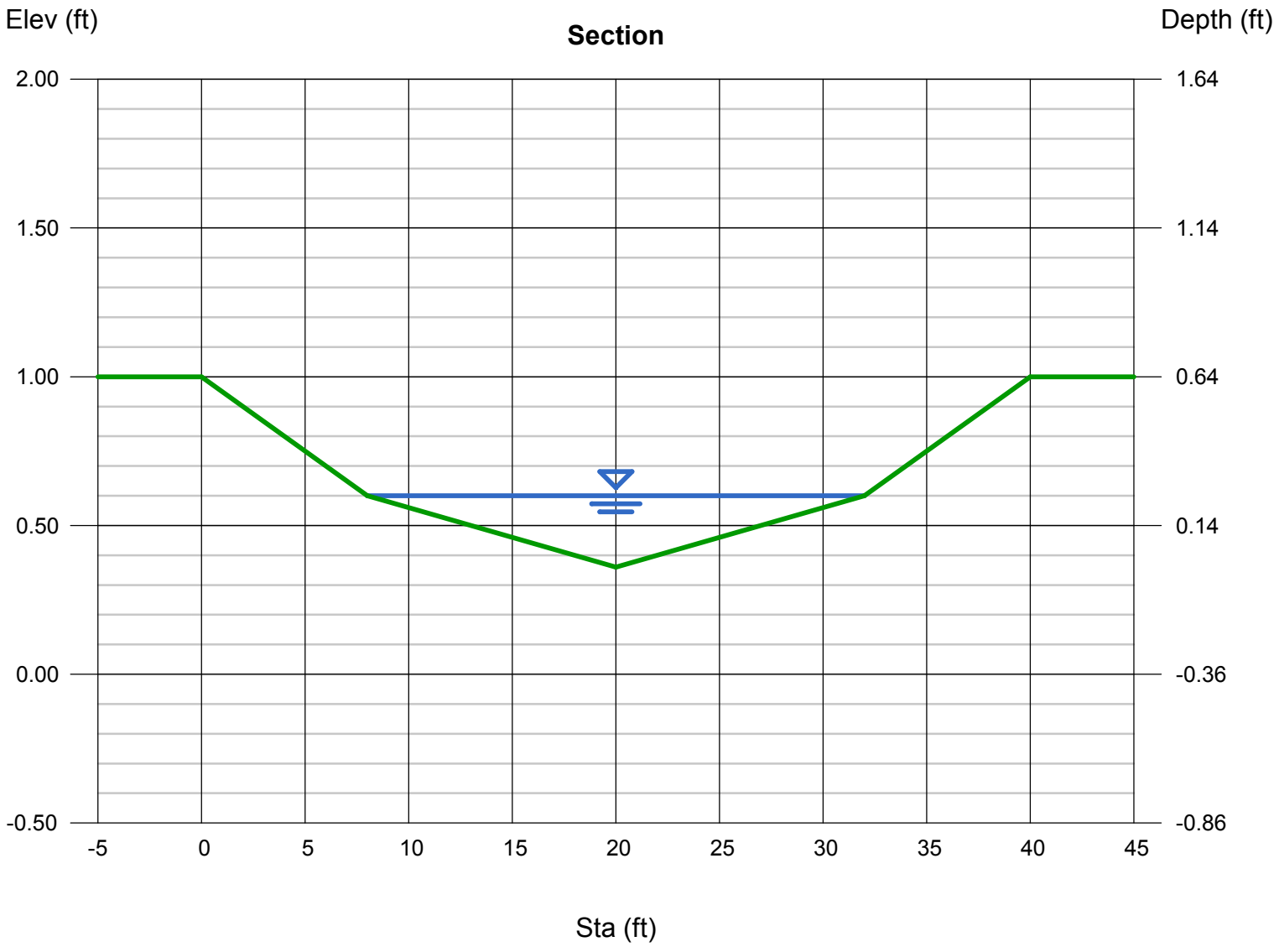
Compute by:	Known Q
Known Q (cfs)	= 6.00

Highlighted

Depth (ft)	= 0.24
Q (cfs)	= 6.000
Area (sqft)	= 2.88
Velocity (ft/s)	= 2.08
Wetted Perim (ft)	= 24.00
Crit Depth, Yc (ft)	= 0.25
Top Width (ft)	= 24.00
EGL (ft)	= 0.31

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

(0.00, 1.00)-(8.00, 0.60, 0.016)-(20.00, 0.36, 0.016)-(32.00, 0.60, 0.016)-(40.00, 1.00, 0.016)



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Monday, Nov 11 2019

Alley Street Capacity - 1.55% CL - Allowable Spread - Edge of Pavement

User-defined

Invert Elev (ft)	= 0.36
Slope (%)	= 1.55
N-Value	= 0.016

Calculations

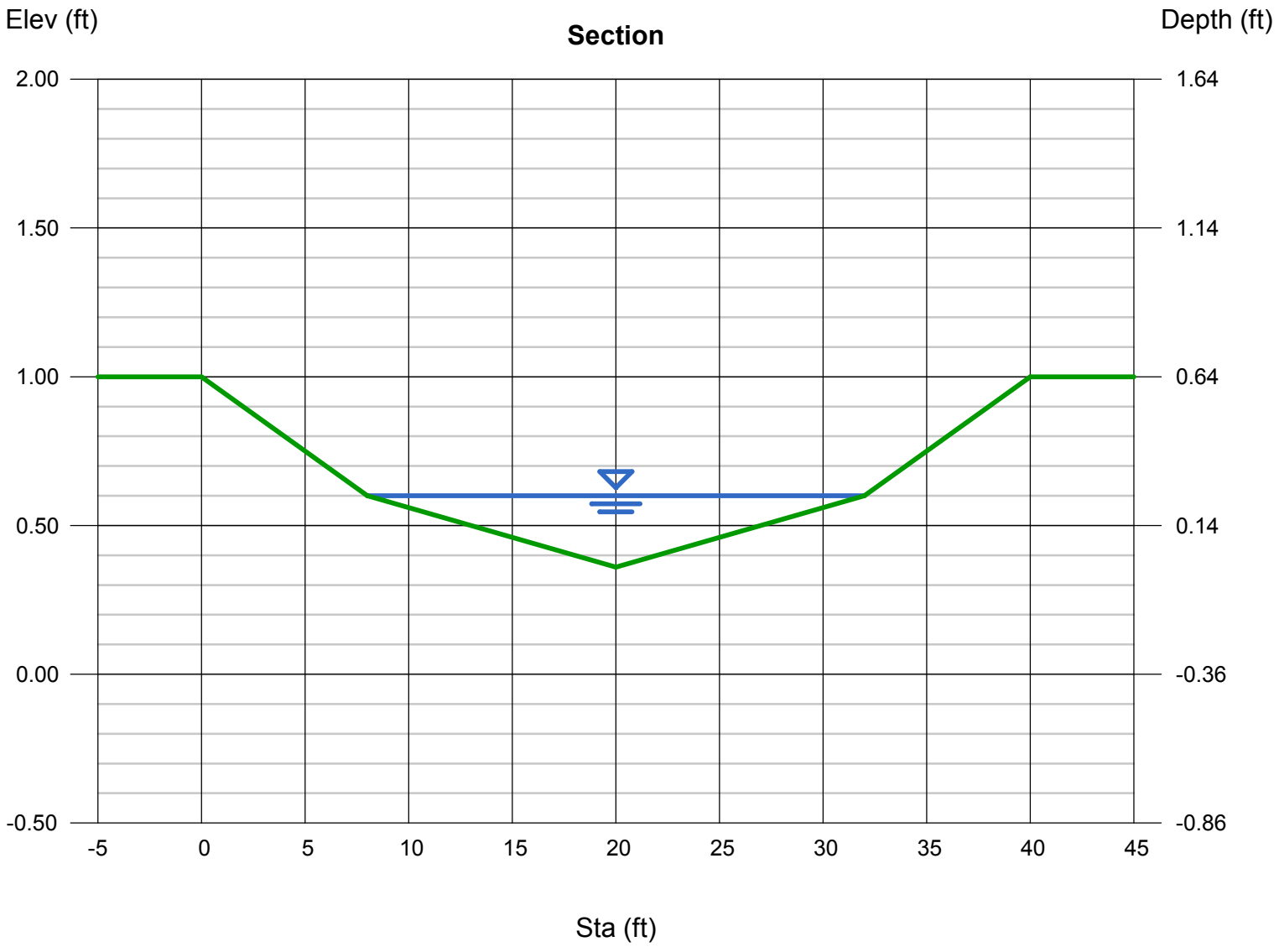
Compute by:	Known Q
Known Q (cfs)	= 8.00

Highlighted

Depth (ft)	= 0.24
Q (cfs)	= 8.000
Area (sqft)	= 2.88
Velocity (ft/s)	= 2.78
Wetted Perim (ft)	= 24.00
Crit Depth, Yc (ft)	= 0.28
Top Width (ft)	= 24.00
EGL (ft)	= 0.36

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

(0.00, 1.00)-(8.00, 0.60, 0.016)-(20.00, 0.36, 0.016)-(32.00, 0.60, 0.016)-(40.00, 1.00, 0.016)



Version 4.05 Released March 2017

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP3	DP4	STREET CAPACITY @ DP4	DP8	DP9	DP24
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	URBAN
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	STREET
Hydraulic Condition	In Sump	On Grade	On Grade	In Sump	In Sump	In Sump
Inlet Type	Denver No. 16 Combination	Denver No. 16 Combination		Denver No. 16 Combination	Denver No. 16 Combination	Denver No. 16 Combination

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	3.0	2.4	2.4	2.4	3.4	1.0
Major Q_{Known} (cfs)	6.2	5.7	5.7	5.9	9.2	3.2

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)						
Percent Impervious						
NRCS Soil Type						

Watershed Profile

Overland Slope (ft/ft)						
Overland Length (ft)						
Channel Slope (ft/ft)						
Channel Length (ft)						

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**3.0**	**2.4**	**2.4**	**2.4**	**3.4**	**1.0**
Major Total Design Peak Flow, Q (cfs)	**6.2**	**5.7**	**5.7**	**5.9**	**9.2**	**3.2**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	0.5		N/A	N/A	N/A
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	2.3		N/A	N/A	N/A

Minor Storm (Calculated) Analysis of Flow Time

C	N/A	N/A	N/A	N/A	N/A	N/A
C_5	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A

Major Storm (Calculated) Analysis of Flow Time

C	N/A	N/A	N/A	N/A	N/A	N/A
C_5	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A

Version 4.05 Released March 2017

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP23	DP17	DP18	DP22	DP19	DP21
Site Type (Urban or Rural)	URBAN	URBAN	URBAN	URBAN	URBAN	RURAL
Inlet Application (Street or Area)	STREET	STREET	STREET	STREET	STREET	AREA
Hydraulic Condition	In Sump	On Grade	In Sump	In Sump	On Grade	Swale
Inlet Type	Denver No. 16 Combination	Denver No. 16 Combination	Denver No. 16 Combination	Denver No. 16 Combination	Denver No. 16 Combination	CDOT Type C

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	2.6	1.7	2.8	1.6	1.9	0.1
Major Q_{Known} (cfs)	5.6	3.6	5.4	3.2	4.8	0.9

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0	0.0	0.0	0.0	0.0	0.0

Watershed Characteristics

Subcatchment Area (acres)						
Percent Impervious						
NRCS Soil Type						

Watershed Profile

Overland Slope (ft/ft)						
Overland Length (ft)						
Channel Slope (ft/ft)						
Channel Length (ft)						

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)						
One-Hour Precipitation, P_1 (inches)						

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**2.6**	**1.7**	**2.8**	**1.6**	**1.9**	**0.1**
Major Total Design Peak Flow, Q (cfs)	**5.6**	**3.6**	**5.4**	**3.2**	**4.8**	**0.9**
Minor Flow Bypassed Downstream, Q_b (cfs)	N/A	0.3	N/A	N/A	0.6	0.0
Major Flow Bypassed Downstream, Q_b (cfs)	N/A	1.3	N/A	N/A	2.6	0.0

Minor Storm (Calculated) Analysis of Flow T

C	N/A	N/A	N/A	N/A	N/A	N/A
C_5	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A

Major Storm (Calculated) Analysis of Flow T

C	N/A	N/A	N/A	N/A	N/A	N/A
C_5	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Velocity, Vi	N/A	N/A	N/A	N/A	N/A	N/A
Channel Flow Velocity, Vt	N/A	N/A	N/A	N/A	N/A	N/A
Overland Flow Time, Ti	N/A	N/A	N/A	N/A	N/A	N/A
Channel Travel Time, Tt	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Time of Concentration, T_c	N/A	N/A	N/A	N/A	N/A	N/A
Regional T_c	N/A	N/A	N/A	N/A	N/A	N/A
Recommended T_c	N/A	N/A	N/A	N/A	N/A	N/A
T_c selected by User	N/A	N/A	N/A	N/A	N/A	N/A
Design Rainfall Intensity, I	N/A	N/A	N/A	N/A	N/A	N/A
Calculated Local Peak Flow, Q_p	N/A	N/A	N/A	N/A	N/A	N/A

Version 4.05 Released March 2017

INLET MANAGEMENT

Worksheet Protected

INLET NAME	DP5
Site Type (Urban or Rural)	URBAN
Inlet Application (Street or Area)	STREET
Hydraulic Condition	On Grade
Inlet Type	Denver No. 16 Combination

USER-DEFINED INPUT

User-Defined Design Flows

Minor Q_{Known} (cfs)	2.0
Major Q_{Known} (cfs)	4.2

Bypass (Carry-Over) Flow from Upstream

Receive Bypass Flow from:	No Bypass Flow Received
Minor Bypass Flow Received, Q_b (cfs)	0.0
Major Bypass Flow Received, Q_b (cfs)	0.0

Watershed Characteristics

Subcatchment Area (acres)	
Percent Impervious	
NRCS Soil Type	

Watershed Profile

Overland Slope (ft/ft)	
Overland Length (ft)	
Channel Slope (ft/ft)	
Channel Length (ft)	

Minor Storm Rainfall Input

Design Storm Return Period, T_r (years)	
One-Hour Precipitation, P_1 (inches)	

Major Storm Rainfall Input

Design Storm Return Period, T_r (years)	
One-Hour Precipitation, P_1 (inches)	

CALCULATED OUTPUT

Minor Total Design Peak Flow, Q (cfs)	**2.0**
Major Total Design Peak Flow, Q (cfs)	**4.2**
Minor Flow Bypassed Downstream, Q_b (cfs)	0.4
Major Flow Bypassed Downstream, Q_b (cfs)	1.5

Minor Storm (Calculated) Analysis of Flow T

C	N/A
C_s	N/A
Overland Flow Velocity, Vi	N/A
Channel Flow Velocity, Vt	N/A
Overland Flow Time, Ti	N/A
Channel Travel Time, Tt	N/A
Calculated Time of Concentration, T_c	N/A
Regional T_c	N/A
Recommended T_c	N/A
T_c selected by User	N/A
Design Rainfall Intensity, I	N/A
Calculated Local Peak Flow, Q_p	N/A

Major Storm (Calculated) Analysis of Flow T

C	N/A
C_s	N/A
Overland Flow Velocity, Vi	N/A
Channel Flow Velocity, Vt	N/A
Overland Flow Time, Ti	N/A
Channel Travel Time, Tt	N/A
Calculated Time of Concentration, T_c	N/A
Regional T_c	N/A
Recommended T_c	N/A
T_c selected by User	N/A
Design Rainfall Intensity, I	N/A
Calculated Local Peak Flow, Q_p	N/A

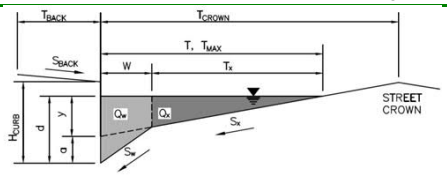
Version 4.05 Released March 2017

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

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

Project: PALMER VILLAGE

Inlet ID: DP3



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	21.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.014	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	21.0	21.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

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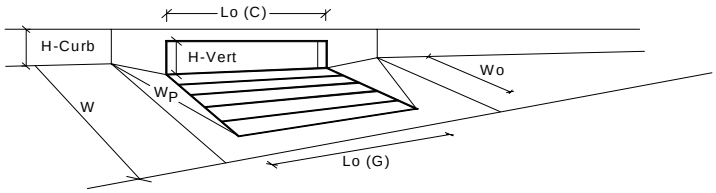


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.6	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.523	0.569	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.38	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.71	0.77	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.71	0.77	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**6.2**	**7.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.0	6.2	cfs

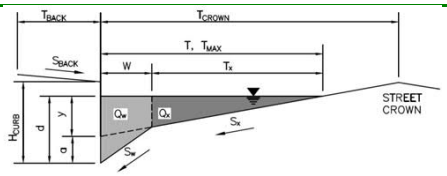
Version 4.05 Released March 2017

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

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

Project: PALMER VILLAGE

Inlet ID: DP4



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	8.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.011	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.014	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	4.4	6.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

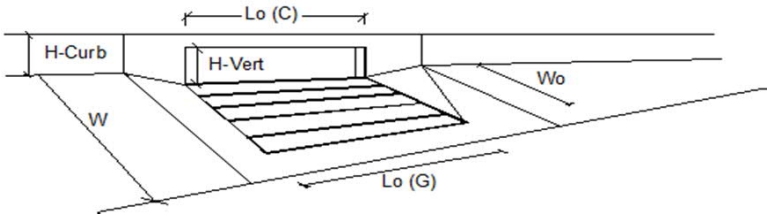
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**5.6**	**5.6**	**cfs**

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

WARNING: MAJOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.9**	**3.4**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.5**	**2.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**80**	**60**	**%**

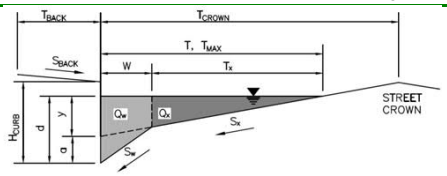
Version 4.05 Released March 2017

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

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

Project: PALMER VILLAGE

Inlet ID: DP5



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	7.5	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.013	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.007	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.014	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	21.0	21.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

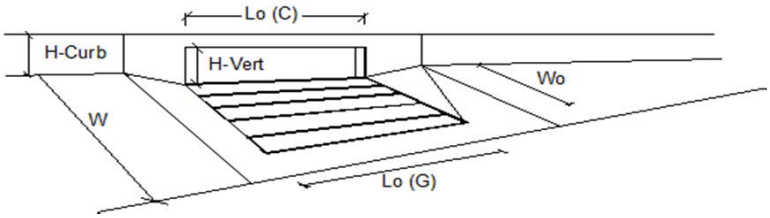
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**8.5**	**8.5**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.6**	**2.7**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.4**	**1.5**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**82**	**64**	**%**

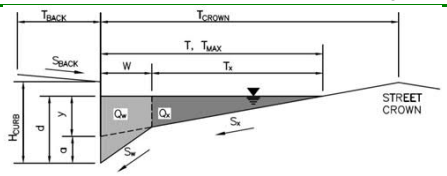
Version 4.05 Released March 2017

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

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

Project: PALMER VILLAGE

Inlet ID: DP8



Gutter Geometry (Enter data in the blue cells)

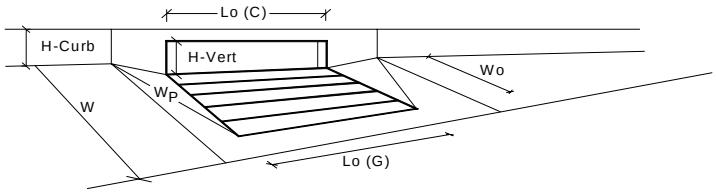
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	30.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.009	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.014	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	30.0	30.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.9	4.9	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.432	0.432	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.24	0.24	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.46	0.46	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.90	0.90	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.46	0.46	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**4.3**	**4.3**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	2.4	5.9	cfs

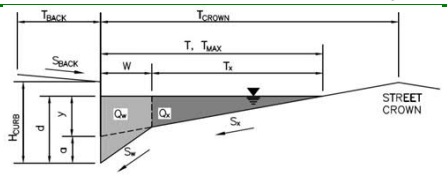
Version 4.05 Released March 2017

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

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

Project: PALMER VILLAGE

Inlet ID: DP9



Gutter Geometry (Enter data in the blue cells)

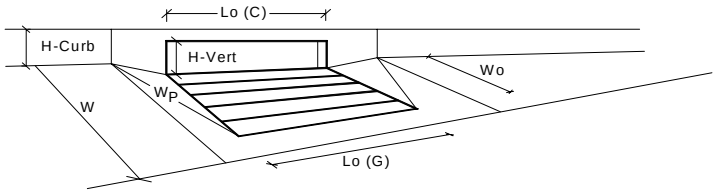
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	21.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.014	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	21.0	21.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.6	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.523	0.569	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.38	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.62	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.97	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.57	0.62	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**7.6**	**9.6**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	3.4	9.2	cfs

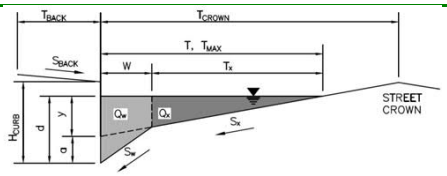
Version 4.05 Released March 2017

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

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

Project: PALMER VILLAGE

Inlet ID: DP17



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.029	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.014	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

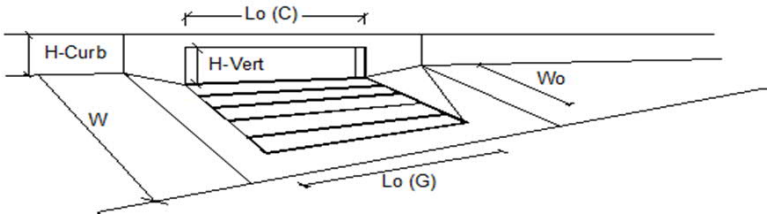
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**9.1**	**9.1**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.4**	**2.3**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.3**	**1.3**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**82**	**64**	**%**

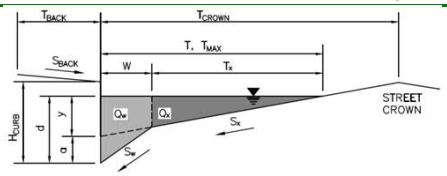
Version 4.05 Released March 2017

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

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

Project: PALMER VILLAGE

Inlet ID: DP18



Gutter Geometry (Enter data in the blue cells)

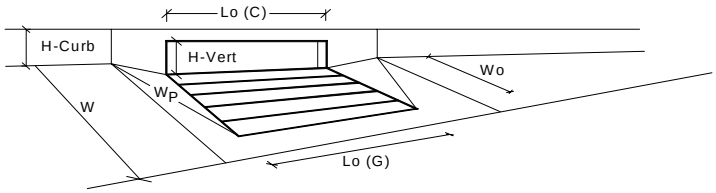
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	21.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.014	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	21.0	21.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.6	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.523	0.569	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.38	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.71	0.77	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.71	0.77	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**6.2**	**7.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.8	5.4	cfs

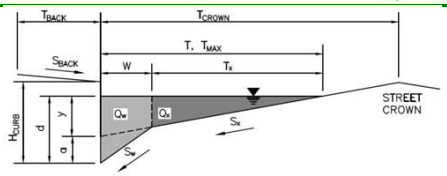
Version 4.05 Released March 2017

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

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

Project: PALMER VILLAGE

Inlet ID: DP19



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.025	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.014	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Allow Flow Depth at Street Crown (leave blank for no)		☐	☐	check = yes

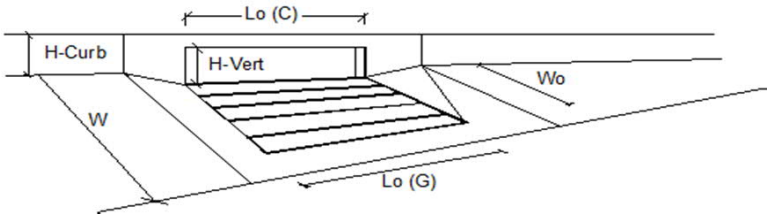
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**8.5**	**8.5**	**cfs**

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

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

INLET ON A CONTINUOUS GRADE

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (Denver No. 16 Combination)	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)	L_o =	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)	W_o =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)	C_f-G =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)	C_f-C =	0.10	0.10	

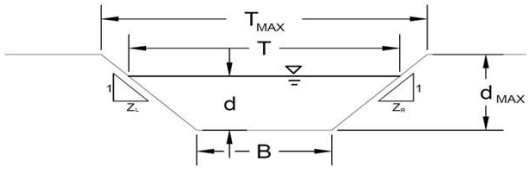
Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.3**	**2.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.6**	**2.6**	**cfs**
Capture Percentage = Q_a/Q_o =	**C% =**	**68**	**45**	**%**

Version 4.05 Released March 2017

AREA INLET IN A SWALE

PALMER VILLAGE

DP21



This worksheet uses the NRCS vegetal retardance method to determine Manning's n.

For more information see Section 7.2.3 of the USDCM.

Analysis of Trapezoidal Grass-Lined Channel Using SCS Method

NRCS Vegetal Retardance (A, B, C, D, or E)	A, B, C, D or E	C	
Manning's n (Leave cell D16 blank to manually enter an n value)	n =	see details below	
Channel Invert Slope	S_O =	0.0300	ft/ft
Bottom Width	B =	1.00	ft
Left Side Slope	Z1 =	4.00	ft/ft
Right Side Slope	Z2 =	3.00	ft/ft

Check one of the following soil types:

Soil Type:	Max. Velocity (V_{MAX})	Max Froude No. (F_{MAX})
Non-Cohesive	5.0 fps	0.60
Cohesive	7.0 fps	0.80
Paved	N/A	N/A

Choose One:
- ○ Non-Cohesive
- ◉ Cohesive
- ○ Paved

		Minor Storm	Major Storm	
Max. Allowable Top Width of Channel for Minor & Major Storm	T_{MAX} =	6.00	6.00	feet
Max. Allowable Water Depth in Channel for Minor & Major Storm	d_{MAX} =	1.00	1.00	feet

Allowable Channel Capacity Based On Channel Geometry

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Top Width Criterion	Q_{allow} =	1.7	1.7	cfs
MAJOR STORM Allowable Capacity is based on Top Width Criterion	d_{allow} =	0.71	0.71	ft

Water Depth in Channel Based On Design Peak Flow

Design Peak Flow	Q_o =	0.1	0.9	cfs
Water Depth	d =	0.27	0.67	feet

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

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

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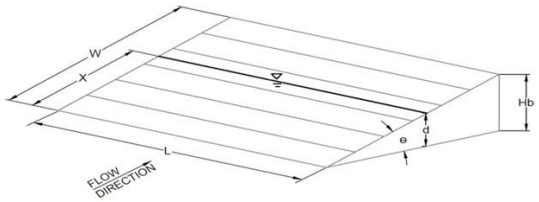
AREA INLET IN A SWALE

PALMER VILLAGE

DP21

Inlet Design Information (Input)

Type of Inlet: CDOT Type C — Inlet Type = CDOT Type C



Angle of Inclined Grate (must be <= 30 degrees)	θ =	0.00	degrees
Width of Grate	W =	3.00	feet
Length of Grate	L =	3.00	feet
Open Area Ratio	A_{RATIO} =	0.70	
Height of Inclined Grate	H_B =	0.00	feet
Clogging Factor	C_f =	0.50	
Grate Discharge Coefficient	C_d =	0.96	
Orifice Coefficient	C_o =	0.64	
Weir Coefficient	C_w =	2.05	

		MINOR	MAJOR	
Water Depth at Inlet (for depressed inlets, 1 foot is added for depression)	d =	0.27	0.67	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.6**	**10.0**	**cfs**
	Bypassed Flow, Q_b =	**0.0**	**0.0**	**cfs**
	Capture Percentage = Q_a/Q_o = C%	**100**	**100**	**%**

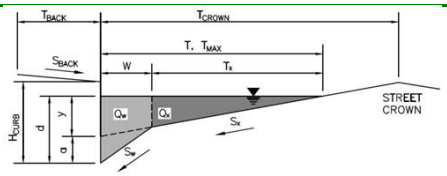
Version 4.05 Released March 2017

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

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

Project: PALMER VILLAGE

Inlet ID: DP22



Gutter Geometry (Enter data in the blue cells)

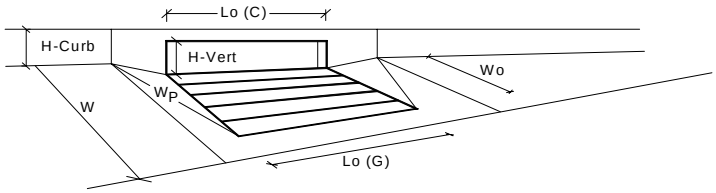
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.014	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	4.4	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.389	0.389	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.20	0.20	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.52	0.52	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.52	0.52	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**2.6**	**2.6**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	1.6	3.2	cfs

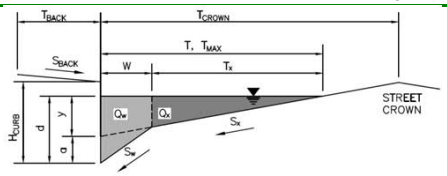
Version 4.05 Released March 2017

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

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

Project: PALMER VILLAGE

Inlet ID: DP23



Gutter Geometry (Enter data in the blue cells)

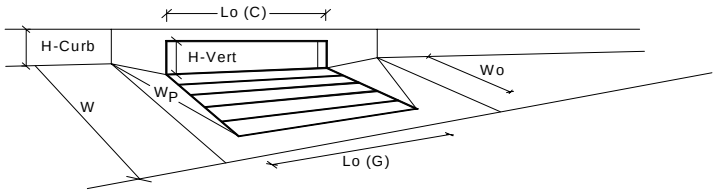
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	21.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.014	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	21.0	21.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	2	2	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.6	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.523	0.569	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.38	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.71	0.77	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	1.00	1.00	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.71	0.77	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**6.2**	**7.9**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)	$Q_{PEAK\ REQUIRED}$ =	2.6	5.6	cfs

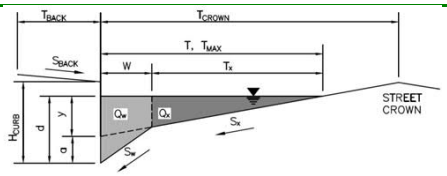
Version 4.05 Released March 2017

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

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

Project: PALMER VILLAGE

Inlet ID: DP24



Gutter Geometry (Enter data in the blue cells)

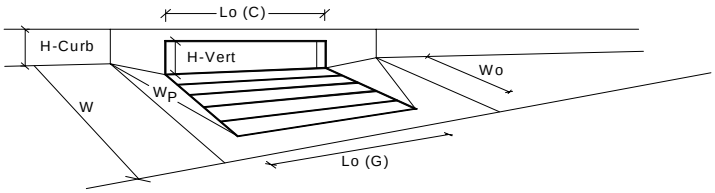
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.018	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	12.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.020	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.014	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	12.0	12.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	8.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

Version 4.05 Released March 2017



Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	4.4	4.4	inches
Grate Information		MINOR	MAJOR	☐ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	

Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.389	0.389	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.20	0.20	ft
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.41	0.41	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.86	0.86	
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.41	0.41	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**3.2**	**3.2**	**cfs**
WARNING: Inlet Capacity less than Q Peak for Major Storm	$Q_{PEAK\ REQUIRED}$ =	1.0	3.2	cfs

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Jan 15 2021

SWALE A

Triangular

Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 0.33
Invert Elev (ft)	= 1.00
Slope (%)	= 1.00
N-Value	= 0.013

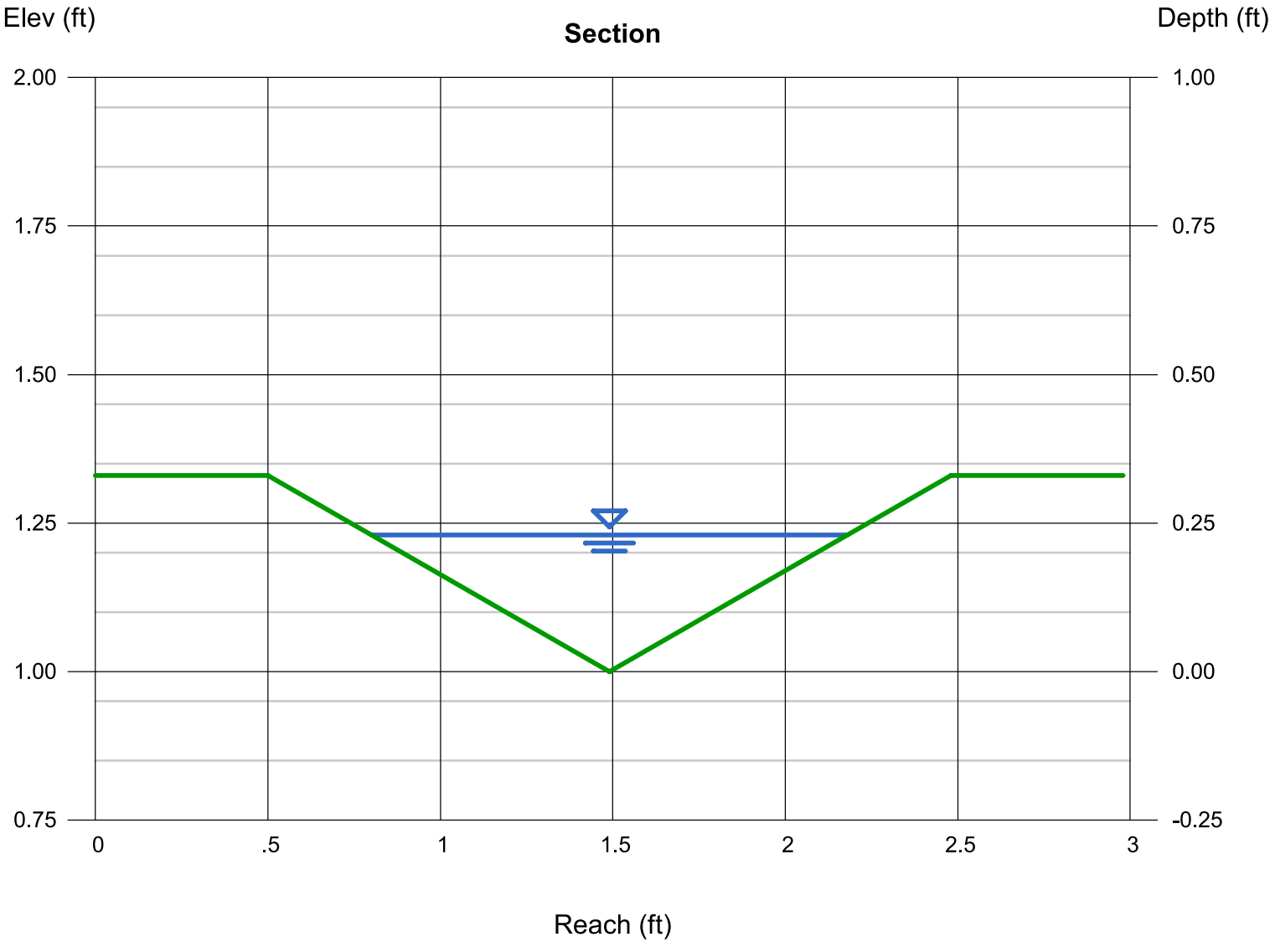
Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.38

Highlighted

Depth (ft)	= 0.23
Q (cfs)	= 0.380
Area (sqft)	= 0.16
Velocity (ft/s)	= 2.39
Wetted Perim (ft)	= 1.45
Crit Depth, Yc (ft)	= 0.26
Top Width (ft)	= 1.38
EGL (ft)	= 0.32

100-year Flow Calculation:
Area drainage to swale: 0.14 ac
Basin A10 area: 0.78 ac
Percentage of Basin A10 draining to swale: 18%
Basin A10 Q100: 2.1 cfs
Q100 in swale: 0.38 cfs (2.1 cfs * 18%)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Jan 15 2021

SWALE B

Triangular

Side Slopes (z:1)	= 5.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 3.06
N-Value	= 0.040

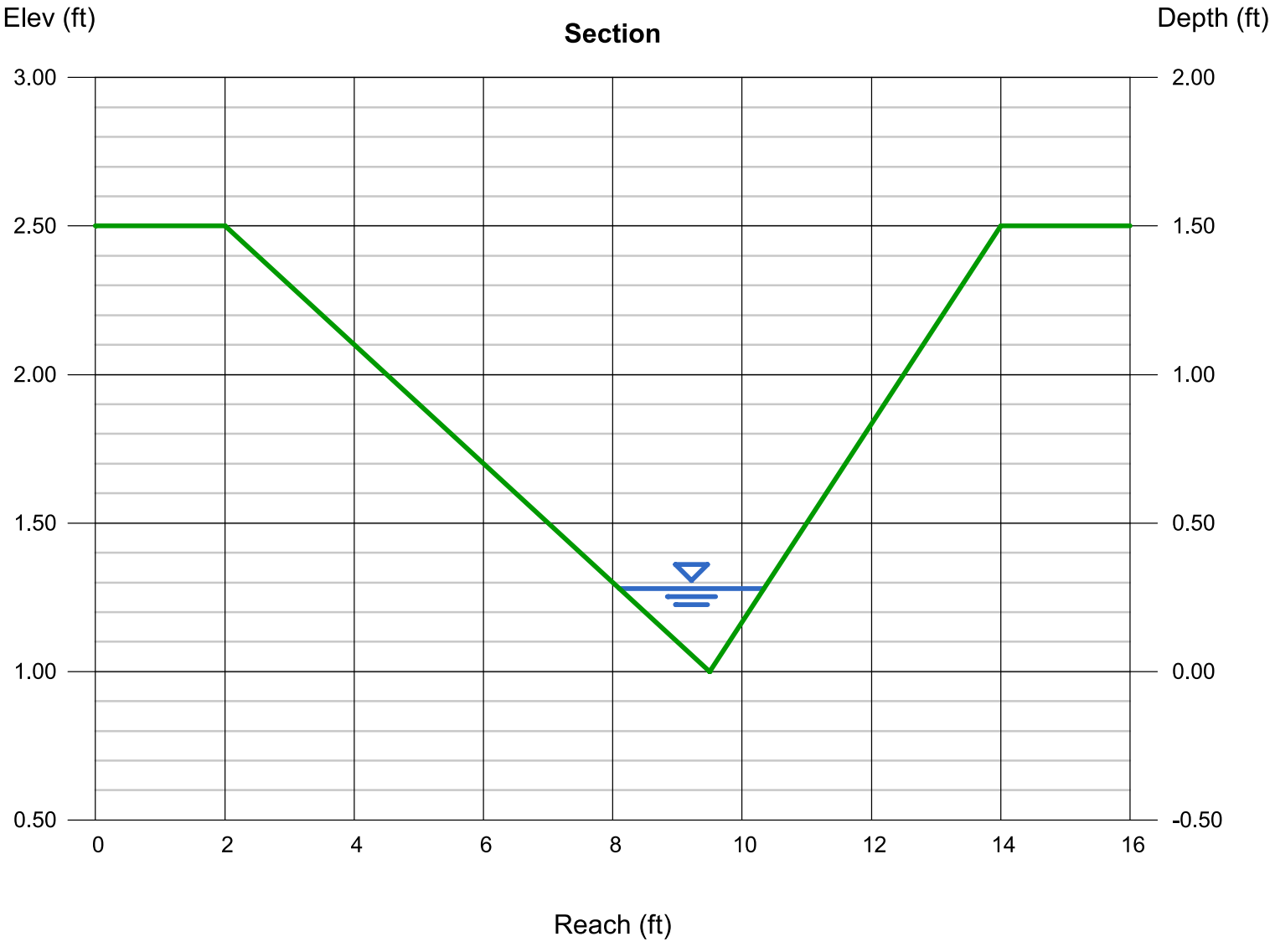
Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.52

Highlighted

Depth (ft)	= 0.28
Q (cfs)	= 0.520
Area (sqft)	= 0.31
Velocity (ft/s)	= 1.66
Wetted Perim (ft)	= 2.31
Crit Depth, Yc (ft)	= 0.26
Top Width (ft)	= 2.24
EGL (ft)	= 0.32

Area draining to Swale B: 0.18 ac
Basin B9 area: 0.31 ac
Percentage of Basin B9 draining to Swale B: 58%
Basin B9 Q100: 0.9 cfs
Q100 in Swale B: 0.52 cfs (0.9 cfs * 58%)



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Jan 15 2021

SWALE B'

Triangular

Side Slopes (z:1)	= 8.00, 3.00
Total Depth (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 3.06
N-Value	= 0.040

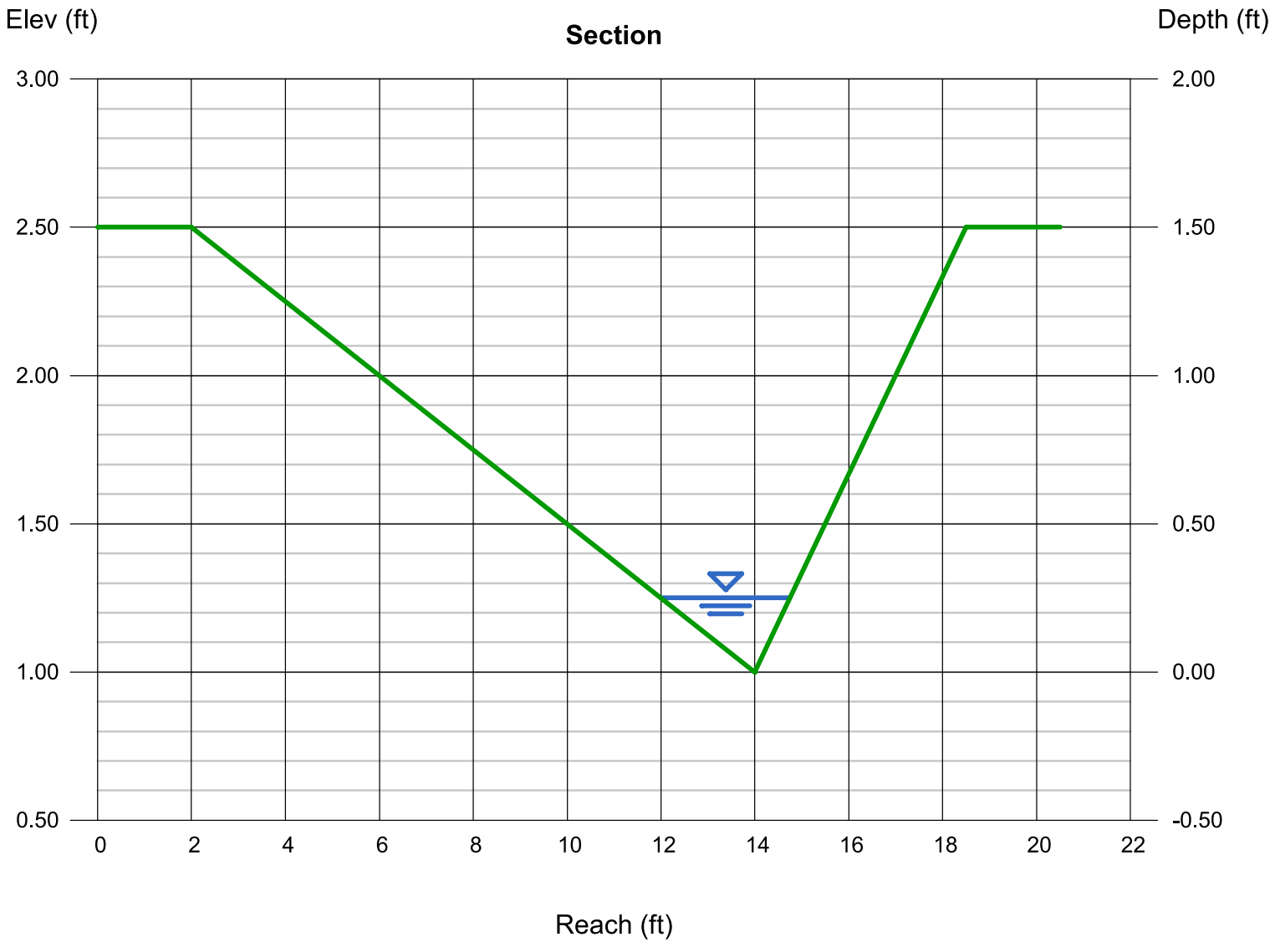
Highlighted

Depth (ft)	= 0.25
Q (cfs)	= 0.520
Area (sqft)	= 0.34
Velocity (ft/s)	= 1.51
Wetted Perim (ft)	= 2.81
Crit Depth, Yc (ft)	= 0.23
Top Width (ft)	= 2.75
EGL (ft)	= 0.29

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.52

See 100-year flow calculation on Swale B Channel Report.



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Jan 15 2021

SWALE C

Triangular

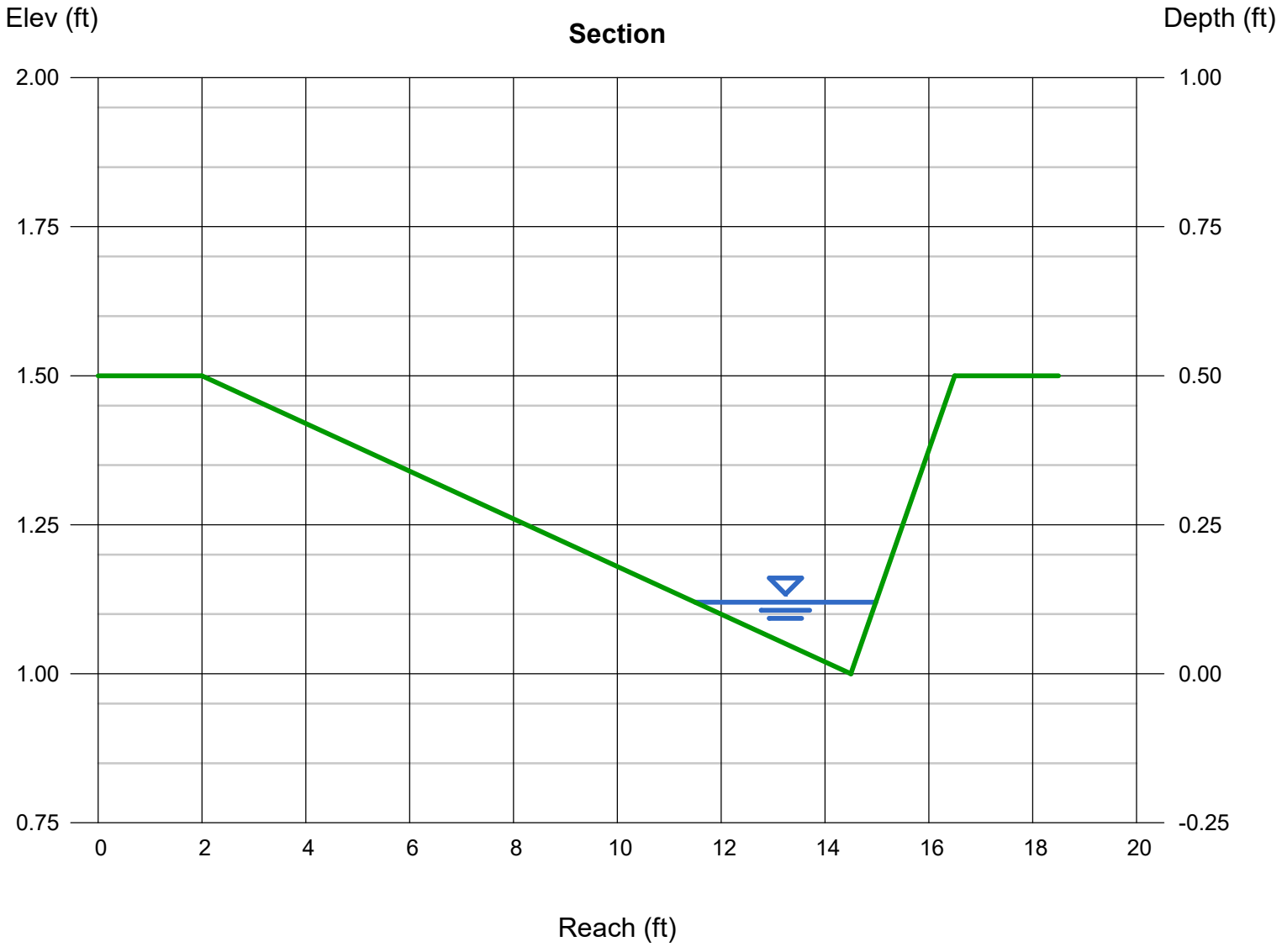
Side Slopes (z:1)	= 25.00, 4.00
Total Depth (ft)	= 0.50
Invert Elev (ft)	= 1.00
Slope (%)	= 4.80
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.30

Highlighted

Depth (ft)	= 0.12
Q (cfs)	= 0.300
Area (sqft)	= 0.21
Velocity (ft/s)	= 1.44
Wetted Perim (ft)	= 3.50
Crit Depth, Yc (ft)	= 0.13
Top Width (ft)	= 3.48
EGL (ft)	= 0.15



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Jan 15 2021

SWALE C'

Triangular

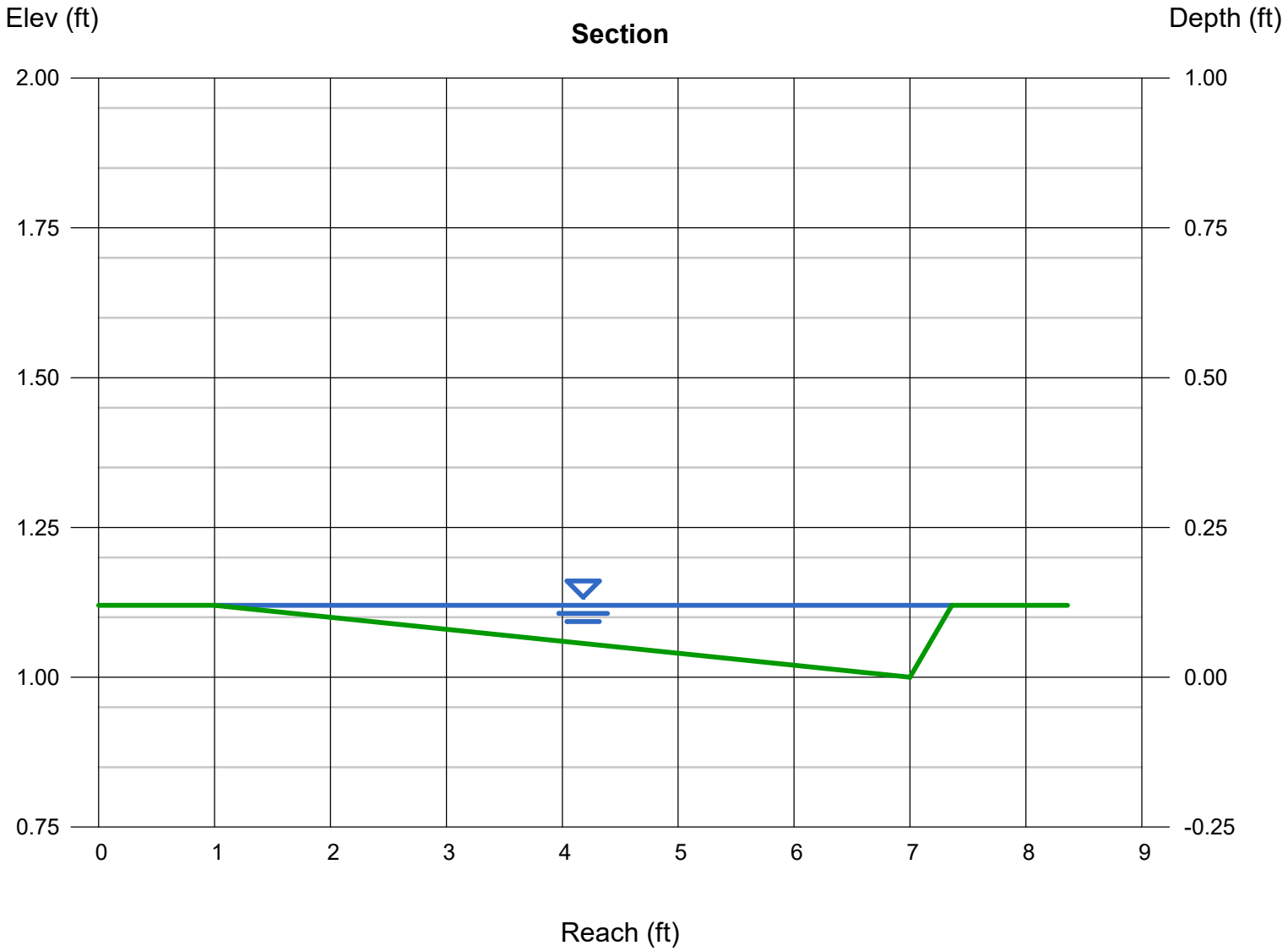
Side Slopes (z:1)	= 50.00, 3.00
Total Depth (ft)	= 0.12
Invert Elev (ft)	= 1.00
Slope (%)	= 1.50
N-Value	= 0.030

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.30

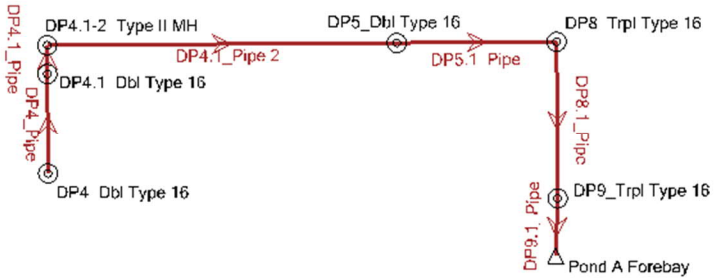
Highlighted

Depth (ft)	= 0.12
Q (cfs)	= 0.300
Area (sqft)	= 0.38
Velocity (ft/s)	= 0.79
Wetted Perim (ft)	= 6.38
Crit Depth, Yc (ft)	= 0.10
Top Width (ft)	= 6.36
EGL (ft)	= 0.13



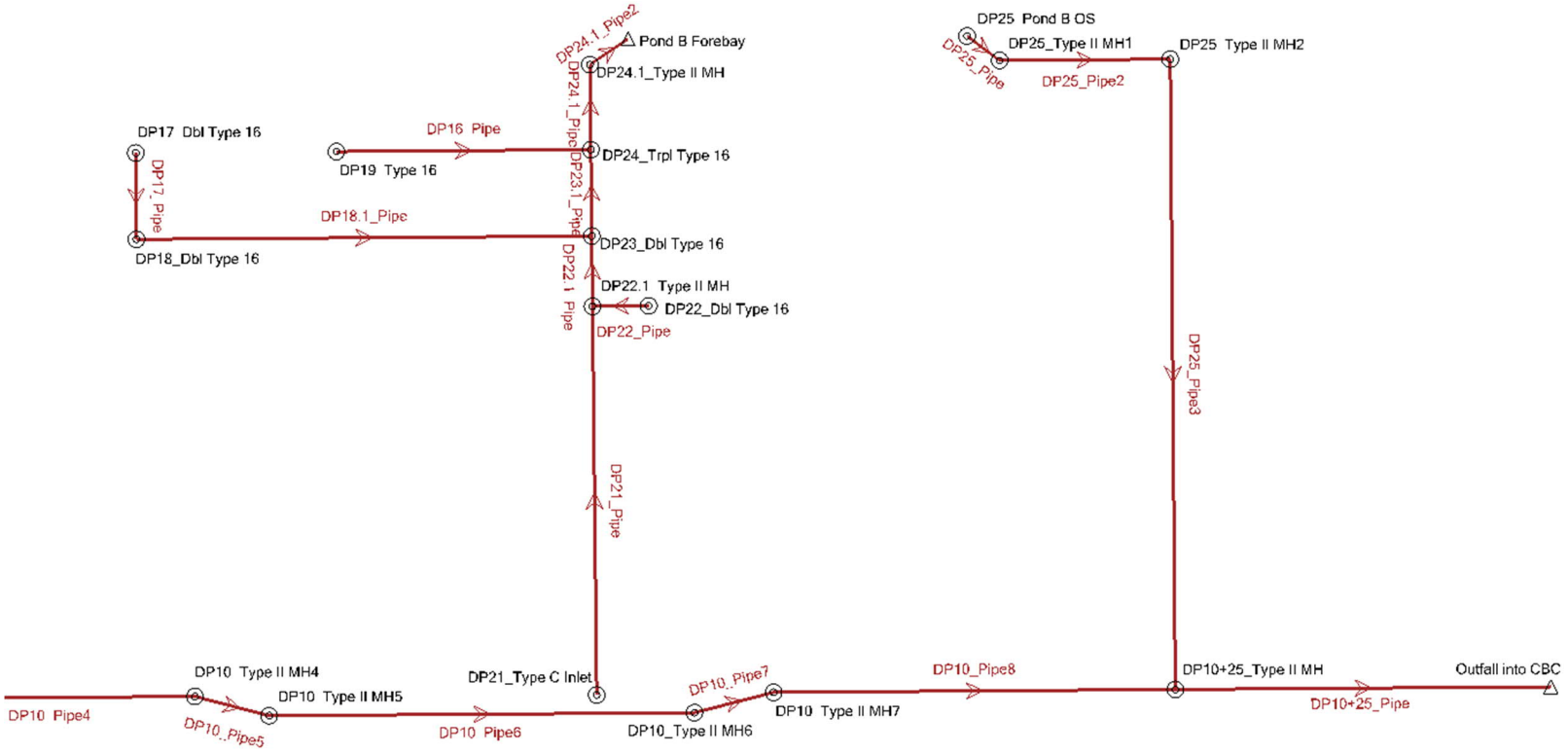
URBAN COLLECTION AT BRIARGATE SQUARE

StormCAD Map 1



URBAN COLLECTION AT BRIARGATE SQUARE

StormCAD Map 2



URBAN COLLECTION AT BRIARGATE SQUARE

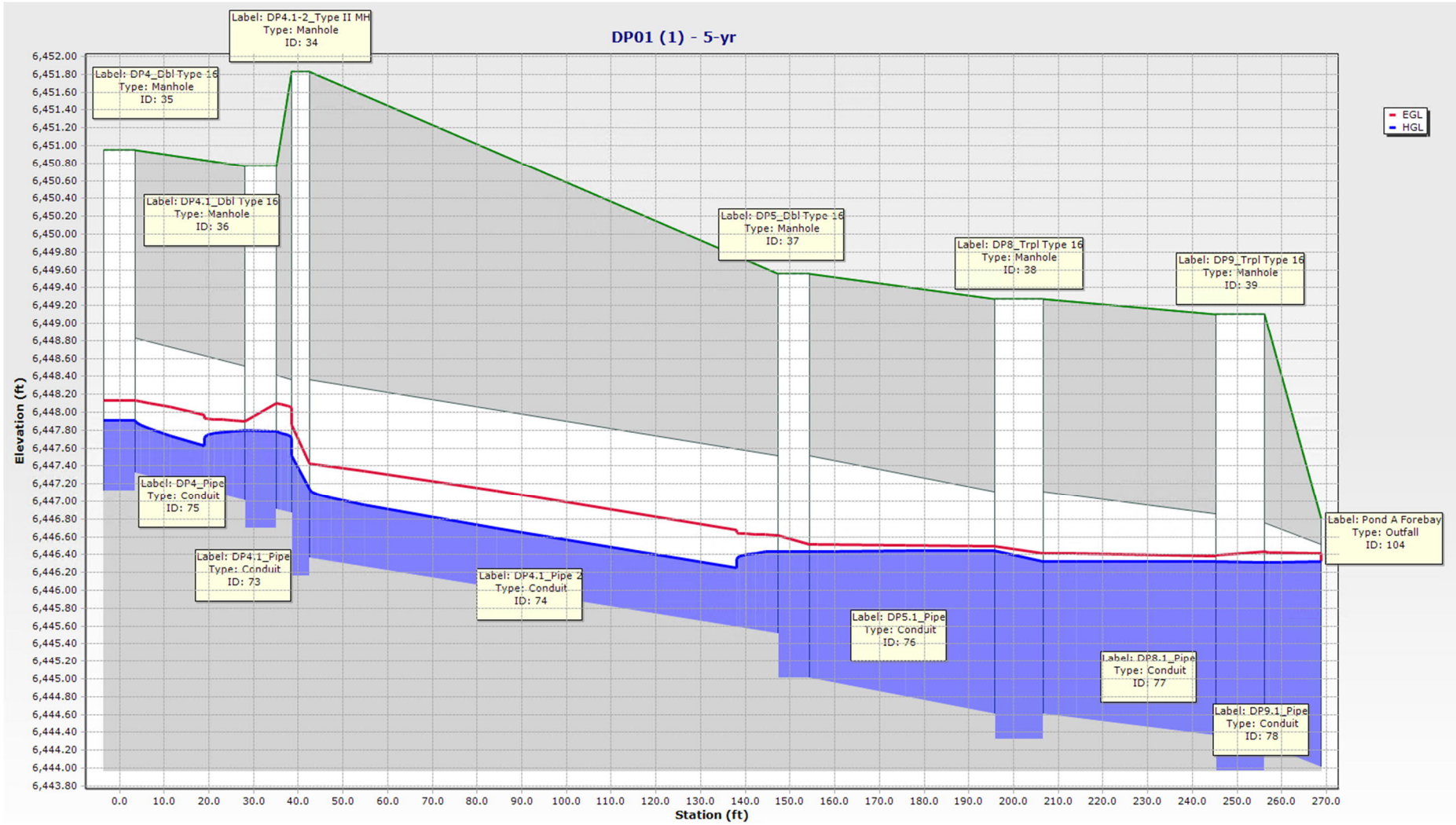
StormCAD Pipe and Node Report - 5-Year

Upstream Structure	Label	Flow (cfs)	Velocity (ft/s)	Diameter (in)	Slope (ft/ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	HGL (Up) (ft)	HGL (Down) (ft)	EGL (In) (ft)	EGL (Out) (ft)	Upstream Structure Headloss Coefficient	Length (ft)	Capacity (Full Flow) (cfs)	Manning's n
DP4.1_Dbl Type 16	DP4.1_Pipe	4.8	4.47	18	0.005	6,446.91	6,446.87	6,450.77	6,451.83	6,447.79	6,447.71	6,448.10	6,448.05	0.05	9	7.43	0.013
DP4.1-2_Type II MH	DP4.1_Pipe 2	4.8	5.22	24	0.008	6,446.37	6,445.51	6,451.83	6,449.55	6,447.14	6,446.44	6,447.43	6,446.62	1.32	110.2	19.93	0.013
DP4_Dbl Type 16	DP4_Pipe	2.4	4.81	18	0.01	6,447.33	6,447.01	6,450.95	6,450.77	6,447.91	6,447.80	6,448.13	6,447.90	0	31.5	10.5	0.013
DP5_Dbl Type 16	DP5.1_Pipe	6.6	5.65	30	0.008	6,445.01	6,444.61	6,449.55	6,449.27	6,446.44	6,446.45	6,446.52	6,446.49	0.05	50.4	36.58	0.013
DP8_Trpl Type 16	DP8.1_Pipe	8.7	5.16	30	0.005	6,444.61	6,444.36	6,449.27	6,449.11	6,446.33	6,446.32	6,446.42	6,446.39	1.32	49.5	29	0.013
DP9_Trpl Type 16	DP9.1_Pipe	11.8	8.07	30	0.014	6,444.26	6,444.01	6,449.11	6,446.80	6,446.31	6,446.32	6,446.43	6,446.42	0.05	18	47.87	0.013
DP10+25_Type II MH	DP10+25_Pipe	0.4	2.04	36	0.005	6,426.88	6,426.20	6,434.67	6,429.54	6,427.08	6,426.40	6,427.14	6,426.46	1.02	136.1	47.16	0.013
DP10_Pond A OS	DP10_Pipe1	0.2	2.35	30	0.013	6,441.24	6,440.73	6,444.03	6,452.20	6,441.39	6,440.84	6,441.44	6,440.93	0	40.2	46.54	0.013
DP10_Type II MH1	DP10_Pipe2	0.2	2.9	30	0.024	6,440.62	6,436.77	6,452.20	6,452.64	6,440.77	6,436.88	6,440.82	6,437.01	0.4	163.4	62.96	0.013
DP10_Type II MH2	DP10_Pipe3	0.2	1.69	30	0.005	6,435.77	6,435.34	6,452.64	6,452.54	6,435.92	6,435.48	6,435.97	6,435.53	0.05	86.6	29	0.013
DP10_Type II MH3	DP10_Pipe4	0.2	1.7	30	0.005	6,435.24	6,433.94	6,452.54	6,442.89	6,435.39	6,434.09	6,435.44	6,434.14	0.05	257.9	29.11	0.013
DP10_Type II MH4	DP10_Pipe5	0.2	2.64	30	0.018	6,433.84	6,433.34	6,442.89	6,442.41	6,433.99	6,433.45	6,434.04	6,433.56	0.1	27.8	55.12	0.013
DP10_Type II MH5	DP10_Pipe6	0.2	2.57	30	0.016	6,433.24	6,430.70	6,442.41	6,437.77	6,433.39	6,430.81	6,433.44	6,430.92	0.1	154.2	52.64	0.013
DP10_Type II MH6	DP10_Pipe7	0.2	2.48	30	0.015	6,430.61	6,430.16	6,437.77	6,437.81	6,430.75	6,430.28	6,430.80	6,430.37	0.1	29.6	50.23	0.013
DP10_Type II MH7	DP10_Pipe8	0.2	2.48	30	0.015	6,430.07	6,427.88	6,437.81	6,434.67	6,430.21	6,428.00	6,430.26	6,428.09	0.1	145.6	50.23	0.013
DP19_Type 16	DP16_Pipe	1.2	3.75	18	0.009	6,435.37	6,434.57	6,439.82	6,438.25	6,435.78	6,435.03	6,435.92	6,435.14	0	92.2	9.75	0.013
DP17_Dbl Type 16	DP17_Pipe	1.4	4.13	18	0.01	6,437.63	6,437.31	6,441.89	6,441.71	6,438.18	6,438.21	6,438.27	6,438.24	0	31.5	10.5	0.013
DP18_Dbl Type 16	DP18.1_Pipe	4.2	6.32	18	0.014	6,437.01	6,434.73	6,441.71	6,438.07	6,437.80	6,435.65	6,438.11	6,435.86	1.32	165	12.35	0.013
DP21_Type C Inlet	DP21_Pipe	0.1	1.48	18	0.005	6,435.67	6,434.96	6,437.98	6,439.33	6,435.79	6,435.69	6,435.82	6,435.69	0	140.9	7.43	0.013
DP22.1_Type II MH	DP22.1_Pipe	1.5	3.29	18	0.005	6,434.86	6,434.73	6,439.33	6,438.07	6,435.65	6,435.65	6,435.69	6,435.68	1.02	25.4	7.42	0.013
DP22_Dbl Type 16	DP22_Pipe	1.4	4.13	18	0.01	6,435.05	6,434.84	6,438.42	6,439.33	6,435.68	6,435.69	6,435.74	6,435.72	0	20.3	10.5	0.013
DP23_Dbl Type 16	DP23.1_Pipe	8.1	5.11	24	0.005	6,434.23	6,434.07	6,438.07	6,438.25	6,435.24	6,435.08	6,435.64	6,435.49	1.02	31.5	16	0.013
DP24_Trpl Type 16	DP24.1_Pipe	10	5.41	30	0.005	6,433.57	6,433.41	6,438.25	6,438.48	6,434.63	6,434.59	6,435.03	6,434.89	1.02	30.7	29.34	0.013
DP24.1_Type II MH	DP24.1_Pipe2	10	5.97	30	0.007	6,433.11	6,433.00	6,438.48	6,435.79	6,434.51	6,434.52	6,434.70	6,434.68	0.4	16.6	33.58	0.013
DP25_Pond B OS	DP25_Pipe	0.2	1.72	30	0.005	6,430.84	6,430.77	6,433.63	6,438.04	6,430.99	6,430.91	6,431.04	6,430.96	0	14.8	29.53	0.013
DP25_Type II MH1	DP25_Pipe2	0.2	1.69	30	0.005	6,430.56	6,430.25	6,438.04	6,436.82	6,430.71	6,430.40	6,430.76	6,430.45	0.4	61.8	29	0.013
DP25_Type II MH2	DP25_Pipe3	0.2	2.25	30	0.011	6,429.95	6,427.38	6,436.82	6,434.67	6,430.10	6,427.51	6,430.15	6,427.58	1.32	228.4	43.5	0.013

URBAN COLLECTION AT BRIARGATE SQUARE

StormCAD Pipe and Node Report - 100-Year

Upstream Structure	Label	Flow (cfs)	Velocity (ft/s)	Diameter (in)	Slope (ft/ft)	Invert (Start) (ft)	Invert (Stop) (ft)	Elevation Ground (Start) (ft)	Elevation Ground (Stop) (ft)	HGL (Up) (ft)	HGL (Down) (ft)	EGL (In) (ft)	EGL (Out) (ft)	Upstream Structure Headloss Coefficient	Length (ft)	Capacity (Full Flow) (cfs)	Manning's n
DP4.1_Dbl Type 16	DP4.1_Pipe	9.3	5.26	18	0.005	6,446.91	6,446.87	6,450.77	6,451.83	6,448.76	6,448.69	6,449.19	6,449.12	0.05	9	7.43	0.013
DP4.1-2_Type II MH	DP4.1_Pipe 2	9.3	2.96	24	0.008	6,446.37	6,445.51	6,451.83	6,449.55	6,448.51	6,448.32	6,448.65	6,448.46	1.32	110.2	19.93	0.013
DP4_Dbl Type 16	DP4_Pipe	3.4	5.3	18	0.01	6,447.33	6,447.01	6,450.95	6,450.77	6,448.81	6,448.78	6,448.87	6,448.84	0	31.5	10.5	0.013
DP5_Dbl Type 16	DP5.1_Pipe	13.4	2.73	30	0.008	6,445.01	6,444.61	6,449.55	6,449.27	6,448.32	6,448.26	6,448.43	6,448.38	0.05	50.4	36.58	0.013
DP8_Trpl Type 16	DP8.1_Pipe	14.9	3.04	30	0.005	6,444.61	6,444.36	6,449.27	6,449.11	6,448.07	6,448.01	6,448.22	6,448.15	1.32	49.5	29	0.013
DP9_Trpl Type 16	DP9.1_Pipe	23.8	4.85	30	0.014	6,444.26	6,444.01	6,449.11	6,447.93	6,447.99	6,447.93	6,448.36	6,448.30	0.05	18	47.87	0.013
DP10+25_Type II MH	DP10+25_Pipe	48.2	7.6	36	0.005	6,426.88	6,426.20	6,434.67	6,429.54	6,429.38	6,428.46	6,430.29	6,429.57	1.02	136.1	47.16	0.013
DP10_Pond A OS	DP10_Pipe1	25.6	9.71	30	0.013	6,441.24	6,440.73	6,444.03	6,452.20	6,442.97	6,442.66	6,443.75	6,443.27	0	40.2	46.54	0.013
DP10_Type II MH1	DP10_Pipe2	25.6	12.16	30	0.024	6,440.62	6,436.77	6,452.20	6,452.64	6,442.35	6,437.88	6,443.13	6,440.18	0.4	163.4	62.96	0.013
DP10_Type II MH2	DP10_Pipe3	25.6	6.67	30	0.005	6,435.77	6,435.34	6,452.64	6,452.54	6,437.60	6,437.10	6,438.29	6,437.85	0.05	86.6	29	0.013
DP10_Type II MH3	DP10_Pipe4	25.6	6.69	30	0.005	6,435.24	6,433.94	6,452.54	6,442.89	6,437.06	6,435.67	6,437.76	6,436.45	0.05	257.9	29.11	0.013
DP10_Type II MH4	DP10_Pipe5	25.6	11.02	30	0.018	6,433.84	6,433.34	6,442.89	6,442.41	6,435.57	6,434.70	6,436.35	6,436.08	0.1	27.8	55.12	0.013
DP10_Type II MH5	DP10_Pipe6	25.6	10.65	30	0.016	6,433.24	6,430.70	6,442.41	6,437.77	6,434.97	6,431.93	6,435.75	6,433.69	0.1	154.2	52.64	0.013
DP10_Type II MH6	DP10_Pipe7	25.6	10.28	30	0.015	6,430.61	6,430.16	6,437.77	6,437.81	6,432.33	6,431.56	6,433.11	6,432.84	0.1	29.6	50.23	0.013
DP10_Type II MH7	DP10_Pipe8	25.6	10.28	30	0.015	6,430.07	6,427.88	6,437.81	6,434.67	6,431.79	6,430.31	6,432.57	6,430.74	0.1	145.6	50.23	0.013
DP19_Type 16	DP16_Pipe	2.1	4.4	18	0.009	6,435.37	6,434.57	6,439.82	6,438.25	6,436.39	6,436.37	6,436.43	6,436.40	0	92.2	9.75	0.013
DP17_Dbl Type 16	DP17_Pipe	2.3	4.76	18	0.01	6,437.63	6,437.31	6,441.89	6,441.71	6,438.77	6,438.76	6,438.81	6,438.79	0	31.5	10.5	0.013
DP18_Dbl Type 16	DP18.1_Pipe	7.8	7.39	18	0.014	6,437.01	6,434.73	6,441.71	6,438.07	6,438.10	6,436.96	6,438.60	6,437.27	1.32	165	12.35	0.013
DP21_Type C Inlet	DP21_Pipe	0.9	2.84	18	0.005	6,435.67	6,434.96	6,437.98	6,439.33	6,437.06	6,437.05	6,437.07	6,437.06	0	140.9	7.43	0.013
DP22.1_Type II MH	DP22.1_Pipe	3.5	1.98	18	0.005	6,434.86	6,434.73	6,439.33	6,438.07	6,436.99	6,436.96	6,437.05	6,437.02	1.02	25.4	7.42	0.013
DP22_Dbl Type 16	DP22_Pipe	2.6	1.47	18	0.01	6,435.05	6,434.84	6,438.42	6,439.33	6,437.07	6,437.05	6,437.10	6,437.09	0	20.3	10.5	0.013
DP23_Dbl Type 16	DP23.1_Pipe	16.3	5.19	24	0.005	6,434.23	6,434.07	6,438.07	6,438.25	6,436.54	6,436.37	6,436.96	6,436.79	1.02	31.5	16	0.013
DP24_Trpl Type 16	DP24.1_Pipe	21.1	4.3	30	0.005	6,433.57	6,433.41	6,438.25	6,438.48	6,436.08	6,436.00	6,436.37	6,436.29	1.02	30.7	29.34	0.013
DP24.1_Type II MH	DP24.1_Pipe2	21.1	4.3	30	0.007	6,433.11	6,433.00	6,438.48	6,435.84	6,435.88	6,435.84	6,436.17	6,436.13	0.4	16.6	33.58	0.013
DP25_Pond B OS	DP25_Pipe	22.6	6.63	30	0.005	6,430.84	6,430.77	6,433.63	6,438.04	6,432.81	6,432.79	6,433.27	6,433.23	0	14.8	29.53	0.013
DP25_Type II MH1	DP25_Pipe2	22.6	6.53	30	0.005	6,430.56	6,430.25	6,438.04	6,436.82	6,432.61	6,432.50	6,433.04	6,432.87	0.4	61.8	29	0.013
DP25_Type II MH2	DP25_Pipe3	22.6	8.95	30	0.011	6,429.95	6,427.38	6,436.82	6,434.67	6,431.57	6,430.31	6,432.27	6,430.64	1.32	228.4	43.5	0.013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Label: DP4_Dbl Type 16
Type: Manhole
ID: 35
Label: DP4.1_Dbl Type 16
Type: Manhole
ID: 36
Label: DP5_Dbl Type 16
Type: Manhole
ID: 37
Label: DP8_Trpl Type 16
Type: Manhole
ID: 38
Label: DP9_Trpl Type 16
Type: Manhole
ID: 39
Label: Pond A Forebay
Type: Outfall
ID: 104
Label: DP4_Pipe
Type: Conduit
ID: 75
Label: DP4.1_Pipe
Type: Conduit
ID: 73
Label: DP4.1_Pipe 2
Type: Conduit
ID: 74
Label: DP5.1_Pipe
Type: Conduit
ID: 76
Label: DP8.1_Pipe
Type: Conduit
ID: 77
Label: DP9.1_Pipe
Type: Conduit
ID: 78
EGL
HGL
Elevation (ft)
Station (ft)
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6,451.80
6,451.60
6,451.40
6,451.20
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6,450.60
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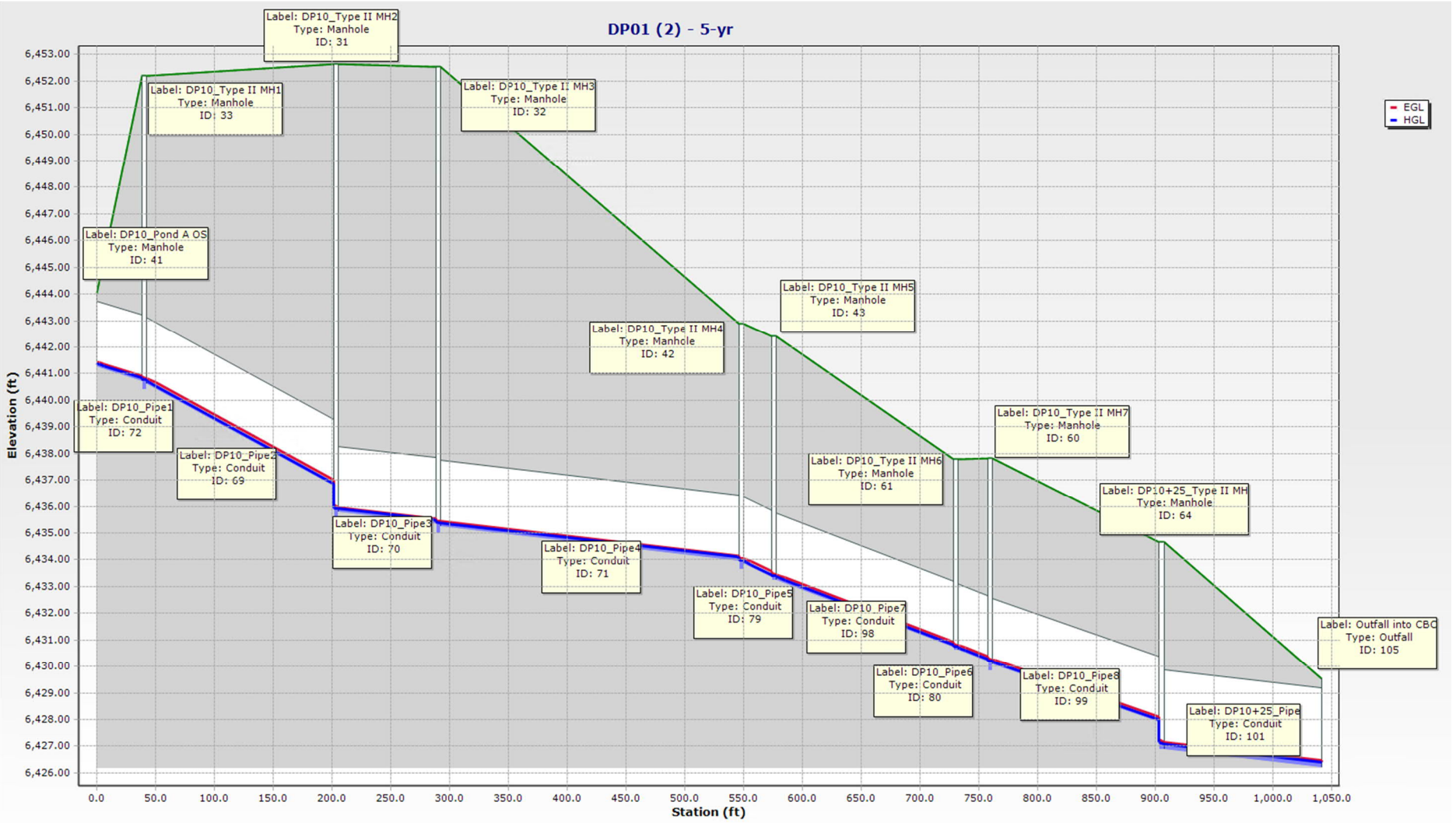
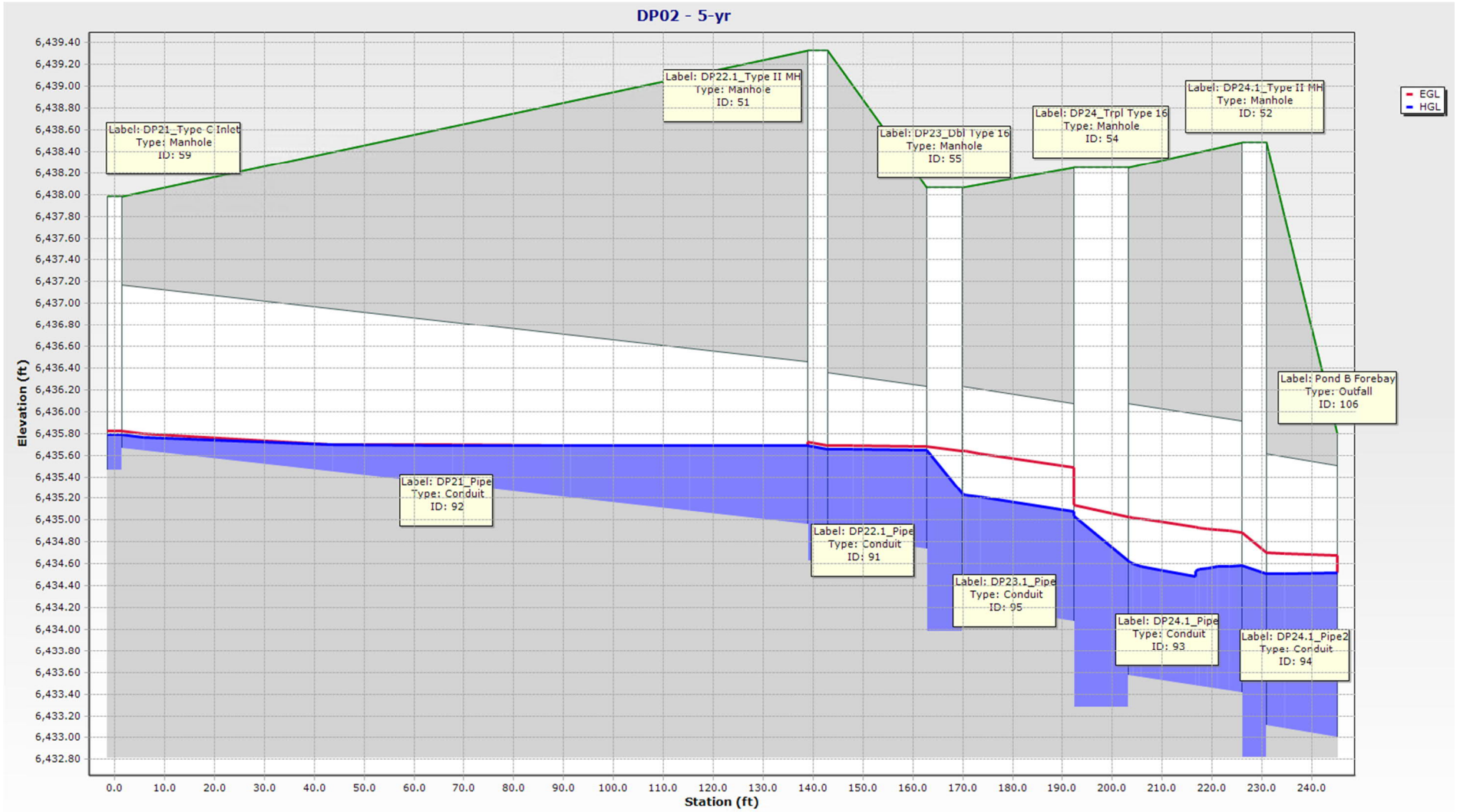
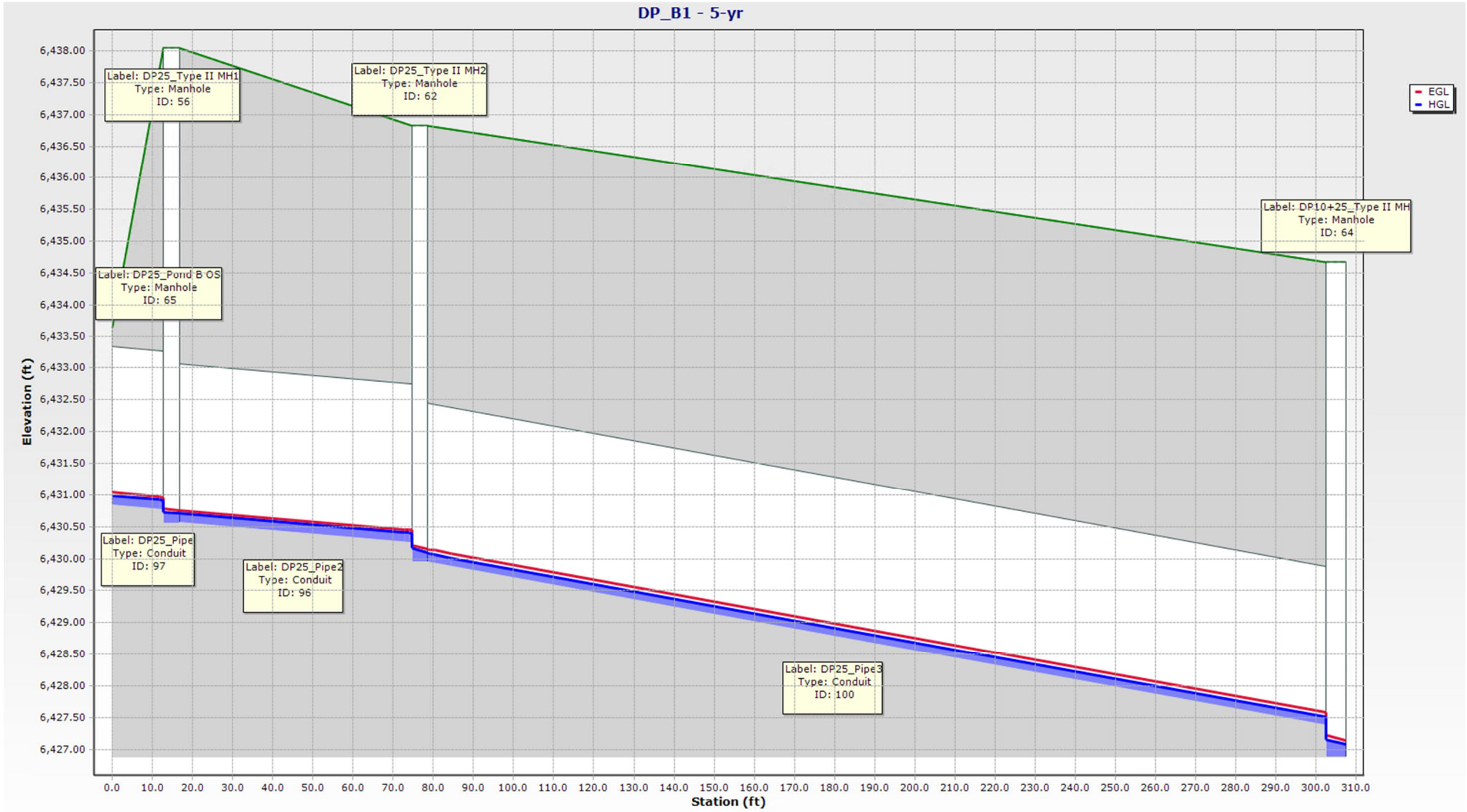
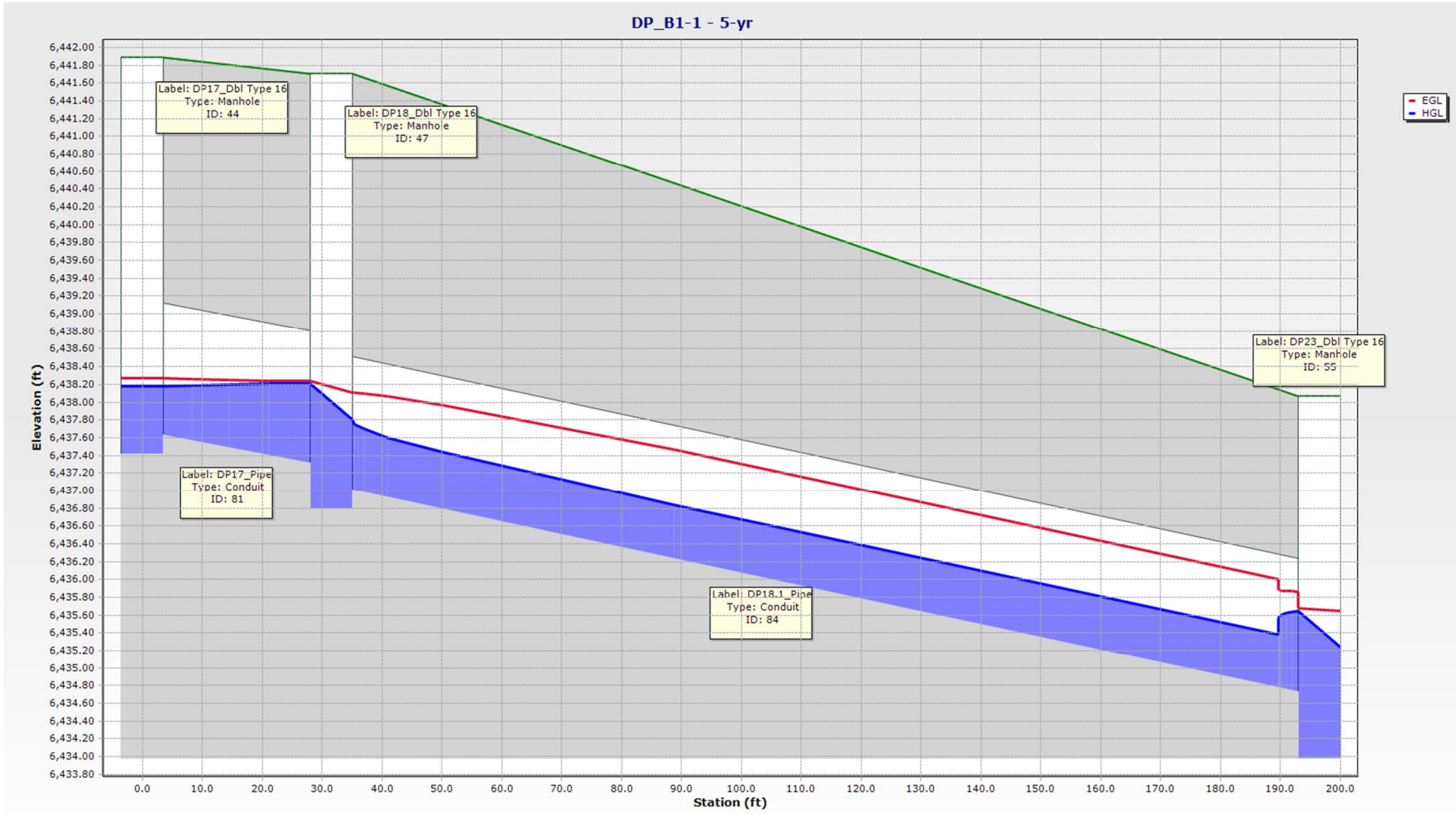
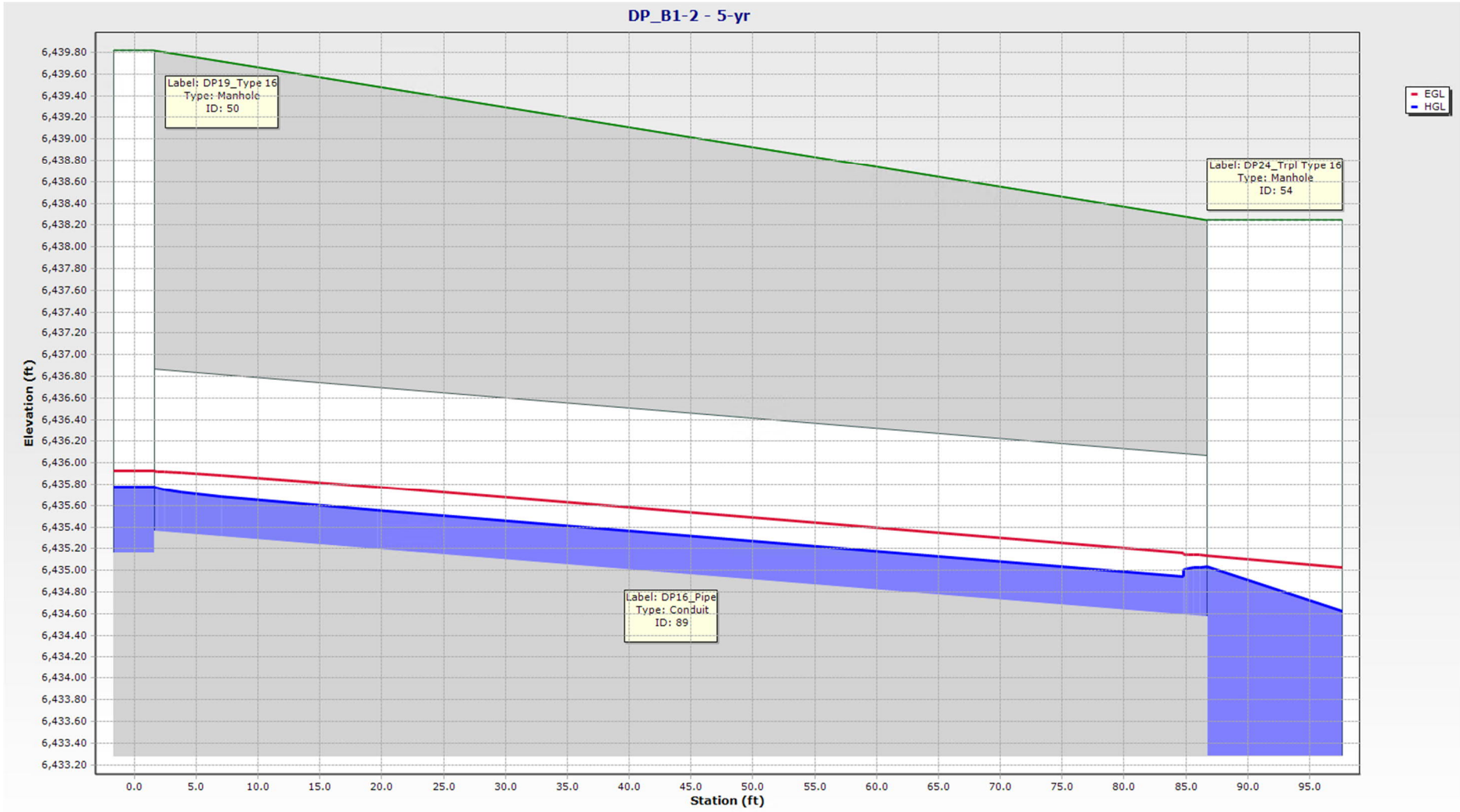

DP01 (2) - 5-yr
Label: DP10_Type II MH2
Type: Manhole
ID: 31
Label: DP10_Type II MH1
Type: Manhole
ID: 33
Label: DP10_Type II MH3
Type: Manhole
ID: 32
Label: DP10_Pond A OS
Type: Manhole
ID: 41
Label: DP10_Type II MH5
Type: Manhole
ID: 43
Label: DP10_Type II MH4
Type: Manhole
ID: 42
Label: DP10_Type II MH7
Type: Manhole
ID: 60
Label: DP10_Type II MH6
Type: Manhole
ID: 61
Label: DP10+25_Type II MH
Type: Manhole
ID: 64
Label: DP10_Pipe1
Type: Conduit
ID: 72
Label: DP10_Pipe2
Type: Conduit
ID: 69
Label: DP10_Pipe3
Type: Conduit
ID: 70
Label: DP10_Pipe4
Type: Conduit
ID: 71
Label: DP10_Pipe5
Type: Conduit
ID: 79
Label: DP10_Pipe7
Type: Conduit
ID: 98
Label: DP10_Pipe6
Type: Conduit
ID: 80
Label: DP10_Pipe8
Type: Conduit
ID: 99
Label: DP10+25_Pipe
Type: Conduit
ID: 101
Label: Outfall into CBC
Type: Outfall
ID: 105
EGL
HGL
Elevation (ft)
6,453.00
6,452.00
6,451.00
6,450.00
6,449.00
6,448.00
6,447.00
6,446.00
6,445.00
6,444.00
6,443.00
6,442.00
6,441.00
6,440.00
6,439.00
6,438.00
6,437.00
6,436.00
6,435.00
6,434.00
6,433.00
6,432.00
6,431.00
6,430.00
6,429.00
6,428.00
6,427.00
6,426.00
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
550.0
600.0
650.0
700.0
750.0
800.0
850.0
900.0
950.0
1,000.0
1,050.0
Station (ft)


DP02 - 5-yr
Elevation (ft)
Station (ft)
EGL
HGL
Label: DP21_Type C Inlet
Type: Manhole
ID: 59
Label: DP22.1_Type II MH
Type: Manhole
ID: 51
Label: DP23_Dbl Type 16
Type: Manhole
ID: 55
Label: DP24_Trpl Type 16
Type: Manhole
ID: 54
Label: DP24.1_Type II MH
Type: Manhole
ID: 52
Label: Pond B Forebay
Type: Outfall
ID: 106
Label: DP21_Pipe
Type: Conduit
ID: 92
Label: DP22.1_Pipe
Type: Conduit
ID: 91
Label: DP23.1_Pipe
Type: Conduit
ID: 95
Label: DP24.1_Pipe
Type: Conduit
ID: 93
Label: DP24.1_Pipe2
Type: Conduit
ID: 94


DP_B1 - 5-yr
Label: DP25_Type II MH1
Type: Manhole
ID: 56
Label: DP25_Type II MH2
Type: Manhole
ID: 62
Label: DP10+25_Type II MH
Type: Manhole
ID: 64
Label: DP25_Pond B OS
Type: Manhole
ID: 65
Label: DP25_Pipe
Type: Conduit
ID: 97
Label: DP25_Pipe2
Type: Conduit
ID: 96
Label: DP25_Pipe3
Type: Conduit
ID: 100
EGL
HGL
Elevation (ft)
Station (ft)
6,438.00
6,437.50
6,437.00
6,436.50
6,436.00
6,435.50
6,435.00
6,434.50
6,434.00
6,433.50
6,433.00
6,432.50
6,432.00
6,431.50
6,431.00
6,430.50
6,430.00
6,429.50
6,429.00
6,428.50
6,428.00
6,427.50
6,427.00
0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 180.0 190.0 200.0 210.0 220.0 230.0 240.0 250.0 260.0 270.0 280.0 290.0 300.0 310.0


DP_B1-1 - 5-yr
Elevation (ft)
Station (ft)
EGL
HGL
Label: DP17_Dbl Type 16
Type: Manhole
ID: 44
Label: DP18_Dbl Type 16
Type: Manhole
ID: 47
Label: DP23_Dbl Type 16
Type: Manhole
ID: 55
Label: DP17_Pipe
Type: Conduit
ID: 81
Label: DP18.1_Pipe
Type: Conduit
ID: 84


DP_B1-2 - 5-yr
Label: DP19_Type 16
Type: Manhole
ID: 50
Label: DP24_Trpl Type 16
Type: Manhole
ID: 54
Label: DP16_Pipe
Type: Conduit
ID: 89
EGL
HGL
Elevation (ft)
Station (ft)
6,439.80
6,439.60
6,439.40
6,439.20
6,439.00
6,438.80
6,438.60
6,438.40
6,438.20
6,438.00
6,437.80
6,437.60
6,437.40
6,437.20
6,437.00
6,436.80
6,436.60
6,436.40
6,436.20
6,436.00
6,435.80
6,435.60
6,435.40
6,435.20
6,435.00
6,434.80
6,434.60
6,434.40
6,434.20
6,434.00
6,433.80
6,433.60
6,433.40
6,433.20
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5.0
10.0
15.0
20.0
25.0
30.0
35.0
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55.0
60.0
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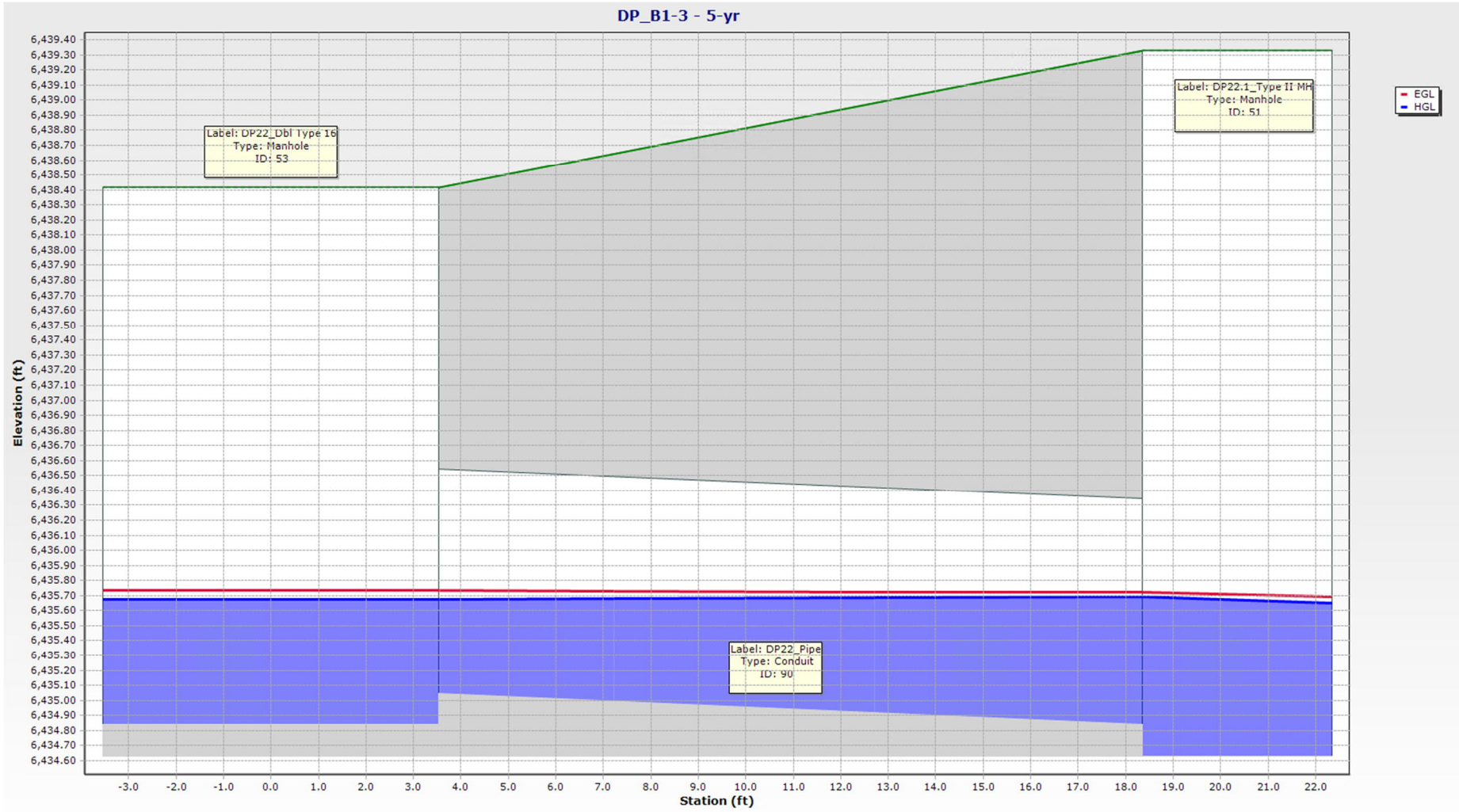
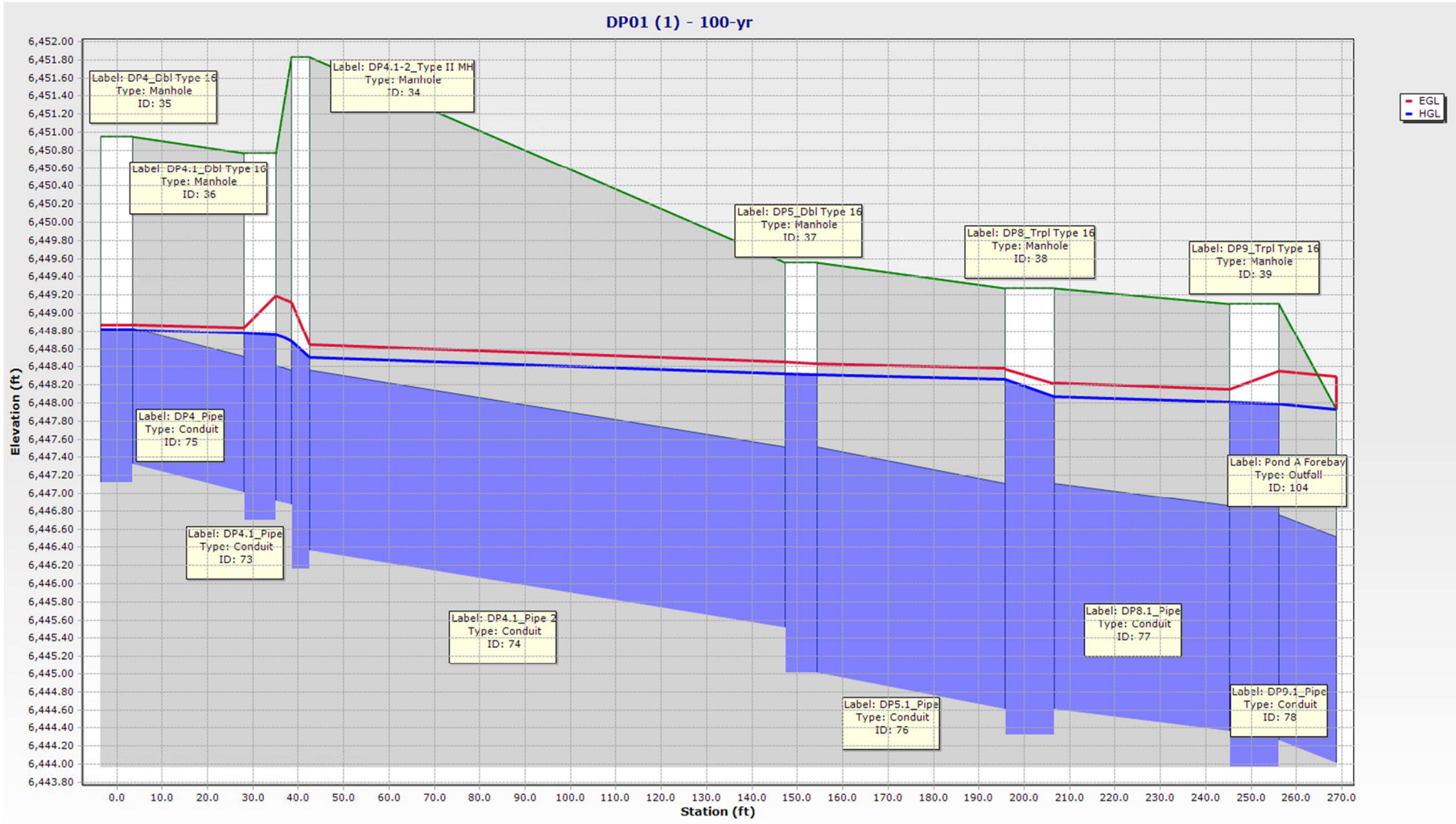
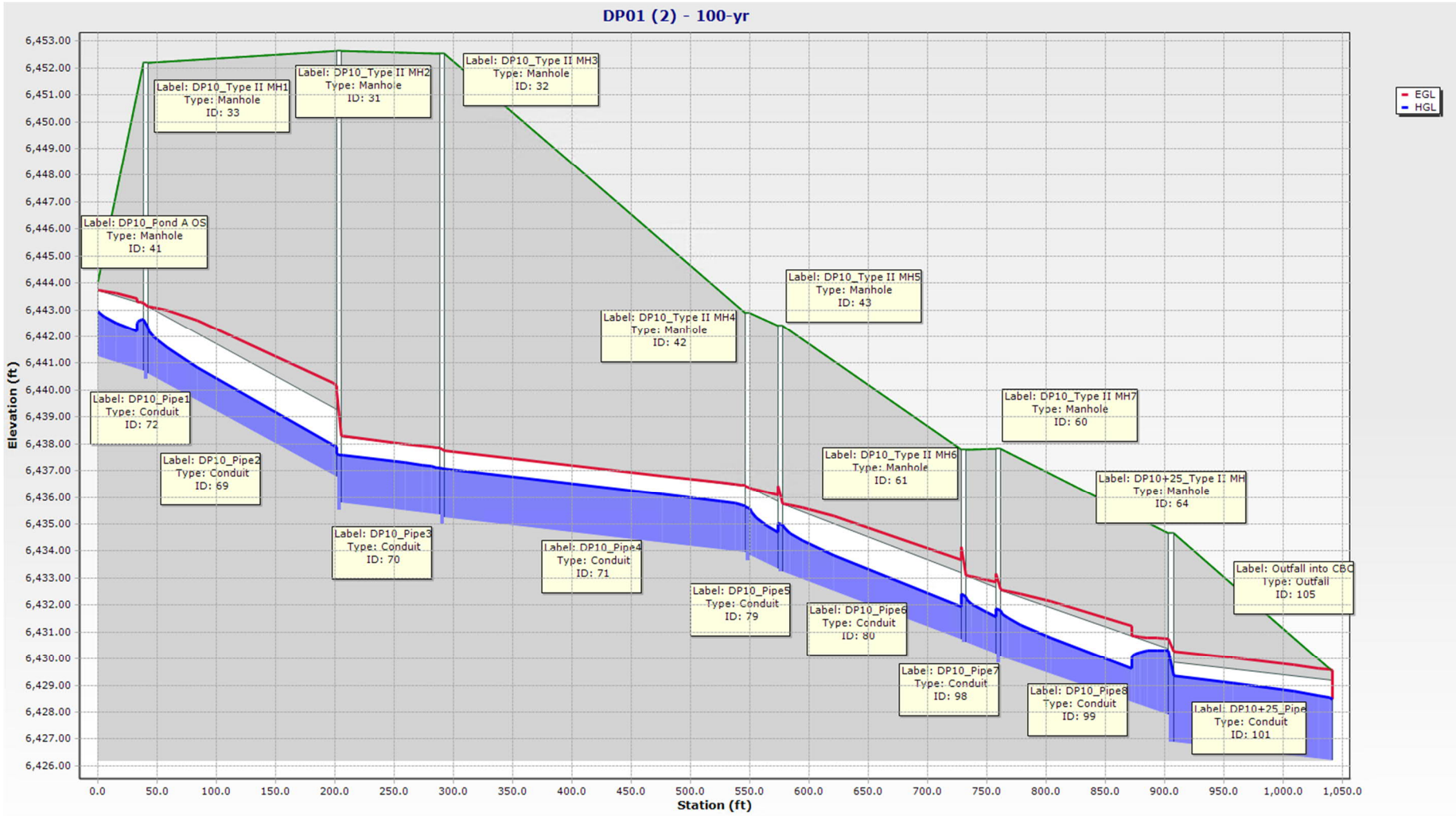
90.0
95.0


DP_B1-3 - 5-yr
Elevation (ft)
Station (ft)
Label: DP22_Dbl Type 16
Type: Manhole
ID: 53
Label: DP22.1_Type II MH
Type: Manhole
ID: 51
Label: DP22_Pipe
Type: Conduit
ID: 90
EGL
HGL


DP01 (1) - 100-yr
EGL
HGL
Elevation (ft)
Station (ft)
Label: DP4_Dbl Type 16
Type: Manhole
ID: 35
Label: DP4.1-2_Type II MH
Type: Manhole
ID: 34
Label: DP4.1_Dbl Type 16
Type: Manhole
ID: 36
Label: DP5_Dbl Type 16
Type: Manhole
ID: 37
Label: DP8_Trpl Type 16
Type: Manhole
ID: 38
Label: DP9_Trpl Type 16
Type: Manhole
ID: 39
Label: DP4_Pipe
Type: Conduit
ID: 75
Label: Pond A Forebay
Type: Outfall
ID: 104
Label: DP4.1_Pipe
Type: Conduit
ID: 73
Label: DP4.1_Pipe 2
Type: Conduit
ID: 74
Label: DP8.1_Pipe
Type: Conduit
ID: 77
Label: DP5.1_Pipe
Type: Conduit
ID: 76
Label: DP9.1_Pipe
Type: Conduit
ID: 78


DP01 (2) - 100-yr
EGL
HGL
Elevation (ft)
Station (ft)
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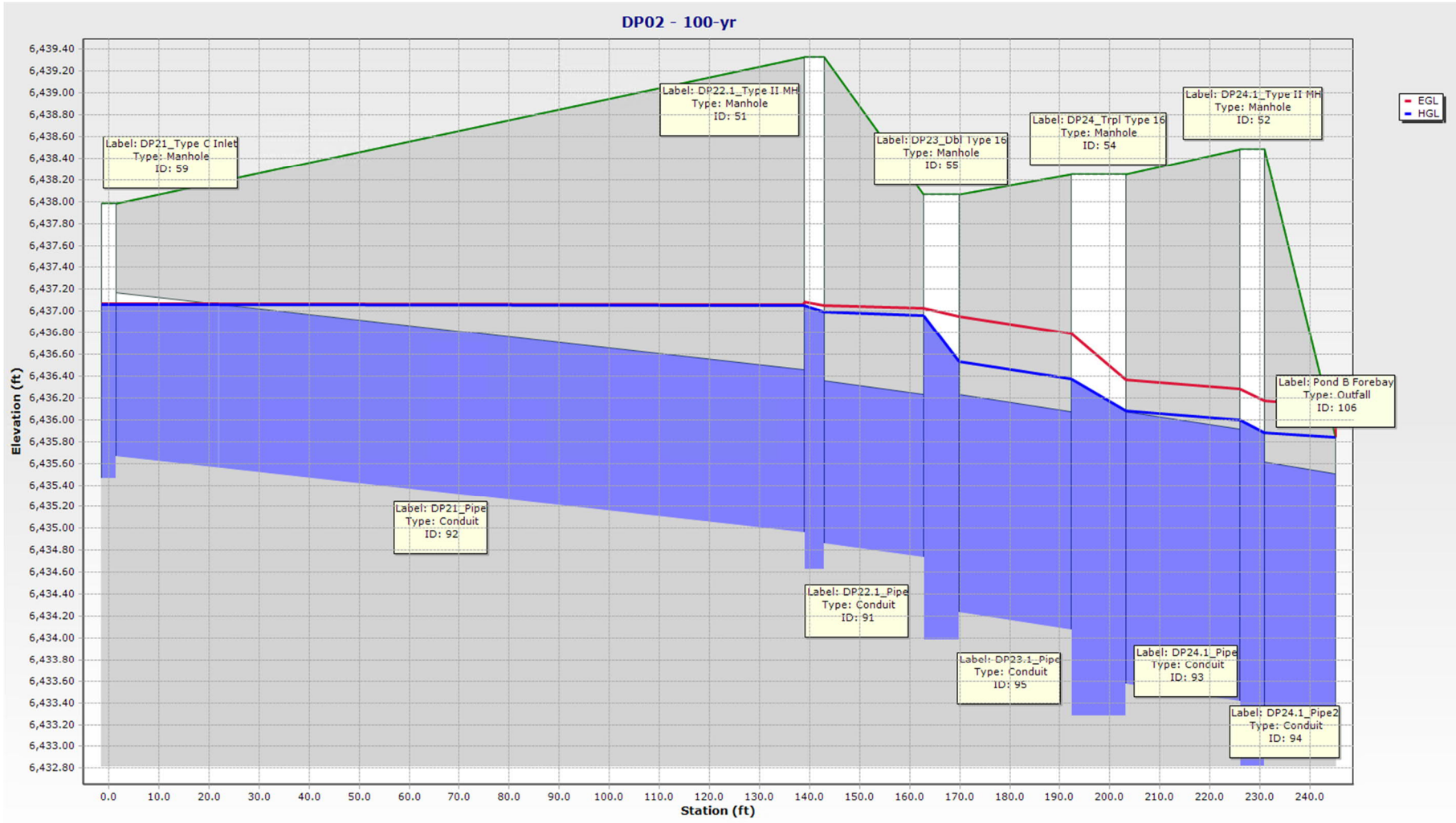
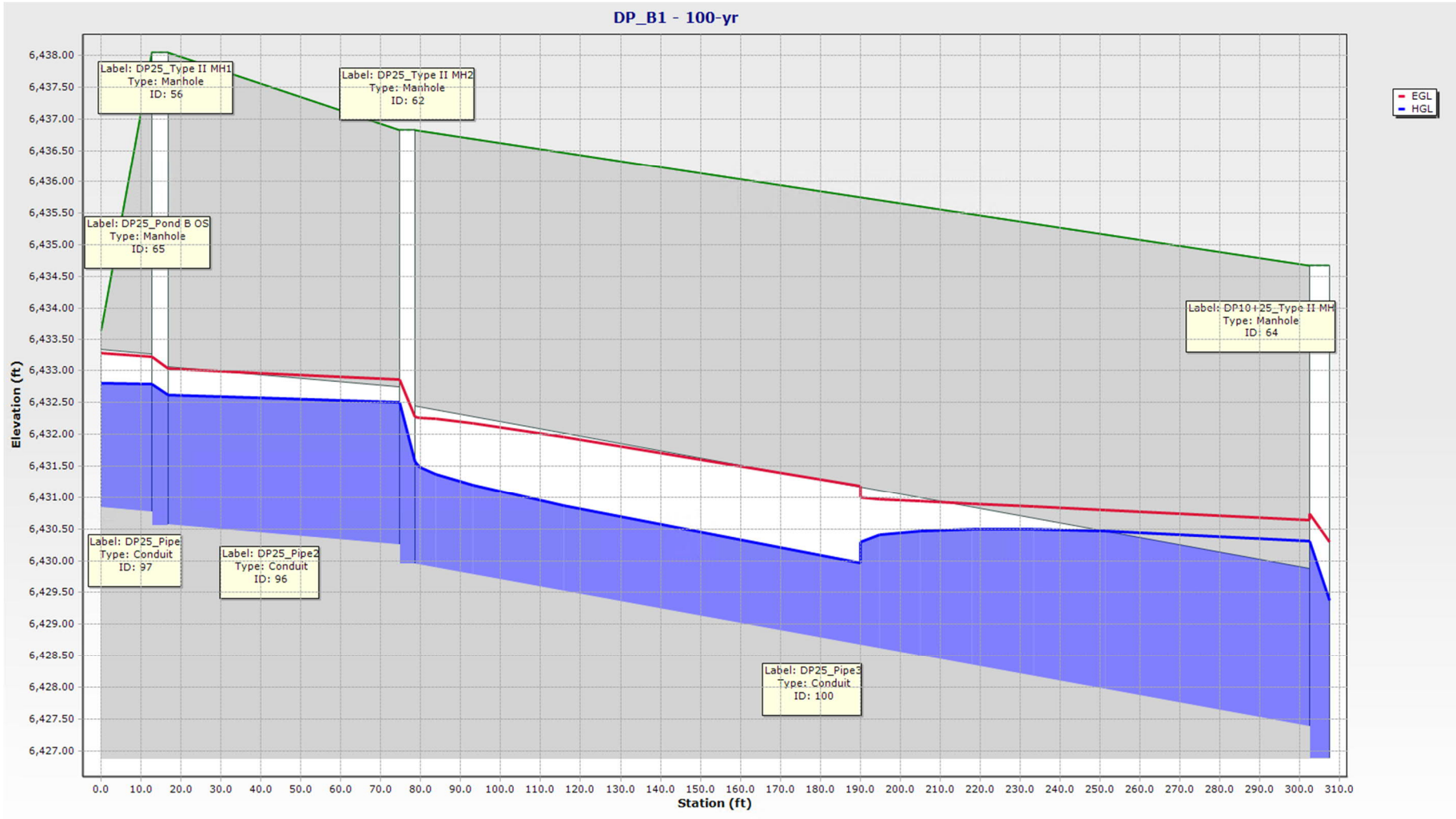
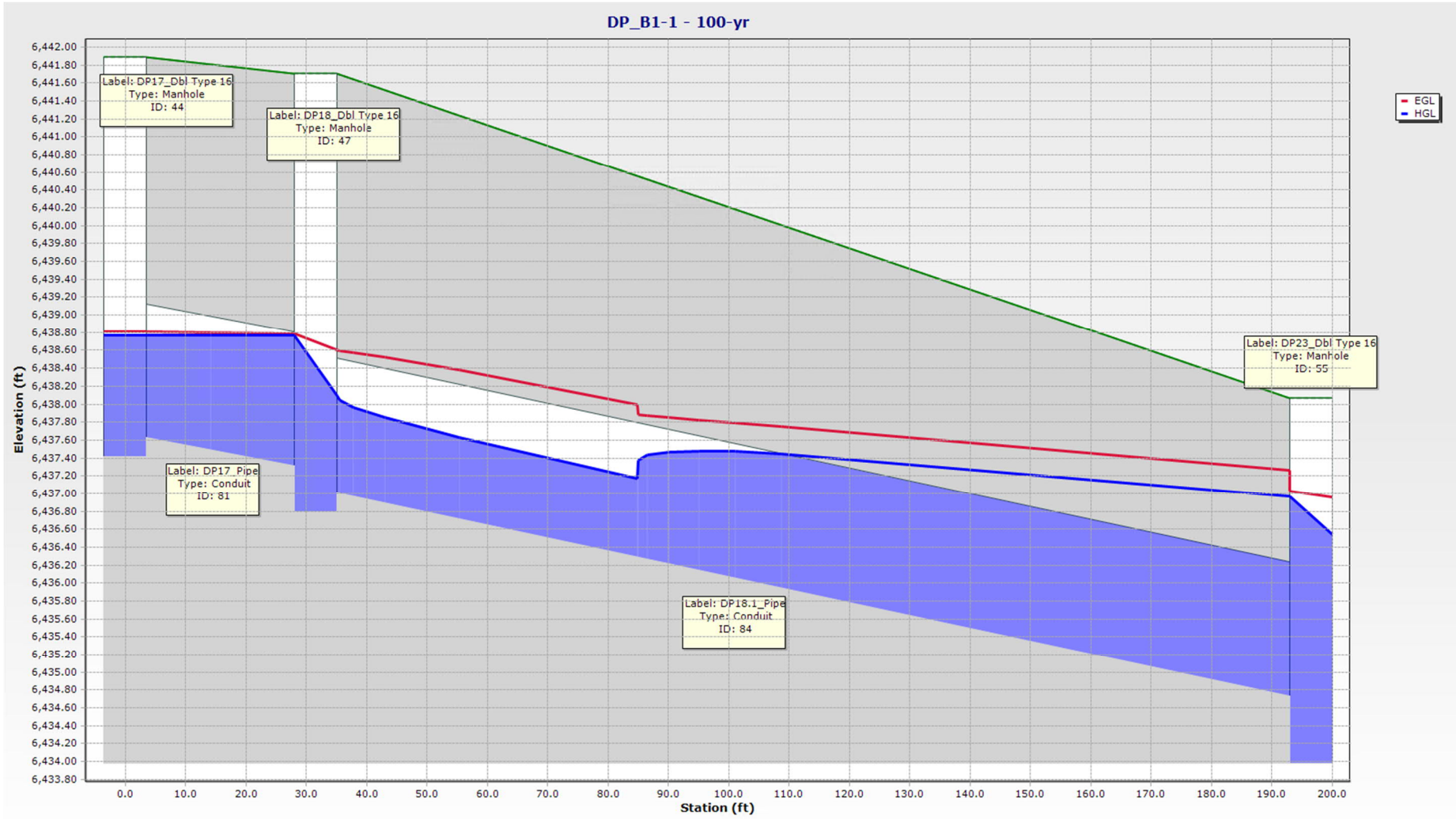
6,450.00
6,449.00
6,448.00
6,447.00
6,446.00
6,445.00
6,444.00
6,443.00
6,442.00
6,441.00
6,440.00
6,439.00
6,438.00
6,437.00
6,436.00
6,435.00
6,434.00
6,433.00
6,432.00
6,431.00
6,430.00
6,429.00
6,428.00
6,427.00
6,426.00
0.0
50.0
100.0
150.0
200.0
250.0
300.0
350.0
400.0
450.0
500.0
550.0
600.0
650.0
700.0
750.0
800.0
850.0
900.0
950.0
1,000.0
1,050.0
Label: DP10_Type II MH1
Type: Manhole
ID: 33
Label: DP10_Type II MH2
Type: Manhole
ID: 31
Label: DP10_Type II MH3
Type: Manhole
ID: 32
Label: DP10_Pond A OS
Type: Manhole
ID: 41
Label: DP10_Type II MH4
Type: Manhole
ID: 42
Label: DP10_Type II MH5
Type: Manhole
ID: 43
Label: DP10_Type II MH6
Type: Manhole
ID: 61
Label: DP10_Type II MH7
Type: Manhole
ID: 60
Label: DP10+25_Type II MH
Type: Manhole
ID: 64
Label: Outfall into CBC
Type: Outfall
ID: 105
Label: DP10_Pipe1
Type: Conduit
ID: 72
Label: DP10_Pipe2
Type: Conduit
ID: 69
Label: DP10_Pipe3
Type: Conduit
ID: 70
Label: DP10_Pipe4
Type: Conduit
ID: 71
Label: DP10_Pipe5
Type: Conduit
ID: 79
Label: DP10_Pipe6
Type: Conduit
ID: 80
Label: DP10_Pipe7
Type: Conduit
ID: 98
Label: DP10_Pipe8
Type: Conduit
ID: 99
Label: DP10+25_Pipe
Type: Conduit
ID: 101


DP02 - 100-yr
Elevation (ft)
Station (ft)
EGL
HGL
Label: DP21_Type C Inlet
Type: Manhole
ID: 59
Label: DP22.1_Type II MH
Type: Manhole
ID: 51
Label: DP23_Dbl Type 16
Type: Manhole
ID: 55
Label: DP24_Trpl Type 16
Type: Manhole
ID: 54
Label: DP24.1_Type II MH
Type: Manhole
ID: 52
Label: Pond B Forebay
Type: Outfall
ID: 106
Label: DP21_Pipe
Type: Conduit
ID: 92
Label: DP22.1_Pipe
Type: Conduit
ID: 91
Label: DP23.1_Pipe
Type: Conduit
ID: 95
Label: DP24.1_Pipe
Type: Conduit
ID: 93
Label: DP24.1_Pipe2
Type: Conduit
ID: 94


DP_B1 - 100-yr
Label: DP25_Type II MH1
Type: Manhole
ID: 56
Label: DP25_Type II MH2
Type: Manhole
ID: 62
Label: DP25_Pond B OS
Type: Manhole
ID: 65
Label: DP10+25_Type II MH
Type: Manhole
ID: 64
Label: DP25_Pipe
Type: Conduit
ID: 97
Label: DP25_Pipe2
Type: Conduit
ID: 96
Label: DP25_Pipe3
Type: Conduit
ID: 100
EGL
HGL
Elevation (ft)
Station (ft)
6,438.00
6,437.50
6,437.00
6,436.50
6,436.00
6,435.50
6,435.00
6,434.50
6,434.00
6,433.50
6,433.00
6,432.50
6,432.00
6,431.50
6,431.00
6,430.50
6,430.00
6,429.50
6,429.00
6,428.50
6,428.00
6,427.50
6,427.00
0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0 100.0 110.0 120.0 130.0 140.0 150.0 160.0 170.0 180.0 190.0 200.0 210.0 220.0 230.0 240.0 250.0 260.0 270.0 280.0 290.0 300.0 310.0


DP_B1-1 - 100-yr
EGL
HGL
Label: DP17_Dbl Type 16
Type: Manhole
ID: 44
Label: DP18_Dbl Type 16
Type: Manhole
ID: 47
Label: DP23_Dbl Type 16
Type: Manhole
ID: 55
Label: DP17_Pipe
Type: Conduit
ID: 81
Label: DP18.1_Pipe
Type: Conduit
ID: 84
Elevation (ft)
Station (ft)
6,442.00
6,441.80
6,441.60
6,441.40
6,441.20
6,441.00
6,440.80
6,440.60
6,440.40
6,440.20
6,440.00
6,439.80
6,439.60
6,439.40
6,439.20
6,439.00
6,438.80
6,438.60
6,438.40
6,438.20
6,438.00
6,437.80
6,437.60
6,437.40
6,437.20
6,437.00
6,436.80
6,436.60
6,436.40
6,436.20
6,436.00
6,435.80
6,435.60
6,435.40
6,435.20
6,435.00
6,434.80
6,434.60
6,434.40
6,434.20
6,434.00
6,433.80
0.0
10.0
20.0
30.0
40.0
50.0
60.0
70.0
80.0
90.0
100.0
110.0
120.0
130.0
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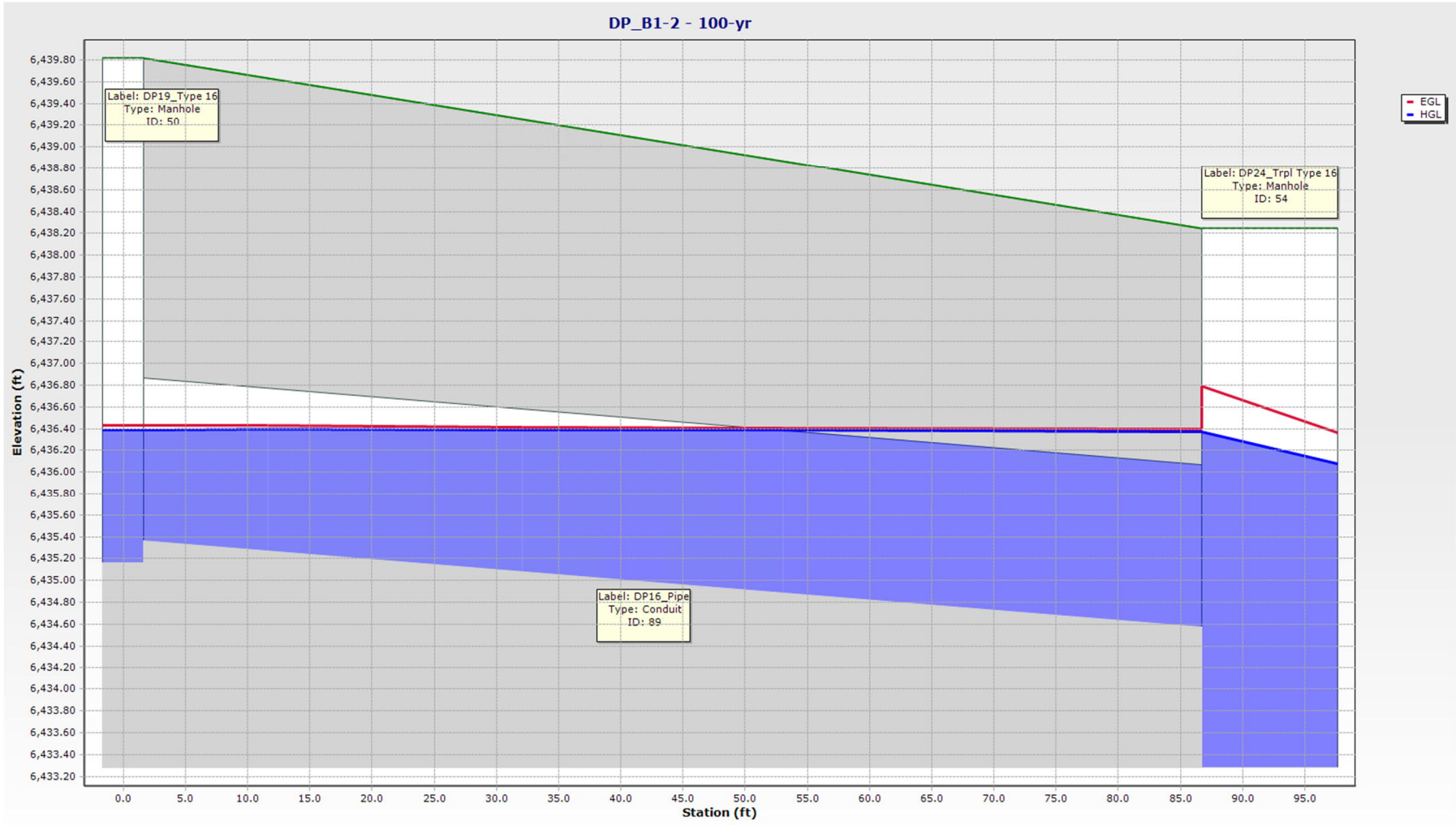
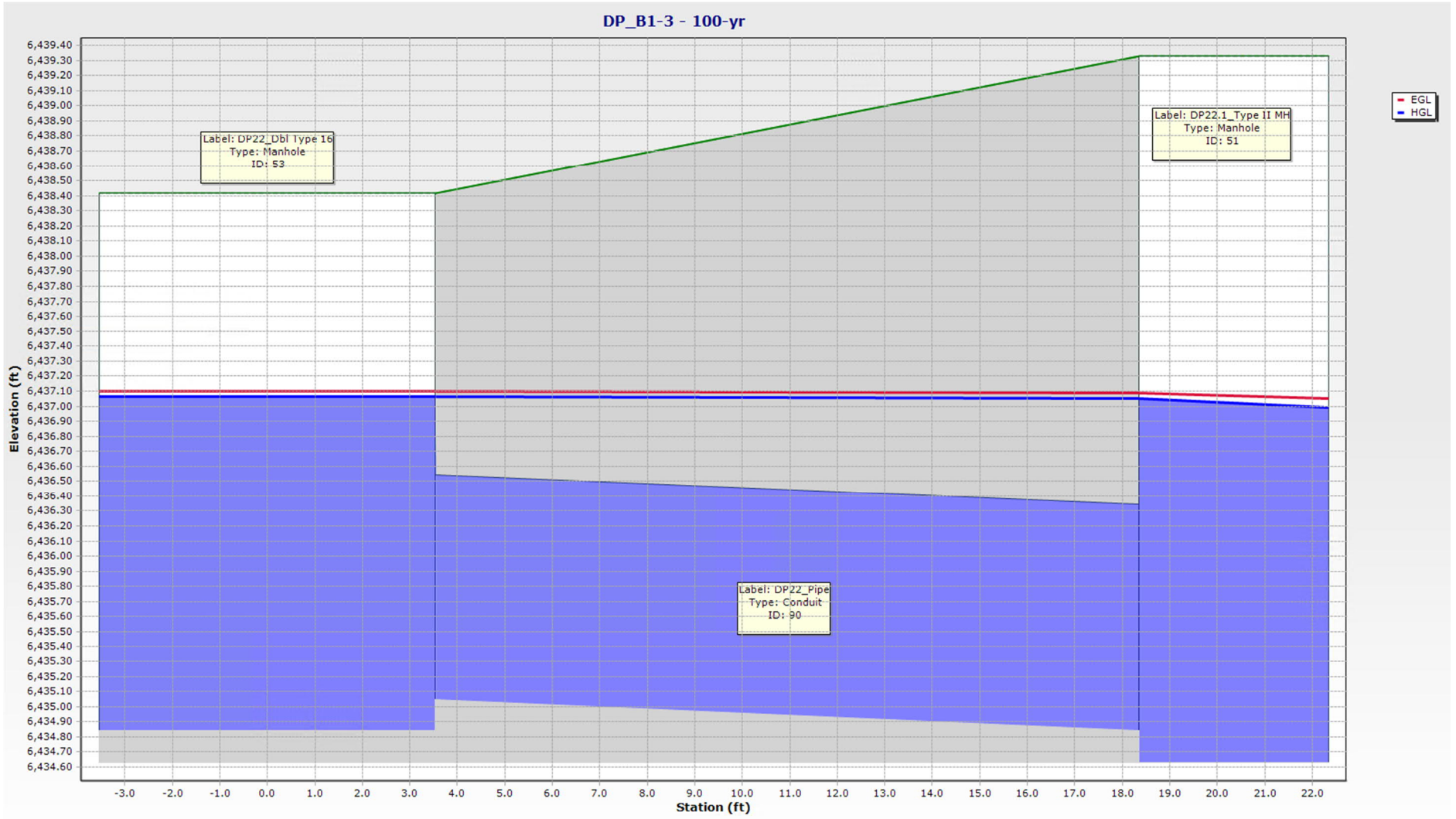
150.0
160.0
170.0
180.0
190.0
200.0


DP_B1-2 - 100-yr
Elevation (ft)
Station (ft)
EGL
HGL
Label: DP19_Type 16
Type: Manhole
ID: 50
Label: DP24_Trpl Type 16
Type: Manhole
ID: 54
Label: DP16_Pipe
Type: Conduit
ID: 89
6,439.80
6,439.60
6,439.40
6,439.20
6,439.00
6,438.80
6,438.60
6,438.40
6,438.20
6,438.00
6,437.80
6,437.60
6,437.40
6,437.20
6,437.00
6,436.80
6,436.60
6,436.40
6,436.20
6,436.00
6,435.80
6,435.60
6,435.40
6,435.20
6,435.00
6,434.80
6,434.60
6,434.40
6,434.20
6,434.00
6,433.80
6,433.60
6,433.40
6,433.20
0.0
5.0
10.0
15.0
20.0
25.0
30.0
35.0
40.0
45.0
50.0
55.0
60.0
65.0
70.0
75.0
80.0
85.0
90.0
95.0


DP_B1-3 - 100-yr
Elevation (ft)
Station (ft)
EGL
HGL
Label: DP22_Dbl Type 16
Type: Manhole
ID: 53
Label: DP22.1_Type II MH
Type: Manhole
ID: 51
Label: DP22_Pipe
Type: Conduit
ID: 90

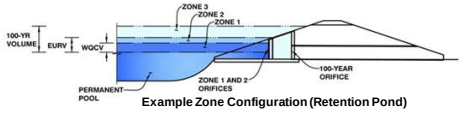
Appendix D
Water Quality & Detention

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Palmer Village

Basin ID: Pond A (West Parcel)



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	5.92	acres
Watershed Length =	700	ft
Watershed Length to Centroid =	152	ft
Watershed Slope =	0.012	ft/ft
Watershed Imperviousness =	50.50%	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 =	40.0	hours
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.

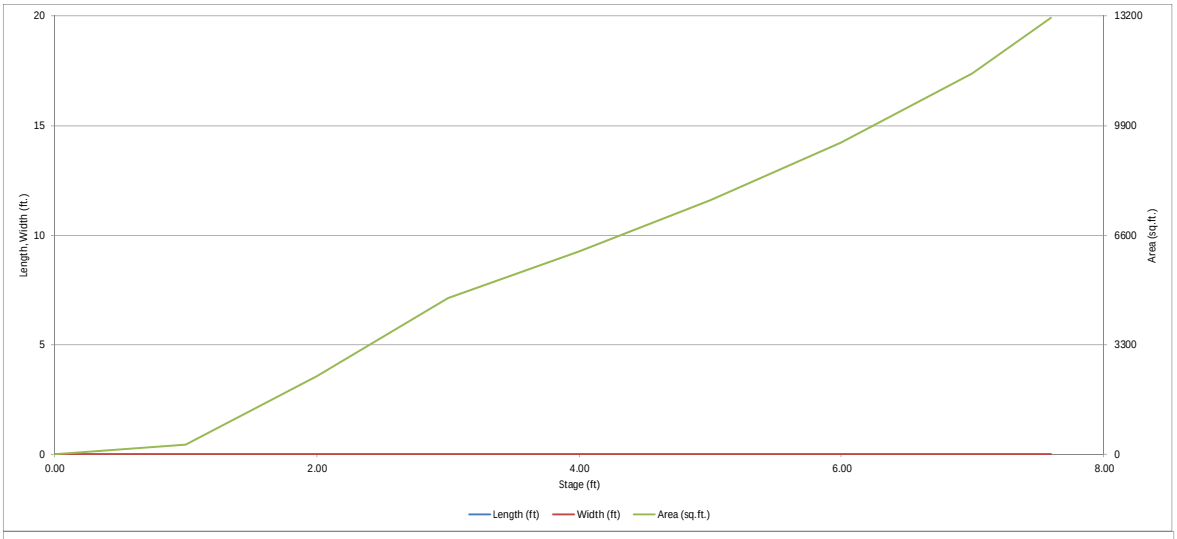
			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.102	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.346	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.245	acre-feet	1.19 inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.326	acre-feet	1.50 inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.390	acre-feet	1.75 inches
25-yr Runoff Volume (P1 = 2 in.) =	0.491	acre-feet	2.00 inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.590	acre-feet	2.25 inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.715	acre-feet	2.52 inches
500-yr Runoff Volume (P1 = 3 in.) =	0.922	acre-feet	3.00 inches
Approximate 2-yr Detention Volume =	0.222	acre-feet	
Approximate 5-yr Detention Volume =	0.293	acre-feet	
Approximate 10-yr Detention Volume =	0.357	acre-feet	
Approximate 25-yr Detention Volume =	0.436	acre-feet	
Approximate 50-yr Detention Volume =	0.487	acre-feet	
Approximate 100-yr Detention Volume =	0.548	acre-feet	

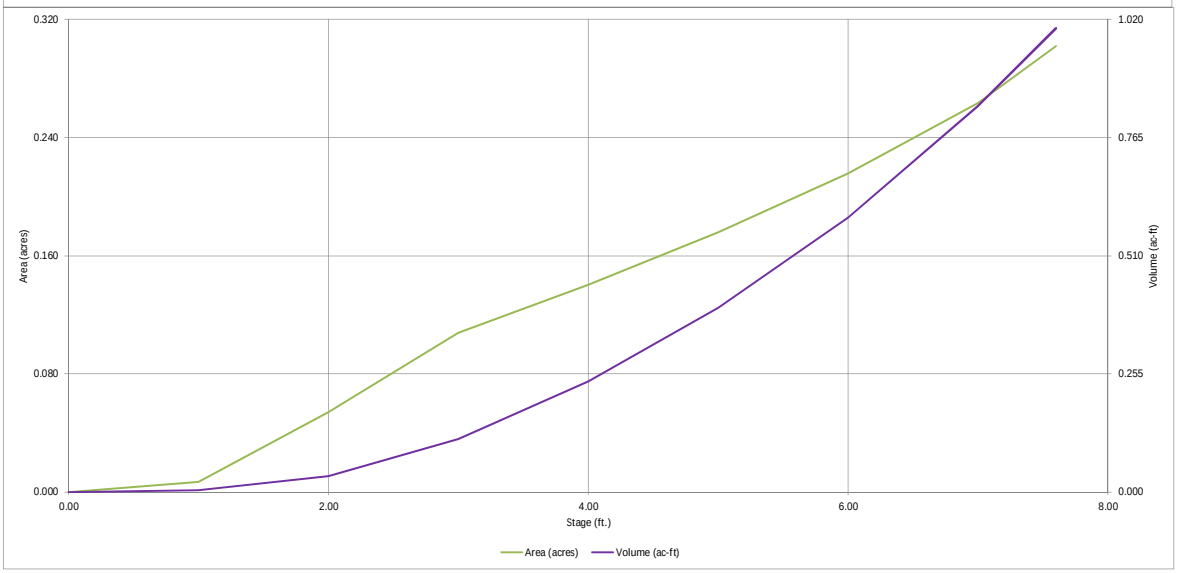
Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.102	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.243	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.202	acre-feet
Total Detention Basin Volume =	0.548	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)
6442 Top of Micropool	--	0.00	--	--	--	0	0.000		
6443	--	1.00	--	--	--	288	0.007	144	0.003
6444	--	2.00	--	--	--	2,350	0.054	1,463	0.034
6445	--	3.00	--	--	--	4,702	0.108	4,989	0.115
6446	--	4.00	--	--	--	6,115	0.140	10,397	0.239
6447	--	5.00	--	--	--	7,661	0.176	17,285	0.397
6448	--	6.00	--	--	--	9,399	0.216	25,815	0.593
6449	--	7.00	--	--	--	11,474	0.263	36,252	0.832
6449.6	--	7.60	--	--	--	13,146	0.302	43,638	1.002


20
15
10
5
0
13200
9900
6600
3300
0
Length, Width (ft.)
Area (sq.ft.)
0.00
2.00
4.00
6.00
8.00
Stage (ft)
Length (ft)
Width (ft)
Area (sq.ft.)

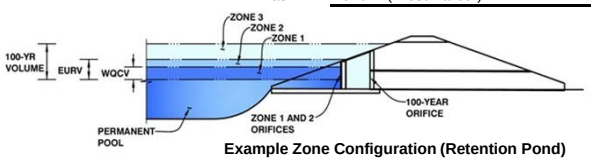

0.320
0.240
0.160
0.080
0.000
1.020
0.765
0.510
0.255
0.000
Area (acres)
Volume (ac-ft)
0.00
2.00
4.00
6.00
8.00
Stage (ft.)
Area (acres)
Volume (ac-ft)

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Palmer Village

Basin ID: Pond A (West Parcel)



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.89	0.102	Orifice Plate
Zone 2 (EURV)	4.71	0.243	Orifice Plate
Zone 3 (100-year)	5.79	0.202	Weir&Pipe (Restrict)
Total (all zones)		0.548	

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

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	2.708E-03	ft^2
Depth at top of Zone using Orifice Plate =	4.69	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	0.39	sq. inches (diameter = 11/16 inch)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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	2.50					
Orifice Area (sq. inches)	0.39	0.39	0.39					

	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			Not Selected	Not Selected	
Invert of Vertical Orifice =	3.60	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.03	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	4.69	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.08	N/A	feet
Vertical Orifice Diameter or Height =	2.00	N/A	inches				
Vertical Orifice Width =	2.00		inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	5.60	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	5.60	N/A	feet
Overflow Weir Front Edge Length =	3.00	N/A	feet	Overflow Weir Slope Length =	3.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	36.77	N/A	
Horiz. Length of Weir Sides =	3.00	N/A	feet	Overflow Grate Open Area w/o Debris =	7.12	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	3.56	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.67	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.19	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.15	N/A	feet
Restrictor Plate Height Above Pipe Invert =	3.00		inches	Half-Central Angle of Restrictor Plate on Pipe =	0.84	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=		ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=		feet
Spillway Crest Length =		feet	Stage at Top of Freeboard =		feet
Spillway End Slopes =		H:V	Basin Area at Top of Freeboard =		acres
Freeboard above Max Water Surface =		feet	Basin Volume at Top of Freeboard =		acre-ft

Calculated Parameters for Spillway

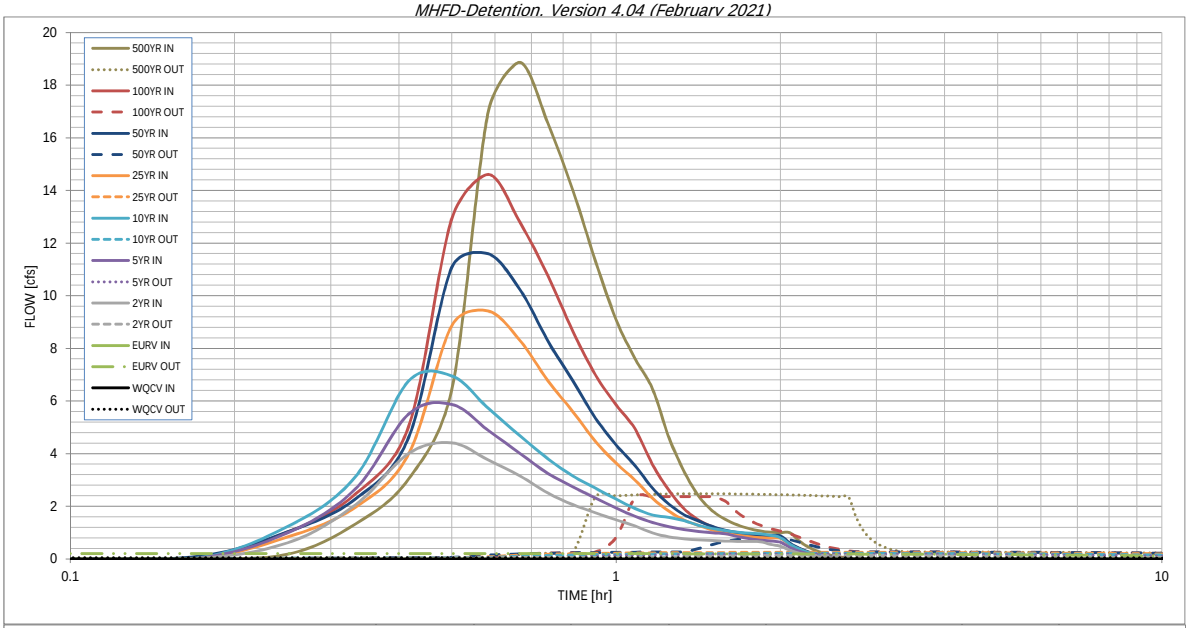
Routed Hydrograph Results

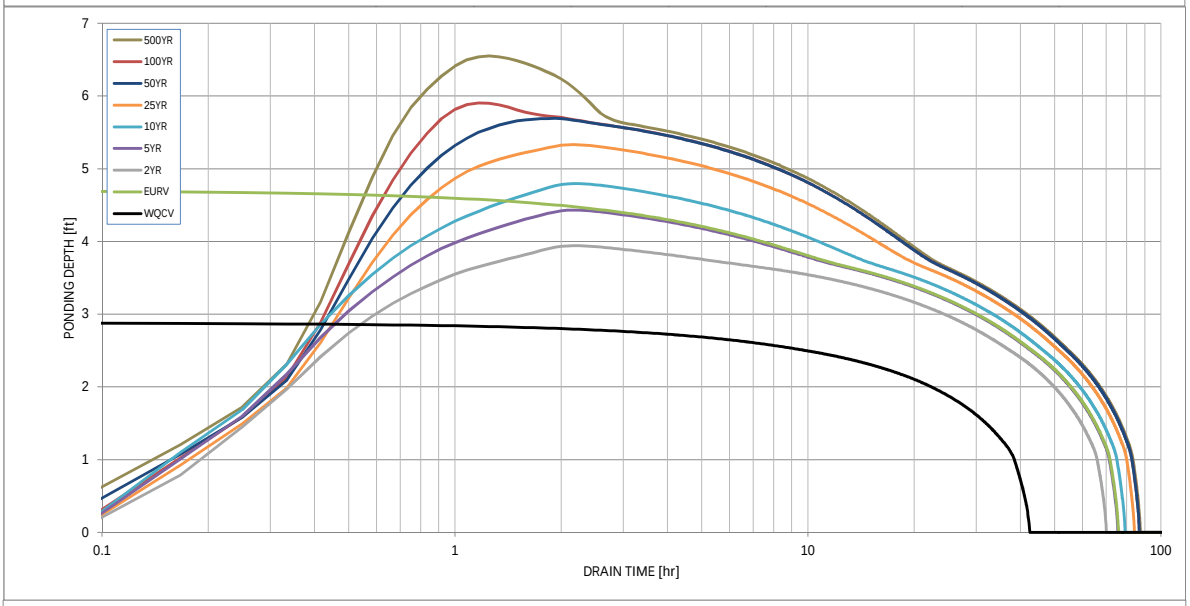
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

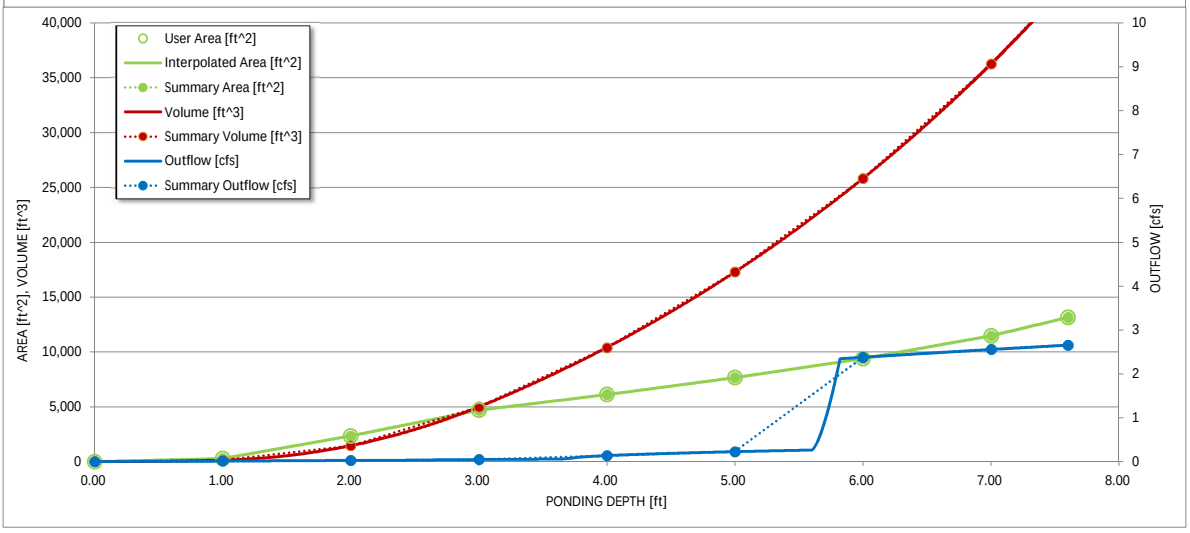
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.00
CUHP Runoff Volume (acre-ft) =	0.102	0.346	0.245	0.326	0.390	0.491	0.590	0.715	0.922
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.245	0.326	0.390	0.491	0.590	0.715	0.922
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.1	0.1	0.2	1.4	2.8	4.5	7.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.03	0.24	0.47	0.77	1.22
Peak Inflow Q (cfs) =	N/A	N/A	4.4	5.9	7.0	9.4	11.6	14.6	18.9
Peak Outflow Q (cfs) =	0.0	0.2	0.1	0.2	0.2	0.3	0.8	2.4	2.5
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	1.6	1.3	0.2	0.3	0.5	0.3
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Outlet Plate 1	Outlet Plate 1
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	0.1	0.3	0.3
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	67	63	67	69	72	74	72	70
Time to Drain 99% of Inflow Volume (hours) =	41	72	67	72	75	79	81	80	79
Maximum Ponding Depth (ft) =	2.89	4.71	3.94	4.43	4.80	5.33	5.69	5.91	6.55
Area at Maximum Ponding Depth (acres) =	0.10	0.17	0.14	0.16	0.17	0.19	0.20	0.21	0.24
Maximum Volume Stored (acre-ft) =	0.103	0.347	0.230	0.302	0.361	0.457	0.528	0.571	0.719

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename: _____

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	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	0.07	0.01	0.17
	0:15:00	0.00	0.00	0.61	0.99	1.23	0.83	1.03	1.01	1.33
	0:20:00	0.00	0.00	2.06	2.67	3.13	1.97	2.29	2.47	3.03
	0:25:00	0.00	0.00	4.00	5.50	6.75	3.98	4.61	5.02	6.44
	0:30:00	0.00	0.00	4.41	5.87	6.95	8.87	11.08	12.92	16.98
	0:35:00	0.00	0.00	3.75	4.88	5.72	9.42	11.59	14.61	18.86
	0:40:00	0.00	0.00	3.15	4.01	4.68	8.30	10.23	12.78	16.55
	0:45:00	0.00	0.00	2.50	3.25	3.80	6.77	8.28	10.76	14.00
	0:50:00	0.00	0.00	2.06	2.74	3.15	5.60	6.77	8.65	11.31
	0:55:00	0.00	0.00	1.75	2.31	2.69	4.46	5.35	6.99	9.09
	1:00:00	0.00	0.00	1.48	1.93	2.27	3.64	4.33	5.85	7.61
	1:05:00	0.00	0.00	1.25	1.62	1.92	2.99	3.54	4.94	6.45
	1:10:00	0.00	0.00	0.98	1.38	1.67	2.30	2.68	3.58	4.60
	1:15:00	0.00	0.00	0.84	1.23	1.58	1.81	2.08	2.60	3.31
	1:20:00	0.00	0.00	0.77	1.11	1.45	1.47	1.67	1.89	2.39
	1:25:00	0.00	0.00	0.72	1.04	1.27	1.27	1.44	1.48	1.83
	1:30:00	0.00	0.00	0.70	0.99	1.16	1.09	1.23	1.23	1.51
	1:35:00	0.00	0.00	0.68	0.96	1.07	0.97	1.09	1.07	1.29
	1:40:00	0.00	0.00	0.67	0.85	1.02	0.90	1.01	0.96	1.16
	1:45:00	0.00	0.00	0.66	0.77	0.98	0.84	0.95	0.89	1.06
	1:50:00	0.00	0.00	0.66	0.72	0.95	0.81	0.91	0.85	1.01
	1:55:00	0.00	0.00	0.55	0.68	0.90	0.79	0.89	0.84	1.00
	2:00:00	0.00	0.00	0.48	0.63	0.81	0.78	0.88	0.83	0.99
	2:05:00	0.00	0.00	0.33	0.43	0.55	0.53	0.60	0.57	0.68
	2:10:00	0.00	0.00	0.22	0.29	0.37	0.36	0.40	0.38	0.45
	2:15:00	0.00	0.00	0.15	0.19	0.25	0.24	0.27	0.25	0.30
	2:20:00	0.00	0.00	0.09	0.12	0.16	0.15	0.17	0.16	0.19
	2:25:00	0.00	0.00	0.05	0.08	0.10	0.10	0.11	0.10	0.12
	2:30:00	0.00	0.00	0.03	0.04	0.06	0.06	0.06	0.06	0.07
	2:35:00	0.00	0.00	0.01	0.02	0.02	0.03	0.03	0.03	0.03
	2:40:00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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 4.04 (February 2021)

Summary Stage-Area-Volume-Discharge Relationships

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]
6442	0.00	0	0.000	0	0.000	0.00
6443	1.00	288	0.007	144	0.003	0.01
6444	2.00	2,350	0.054	1,463	0.034	0.03
6445	3.00	4,702	0.108	4,989	0.115	0.05
6446	4.00	6,115	0.140	10,397	0.239	0.14
6447	5.00	7,661	0.176	17,285	0.397	0.23
6448	6.00	9,399	0.216	25,815	0.593	2.38
6449	7.00	11,474	0.263	36,252	0.832	2.56
6449.60	7.60	13,146	0.302	43,638	1.002	2.66

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'.

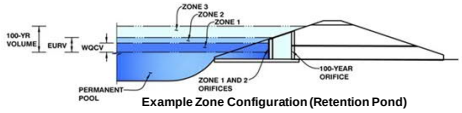
Also include the inverts of all outlets (e.g. vertical orifice, overflow grate, and spillway, where applicable).

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)

Project: Palmer Village

Basin ID: Pond B (East Parcel)



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	4.57	acres
Watershed Length =	700	ft
Watershed Length to Centroid =	227	ft
Watershed Slope =	0.028	ft/ft
Watershed Imperviousness =	54.30%	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 =	40.0	hours
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) =	0.083	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.293	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 1.19 in.) =	0.207	acre-feet	1.19	inches
5-yr Runoff Volume (P1 = 1.5 in.) =	0.274	acre-feet	1.50	inches
10-yr Runoff Volume (P1 = 1.75 in.) =	0.328	acre-feet	1.75	inches
25-yr Runoff Volume (P1 = 2 in.) =	0.408	acre-feet	2.00	inches
50-yr Runoff Volume (P1 = 2.25 in.) =	0.485	acre-feet	2.25	inches
100-yr Runoff Volume (P1 = 2.52 in.) =	0.583	acre-feet	2.52	inches
500-yr Runoff Volume (P1 = 3 in.) =	0.745	acre-feet	3.00	inches
Approximate 2-yr Detention Volume =	0.189	acre-feet		
Approximate 5-yr Detention Volume =	0.248	acre-feet		
Approximate 10-yr Detention Volume =	0.302	acre-feet		
Approximate 25-yr Detention Volume =	0.367	acre-feet		
Approximate 50-yr Detention Volume =	0.408	acre-feet		
Approximate 100-yr Detention Volume =	0.456	acre-feet		

Define Zones and Basin Geometry

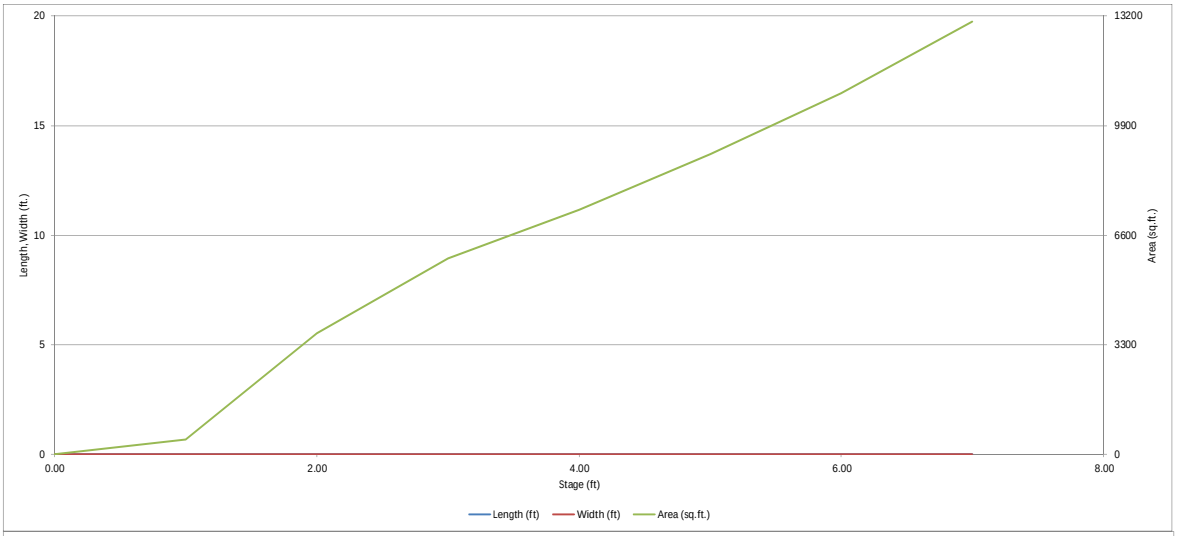
Zone 1 Volume (WQCV) =	0.083	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.210	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.163	acre-feet
Total Detention Basin Volume =	0.456	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (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_{LW}) =	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

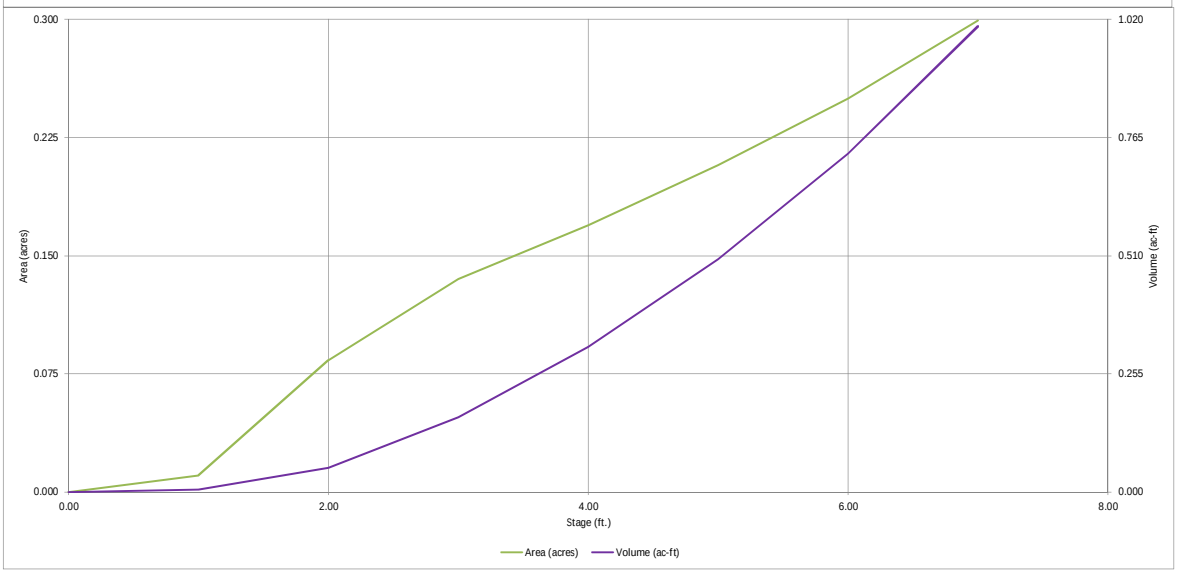
Depth Increment = ft

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)
6431 Top of Micropool	--	0.00	--	--	--	0	0.000		
6432	--	1.00	--	--	--	447	0.010	223	0.005
6433	--	2.00	--	--	--	3,633	0.083	2,263	0.052
6434	--	3.00	--	--	--	5,896	0.135	7,028	0.161
6435	--	4.00	--	--	--	7,370	0.169	13,661	0.314
6436	--	5.00	--	--	--	9,044	0.208	21,868	0.502
6437	--	6.00	--	--	--	10,876	0.250	31,828	0.731
6438	--	7.00	--	--	--	13,042	0.299	43,787	1.005

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.04 (February 2021)



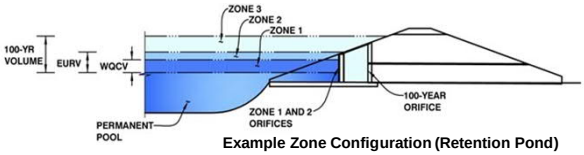


DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)

Project: Palmer Village

Basin ID: Pond B (East Parcel)



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	2.34	0.083	Orifice Plate
Zone 2 (EURV)	3.88	0.210	Orifice Plate
Zone 3 (100-year)	4.78	0.163	Weir&Pipe (Restrict)
Total (all zones)		0.456	

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

Calculated Parameters for Underdrain

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

Invert of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)	WQ Orifice Area per Row =	2.361E-03	ft^2
Depth at top of Zone using Orifice Plate =	3.90	ft (relative to basin bottom at Stage = 0 ft)	Elliptical Half-Width =	N/A	feet
Orifice Plate: Orifice Vertical Spacing =	N/A	inches	Elliptical Slot Centroid =	N/A	feet
Orifice Plate: Orifice Area per Row =	0.34	sq. inches (diameter = 5/8 inch)	Elliptical Slot Area =	N/A	ft^2

Calculated Parameters for Plate

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	1.00	2.00					
Orifice Area (sq. inches)	0.34	0.34	0.34					

	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			Not Selected	Not Selected	
Invert of Vertical Orifice =	2.85	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Area =	0.03	N/A	ft^2
Depth at top of Zone using Vertical Orifice =	3.84	N/A	ft (relative to basin bottom at Stage = 0 ft)	Vertical Orifice Centroid =	0.08	N/A	feet
Vertical Orifice Diameter or Height =	2.00	N/A	inches				
Vertical Orifice Width =	2.00		inches				

Calculated Parameters for Vertical Orifice

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

	Zone 3 Weir	Not Selected			Zone 3 Weir	Not Selected	
Overflow Weir Front Edge Height, Ho =	4.55	N/A	ft (relative to basin bottom at Stage = 0 ft)	Height of Grate Upper Edge, H_t =	4.55	N/A	feet
Overflow Weir Front Edge Length =	3.00	N/A	feet	Overflow Weir Slope Length =	3.00	N/A	feet
Overflow Weir Grate Slope =	0.00	N/A	H:V	Grate Open Area / 100-yr Orifice Area =	40.63	N/A	
Horiz. Length of Weir Sides =	3.00	N/A	feet	Overflow Grate Open Area w/o Debris =	7.12	N/A	ft^2
Overflow Grate Type =	Close Mesh Grate	N/A		Overflow Grate Open Area w/ Debris =	3.56	N/A	ft^2
Debris Clogging % =	50%	N/A	%				

Calculated Parameters for Overflow Weir

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

	Zone 3 Restrictor	Not Selected			Zone 3 Restrictor	Not Selected	
Depth to Invert of Outlet Pipe =	0.00	N/A	ft (distance below basin bottom at Stage = 0 ft)	Outlet Orifice Area =	0.18	N/A	ft^2
Outlet Pipe Diameter =	18.00	N/A	inches	Outlet Orifice Centroid =	0.14	N/A	feet
Restrictor Plate Height Above Pipe Invert =	2.80		inches	Half-Central Angle of Restrictor Plate on Pipe =	0.81	N/A	radians

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	5.00	ft (relative to basin bottom at Stage = 0 ft)	Spillway Design Flow Depth=	0.31 feet
Spillway Crest Length =	20.00	feet	Stage at Top of Freeboard =	6.31 feet
Spillway End Slopes =	4.00	H:V	Basin Area at Top of Freeboard =	0.27 acres
Freeboard above Max Water Surface =	1.00	feet	Basin Volume at Top of Freeboard =	0.81 acre-ft

Calculated Parameters for Spillway

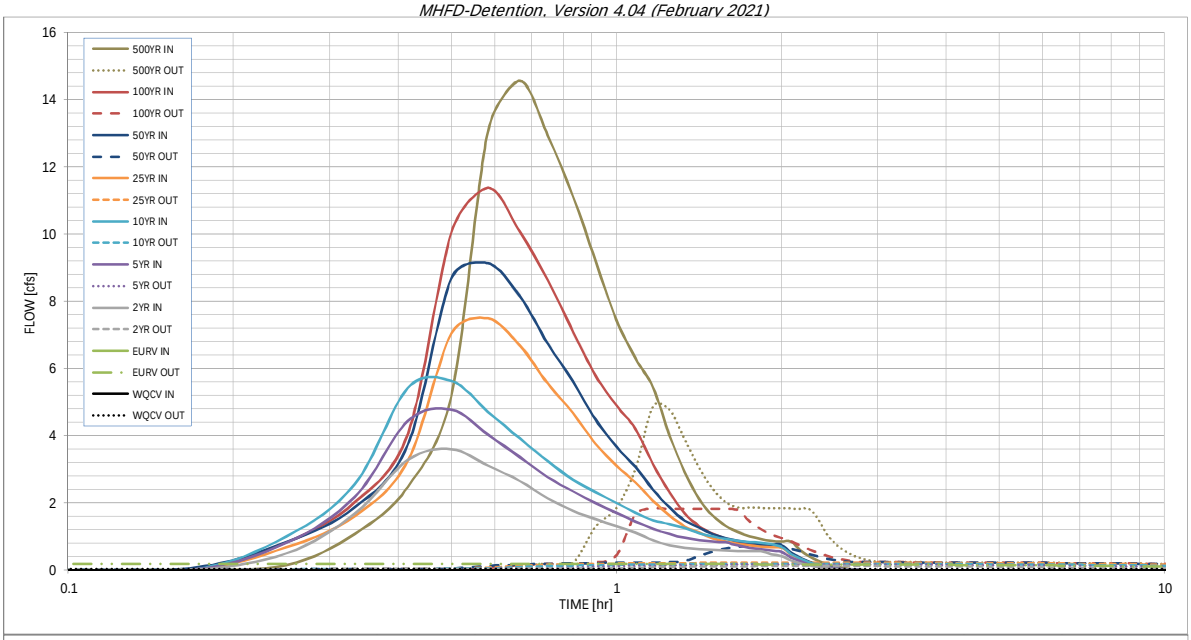
Routed Hydrograph Results

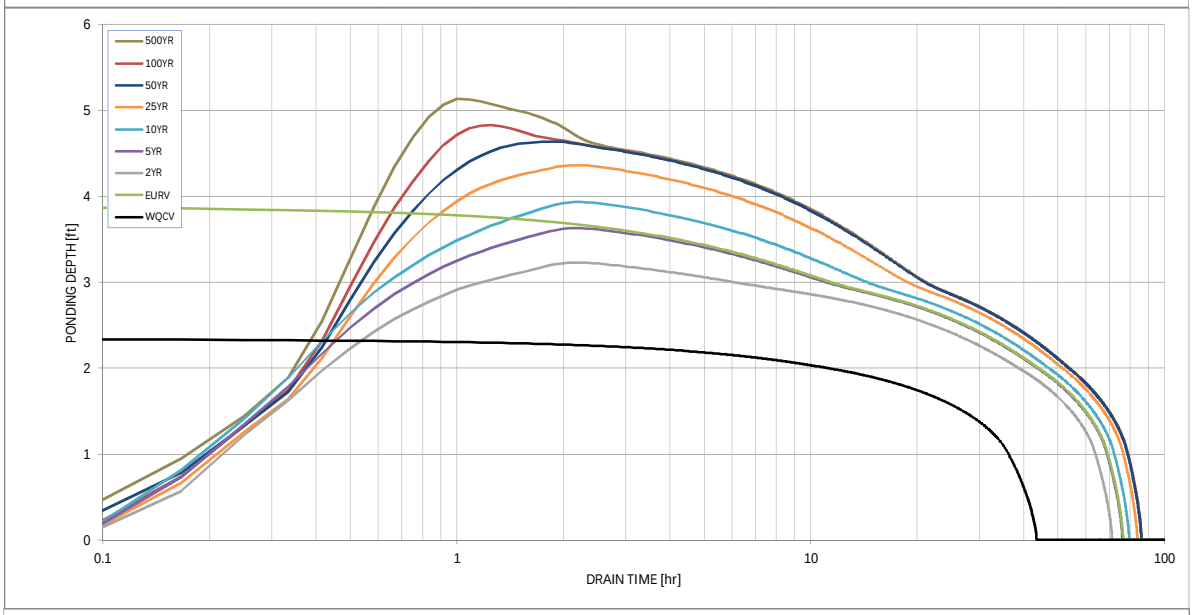
The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

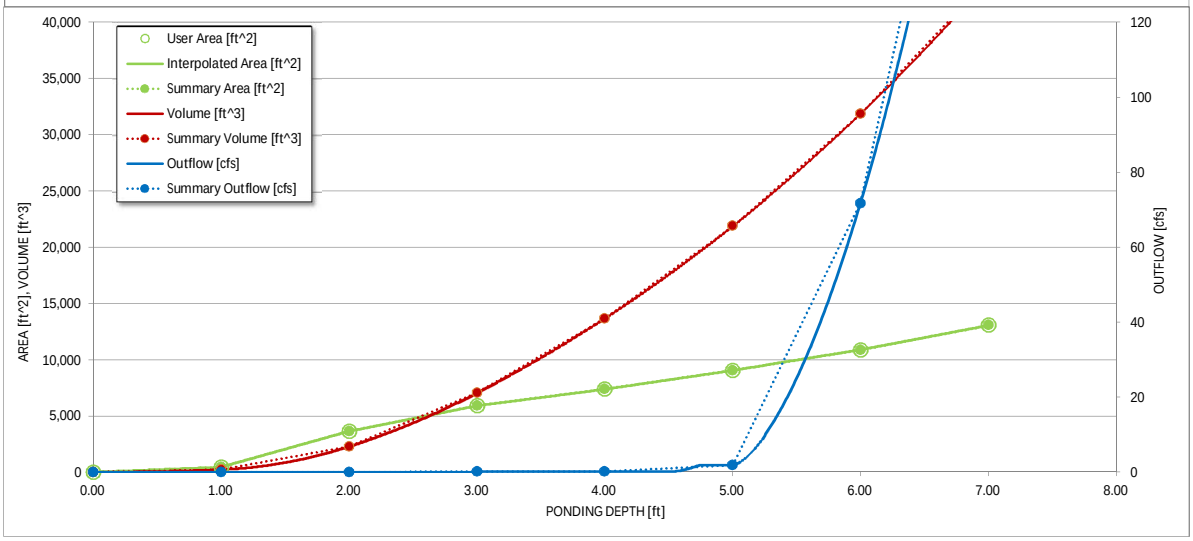
Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	1.19	1.50	1.75	2.00	2.25	2.52	3.00
CUHP Runoff Volume (acre-ft) =	0.083	0.293	0.207	0.274	0.328	0.408	0.485	0.583	0.745
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.207	0.274	0.328	0.408	0.485	0.583	0.745
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.1	0.1	1.0	2.0	3.3	5.2
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.02	0.02	0.22	0.43	0.71	1.14
Peak Inflow Q (cfs) =	N/A	N/A	3.6	4.8	5.6	7.5	9.1	11.4	14.6
Peak Outflow Q (cfs) =	0.0	0.2	0.1	0.2	0.2	0.2	0.7	1.8	4.9
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	2.0	1.7	0.2	0.4	0.6	0.9
Structure Controlling Flow =	Plate	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Vertical Orifice 1	Overflow Weir 1	Outlet Plate 1	Spillway
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	0.1	0.2	0.2
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	39	66	63	66	69	71	72	71	68
Time to Drain 99% of Inflow Volume (hours) =	42	72	67	72	74	78	79	78	77
Maximum Ponding Depth (ft) =	2.34	3.88	3.23	3.63	3.93	4.36	4.64	4.83	5.13
Area at Maximum Ponding Depth (acres) =	0.10	0.17	0.14	0.16	0.17	0.18	0.19	0.20	0.21
Maximum Volume Stored (acre-ft) =	0.083	0.294	0.192	0.253	0.302	0.377	0.428	0.465	0.529

DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.04 (February 2021)







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

DETENTION BASIN OUTLET STRUCTURE DESIGN

Outflow Hydrograph Workbook Filename:

Inflow Hydrographs

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

	SOURCE	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP	CUHP
Time Interval	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	0.06	0.01	0.14
	0:15:00	0.00	0.00	0.50	0.81	1.00	0.67	0.83	0.82	1.08
	0:20:00	0.00	0.00	1.68	2.18	2.56	1.61	1.87	2.01	2.47
	0:25:00	0.00	0.00	3.28	4.43	5.42	3.25	3.73	4.05	5.17
	0:30:00	0.00	0.00	3.59	4.77	5.63	7.03	8.68	10.03	13.05
	0:35:00	0.00	0.00	3.11	4.03	4.71	7.49	9.13	11.37	14.56
	0:40:00	0.00	0.00	2.65	3.36	3.92	6.68	8.15	10.07	12.93
	0:45:00	0.00	0.00	2.13	2.76	3.24	5.55	6.73	8.62	11.12
	0:50:00	0.00	0.00	1.76	2.34	2.69	4.67	5.62	7.10	9.19
	0:55:00	0.00	0.00	1.52	1.99	2.32	3.76	4.48	5.79	7.45
	1:00:00	0.00	0.00	1.31	1.70	2.00	3.11	3.68	4.90	6.31
	1:05:00	0.00	0.00	1.12	1.44	1.71	2.61	3.06	4.21	5.43
	1:10:00	0.00	0.00	0.88	1.24	1.48	2.06	2.39	3.15	4.02
	1:15:00	0.00	0.00	0.74	1.07	1.36	1.63	1.86	2.32	2.92
	1:20:00	0.00	0.00	0.66	0.96	1.24	1.30	1.47	1.68	2.10
	1:25:00	0.00	0.00	0.62	0.89	1.09	1.11	1.25	1.30	1.61
	1:30:00	0.00	0.00	0.60	0.85	0.99	0.95	1.07	1.08	1.32
	1:35:00	0.00	0.00	0.58	0.82	0.92	0.84	0.95	0.93	1.13
	1:40:00	0.00	0.00	0.57	0.73	0.87	0.77	0.87	0.84	1.01
	1:45:00	0.00	0.00	0.56	0.66	0.84	0.73	0.82	0.77	0.92
	1:50:00	0.00	0.00	0.56	0.62	0.81	0.70	0.78	0.73	0.87
	1:55:00	0.00	0.00	0.47	0.58	0.77	0.68	0.76	0.71	0.85
	2:00:00	0.00	0.00	0.41	0.54	0.69	0.66	0.75	0.71	0.84
	2:05:00	0.00	0.00	0.29	0.38	0.48	0.46	0.52	0.49	0.59
	2:10:00	0.00	0.00	0.20	0.26	0.33	0.32	0.36	0.34	0.40
	2:15:00	0.00	0.00	0.13	0.17	0.23	0.22	0.24	0.23	0.27
	2:20:00	0.00	0.00	0.09	0.11	0.15	0.14	0.16	0.15	0.18
	2:25:00	0.00	0.00	0.05	0.07	0.09	0.09	0.10	0.10	0.12
	2:30:00	0.00	0.00	0.03	0.05	0.06	0.06	0.06	0.06	0.07
	2:35:00	0.00	0.00	0.02	0.02	0.03	0.03	0.03	0.03	0.04
	2:40:00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	2:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	2:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:15:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:20:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:25:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:30:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:35:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:40:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:45:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:50:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	3:55:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:00:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:05:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	4:10:00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	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 4.04 (February 2021)

Summary Stage-Area-Volume-Discharge Relationships

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]
6431	0.00	0	0.000	0	0.000	0.00
6432	1.00	447	0.010	223	0.005	0.01
6433	2.00	3,633	0.083	2,263	0.052	0.03
6434	3.00	5,896	0.135	7,028	0.161	0.08
6435	4.00	7,370	0.169	13,661	0.314	0.20
6436	5.00	9,044	0.208	21,868	0.502	1.86
6437	6.00	10,876	0.250	31,828	0.731	71.64
6538	7.00	13,042	0.299	43,787	1.005	226.22

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).

Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 28 2020

POND A FOREBAY NOTCH

Rectangular Weir

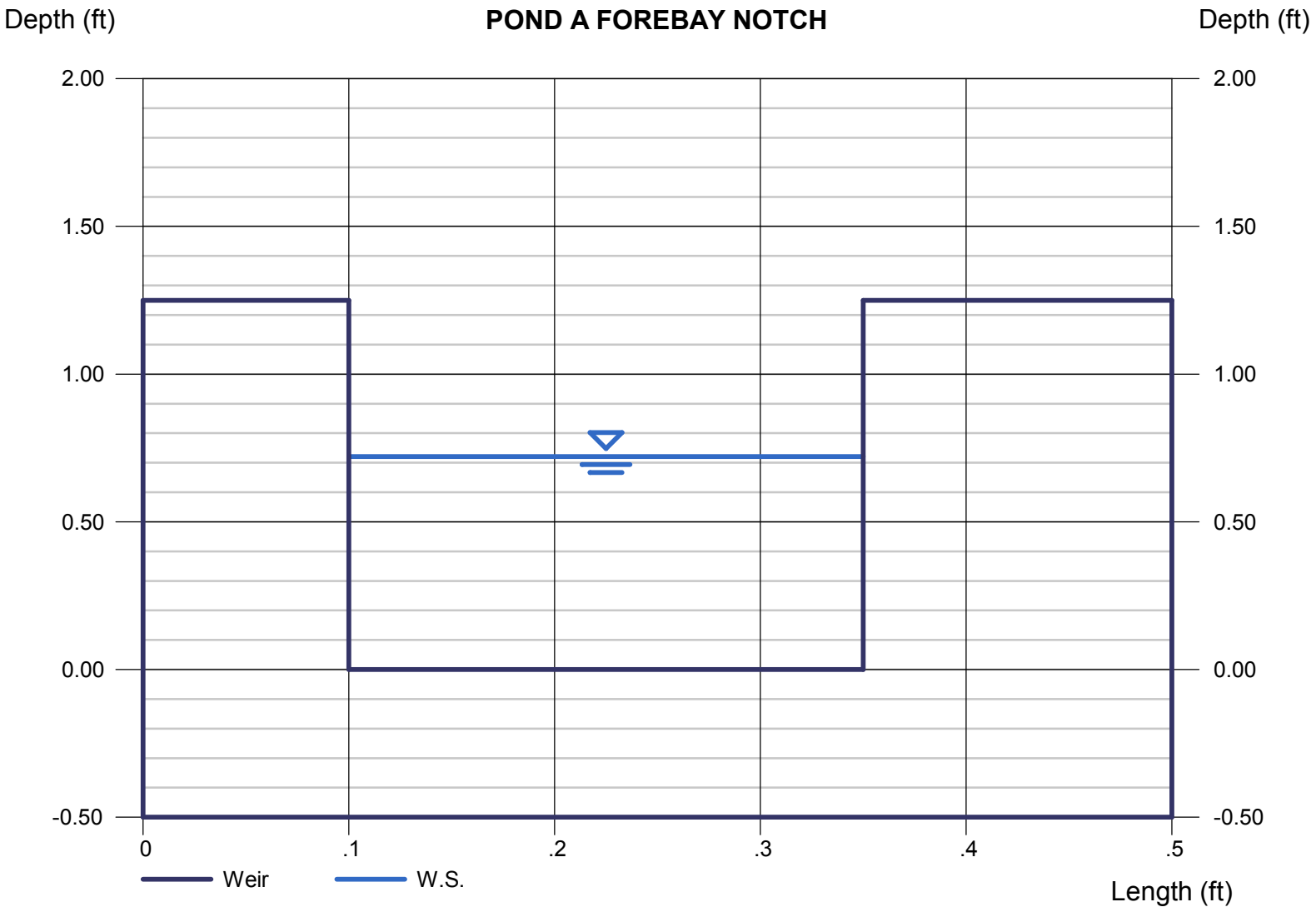
Crest	= Sharp
Bottom Length (ft)	= 0.25
Total Depth (ft)	= 1.25

Calculations

Weir Coeff. Cw	= 3.33
Compute by:	Known Q
Known Q (cfs)	= 0.51

Highlighted

Depth (ft)	= 0.72
Q (cfs)	= 0.510
Area (sqft)	= 0.18
Velocity (ft/s)	= 2.83
Top Width (ft)	= 0.25



Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 28 2020

POND B FOREBAY NOTCH

Rectangular Weir

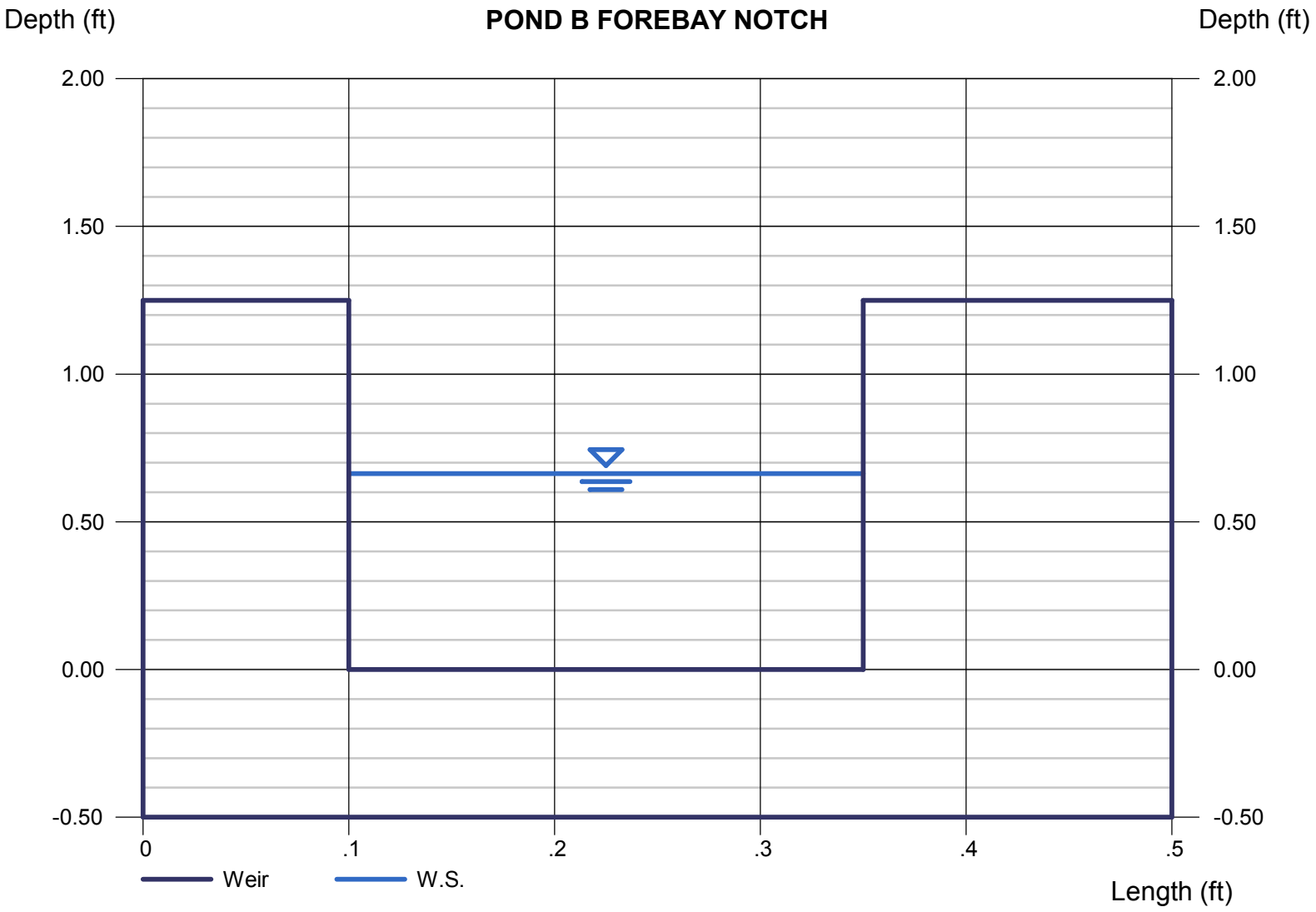
Crest	= Sharp
Bottom Length (ft)	= 0.25
Total Depth (ft)	= 1.25

Calculations

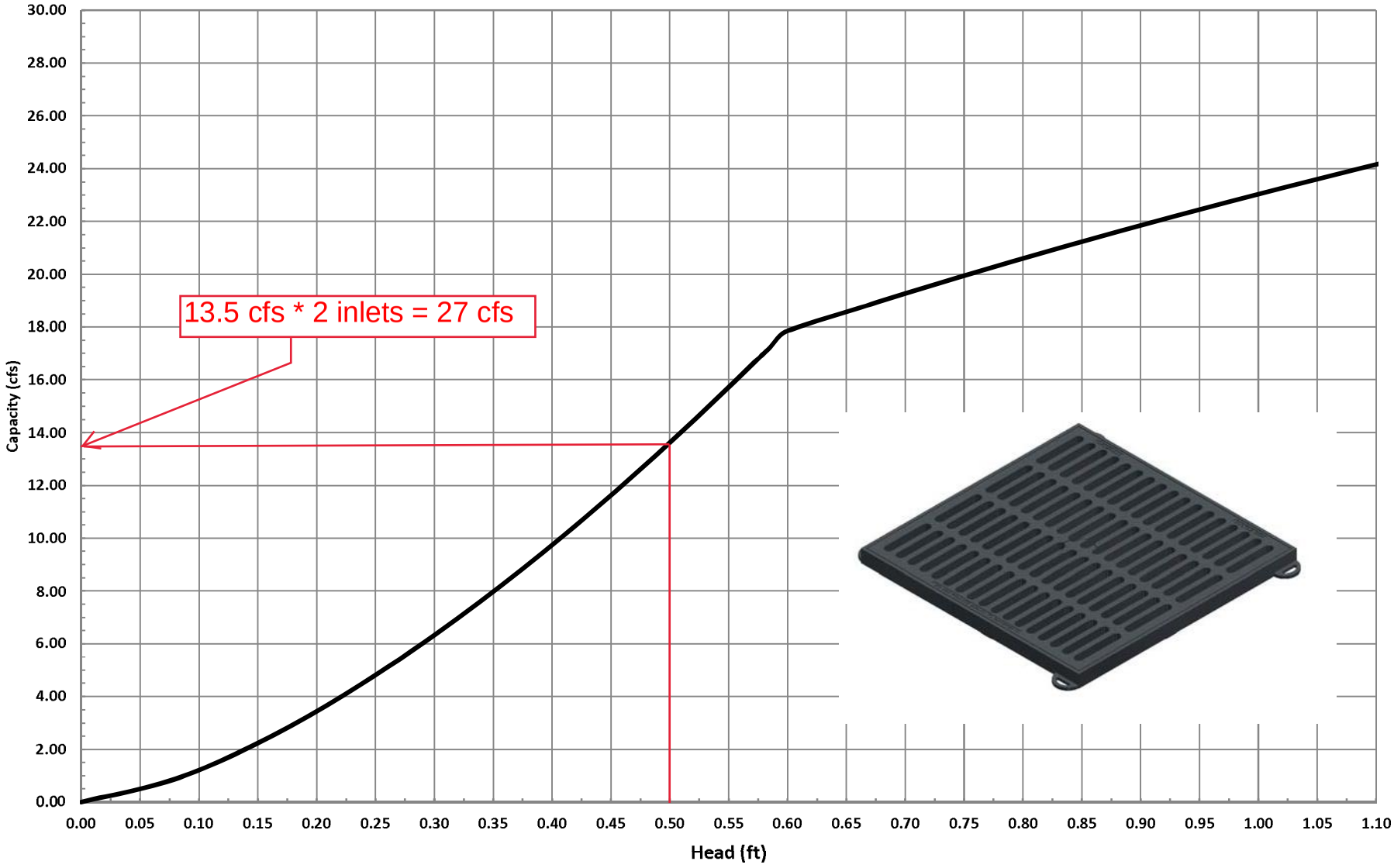
Weir Coeff. Cw	= 3.33
Compute by:	Known Q
Known Q (cfs)	= 0.45

Highlighted

Depth (ft)	= 0.66
Q (cfs)	= 0.450
Area (sqft)	= 0.17
Velocity (ft/s)	= 2.71
Top Width (ft)	= 0.25



Nyloplast 3' x 3' Road & Highway Inlet Capacity Chart



100-year peak flow to pond (SF-3):
Pond A: 25.6 cfs
Pond B: 22.6 cfs

Nyloplast
3130 Verona Avenue • Buford, GA 30518
(866) 888-8479 / (770) 932-2443 • Fax: (770) 932-2490

Weir Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 28 2020

POND B SPILLWAY (Q100 = 22.6 CFS PER SF-3 MAJOR (RATIONAL CALCULATIONS))

Trapezoidal Weir

Crest	= Sharp
Bottom Length (ft)	= 20.00
Total Depth (ft)	= 1.50
Side Slope (z:1)	= 4.00

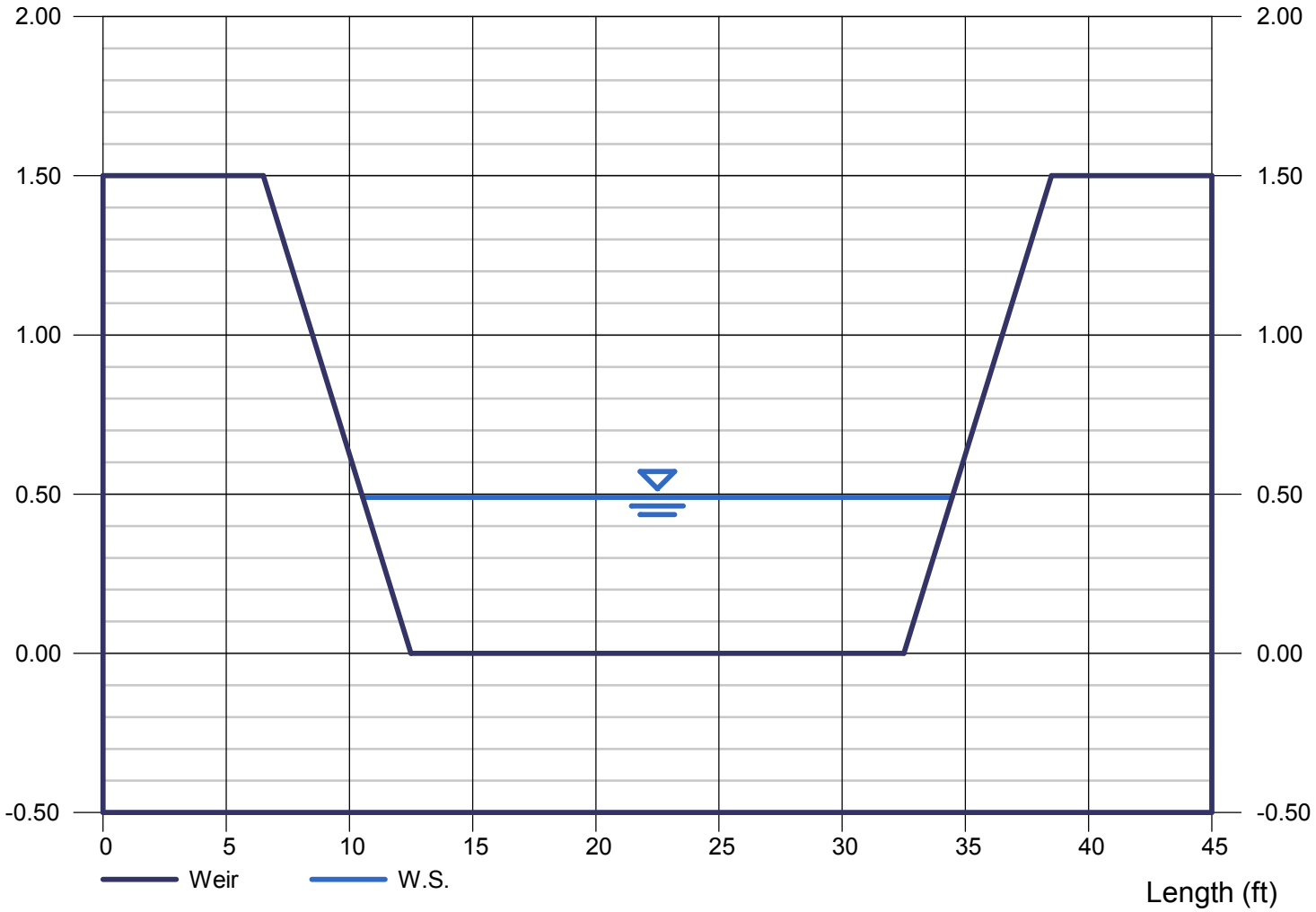
Calculations

Weir Coeff. Cw	= 3.10
Compute by:	Known Q
Known Q (cfs)	= 22.60

Highlighted

Depth (ft)	= 0.49
Q (cfs)	= 22.60
Area (sqft)	= 10.76
Velocity (ft/s)	= 2.10
Top Width (ft)	= 23.92

Depth (ft) **POND B SPILLWAY (Q100 = 22.6 CFS PER SF-3 MAJOR (RATIONAL CALCULATIONS))** Depth (ft)



Appendix E
Reference Material

El Paso County Drainage Basin Fees

Resolution No. 19-441

Basin Number	Receiving Waters	Year Studied	Drainage Basin Name	2020 Drainage Fee (per Impervious Acre)	2020 Bridge Fee (per Impervious Acre)
Drainage Basins with DBPS's:					
CHMS0200	Chico Creek	2013	Haegler Ranch	$10,737	$1,585
CHWS1200	Chico Creek	2001	Bennett Ranch	$12,020	$4,611
CHWS1400	Chico Creek	2013	Falcon	$30,807	$4,232
FOFO2000	Fountain Creek	2001	West Fork Jimmy Camp Creek	$13,066	$3,866
FOFO2600	Fountain Creek	1991*	Big Johnson / Crews Gulch	$19,084	$2,464
FOFO2800	Fountain Creek	1988*	Widefield	$19,084	$0
FOFO2900	Fountain Creek	1988*	Security	$19,084	$0
FOFO3000	Fountain Creek	1991*	Windmill Gulch	$19,084	$286
FOFO3100 / FOFO3200	Fountain Creek	1988*	Carson Street / Little Johnson	$11,640	$0
FOFO3400	Fountain Creek	1984*	Peterson Field	$13,764	$1,044
FOFO3600	Fountain Creek	1991*	Fisher's Canyon	$19,084	$0
FOFO4000	Fountain Creek	1996	Sand Creek	$19,698	$8,057
FOFO4200	Fountain Creek	1977	Spring Creek	$9,897	$0
FOFO4600	Fountain Creek	1984*	Southwest Area	$19,084	$0
FOFO4800	Fountain Creek	1991	Bear Creek	$19,084	$1,044
FOFO5400	Fountain Creek	1977	21st Street	$5,742	$0
FOFO5600	Fountain Creek	1964	19th Street	$3,756	$0
FOFO5800	Fountain Creek	1964	Camp Creek	$2,115	$0
FOMO0400	Monument Creek	1986*	Mesa	$9,982	$0
FOMO1000	Monument Creek	1981	Douglas Creek	$12,001	$265
FOMO1200	Monument Creek	1977	Templeton Gap	$12,320	$286
FOMO1400	Monument Creek	1976	Pope's Bluff	$3,823	$652
FOMO1600	Monument Creek	1976	South Rockrimmon	$4,486	$0
FOMO1800	Monument Creek	1973	North Rockrimmon	$5,742	$0
FOMO2000	Monument Creek	1971	Pulpit Rock	$6,328	$0
FOMO2200	Monument Creek	1994	Cottonwood Creek / S. Pine	$19,084	$1,044
FOMO2400	Monument Creek	1966	Dry Creek	$15,065	$545
FOMO3600	Monument Creek	1989*	Black Squirrel Creek	$8,664	$545
FOMO3700	Monument Creek	1987*	Middle Tributary	$15,925	$0
FOMO3800	Monument Creek	1987*	Monument Branch	$19,084	$0
FOMO4000	Monument Creek	1996	Smith Creek	$7,780	$1,044
FOMO4200	Monument Creek	1989*	Black Forest	$19,084	$520
FOMO5200	Monument Creek	1993*	Dirty Woman Creek	$19,084	$1,044
FOMO5300	Fountain Creek	1993*	Crystal Creek	$19,084	$1,044
Miscellaneous Drainage Basins: [1]					
CHBS0800	Chico Creek		Book Ranch	$17,906	$2,592
CHEC0400	Chico Creek		Upper East Chico	$9,755	$283
CHWS0200	Chico Creek		Telephone Exchange	$10,718	$251
CHWS0400	Chico Creek		Livestock Company	$17,655	$210
CHWS0600	Chico Creek		West Squirrel	$9,203	$3,819
CHWS0800	Chico Creek		Solberg Ranch	$19,084	$0
FOFO1200	Fountain Creek		Crooked Canyon	$5,761	$0
FOFO1400	Fountain Creek		Calhan Reservoir	$4,810	$280
FOFO1600	Fountain Creek		Sand Canyon	$3,475	$0
FOFO2000	Fountain Creek		Jimmy Camp Creek[3]	$19,084	$893
FOFO2200	Fountain Creek		Fort Carson	$15,065	$545
FOFO2700	Fountain Creek		West Little Johnson	$1,257	$0
FOFO3800	Fountain Creek		Stratton	$9,154	$409
FOFO5000	Fountain Creek		Midland	$15,065	$545
FOFO6000	Fountain Creek		Palmer Trail	$15,065	$545
FOFO6800	Fountain Creek		Black Canyon	$15,065	$545
FOMO4600	Monument Creek		Beaver Creek	$11,409	$0
FOMO3000	Monument Creek		Kettle Creek	$10,305	$0
FOMO3400	Monument Creek		Elkhorn	$1,731	$0
FOMO5000	Monument Creek		Monument Rock	$8,272	$0
FOMO5400	Monument Creek		Palmer Lake	$13,226	$0
FOMO5600	Monument Creek		Raspberry Mountain	$4,449	$0
PLPL0200	Monument Creek		Bald Mountain	$9,481	$0
Interim Drainage Basins: [2]					
FOFO1800	Fountain Creek		Little Fountain Creek	$2,440	$0
FOMO4400	Monument Creek		Jackson Creek	$7,554	$0
FOMO4800	Monument Creek		Teachout Creek	$5,245	$788

1. The miscellaneous drainage fee previous to September 1999 resolution was the average of all drainage fees for basins with Basin Planning Studies performed within the last 14 years.

2. Interim Drainage Fees are based upon draft Drainage Basin Planning Studies or the Drainage Basin Identification and Fee Estimation Report. (Best available information suitable for setting a fee.)

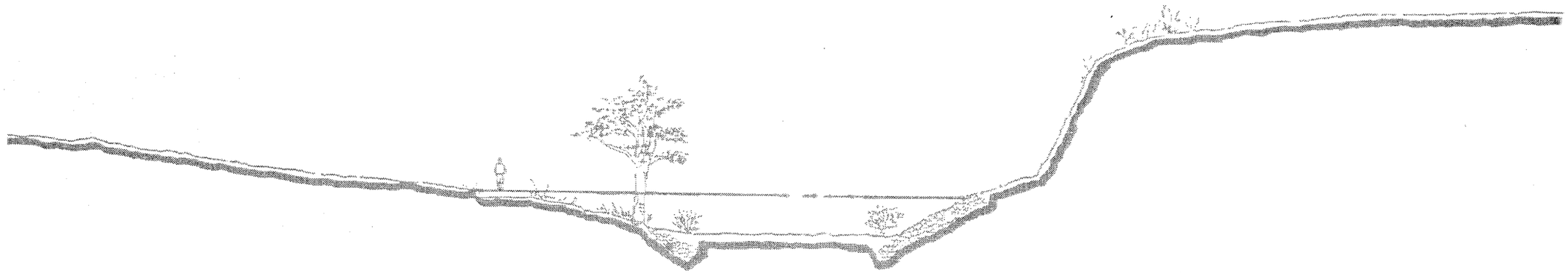
3. This is an interim fee and will be adjusted when a DBPS is completed. In addition to the Drainage Fee a surety in the amount of $7,285 per impervious acre shall be provided to secure payment of additional fees in the event that the DBPS results in a fee greater than the current fee. Fees paid in excess of the future revised fee will be reimbursed. See Resolution 06-326 (9/14/06) and Resolution 16-320 (9/07/16).

EPC Stormwater Management *Jennifer Irvine, P.E.*

SAND CREEK DRAINAGE BASIN PLANNING STUDY

PRELIMINARY DESIGN REPORT

CITY OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO



PREPARED FOR:

City of Colorado Springs
Department of Comprehensive Planning, Development and Finance
Engineering Division
30 S. Nevada
Colorado Springs, Colorado 80903

PREPARED BY:

Kiowa Engineering Corporation
1011 North Weber
Colorado Springs, CO 80903

II. STUDY AREA DESCRIPTION

The Sand Creek drainage basin is a left-bank tributary to the Fountain Creek lying in the west-central portions of El Paso County. Sand Creek's drainage area at Fountain Creek is approximately 54 square miles of which approximately 18.8 square miles are inside the City of Colorado Springs corporate limits. The basin is divided into five major sub-basins, the Sand Creek mainstem, the East Fork Sand Creek, the Central Tributary to East Fork, the West Fork, and the East Fork Subtributary. Figure II-1 shows the location of the Sand Creek basin.

Basin Description

The Sand Creek basin covers a total of 54 square miles in unincorporated El Paso County and Colorado Springs, Colorado. Of this total, approximately 28 square miles is encompassed by the Sand Creek basin, and 26 square miles for the East Fork Sand Creek basin. The basin trends in generally a south to southwesterly direction, entering the Fountain Creek approximately two miles upstream of the Academy Boulevard bridge over Fountain Creek. Two main tributaries drain the basin, those being the mainstem of Sand Creek and East Fork Sand Creek. Development presence in most evident along the mainstream. At this time, approximately 25 percent of the basin is developed. This alternative evaluation focuses upon the Sand Creek basin only.

The maximum basin elevation is approximately 7,620 feet above mean sea level, and falls to approximately 5,790 feet at the confluence with Fountain Creek. The headwaters of the basin originate in the conifer covered areas of The Black Forest. The middle eastern portions of the basin are typified by rolling range land with fair to good vegetative cover associated with semi-arid climates.

Climate

This area of El Paso County can be described, in general as high plains, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry. Precipitation ranges from 14 to 16 inches per year, with the majority of this precipitation occurring in spring and summer in the form of rainfall. Thunderstorms are common during the summer months, and are typified by quick-moving low pressure cells which draw moisture from the Gulf of Mexico into the region. Average temperatures range from about 30^{O}F in the winter to 75^{O} in the summer. The relative humidity ranges from about 25 percent in the summer to 45 percent in the winter.

Soils and Geology

Soils within the Sand Creek basin vary between soil types A through D, as identified by the U. S. Department of Agriculture, Soil Conservation Service. The predominant soil groupings are in the Truckton and Bresser soil associations. The soils consist of deep, well drained soils that formed in alluvium and residium, derived from sedimentary rock. The soils have high to moderate infiltration rates, and are extremely susceptible to wind and water erosion where poor vegetation cover exists. In undeveloped areas, the predominance of Type A and B soils give this basin a lower runoff per unit area as compared to basins with soils dominated by Types C and D. Presented on Figure II-2 is the Hydrologic Soil distribution map for the Sand Creek basin.

Property Ownership and Impervious Land Densities

Property ownership along the major drainageway within the Sand Creek basin vary from public to private. Along the developed reaches, drainage right-of-ways and greenbelts have been dedicated during the development of the adjacent residential and commercial land. Where development has not occurred, the drainageways remain under private ownership with no delineated drainage right-of-way or easements. There are several public parks which abut the mainstem of Sand Creek. Roadway and utility easements abutting or crossing the major drainageways occur most frequently in the developed portions of the basin.

Land use information for the existing and future conditions were reviewed as part of the planning effort. This information is used in the hydrologic analysis to predict runoff rates and volumes for the purposes of facility evaluation. The identification of land uses abutting the drainageways is also useful in the identification of feasible plans for stabilization and aesthetic treatment of the creek. Presented on Figure II-3 is the proposed land use map used in the evaluation of impervious land densities discussed in the hydrologic section of this report. Figure II-3 is not intended to reflect the future zoning or land use policies of the City or the County.

The land use information within the Banning-Lewis Ranch property was obtained from Aries Properties during the time the draft East Fork Sand Creek Drainage Basin Planning Study was being prepared. The land use information was again reviewed with the City of Colorado Springs Department of Planning and was found to be appropriate for use in the estimation of hydrology for the East Fork Basin. The location of future arterial streets and roadways within

N

EAST BIERSTADT CREEK

WEST BIERSTADT CREEK

EAST FORK SAND CREEK

SITE

WEST TRIB TO RANCHES BASIN SAND CREEK

CENTER TRIBUTARY SAND CREEK

LOWER BASIN SAND CREEK

UPPER BASIN SAND CREEK

WEST FORK SAND CREEK

FOUNTAIN CREEK

WOODMEN

HILLTOP BLVD

STETSON

CONSTITUTION

VOLLMER RD.

MARKSHEFFEL RD.

POWERS BLVD.

GALLEY

PLATTE

FOUNTAIN

HANCOCK

Kiowa Engineering Corporation
419 W. Bijou Street
Colorado Springs, Colorado
80905-1308

SAND CREEK DRAINAGE BASIN PLANNING STUDY

REGIONAL SUB-BASINS

Project No	90-04-09
Date:	11/90
Design:	
Drawn:	EAK
Check:	
Revisions:	

11

FIG. III-1

HANNAH RIDGE AT FEATHERGRASS
MASTER DRAINAGE DEVELOPMENT PLAN

November 15, 2007
Project No. 60754

PREPARED FOR:

FEATHERGRASS INVESTMENTS, LLC
4715 North Chestnut Street
Colorado Springs, CO 80907
(719) 593-8367

Kenneth P. Driscoll, Manager

PREPARED BY:

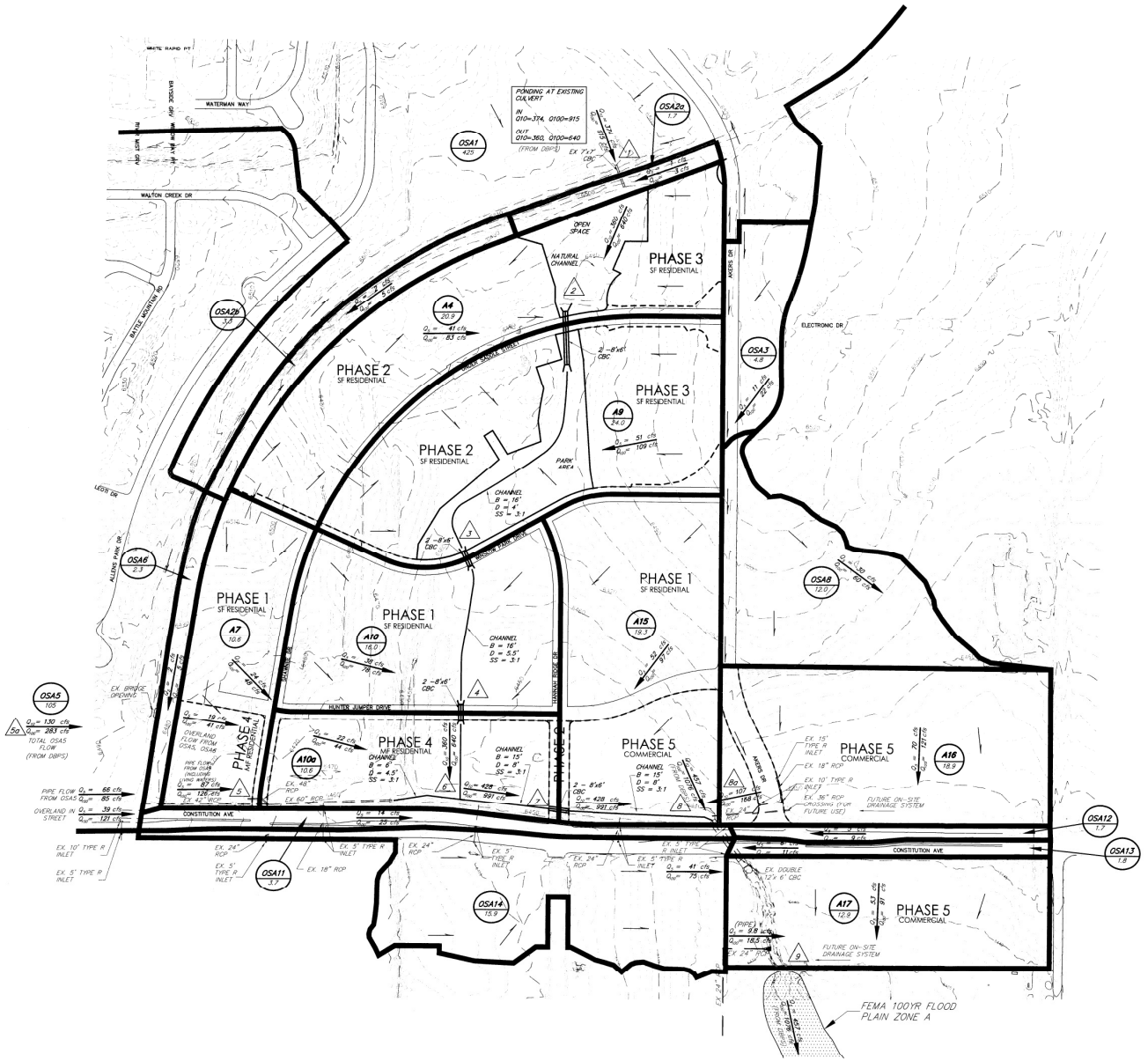
M.V.E., Inc.
1903 Lelaray Street, Suite 200
Colorado Springs, CO 80909
(719) 635-5736

discharges of $Q_5 = 2$ cfs and $Q_{100} = 5$ cfs. Basin OSA8, on the east side of Akers Drive, drains south onto the eastern section of the property with peak discharges of $Q_5 = 30$ cfs and $Q_{100} = 60$ cfs. Flows from Basin OSA3 and a portion of Basin OSA8 enters Akers Drive. The existing Akers Drive and Akers drainage improvements were designed by M.V.E., Inc. and approved by El Paso County D.O.T. in September 2006. The system was designed to capture and convey developed flows in Akers Drive. One 10 ft Type R inlet and one 15 ft Type R inlet, connected by an 18" RCP are installed on the east side of Akers, just north of the Constitution intersection. A 10 ft Type R inlet is located on the west side of Akers. The flows collected by the inlets are discharged at the CBC opening, just to the west, with a 24" RCP. The inlets and connecting pipes are adequate to collect and route developed 100 year flows of 20.9 cfs to the creek. In the 100-year event, bypass flows of 5.1 cfs reaches Constitution and travels west to the sump inlet at the CBC crossing. Off-site basins OSA11, OSA12, and OSA13 contain portions of Constitution Avenue. These basins drain to the existing double 12' x 6' CBC under Constitution Avenue. Runoff from Basin OSA14 drains easterly onto the southern portion of the proposed project located on the south side of Constitution Avenue with flows of $Q_5 = 14$ cfs and $Q_{100} = 27$ cfs. Basin OSA14 is currently undeveloped commercial property, just north of the Jessica Heights Filing Nol. 1 residential subdivision. A storm drain pipe from Jessica Heights delivers an additional $Q_5 = 9.8$ cfs and $Q_{100} = 18.5$ cfs to the Tributary 6 channel. These flow enter the property and then travel to the creek flowing to the south.

IV. ON-SITE DRAINAGE BASINS

The existing site drains southerly and easterly from the old Rock Island Railroad that bounds the property on the north and west. Tributary 6 to the East Fork of Sand Creek runs north to south through the property to Constitution Avenue. Offsite storm discharges from the Tributary enter onsite Basin A4 at Design Point 1 (the existing 7'x7' CBC). The existing channel area from the railroad culvert to existing Electronic Drive will be maintained in nearly existing condition. Basin A4 will contain single family residential development with open space components and produce runoff quantities of $Q_5 = 41$ cfs and $Q_{100} = 83$ cfs. Flows from Basin A4, along with the Tributary flows will drain to Design Point 2 at proposed Under Saddle Street. A new CBC beneath the street will allow runoff into Basin A9, where flows will enter a park area by way of an improved channel from the DP 2 culvert. Basin A9 contains single family residential development and open space. Developed runoff discharges of $Q_5 = 51$ cfs and $Q_{100} = 109$ cfs are generated by the basin. A storm

MASTER DEVELOPMENT DRAINAGE PLAN



SCALE

200' 100' 0 100' 200' 400'

150' 50'

1"= 200' 1:2400

NORTH

DEVELOPED SITE HYDROLOGY DATA

DESIGN POINT	AREA (Ac)	Q_{10} (cfs)	Q_{100} (cfs)	INCL. BASINS
1	425.0 (Q_{10})	360	640	OSA1
2	450.9 (Q_{10})	360	640	OSA1, OSA2a, OSA2b, A4
3	474.9 (Q_{10})	360	640	OSA1, OSA2, OSA2b, A4, A9
4	490.9 (Q_{10})	360	640	OSA1, OSA2, A4, A9, A10
5a	105.0 (Q_{10})	130	283	OSA5
5	117.9 (Q_{10})	130	283	OSA5, OSA6, A7
6	619.4 (Q_{10})	428	991	OSA1, OSA2, OSA3, A4, OSA5, OSA6, A7, A9, A10
7	619.4 (Q_{10})	428	991	OSA1, OSA2, OSA3, A4, OSA5, OSA6, A7, A9, A10
8a	35.7 (Q_{10})	107	168	OSA3, OSA8, A16
8	679.8 (Q_{10})	457	1076	OSA1, OSA2, OSA3, A4, OSA5, OSA6 A7, OSA8, A9, A10, A10a, OSA11, OSA12 A15, A16
9	710.4 (Q_{10})	457	1076	OSA1, OSA2, OSA3, A4, OSA5, OSA6 A7, OSA8, A9, A10, A10a, OSA11, OSA12 OSA13, OSA14, A15, A16, A17

LEGEND

- EXISTING INDEX CONTOUR
- EXISTING INTERMEDIATE CONTOUR
- EXISTING STORM DRAIN CURB INLET
- EXISTING STORM DRAIN LINE
- EXISTING PROPERTY LINE
- EXISTING ROAD
- PROPOSED CULVERT W/ RIPRAP APRON
- PROPOSED DRAINAGE CHANNEL
- PROPOSED PROJECT PHASE LINE
- DRAINAGE BASIN BOUNDARY
- DRAINAGE BASIN DESIGNATION (OSA2, 14.9)
- DRAINAGE BASIN AREA (A5, 2.56)
- FLOW DIRECTION AND QUANTITIES (Q_{10} = 3.3 cfs, Q_{100} = 7.4 cfs)
- FLOW DIRECTION
- DESIGN POINT DESIGNATION (8)

PROJECT: HANNAH RIDGE

TITLE: MDDP DEVELOPED MAP

MONUMENT VALLEY ENGINEERS INC.
ENGINEERS • SURVEYORS
1903 LAKE AVENUE
COLORADO SPRINGS, COLORADO 80909
PHONE (719) 635-5736

DISK NO.
XREFS

PROJ. NO. 60754
DRAWN: DRG
ENGINEER: DRG
CHECKED:
SCALE: 1" = 200'
DATE: 11/15/07
REVISIONS:

NO.:	DATE:	ITEM

SHEET 1 OF 1

DRAWING NO. 60754077

JESSICA HEIGHTS FILING NO. 1
FINAL DRAINAGE REPORT

April 27, 2005
Project No. 60742

PREPARED FOR:

Sand Creek Investments South, LLC
%
Equity Investments
90 South Cascade, Suite 1500
Colorado Springs, CO 80903

PREPARED BY:

M.V.E., Inc.
1903 Lelaray Street, Suite 200
Colorado Springs, CO 80909
(719) 635-5736

roads will be paved county streets within 50 to 80 foot of right-of-ways. Curb & gutter will be constructed on the streets and route storm water flows to storm water inlets. Grading operations will be done in order to improve drainage conditions and to direct runoff to a desired location. Overlot grading will be necessary for subdivision development.

The included **Drainage Map - Developed Condition** shows the proposed road scheme, lot layout, and developed drainage basins with basin designations. The basin sizes and estimated peak storm runoff flows are shown in the table below and on the included map.

Table 3.1 - Developed Condition Hydrologic Data

Design Point or Basin		Cumulative Drainage Area (Ac)	5-yr Discharge (cfs)	100-yr Discharge (cfs)
	OSA	0.15	0.6	1.1
	OSB	0.46	1.8	3.3
	OSC	0.88	3.3	6.0
	A1	0.96	2.0	4.0
	A2	5.25	3.2	7.6
	A3	0.51	1.4	2.8
	A4	O.32	1.3	2.3
	B1	2.27	4.1	8.2
DP 2	B2	0.70	2.0	3.8
DP 3a	B3a	0.77	1.7	3.4
DP 3b	B3b	2.53	4.8	9.6
	B3c	1.35	3.2	6.6
DP3	B3+3b+3c	4.65	8.4	16.9
	B4	0.51	1.4	2.7
	B5	1.06	2.5	5.0
DP5	B6	0.53	1.4	2.6
DP6	B8	1.98	3.9	7.8

Table 3.1 - Developed Condition Hydrologic Data				
Design Point or Basin		Cumulative Drainage Area (Ac)	5-yr Discharge (cfs)	100-yr Discharge (cfs)
DP7	B9	1.29	3.3	6.3
DP8	B10	1.75	3.7	7.6
	B11	1.88	3.9	7.9
DP10	B12	2.48	4.9	9.8
DP11	B13	2.30	5.1	10.2
	B14	0.98	2.4	4.9
	B15	0.24	1.1	2.1
	C1	5.99	2.8	6.8
	OSA+OSB+C1	6.19	3.6	8.1
DP1	OSC+B1	3.15	6.6	12.8
	OSC1+B1+B2+B4	4.36	8.7	17.1
DP4	OSC1+B1+B2+B4+B5	5.42	10.3	20.3
	OSC1+B1+B2+B4+B5+B8	7.40	14.0	27.6
	OSC1+B1+B2+B4+B5+B8+B9	8.69	15.2	30.5
DP9	B10+B11	3.63	7.5	15.2
	A1+A2	6.21	4.6	10.6
	B10+B11+B13+B15+A3	6.68	13.8	27.9

The future lot owners in Jessica Heights Filing No. 1 will adhere to proper construction technics and erosion control. The recommendations within this report need to be followed by the new lot owners. We also recommend that the existing down gradient lot owners not construct their homes in existing drainage swales or flow paths.

The developed conditions will route storm water flows over the site in sheet flow and shallow concentrated flow, depending on the topography and the contributing flow areas. These flows will be routed to the streets. The five and one hundred year frequency storm water flows will be collected and routed to the offsite earthen channel.

The nature of this development dictates that some lots will contribute storm flows onto other lots. This cross-lot drainage cannot be avoided. It is the responsibility of the individual lot owners and the building contractors to locate new structures on each lot so that the structures do not interfere with the proposed drainage pathways. The individual lot owners and contractors should provide positive drainage away from all structures. Individual lot owners are also responsible for maintaining their properties in such a manner that does not allow soil movement from one lot to another.

3.2 Offsite

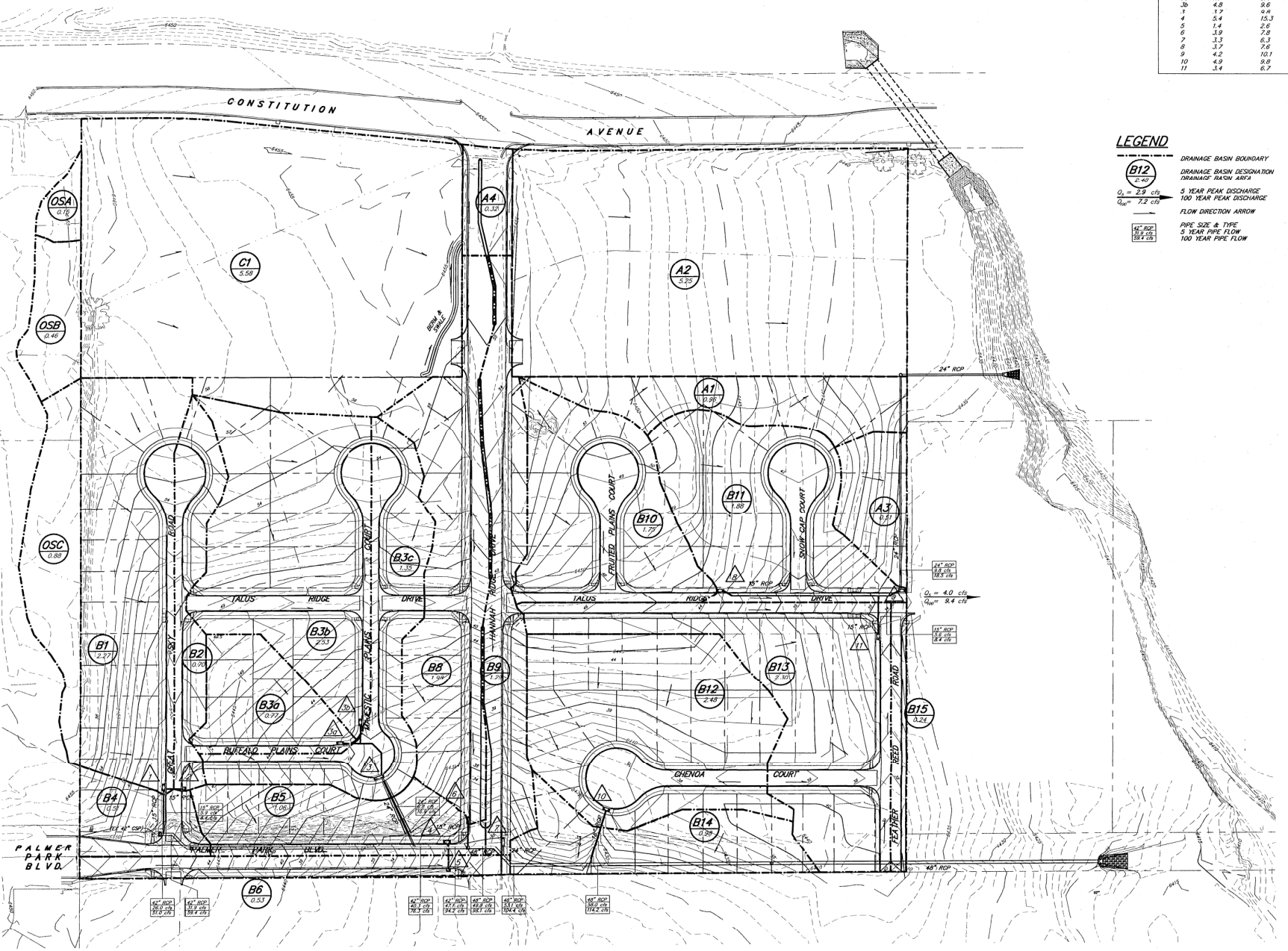
The offsite pipe flow will continue to drain easterly. The pipe will be extended easterly and shall, in addition to the offsite flow, carry the proposed pipe flows from Jessica Heights. The small strip of land adjacent to the west boundary of the site shall continue to drain onto the site as defined by Basin OSC to the north and Basin OSB to the south. Basin C1, which is not being developed at this time, will continue to drain to the east. A berm and swale will direct runoff to the northeast where the flow will enter Hannah Ridge Drive and flow north. When Basin C1 is developed, all flows will be collected and piped to the east. Basin A2 is also not to be developed at this time. Basin A2 will continue to drain to the east.

3.3 Onsite

Basin OSC overland storm water flows enter the subdivision along the western boundary of Basin B1 and travel easterly overland to Great Sky Road. These flows then travel southerly in the street section of said Great Sky Road to a 10' inlet at Design Point No.1. The inlet intercepts Q_5 = 4.5 cfs / Q_{100}= 6.5 cfs of the calculated storm water runoff.

Basin B2 overland storm water flows enter Great Sky Road from the adjacent lots and travel southerly in the street section of said Great Sky Road to a 5' inlet at Design Point No. 2. The inlet intercepts Q_5 = 1.4 cfs / Q_{100}= 1.9 cfs of the calculated storm water runoff. This collected inlet runoff flows via a 15" reinforced concrete pipe (RC Pipe) to the 10' inlet at Design Point No. 1. The combined collected flows of Design Point No's 1 & 2 then flow in a 24" RC Pipe which connects to a Type I Manhole along with the extended existing 42" corrugated metal pipe in Palmer Park Boulevard. A 42" RC Pipe continues east in Palmer Park Boulevard.

Basins B3a, B3b and B3c overland storm water flows enter Buffalo Plains Court, Majestic plains Court, and Talus Ridge Drive. These flows travel via street section easterly, westerly, and



PROPOSED DRAINAGE INLET DATA

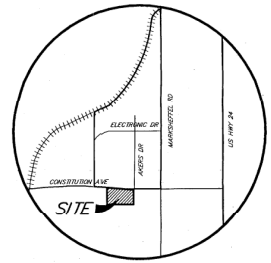
POINT OF INTEREST	Q5 W/ INLETS	Q100 W/ INLETS	INLET SIZE	Q5 INTERCEPTED	Q5 BYPASS	Q100 INTERCEPTED	Q100 BYPASS
1	6.6	12.8	10	4.5	2.1	6.5	6.3
2	2.0	3.8	5	1.4	0.6	1.9	1.9
3a	1.7	3.4	10	1.6	0.1	2.6	0.8
3b	4.8	9.6	10	3.1	1.7	4.5	5.1
1	1.7	9.4	14 (SUMP)	1.7	0.0	9.4	0.0
4	5.4	15.3	10 (SUMP)	5.4	0.0	15.3	0.0
5	1.4	2.6	5 (SUMP)	1.4	0.0	2.6	0.0
6	3.9	7.8	10	2.7	1.2	3.9	3.9
7	3.3	6.3	15 (SUMP)	3.3	0.0	6.3	0.0
8	3.7	7.6	10	2.3	1.4	3.3	4.3
9	4.2	10.1	10 (SUMP)	4.2	0.0	10.1	0.0
10	4.9	9.8	10 (SUMP)	4.9	0.0	9.8	0.0
11	3.4	6.7	10	3.3	0.1	5.1	1.6

LEGEND

- DRAINAGE BASIN BOUNDARY
- B12 / 2.40 — DRAINAGE BASIN DESIGNATION / DRAINAGE BASIN AREA
- Q_5 = 2.9 cfs, Q_{100} = 7.2 cfs — 5 YEAR PEAK DISCHARGE / 100 YEAR PEAK DISCHARGE
- FLOW DIRECTION ARROW
- 42" RCP 59.8 cfs 59.4 cfs — PIPE SIZE & TYPE / 5 YEAR PIPE FLOW / 100 YEAR PIPE FLOW

DEVELOPED DRAINAGE BASIN DATA

	BASIN	AREA	Q5	Q100
	OSA	0.15	0.6	1.1
	OSB	0.46	1.8	3.3
	OSC	0.88	3.3	6.0
	A1	0.96	2.0	4.0
	A2	5.25	3.2	7.6
	A3	0.51	1.4	2.8
	A4	0.32	1.3	2.3
	B1	2.27	4.1	8.2
1	B2	0.70	2.0	3.8
3a	B3a	0.77	1.7	3.4
3b	B3b	2.53	4.8	9.6
	B3c	1.35	3.2	6.6
	B4	0.51	1.4	2.7
	B5	1.06	2.5	5.0
2	B6	0.53	1.4	2.6
4	B8	1.98	3.9	7.8
5	B9	1.29	3.3	6.3
6	B10	1.75	3.7	7.6
	B11	1.88	3.9	7.9
10	B12	2.48	4.9	9.8
11	B13	2.30	5.1	10.2
	B14	0.98	2.4	4.9
	B15	0.24	1.1	2.1
	C1	5.99	2.8	6.8
	OSA+OSB+C1	6.19	3.6	8.1
3	B3a+B3b+B3c	4.65	8.4	16.9
7	OSC+B1	3.15	6.6	12.8
	OSC+B1+B2+B4	4.36	8.7	17.1
8	OSC+B1+B2+B4+B5	5.42	10.3	20.3
	OSC+B1+B2+B4+B5+B8	7.40	14.0	27.6
9	OSC+B1+B2+B4+B5+B8+B9	8.69	15.2	30.5
	B10+B11	3.63	7.5	15.2
	A1+A2	6.21	4.6	10.6
	B10+B11+B13+B15+A3	6.68	13.8	27.9



VICINITY MAP
N.T.S.

NORTH

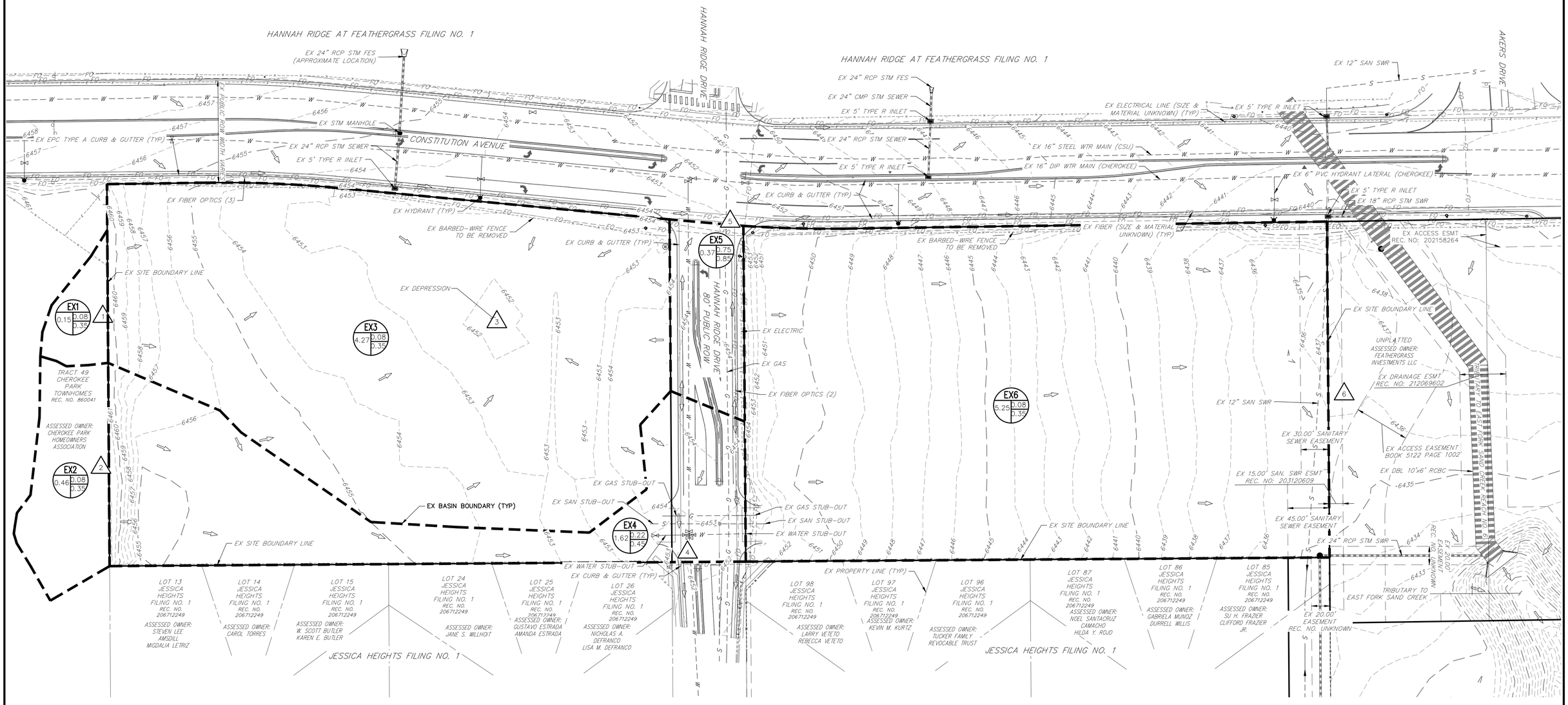
SCALE

80' 40' 0 40' 80' 160'
60' 20'
1"=80' 1:960

Appendix F
Drainage Maps

URBAN COLLECTION AT PALMER VILLAGE

EXISTING DRAINAGE MAP



EXISTING BASIN SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EX1	0.15	2%	0.08	0.35	7.9	0.04	0.4
EX2	0.46	2%	0.08	0.35	8.1	0.2	1.2
EX3	4.27	2%	0.08	0.35	14.2	1.2	9.0
EX4	1.62	19%	0.22	0.45	17.9	1.1	4.0
EX5	0.37	82%	0.75	0.85	5.0	1.4	2.7
EX6	5.25	2%	0.08	0.35	14.4	1.5	11.1

EXISTING DESIGN POINT SUMMARY TABLE

DP	Q_5	Q_{100}
1	0.04	0.4
2	0.2	1.2
3	1.3	9.3
4	1.3	4.9
5	1.4	2.7
6	1.5	11.1

LEGEND

- I.D. (A: BASIN AREA, B: MINOR COEFFICIENT, C: MAJOR COEFFICIENT) — BASIN DESIGNATION
- I.D.: BASIN IDENTIFIER
- X — DESIGN POINT
- BASIN DELINEATION
- --6100-- EXISTING INDEX CONTOURS
- --6101-- EXISTING INTERMEDIATE CONTOURS
- EXISTING FLOW DIRECTION

N

50 25 0 50

ORIGINAL SCALE: 1" = 50'

EXISTING DRAINAGE MAP
URBAN COLLECTION AT PALMER VILLAGE
JOB NO. 25149.01
01/30/2020
SHEET 1 OF 1

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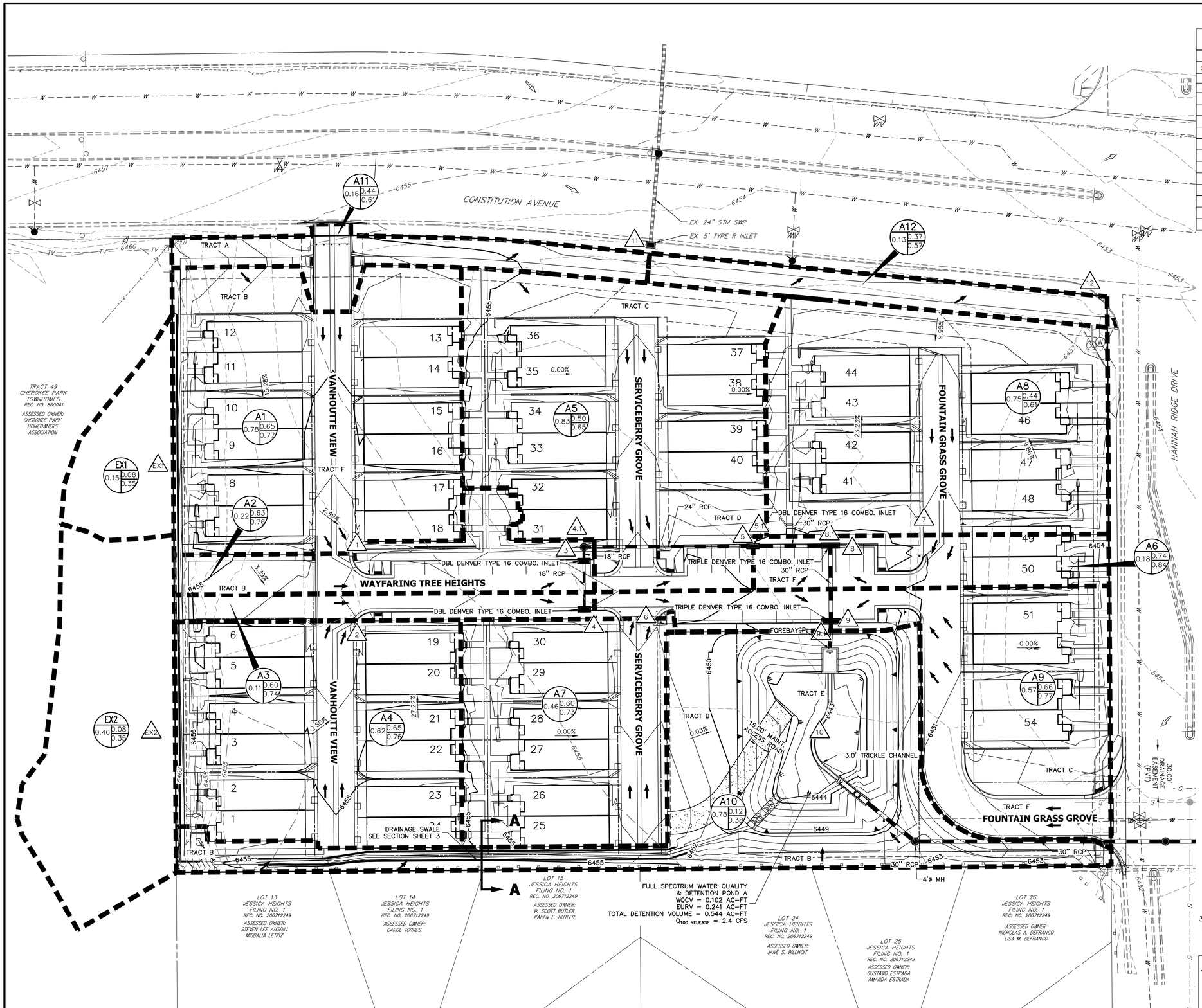

BASIN 'A' SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
EX1	0.15	0%	0.08	0.35	7.9	0.0	0.2
EX2	0.46	0%	0.08	0.35	8.1	0.2	0.7
A1	0.78	75%	0.65	0.77	5.5	2.6	5.1
A2	0.22	67%	0.63	0.76	7.8	0.6	1.3
A3	0.11	63%	0.60	0.74	6.2	0.3	0.7
A4	0.62	75%	0.65	0.76	5.2	2.0	4.0
A5	0.83	55%	0.50	0.65	7.0	2.0	4.2
A6	0.18	84%	0.74	0.84	7.9	0.6	1.1
A7	0.46	67%	0.60	0.73	5.8	1.3	2.7
A8	0.75	48%	0.44	0.61	7.8	1.5	3.5
A9	0.57	72%	0.66	0.77	6.9	1.8	3.5
A10	0.78	5%	0.12	0.38	9.4	0.4	2.1
A11	0.16	40%	0.41	0.60	9.8	0.3	0.6
A12	0.13	39%	0.40	0.59	7.8	0.2	0.6

DESIGN POINT SUMMARY TABLE

Design Point	Q_5 (cfs)	Q_{100} (cfs)
EX1	0.04	0.2
EX2	0.2	0.7
1	2.3	4.9
2	2.0	4.7
3	3.0	6.2
4	2.4	5.7
4.1	4.8	9.4
5	2.0	4.2
5.1	6.7	13.5
6	1.8	4.8
7	1.5	3.5
8	2.4	5.9
8.1	8.8	15.0
9	3.4	9.2
9.1	11.9	23.9
10	12.1	25.7
11	0.3	0.6
12	0.2	0.6

LEGEND

- I.D. (A / B / C): BASIN DESIGNATION
  - I.D.: BASIN IDENTIFIER
  - A: BASIN AREA
  - B: C_5
  - C: C_{100}
- X: DESIGN POINT
- BASIN DELINEATION
- 6100: EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- 6100: PROPOSED INDEX CONTOURS
- PROPOSED INTERMEDIATE CONTOURS
- PROPOSED SANITARY SEWER
- PROPOSED STORM SEWER
- PROPOSED WATER LINE
- EXISTING FLOW DIRECTION
- PROPOSED FLOW DIRECTION

30 15 0 30 60

ORIGINAL SCALE: 1" = 30'

Know what's below. Call before you dig.

ENGINEER'S STATEMENT

PREPARED UNDER MY DIRECT SUPERVISION AND ON BEHALF OF JR ENGINEERING

GLENN D. ELLIS, P.E.
COLORADO P.E. 38861
FOR AND ON BEHALF OF JR ENGINEERING, LLC

DATE

COLORADO REGISTERED PROFESSIONAL ENGINEER 38861 GLENN DAVID ELLIS

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No.	REVISION	BY	DATE
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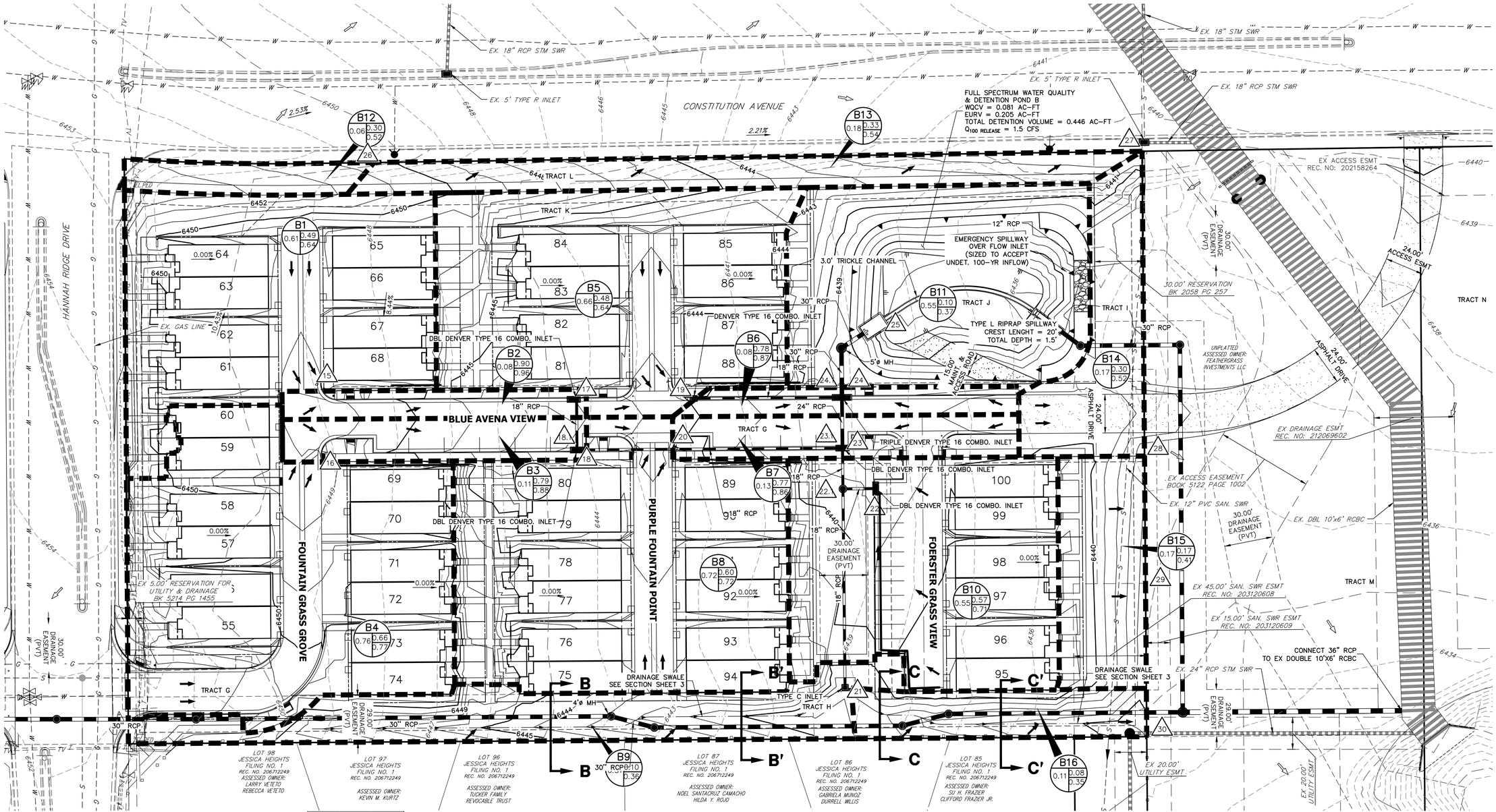
H-SCALE	1" = 30'	DESIGNED BY	RPD
V-SCALE	N/A	DRAWN BY	RPD
DATE	01/27/21	CHECKED BY	

URBAN COLLECTION AT PALMER VILLAGE

WEST DRAINAGE MAP

SHEET 1 OF 2

JOB NO. 25149.01



BASIN 'B' SUMMARY TABLE

Tributary Sub-basin	Area (acres)	Percent Impervious	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
B1	0.61	55%	0.50	0.65	6.3	1.4	3.2
B2	0.08	100%	0.90	0.96	5.0	0.4	0.6
B3	0.12	87%	0.79	0.88	5.0	0.5	0.9
B4	0.76	75%	0.66	0.77	5.9	2.5	4.9
B5	0.66	53%	0.49	0.64	6.2	1.6	3.5
B6	0.08	84%	0.77	0.87	5.0	0.3	0.6
B7	0.13	88%	0.80	0.89	5.0	0.5	1.0
B8	0.72	68%	0.60	0.72	5.5	2.2	4.4
B9	0.31	2%	0.10	0.36	5.6	0.1	0.9
B10	0.55	65%	0.59	0.72	6.4	1.6	3.2
B11	0.55	3%	0.10	0.37	5.6	0.3	1.7
B12	0.06	36%	0.37	0.57	5.0	0.1	0.3
B13	0.18	39%	0.40	0.59	7.0	0.3	0.9
B14	0.17	21%	0.25	0.48	5.6	0.2	0.7
B15	0.17	11%	0.17	0.42	5.0	0.2	0.6
B16	0.11	0%	0.08	0.35	5.0	0.1	0.3

DESIGN POINT SUMMARY TABLE

Design Point	Q_5 (cfs)	Q_{100} (cfs)
15	1.4	3.2
16	2.5	4.9
17	1.7	3.6
18	2.8	5.4
18.1	4.2	7.8
19	1.9	4.8
20	2.2	4.4
21	0.1	0.9
22	1.6	3.2
22.1	1.7	3.5
23	2.6	5.6
23.1	8.2	16.5
24	1.0	3.2
24.1	10.2	21.5
25	10.4	22.9
26	0.3	1.7
27	0.1	0.3
28	0.3	0.9
29	0.2	0.7
30	0.1	0.3

LEGEND

- I.D. (A / B / C): BASIN DESIGNATION
  - I.D.: BASIN IDENTIFIER
  - A: BASIN AREA
  - B: C_5
  - C: C_{100}
- X: DESIGN POINT
- BASIN DELINEATION
- 6100: EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- 6100: PROPOSED INDEX CONTOURS
- PROPOSED INTERMEDIATE CONTOURS
- PROPOSED SANITARY SEWER
- PROPOSED STORM SEWER
- PROPOSED WATER LINE
- EXISTING FLOW DIRECTION
- PROPOSED FLOW DIRECTION

30 15 0 30 60
ORIGINAL SCALE: 1" = 30'

Know what's **below.** **Call** before you dig.

ENGINEER'S STATEMENT

PREPARED UNDER MY DIRECT SUPERVISION AND ON BEHALF OF JR ENGINEERING

GLENN D. ELLIS, P.E.
COLORADO P.E. 38861
FOR AND ON BEHALF OF JR ENGINEERING, LLC

DATE

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A Westrian Company
Centennial: 303-740-9393 • Colorado Springs: 719-593-2593
Fort Collins: 970-491-9888 • www.jrengineering.com

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V-SCALE	N/A
DATE	01/27/21
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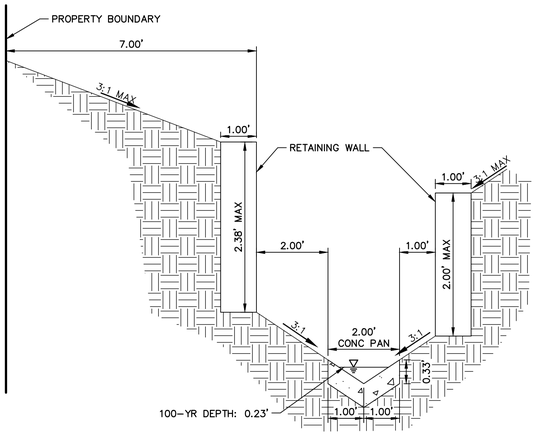
URBAN COLLECTION AT PALMER VILLAGE

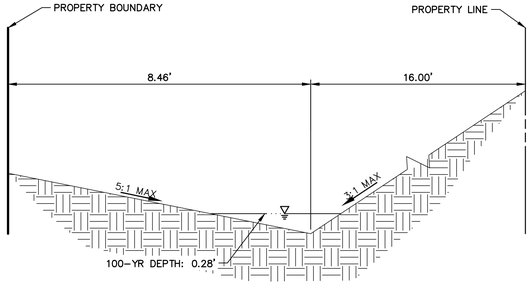
EAST DRAINAGE MAP

SHEET 2 OF 4

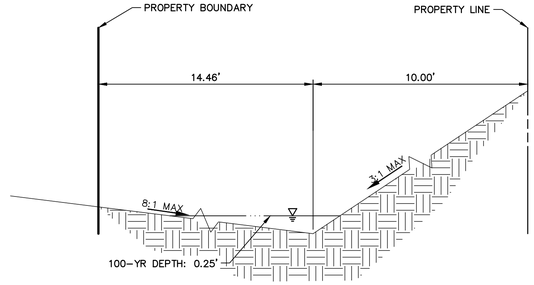
JOB NO. 25149.01



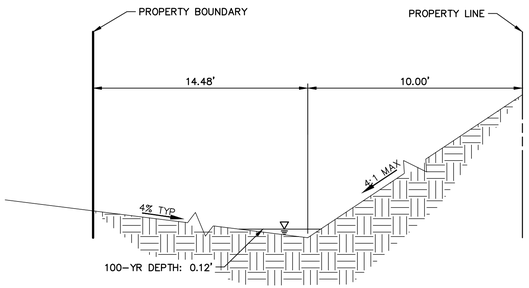
A SWALE A–A SECTION
SCALE: 1"=2' (HOR), 1"=1' (VERT)



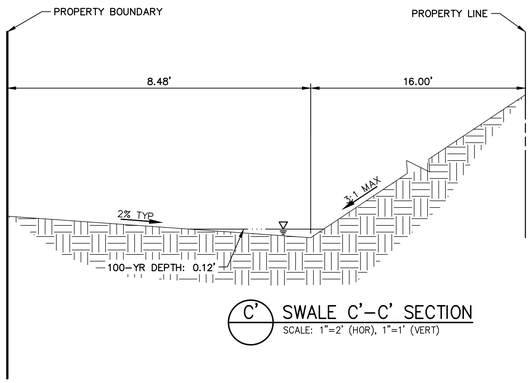
B SWALE B–B SECTION
SCALE: 1"=2' (HOR), 1"=1' (VERT)



B' SWALE B'–B' SECTION
SCALE: 1"=2' (HOR), 1"=1' (VERT)



C SWALE C–C SECTION
SCALE: 1"=2' (HOR), 1"=1' (VERT)



C' SWALE C'–C' SECTION
SCALE: 1"=2' (HOR), 1"=1' (VERT)

SWALE SECTION NOTES

1. ALL SWALE SECTIONS ARE FACING UPSTREAM (WEST).
2. SEE LANDSCAPE PLANS BY OTHERS FOR PROPOSED SURFACE MATERIAL.

ENGINEER'S STATEMENT

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GLENN D. ELLIS, P.E.
COLORADO P.E. 38861
FOR AND ON BEHALF OF JR ENGINEERING, LLC

38861 — COLORADO REGISTERED PROFESSIONAL ENGINEER

DATE

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H-SCALE	1"=2'
V-SCALE	1"=1'
DATE	01/27/21
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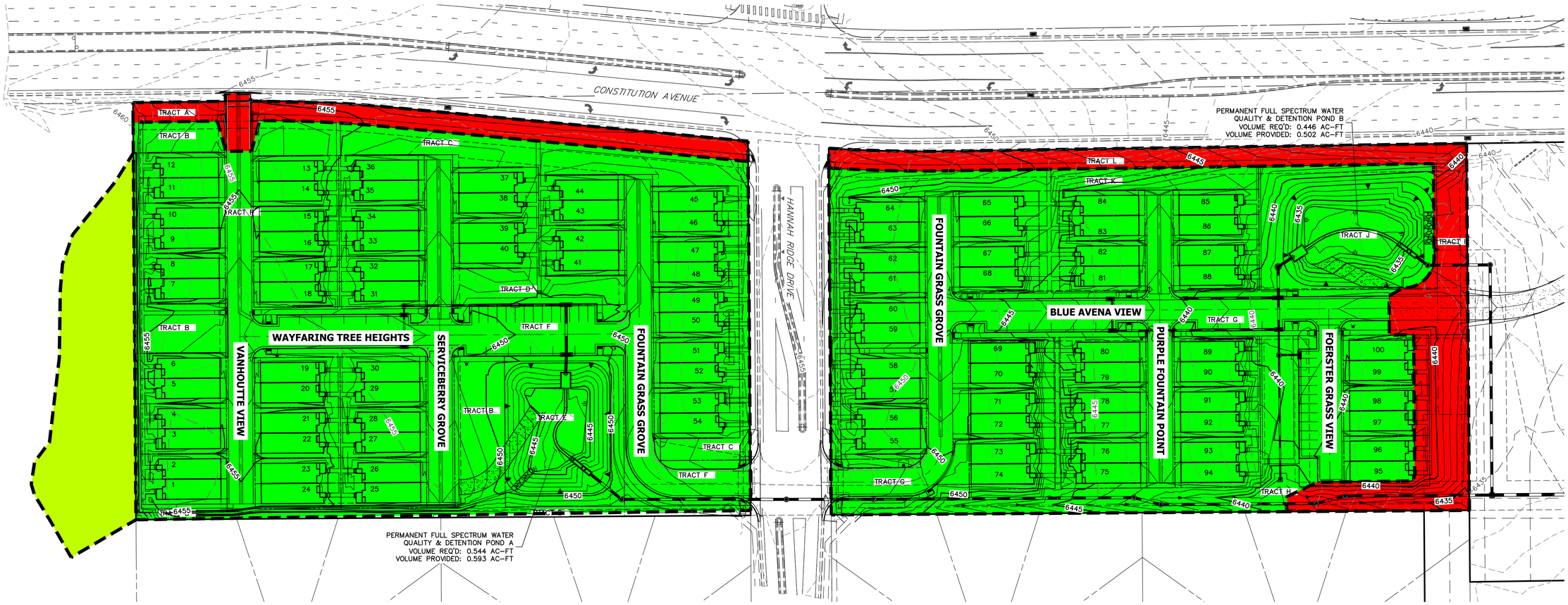
URBAN COLLECTION AT PALMER VILLAGE

SWALE CROSS SECTIONS

SHEET 3 OF 4

JOB NO. 25149.01



LEGEND

- BASIN BOUNDARY
- --6100-- EXISTING INDEX CONTOURS
- EXISTING INTERMEDIATE CONTOURS
- —6100— PROPOSED INDEX CONTOURS
- PROPOSED INTERMEDIATE CONTOURS
- AREA TRIBUTARY TO PBMP (9.87 AC)
- OFFSITE AREA TRIBUTARY TO PBMP (0.62 AC)
- AREA NOT TRIBUTARY TO PBMP (0.97 AC) PER SECTION I.7.1.C.1 (20%, UP TO 1 AC, OF DEVELOPMENT SITE CAN BE EXCLUDED DUE TO TOPOGRAPHY)

50 25 0 50
ORIGINAL SCALE: 1" = 50'

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COLORADO REGISTERED 38861 PROFESSIONAL ENGINEER

GLENN D. ELLIS, P.E. DATE
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URBAN COLLECTION AT PALMER VILLAGE

WATER QUALITY CAPTURE PLAN

SHEET 4 OF 4

JOB NO. 25149.01