Appendix H

Preliminary Drainage and Best Management Practices Report

Kimley»Horn

Preliminary Drainage
and
Best Management Practices
Report

FOR

CANWOOD OFFICE CAMPUS
AGOURA HILLS, CALIFORNIA

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May 2021

TABLE OF CONTENTS

LIST OF EXHIBITS

PURPOSE OF REPORT

The purpose of this report is to outline the existing drainage conditions of the project site and present a description of the post-project drainage conditions, drainage impacts, and proposed drainage improvements. Describe and analyze any significant on-site and off-site facilities, as applicable, in this report. Calculate the Peak 50-year storm water runoff and analyze any potential 100-year flood impacts for the project. Analyze and review proposed storm drain facilities for compliance with local design criteria.

This report shall discuss how the proposed grading and drainage improvements for the project site will be in accordance with the requirements of the City of Agoura Hills and Los Angeles County storm water regulations. The scope of this study is limited to the drainage improvements within the subject area.

LOCATION

The subject project is located at 29541 Canwood Street, Agoura Hills, CA 91301. The site is immediately east of the Los Angeles Fire Department Station 89.

BACKGROUND

The applicant proposes to develop 2.26 acres of an existing 3.25-acre vacant lot for Commercial/Industrial Purposes (APN 2053001008). The northerly acre of the lot will remain undeveloped. The proposed improvements consist of 5 new buildings, a parking lot, and hardscape that will create impervious areas covering approximately 77% of the 2.32-acre project site and 53% of the 3.25-acre lot.

Presently, the site slopes from the north to south. Total relief across the lot is approximately 80 feet, ranging from elevation 945 to 865. An existing culvert located in a sump condition along the southerly boundary captures runoff and connects to the public storm drain within Canwood Street.

The lot receives run-on from an approximate acre of land to the north (off-site). This area includes an un-paved utility access road but is otherwise undeveloped and pervious. Run-on is mostly conveyed southerly along the easterly project boundary as open channel flow to the existing culvert located along southerly project boundary.

METHOD OF ANALYSIS

The hydrologic analysis was based on research that included on-site investigations, review of available approved off-site storm drain plans, and review of aerial and field-surveyed topography. Hydraulic analysis of all drainage facilities began with a definition

of drainage patterns and design flows based on the design criteria for those specific facilities.

Based on the research the project site was found to be located on the Thousand Oaks 50-Year 24-hour Isohyet Map, 1-H1.24 as found in the Los Angeles County Public Works Hydrology Manual, 2006 (Hydrology Manual). Refer to Appendix B for an exhibit.

Detailed watershed subarea boundaries were defined based on proposed drainage patterns and drainage system layouts. The tributary area of each subarea was calculated to the nearest hundredth of an acre. Site characteristics such as soil number, rainfall zone, and land use were identified based on information taken from the Hydrology manual.

The 50-year storm information was calculated using the Rational Method with the use of the L.A. County HydroCalc software. Site properties were inputs into the program which generated Peak runoff values for the 50-year storm event (Q50). The site soil type is 028 and is within 7.4" 50yr- isohyets. The software also generates the storm hydrograph which was then used to size a detention facility.

Inlets and Pipes were sized utilizing Hydraflow Express Extension for AutoCAD Civil 3D by Autodesk Inc., which uses manning's equations to calculate depth of flow given design flow rates. Inlets were sized using Hydraflow as well which uses the Hydraulic Engineering Circular No. 22 (HEC-22) analytical procedures.

DETENTION

The detention basin proposed for the project is an underground pipe system. Analysis was performed using Hydroflow Hydrographs software by ACAD. The Q50 hydrograph output from HydroCalc was exported as a .cvs file and imported into the Hydroflow Hydrographs software. The software was then used to run various configurations of underground pipe layout and outflow structures until an optimal design was achieved.

DETENTION DESIGN and SIZING

The proposed underground storage system consists of five (5) 36-inch diameter storage pipes, each 60-feet long, controlled by a 10-inch diameter orifice. This proposed system reduces 50-year runoff from the developed portion of the site from 8.3 cfs to 3.7 cfs. When combined with off-site runoff that is passed through without comingle, the total 50-year discharge from the site is 10.1 cfs, as compared to 10.8 cfs under pre-development

conditions. Refer to Appendix A for existing and developed conditions hydrologic work maps and Appendix B for runoff calculations.

Project site runoff undergoes treatment prior to comingle with off-site runoff. Both project site runoff and off-site run-on will discharge as pipe flow to the existing public storm drain within Canwood Street, consistent with pre-development conditions.

STORMWATER QUALITY

The City of Agoura Hills has required this development to comply with the County of Los Angeles (County) 2014 Low Impact Development Standards Manual (LID Standards Manual) which has been prepared to comply with the requirements of the National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) Permit for stormwater and non-stormwater discharges from the MS4 within the coastal watersheds of Los Angeles County (CAS004001, Order No. R42012-0175), henceforth referred to in this document as the 2012 MS4 Permit.

To comply with these standards, the project must treat a Stormwater Quality Design Volume (SWQDv) equivalent to the larger of the volume generated by a 0.75 in, 24-hr rain event or the 85TH percentile, 24-hr rain event. The 85th percentile governs for this proposed development.

TECHNICAL INFEASIBLITY SCREENING

The feasibility of BMP's would be analyzed in order of the following priority: (1) Infiltration Systems, (2) Capture and Use, (3) Biofiltration and (4) Alternative Compliance measures should none of the three mentioned previously or combination thereof is found to be infeasible.

Assessment of the site have led to the determination that this project is Technically Infeasible to implement infiltration BMPs because of:

- Soil type: Silty clay and sandy clay. This type of soil will not generate the require infiltration rate. Its soil profile is very stiff to hard condition and underlain by hard claystone bedrock.
- Medium to High potential for Expansive soils
- Project Soils Engineer recommends against the use of infiltration BMPs

STORMWATER QUALITY DESIGN and SIZING

The Stormwater Quality Design Volume (SWQDv) was calculated using the Los Angeles County Hydrocalc software and entering sub-area information taken from the LA County Hydrology Manual. The results of those calculations are as follows:

0.75in, 24-hr storm event

Area = 2.26 acres
Impervious Percentage = 77%
Soil Type = 028
Rainfall Isohyet= 0.75 in
Flow Path Length = 400 ft
Flow Path Slope = 4%
SWQDf = 0.35 cfs
SWQDv = 4,369 cu-ft

85th, 24-hr storm event

Area = 2.26 acres
Impervious Percentage = 77%
Soil Type = 028
Rainfall Isohyet= 0.96 in
Flow Path Length = 400 ft
Flow Path Slope = 4%
SWQDf = 0.49 cfs
SWQDv = 5,592 cu-ft

Treatment V = 5,592 cu.ft
Treatment Q = 0.49 cfs

The BMP chosen for the project is proprietary Biofiltration sized with 1.5 times the storm water quality design volume. This BMP is a logical choice based on the technical infeasibility to infiltrate and the ability to integrate the proprietary Biofiltration BMPs with the proposed underground detention basin used for peak flow mitigation.

All project site runoff will be treated prior to comingle with off-site flow and will discharge from the site to the public storm drain within Canwood Street, consistent with pre-development conditions.

The overall design concept was established to allow water to be treated through a combination of Point Source and Treatment Train treatment methods. The site has been divided into smaller manageable areas where cost effective BMPs can be installed or constructed to capture pollutants at the source. The “treatment train” allows for improved levels of pollutant removals by providing more than one method of removing pollutants and providing them in successive order. Providing more than one treatment method to treat runoff ensures that pollutants are captured with a higher success rate.

The treatment train process begins with routine maintenance on the grounds. The proposed proprietary BMPs will remove pollutants of concern and will also serve as pre-treatment prior to peak flow mitigation within the underground storage pipes.

Proprietary biofiltration is proposed at four (4) locations throughout the site. This will ensure no one BMP is overburdened with a disproportionate area of the developmental area.

Refer to Appendix D for calculations.

100-YR FLOOD PROTECTION

Overall, the 100-yr overflow path matches existing conditions, where flows are in the southerly direction towards Canwood Street. Review of FEMA’s NFIP Flood Insurance Rate Map (FIRM) shows the project within Map Number 06037C1244F, Effective Date September 26,2008. The project site is located in Zone X, which are areas defined as having a 0.2% annual chance of flood; and a 1% annual chance of flood with depths less than 1 foot. See Appendix C for a copy of the FEMA FIRM.

CONCLUSIONS

As shown in the proposed grading and utility plans, storm water drainage will be routed via gutters and swales to drainage inlets and underground pipe facilities to a storm drain.

The proposed grading and drainage infrastructure shown on the Site Plan(s) provide for adequate drainage from the site. Secondary overland escape is provided via the natural grade of the site (north to south) and will which mimic existing conditions in the event that the primary drainage pathways (inlets) are blocked or fail. This is to ensure that the proposed onsite structures are protected from flooding during a 100-year storm event.

Detention is provided such that post-development Q50 does not exceed pre-development conditions. Off-site run-on will be passed through without comingle with project site runoff; all runoff will convey to the public storm drain within Canwood Street consistent with existing conditions.

Proposed drainage control facilities will improve stormwater water quality by capturing site runoff and providing biofiltration. The four (4) proposed proprietary biofiltration units have been sized using the 85th percentile from each respective sub-basin and upsized by 50% given the technical infeasibility of infiltration.

Drainage from the project site will be controlled in a manner, which will allow the project to occur as intended without conflicting with any applicable State, County, or City of Agoura Hills regulations and without adversely affecting adjacent properties and/or the project itself.

REFERENCES

- Los Angeles County Department of Public Works Hydrology Manual, 2006
- FEMA, National Flood Insurance Rate Maps
- Federal Highway Administration Publication No. FHWA-NHI-06-086 Hydraulic Engineering Circular No. 14, 3rd Edition. July 2006
- Development Planning for Storm Water Management by Los Angeles County Department of Public Works (SUSMP), 2002.

EXHIBIT A

HYDROLOGY MAPS

DELANE ENGINEERING

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LEGEND

- DRAINAGE DELINEATION
- SUB-BASIN DELINEATION
- SD SD EXISTING STORM DRAIN
- DRAINAGE DIRECTION
- 100 DRAINAGE NODE

PROPERTY LINES (TYP.)

APPROXIMATE HIGH POINT IN OFF-SITE BROW DITCH

UNDER EXISTING CONDITIONS, AREA WEST (LEFT) OF THIS RED DASHED LINE DRAINS OVERLAND ONTO THE FIRE STATION PROPERTY.

THIS AREA WILL NOT DRAIN TO THE FIRE STATION UNDER PRPOSED CONDITIONS, AS NEW CURB AND GUTTER WILL DIRECT RUNOFF TO PROPOSED ON-SITE BMPs.

NODE 100
EX. ENTIRE AREA
1% IMP
AREA = 4.34 AC
L=910'
Q50 = 10.8 CFS

EXISTING HEADWALL AND PIPE CONNECTS TO PUBLIC S.D. IN CANWOOD STREET

EX. MANHOLE

EX. DISCHARGE TO PUBLIC STORM DRAIN VIA PIPE FLOW

SCALE 1"=40'

40 20 0 40 80 120

SCALE: 1"=40'

Peak Flow Hydrologic Analysis

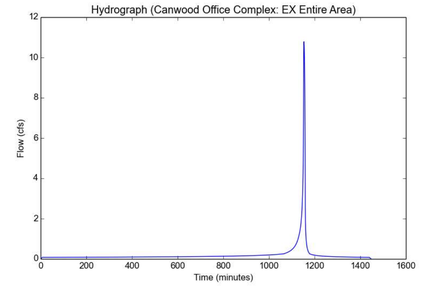
File location: C:/Users/JaySullivan/Cloudstation/DelaneSM/PDATA/0110309/Admin/Reports/Prelim. Drainage Study/App B - Hydrology/309 - E
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Canwood Office Complex
Subarea ID	EX Entire Area
Area (ac)	4.34
Flow Path Length (ft)	910.0
Flow Path Slope (vft/hft)	0.13
50-yr Rainfall Depth (in)	7.4
Percent Impervious	0.01
Soil Type	28
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	7.4
Peak Intensity (in/hr)	3.7692
Undeveloped Runoff Coefficient (Cu)	0.6569
Developed Runoff Coefficient (Cd)	0.6593
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	10.7856
Burned Peak Flow Rate (cfs)	10.7856
24-Hr Clear Runoff Volume (ac-ft)	0.4374
24-Hr Clear Runoff Volume (cu-ft)	19053.7143



REVISION #	SYMBOL	DESCRIPTION OF CHANGE	APPROVED	DATE

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CITY OF AGOURA HILLS APPROVAL

REVIEWED BY DATE

ROMIRO ADEVA
CITY ENGINEER
DATE RCE NO. EXP DATE

CITY OF AGOURA HILLS

EXISTING CONDITION HYDROLOGIC WORK MAP

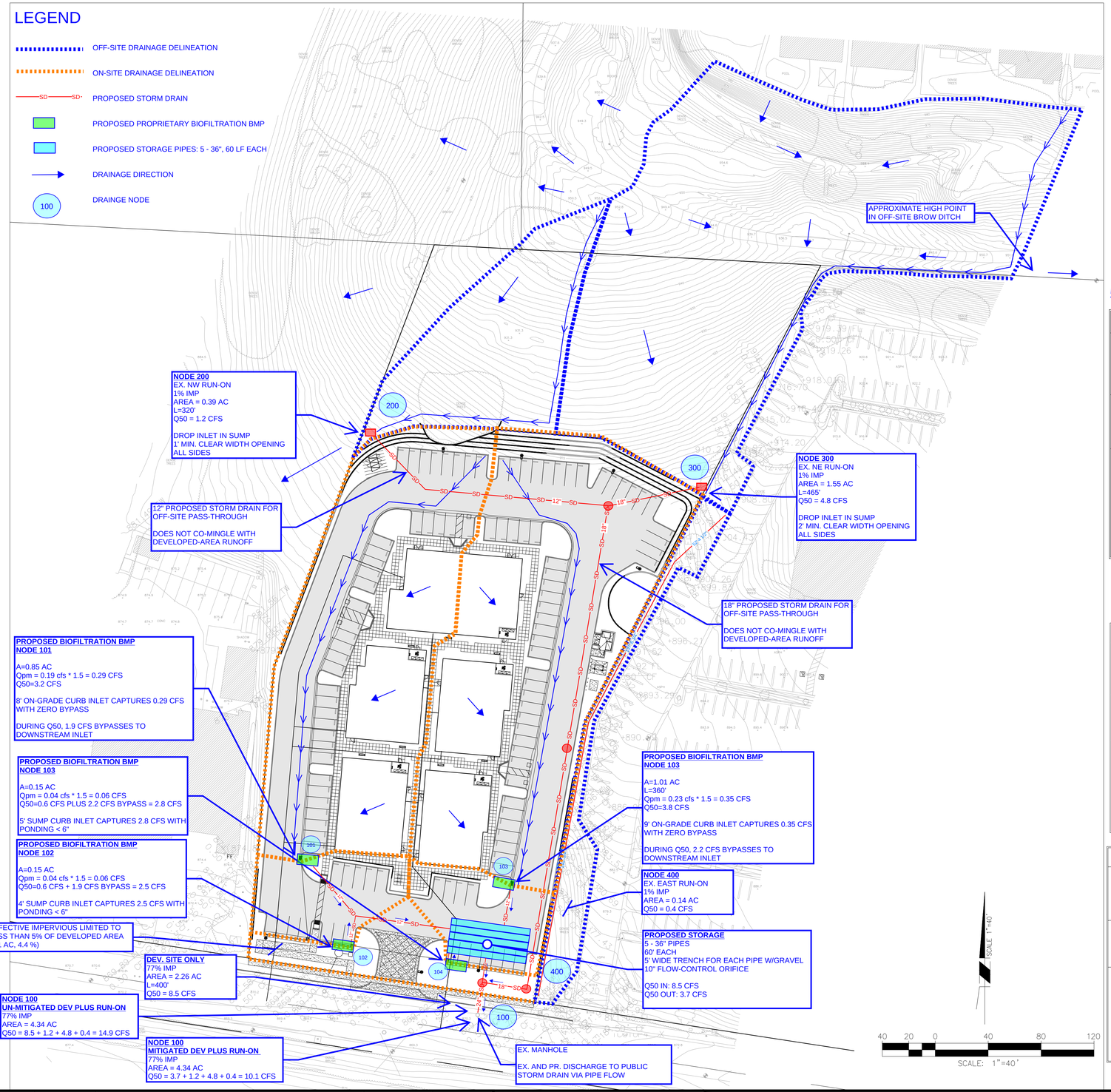
CITY OF AGOURA HILLS DWG. NO. _____

SAVE DATE: 4/27/21 JAYSULLIVAN

PLOT DATE: 4/27/21 9:14 AM FILE NAME: C:\USERS\JAYSULLIVAN\CLOUDSTATION\DELANESM\PDATA\0110309\ADMIN\REPORTS\PRELIM. DRAINAGE STUDY\CAD\309-EX AND DEV HYDRO MP BASE.DWG

LEGEND

- OFF-SITE DRAINAGE DELINEATION
- ON-SITE DRAINAGE DELINEATION
- SD——SD- PROPOSED STORM DRAIN
- PROPOSED PROPRIETARY BIOFILTRATION BMP
- PROPOSED STORAGE PIPES: 5 - 36", 60 LF EACH
- DRAINAGE DIRECTION
- 100 DRAINGE NODE



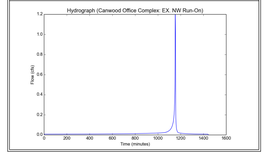
50-YEAR PEAK FLOW (EX. RUN-ON)

Peak Flow Hydrologic Analysis NODE 200

File location: C:/Users/JaySullivan/Cloudstation/Delane/SMP/DATA/S1103B/Admin/Reports/Prelim. Drainage Study/App B - Hydrology/SW - EX
Version: HydroCalc 1.0.3

Input Parameters	
Project Name	Canwood Office Complex
Subarea ID	Ex. NW Run-On
Area (ac)	0.39
Flow Path Length (ft)	320.0
Flow Path Slope (vft/hft)	0.17
50-yr Rainfall Depth (in)	7.4
Percent Impervious	0.01
Soil Type	28
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results	
Modeled (50-yr) Rainfall Depth (in)	7.4
Peak Intensity (in/hr)	4.415
Undeveloped Runoff Coefficient (Cu)	0.693
Developed Runoff Coefficient (Cd)	0.6951
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.1969
Burned Peak Flow Rate (cfs)	1.1969
24-Hr Clear Runoff Volume (ac-ft)	0.0394
24-Hr Clear Runoff Volume (cu-ft)	1717.3515

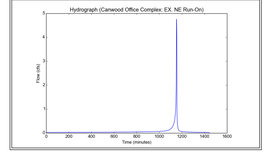


Peak Flow Hydrologic Analysis NODE 300

File location: C:/Users/JaySullivan/Cloudstation/Delane/SMP/DATA/S1103B/Admin/Reports/Prelim. Drainage Study/App B - Hydrology/SW - EX
Version: HydroCalc 1.0.3

Input Parameters	
Project Name	Canwood Office Complex
Subarea ID	Ex. NE Run-On
Area (ac)	1.55
Flow Path Length (ft)	465.0
Flow Path Slope (vft/hft)	0.17
50-yr Rainfall Depth (in)	7.4
Percent Impervious	0.01
Soil Type	28
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results	
Modeled (50-yr) Rainfall Depth (in)	7.4
Peak Intensity (in/hr)	4.415
Undeveloped Runoff Coefficient (Cu)	0.693
Developed Runoff Coefficient (Cd)	0.6951
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	4.7567
24-Hr Clear Runoff Volume (ac-ft)	0.1567
24-Hr Clear Runoff Volume (cu-ft)	6825.0137



Peak Flow Hydrologic Analysis NODE 400

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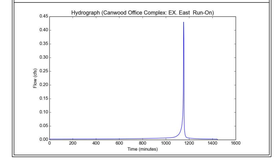
Version: HydroCalc 1.0.3

Input Parameters	
Project Name	Canwood Office Complex
Subarea ID	Ex. East Run-On
Area (ac)	0.14
Flow Path Length (ft)	400.0
Flow Path Slope (vft/hft)	0.1
50-yr Rainfall Depth (in)	7.4
Percent Impervious	0.01
Soil Type	28
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results	
Modeled (50-yr) Rainfall Depth (in)	7.4
Peak Intensity (in/hr)	4.415
Undeveloped Runoff Coefficient (Cu)	0.693
Developed Runoff Coefficient (Cd)	0.6951
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.4296
Burned Peak Flow Rate (cfs)	0.4296
24-Hr Clear Runoff Volume (ac-ft)	0.0142
24-Hr Clear Runoff Volume (cu-ft)	616.4528



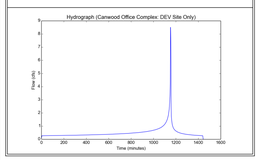
50-YEAR PEAK FLOW (DEVELOPED SITE)

Peak Flow Hydrologic Analysis NODE 100

File location: C:/Users/JaySullivan/Cloudstation/Delane/SMP/DATA/S1103B/Admin/Reports/Prelim. Drainage Study/App B - Hydrology/SW - DEV S
Version: HydroCalc 1.0.3

Input Parameters	
Project Name	Canwood Office Complex
Subarea ID	DEV Site Only
Area (ac)	2.26
Flow Path Length (ft)	400.0
Flow Path Slope (vft/hft)	0.4
50-yr Rainfall Depth (in)	7.4
Percent Impervious	0.77
Soil Type	28
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results	
Modeled (50-yr) Rainfall Depth (in)	7.4
Peak Intensity (in/hr)	4.415
Undeveloped Runoff Coefficient (Cu)	0.693
Developed Runoff Coefficient (Cd)	0.8524
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	8.5052
Burned Peak Flow Rate (cfs)	8.5052
24-Hr Clear Runoff Volume (ac-ft)	1.008
24-Hr Clear Runoff Volume (cu-ft)	43909.0827



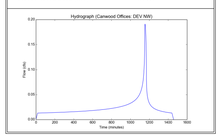
WATER QUALITY

Peak Flow Hydrologic Analysis NODE 101

File location: C:/Users/JaySullivan/Cloudstation/Delane/SMP/DATA/S1103B/Admin/Reports/Prelim. Drainage Study/App B - HydrologySW - DEV S
Version: HydroCalc 1.0.3

Input Parameters	
Project Name	Canwood Offices
Subarea ID	DEV NW
Area (ac)	0.85
Flow Path Length (ft)	180.0
Flow Path Slope (vft/hft)	0.04
85th Percentile Rainfall Depth (in)	0.96
Percent Impervious	0.77
Soil Type	28
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results	
Modeled (85th percentile storm) Rainfall Depth (in)	0.96
Peak Intensity (in/hr)	0.3137
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.716
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	0.1909
Burned Peak Flow Rate (cfs)	0.1909
24-Hr Clear Runoff Volume (ac-ft)	0.0463
24-Hr Clear Runoff Volume (cu-ft)	2329.3302



Peak Flow Hydrologic Analysis NODE 103

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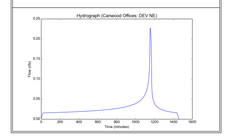
Version: HydroCalc 1.0.3

Input Parameters	
Project Name	Canwood Offices
Subarea ID	DEV NE
Area (ac)	1.01
Flow Path Length (ft)	360.0
Flow Path Slope (vft/hft)	0.04
85th Percentile Rainfall Depth (in)	0.96
Percent Impervious	0.77
Soil Type	28
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results	
Modeled (85th percentile storm) Rainfall Depth (in)	0.96
Peak Intensity (in/hr)	0.3137
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.716
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	0.2269
Burned Peak Flow Rate (cfs)	0.2269
24-Hr Clear Runoff Volume (ac-ft)	0.055
24-Hr Clear Runoff Volume (cu-ft)	2499.2512

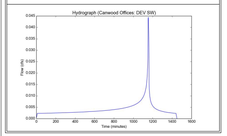


Peak Flow Hydrologic Analysis NODE 102

File location: C:/Users/JaySullivan/Cloudstation/Delane/SMP/DATA/S1103B/Admin/Reports/Prelim. Drainage Study/App B - HydrologySW - DEV S
Version: HydroCalc 1.0.3

Input Parameters	
Project Name	Canwood Offices
Subarea ID	DEV SW
Area (ac)	0.15
Flow Path Length (ft)	120.0
Flow Path Slope (vft/hft)	0.04
85th Percentile Rainfall Depth (in)	0.96
Percent Impervious	0.77
Soil Type	28
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results	
Modeled (85th percentile storm) Rainfall Depth (in)	0.96
Peak Intensity (in/hr)	0.4135
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.716
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	0.0444
Burned Peak Flow Rate (cfs)	0.0444
24-Hr Clear Runoff Volume (ac-ft)	0.0085
24-Hr Clear Runoff Volume (cu-ft)	371.1749

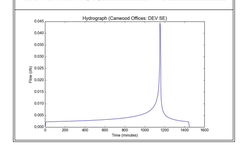


Peak Flow Hydrologic Analysis NODE 104

File location: C:/Users/JaySullivan/Cloudstation/Delane/SMP/DATA/S1103B/Admin/Reports/Prelim. Drainage Study/App B - HydrologySW - DEV S
Version: HydroCalc 1.0.3

Input Parameters	
Project Name	Canwood Offices
Subarea ID	DEV SE
Area (ac)	0.15
Flow Path Length (ft)	120.0
Flow Path Slope (vft/hft)	0.02
85th Percentile Rainfall Depth (in)	0.96
Percent Impervious	0.77
Soil Type	28
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results	
Modeled (85th percentile storm) Rainfall Depth (in)	0.96
Peak Intensity (in/hr)	0.4135
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.716
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	0.0444
Burned Peak Flow Rate (cfs)	0.0444
24-Hr Clear Runoff Volume (ac-ft)	0.0085
24-Hr Clear Runoff Volume (cu-ft)	371.1749



REVISION #	SYMBOL	DESCRIPTION OF CHANGE	APPROVED	DATE

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CITY OF AGOURA HILLS APPROVAL

REVIEWED BY DATE

ROMIRO ADEVA
CITY ENGINEER
DATE RCE NO. EXP DATE

CITY OF AGOURA HILLS

PROPOSED CONDITION HYDROLOGIC WORK MAP

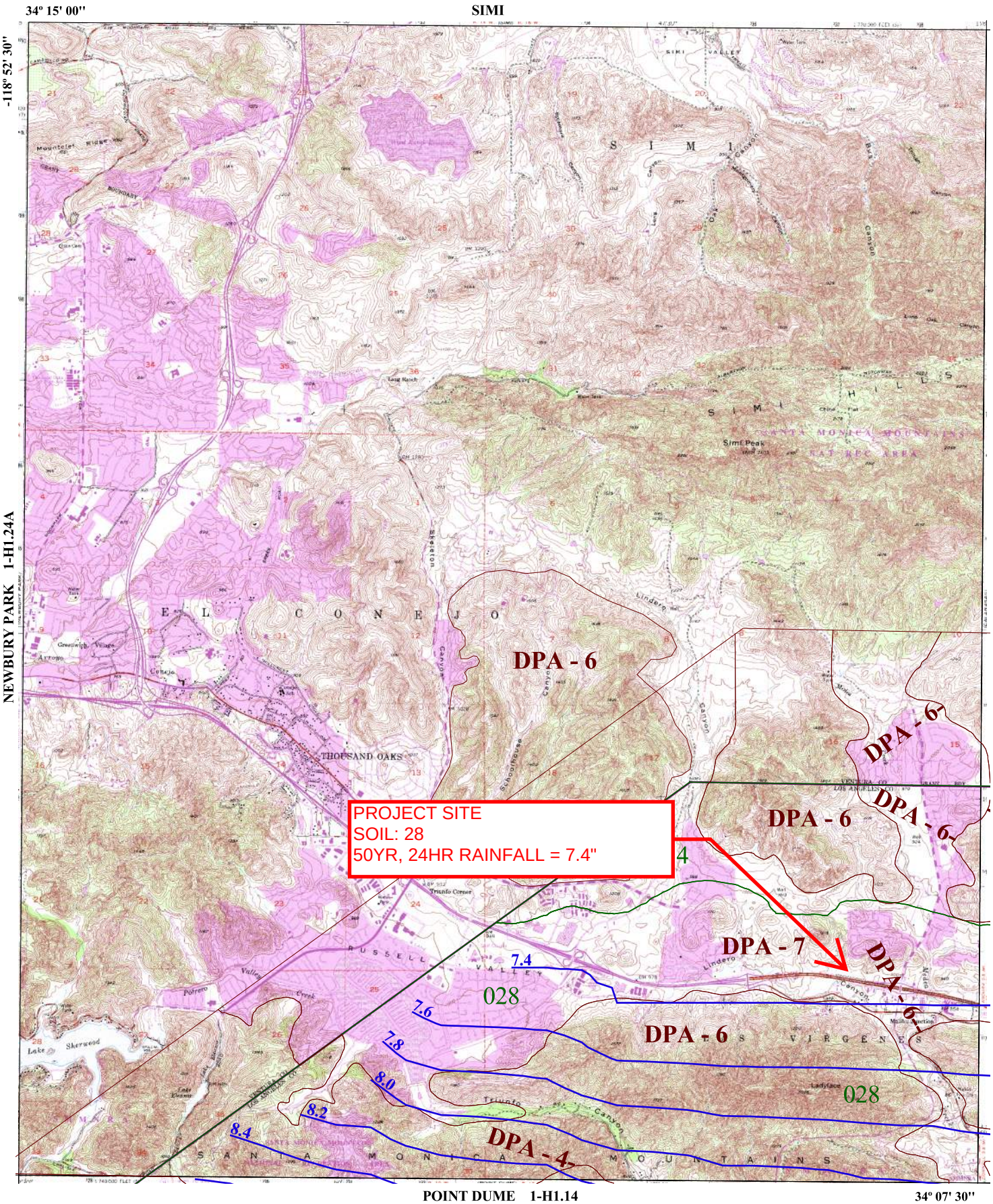
CITY OF AGOURA HILLS DWG. NO. _____

SAVE DATE: 4/28/21 JAYSULLIVAN

PLOT DATE: 4/28/21 8:26 PM FILE NAME: C:\USERS\JAYSULLIVAN\CLOUDSTATION\DELANE\SMP\DATA\S1103B\ADMIN\REPORTS\PRELIM. DRAINAGE STUDY\CAD\S09-EX AND DEV HYDRO BM BASE.DWG

EXHIBIT B

LA COUNTY HYDROLOGY



N
W E
S

016 SOIL CLASSIFICATION AREA

7.2 INCHES OF RAINFALL

DPA - 6 DEBRIS POTENTIAL AREA

1 0 1 2 Miles

25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878
10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714

THOUSAND OAKS
50-YEAR 24-HOUR ISOHYET

1-H1.24

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works

Peak Flow Hydrologic Analysis

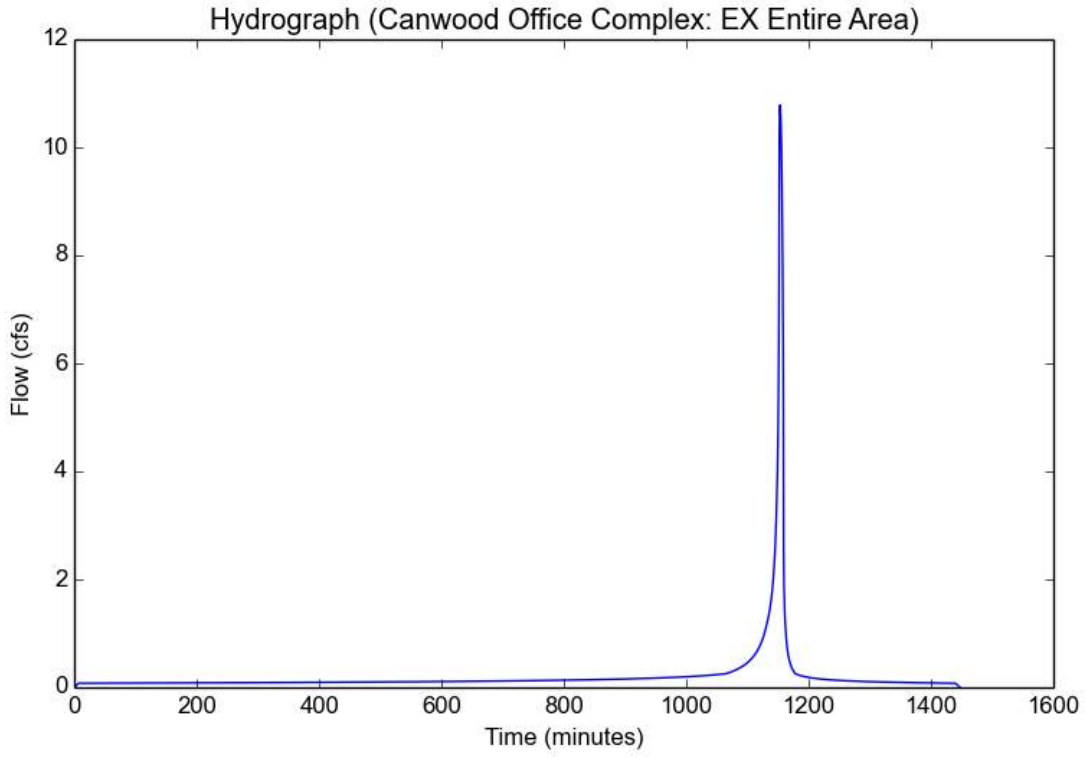
File location: C:/Users/JaySullivan/Cloudstation/DelaneSM/PDATA/0110309/Admin/Reports/Prelim. Drainage Study/App B - Hydrology/309 - EX 50yr Hy
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Canwood Office Complex
Subarea ID	EX Entire Area NODE 100
Area (ac)	4.34
Flow Path Length (ft)	910.0
Flow Path Slope (vft/hft)	0.13
50-yr Rainfall Depth (in)	7.4
Percent Impervious	0.01
Soil Type	28
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	7.4
Peak Intensity (in/hr)	3.7692
Undeveloped Runoff Coefficient (Cu)	0.6569
Developed Runoff Coefficient (Cd)	0.6593
Time of Concentration (min)	7.0
Clear Peak Flow Rate (cfs)	10.7856
Burned Peak Flow Rate (cfs)	10.7856
24-Hr Clear Runoff Volume (ac-ft)	0.4374
24-Hr Clear Runoff Volume (cu-ft)	19053.7143



Peak Flow Hydrologic Analysis

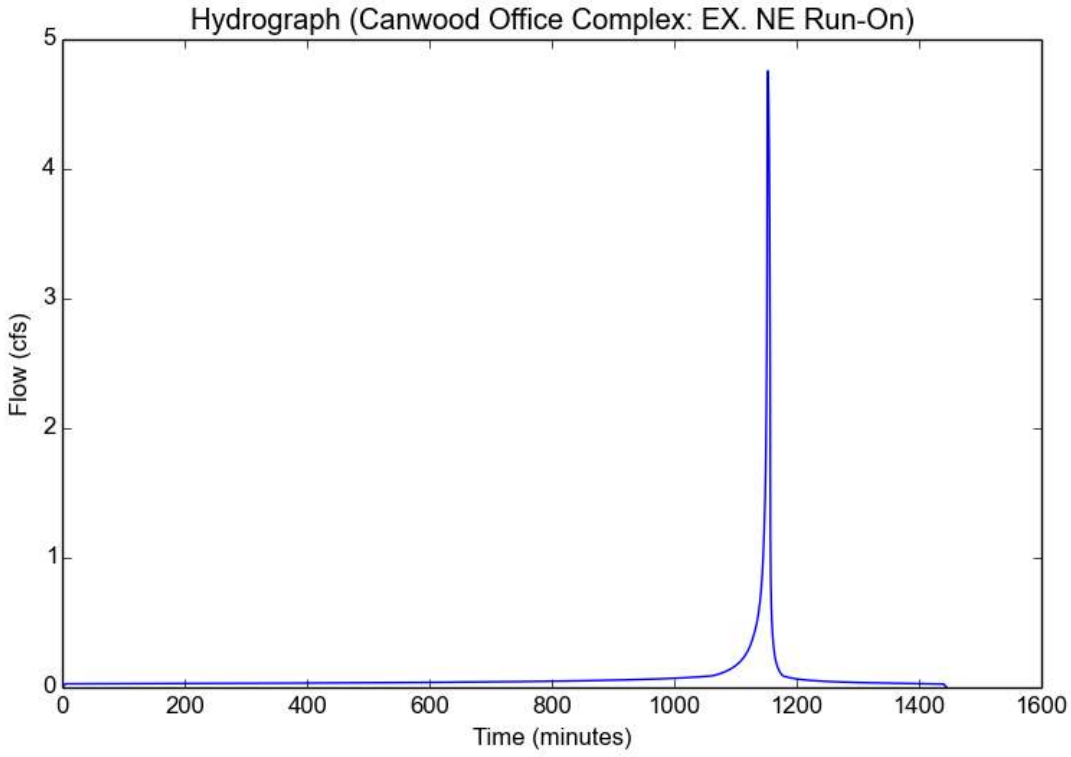
File location: C:/Users/JaySullivan/Cloudstation/DelaneSM/PDATA/0110309/Admin/Reports/Prelim. Drainage Study/App B - Hydrology/309 - EX NE Run
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Canwood Office Complex
Subarea ID	EX. NE Run-On NODE 300
Area (ac)	1.55
Flow Path Length (ft)	465.0
Flow Path Slope (vft/hft)	0.17
50-yr Rainfall Depth (in)	7.4
Percent Impervious	0.01
Soil Type	28
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	7.4
Peak Intensity (in/hr)	4.415
Undeveloped Runoff Coefficient (Cu)	0.693
Developed Runoff Coefficient (Cd)	0.6951
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	4.7567
Burned Peak Flow Rate (cfs)	4.7567
24-Hr Clear Runoff Volume (ac-ft)	0.1567
24-Hr Clear Runoff Volume (cu-ft)	6825.0137



Peak Flow Hydrologic Analysis

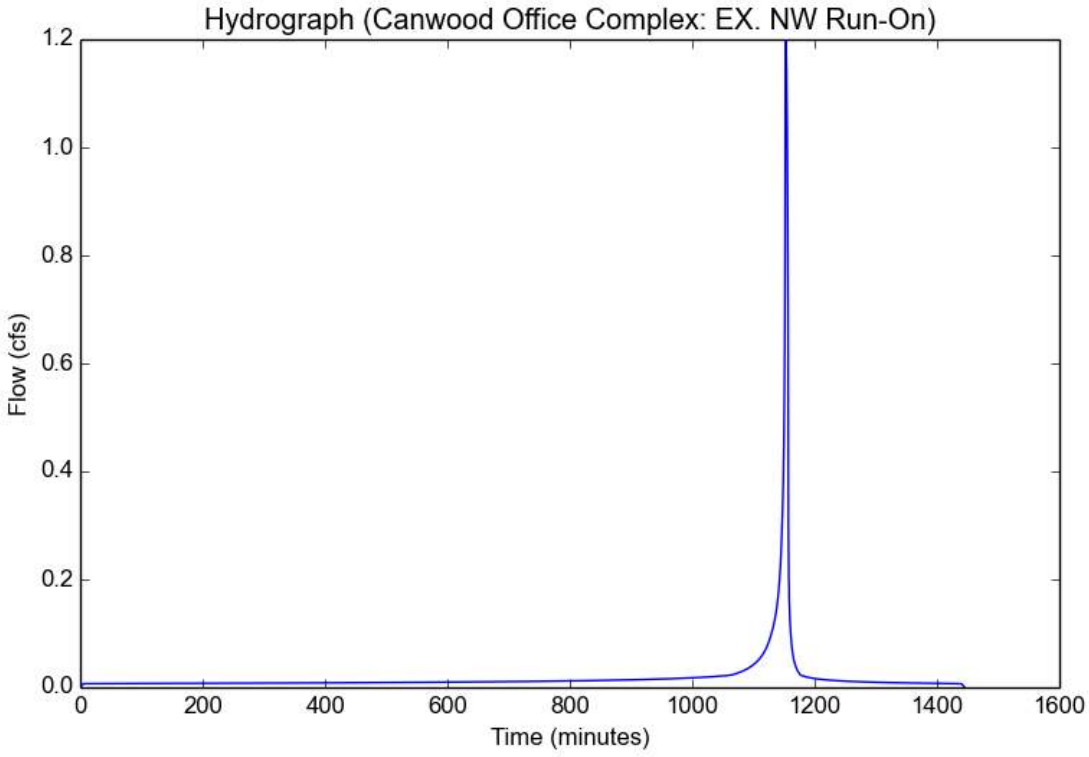
File location: C:/Users/JaySullivan/Cloudstation/DelaneSM/PDATA/0110309/Admin/Reports/Prelim. Drainage Study/App B - Hydrology/309 - EX NW Rur
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Canwood Office Complex
Subarea ID	EX. NW Run-On NODE 200
Area (ac)	0.39
Flow Path Length (ft)	320.0
Flow Path Slope (vft/hft)	0.17
50-yr Rainfall Depth (in)	7.4
Percent Impervious	0.01
Soil Type	28
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	7.4
Peak Intensity (in/hr)	4.415
Undeveloped Runoff Coefficient (Cu)	0.693
Developed Runoff Coefficient (Cd)	0.6951
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	1.1969
Burned Peak Flow Rate (cfs)	1.1969
24-Hr Clear Runoff Volume (ac-ft)	0.0394
24-Hr Clear Runoff Volume (cu-ft)	1717.2615



Peak Flow Hydrologic Analysis

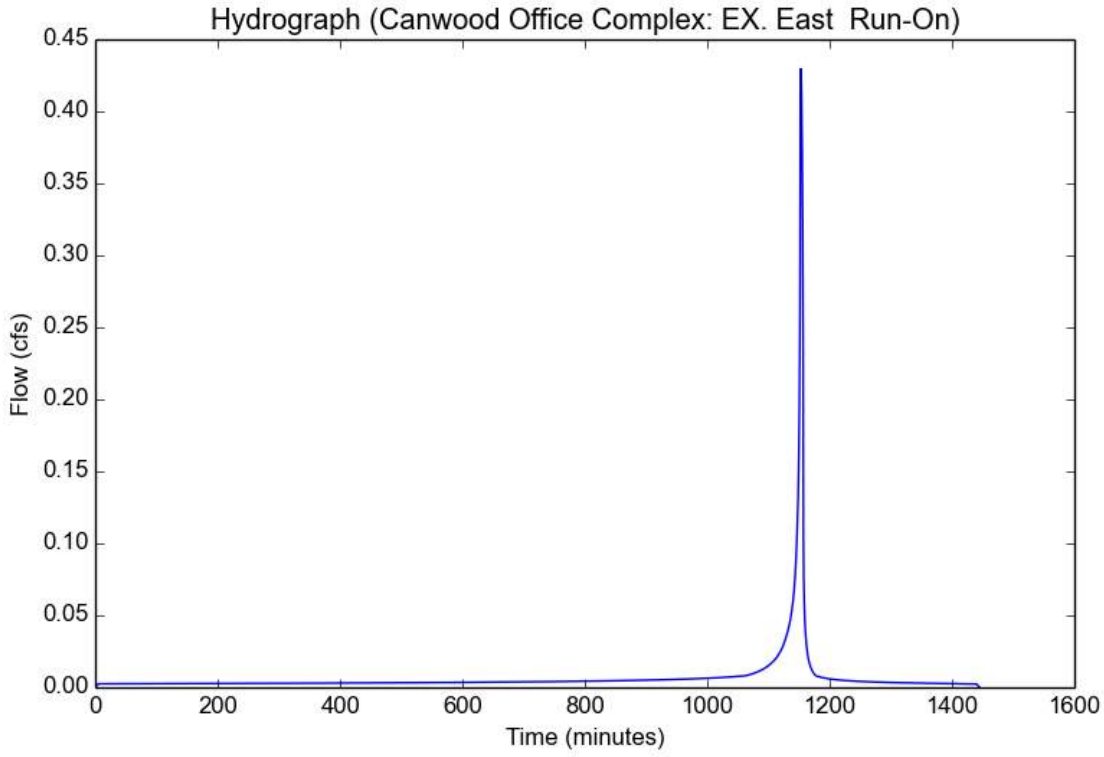
File location: C:/Users/JaySullivan/Cloudstation/DelaneSM/PDATA/0110309/Admin/Reports/Prelim. Drainage Study/App B - Hydrology/309 - EX East Ru
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Canwood Office Complex
Subarea ID	EX. East Run-On NODE 400
Area (ac)	0.14
Flow Path Length (ft)	400.0
Flow Path Slope (vft/hft)	0.1
50-yr Rainfall Depth (in)	7.4
Percent Impervious	0.01
Soil Type	28
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	7.4
Peak Intensity (in/hr)	4.415
Undeveloped Runoff Coefficient (Cu)	0.693
Developed Runoff Coefficient (Cd)	0.6951
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	0.4296
Burned Peak Flow Rate (cfs)	0.4296
24-Hr Clear Runoff Volume (ac-ft)	0.0142
24-Hr Clear Runoff Volume (cu-ft)	616.4528



Peak Flow Hydrologic Analysis

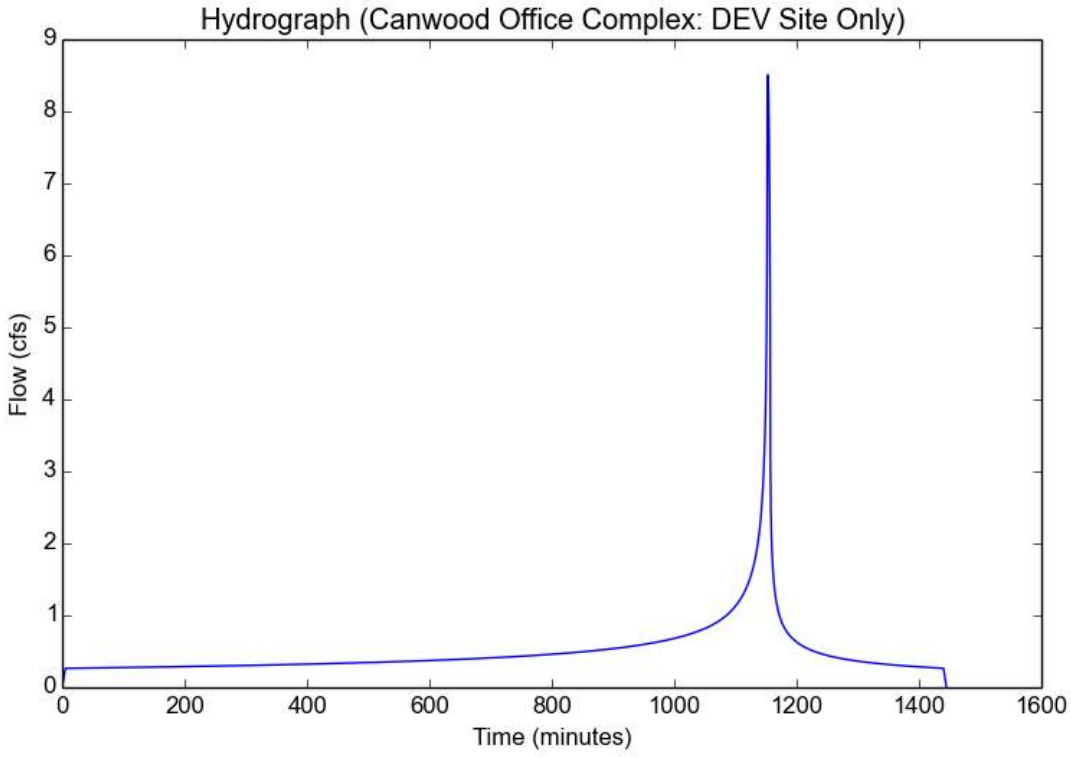
File location: C:/Users/JaySullivan/Cloudstation/DelaneSM/PDATA/0110309/Admin/Reports/Prelim. Drainage Study/App B - Hydrology/309 - DEV Site O
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Canwood Office Complex
Subarea ID	DEV Site Only NODE 100
Area (ac)	2.26
Flow Path Length (ft)	400.0
Flow Path Slope (vft/hft)	0.04
50-yr Rainfall Depth (in)	7.4
Percent Impervious	0.77
Soil Type	28
Design Storm Frequency	50-yr
Fire Factor	0
LID	False

Output Results

Modeled (50-yr) Rainfall Depth (in)	7.4
Peak Intensity (in/hr)	4.415
Undeveloped Runoff Coefficient (Cu)	0.693
Developed Runoff Coefficient (Cd)	0.8524
Time of Concentration (min)	5.0
Clear Peak Flow Rate (cfs)	8.5052
Burned Peak Flow Rate (cfs)	8.5052
24-Hr Clear Runoff Volume (ac-ft)	1.008
24-Hr Clear Runoff Volume (cu-ft)	43909.0827



Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2018 by Autodesk, Inc. v2018.3

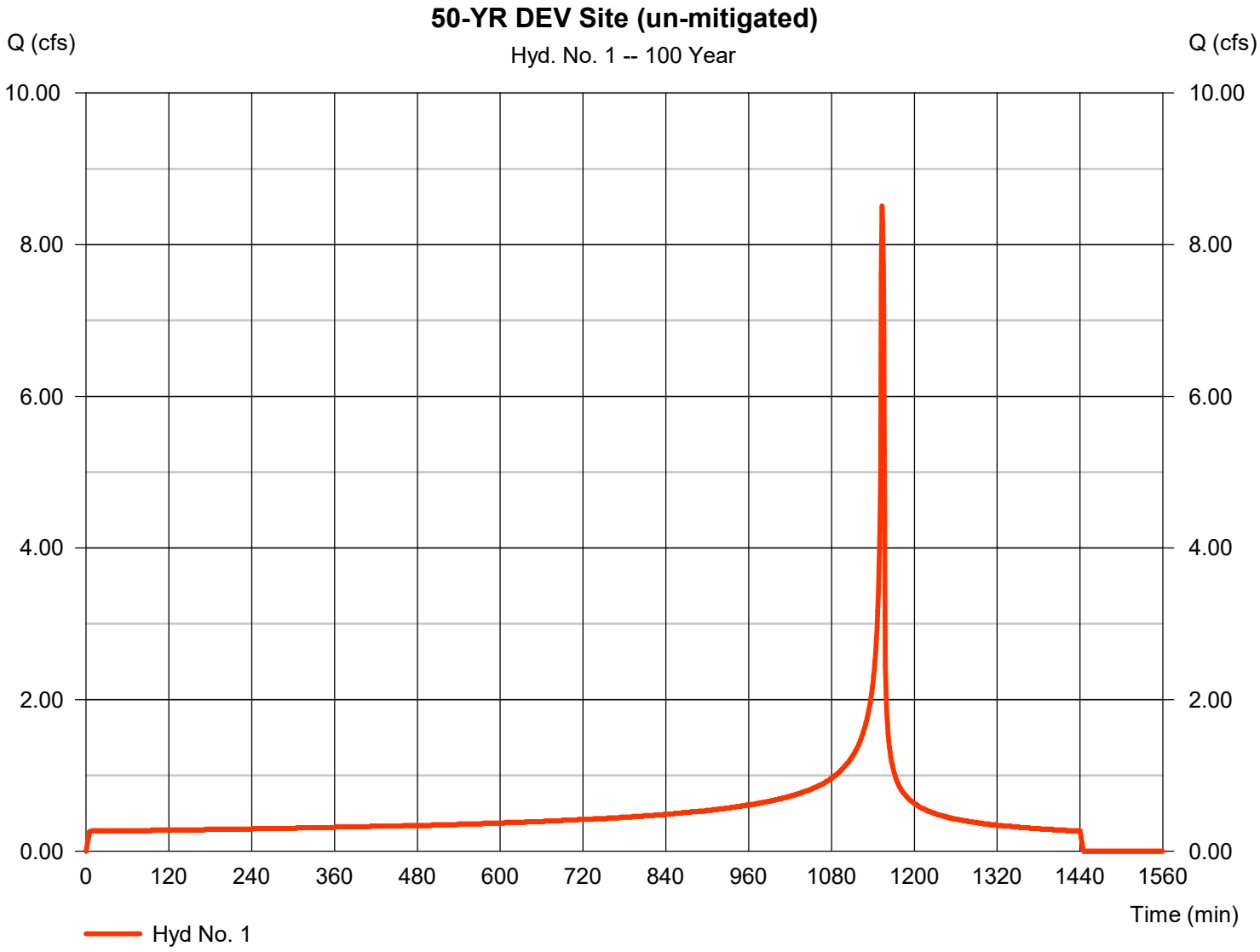
Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	Manual	8.510	1	1153	43,919	------	------	------	50-YR DEV Site (un-mitigated)
2	Reservoir	3.739	1	1157	43,912	1	102.87	2,966	50-YR DEV (mitigated) NODE 100

Hydrograph Report

Hyd. No. 1

50-YR DEV Site (un-mitigated) NODE 100

Hydrograph type	= Manual	Peak discharge	= 8.510 cfs
Storm frequency	= 100 yrs	Time to peak	= 1153 min
Time interval	= 1 min	Hyd. volume	= 43,919 cuft



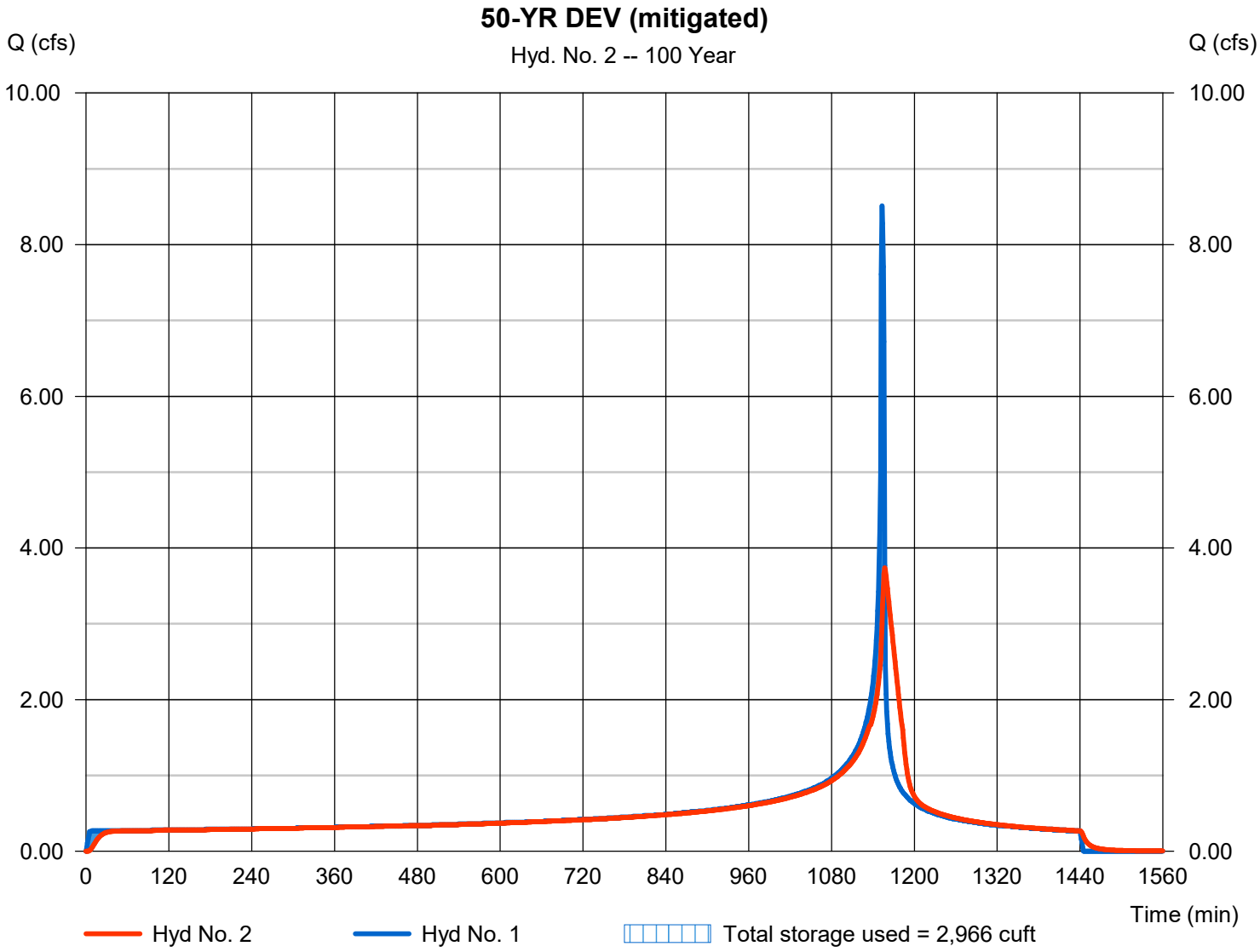
Hydrograph Report

Hyd. No. 2

50-YR DEV (mitigated)

Hydrograph type	= Reservoir	Peak discharge	= 3.739 cfs
Storm frequency	= 100 yrs	Time to peak	= 1157 min
Time interval	= 1 min	Hyd. volume	= 43,912 cuft
Inflow hyd. No.	= 1 - 50-YR DEV Site (un-mitigated)	Max. Elevation	= 102.87 ft
Reservoir name	= DEV Storage Pipes	Max. Storage	= 2,966 cuft

Storage Indication method used.



Pond Report

Pond No. 1 - DEV Storage Pipes

Pond Data

UG Chambers -Invert elev. = 100.00 ft, Rise x Span = 3.00 x 3.00 ft, Barrel Len = 60.00 ft, No. Barrels = 5, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 100.00 ft, Width = 5.00 ft, Height = 3.00 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	100.00	n/a	0	0
0.30	100.30	n/a	246	246
0.60	100.60	n/a	295	541
0.90	100.90	n/a	320	861
1.20	101.20	n/a	334	1,196
1.50	101.50	n/a	341	1,537
1.80	101.80	n/a	341	1,878
2.10	102.10	n/a	334	2,212
2.40	102.40	n/a	320	2,532
2.70	102.70	n/a	295	2,827
3.00	103.00	n/a	246	3,073

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 10.00	0.00	0.00	0.00
Span (in)	= 10.00	0.00	0.00	0.00
No. Barrels	= 1	0	0	0
Invert El. (ft)	= 100.00	0.00	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 1.00	0.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	No	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 0.00	0.00	0.00	0.00
Crest El. (ft)	= 0.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= ---	---	---	---
Multi-Stage	= No	No	No	No

Exfil.(in/hr) = 0.000 (by Contour)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	100.00	0.00	---	---	---	---	---	---	---	---	---	0.000
0.30	246	100.30	0.33 ic	---	---	---	---	---	---	---	---	---	0.330
0.60	541	100.60	1.11 ic	---	---	---	---	---	---	---	---	---	1.110
0.90	861	100.90	1.77 oc	---	---	---	---	---	---	---	---	---	1.767
1.20	1,196	101.20	2.19 oc	---	---	---	---	---	---	---	---	---	2.186
1.50	1,537	101.50	2.54 oc	---	---	---	---	---	---	---	---	---	2.536
1.80	1,878	101.80	2.84 oc	---	---	---	---	---	---	---	---	---	2.844
2.10	2,212	102.10	3.12 oc	---	---	---	---	---	---	---	---	---	3.121
2.40	2,532	102.40	3.38 oc	---	---	---	---	---	---	---	---	---	3.375
2.70	2,827	102.70	3.61 oc	---	---	---	---	---	---	---	---	---	3.612
3.00	3,073	103.00	3.83 oc	---	---	---	---	---	---	---	---	---	3.834

EXHIBIT C

FEMA MAPS

NOTES TO USERS

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

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

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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

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

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 11. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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

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

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

Base map information shown on this FIRM was derived from U.S. Geological Survey Digital Orthophoto Quadrangles produced at a scale of 1:12,000 from photography dated 1994 or later and from National Geospatial Intelligence Agency imagery produced at a scale of 1:4,000 from photography dated 2003 or later.

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

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

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

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report,* and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

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

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.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 (EL 987) Base Flood Elevation line and value; elevation in feet*
- 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
- 87°07'30", 32°22'30" Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4275000mN 1000-meter Universal Transverse Mercator grid values, zone 11
- 6000000 FT 5000-foot grid ticks: California State Plane coordinate system, V zone (FIPSZONE 0405), Lambert Conformal Conic
- DX5510 Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
September 26, 2008
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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

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

MAP SCALE 1" = 500'
250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1244F

FIRM
FLOOD INSURANCE RATE MAP
LOS ANGELES COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 1244 OF 2350
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LOS ANGELES COUNTY	065043	1244	F
AGOURA HILLS, CITY OF	065072	1244	F

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
06037C1244F
EFFECTIVE DATE
SEPTEMBER 26, 2008

Federal Emergency Management Agency

EXHIBIT D

LA COUNTY SUSMP

Peak Flow Hydrologic Analysis

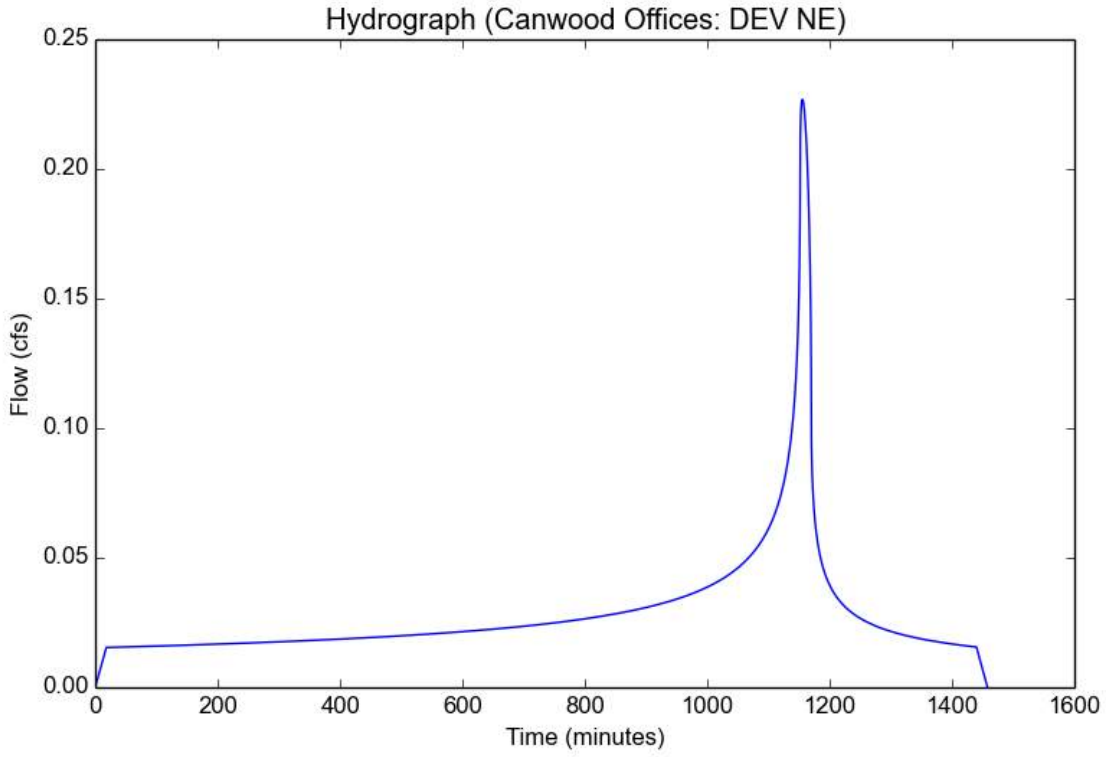
File location: C:/Users/JaySullivan/Cloudstation/DelaneSM/PDATA/0110309/Admin/Reports/Prelim. Drainage Study/App D - WQ/309 - DEV Site (NE) 85
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Canwood Offices
Subarea ID	DEV NE NODE 103
Area (ac)	1.01
Flow Path Length (ft)	360.0
Flow Path Slope (vft/hft)	0.04
85th Percentile Rainfall Depth (in)	0.96
Percent Impervious	0.77
Soil Type	28
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.96
Peak Intensity (in/hr)	0.3137
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.716
Time of Concentration (min)	18.0
Clear Peak Flow Rate (cfs)	0.2269
Burned Peak Flow Rate (cfs)	0.2269
24-Hr Clear Runoff Volume (ac-ft)	0.0574
24-Hr Clear Runoff Volume (cu-ft)	2499.2512



Peak Flow Hydrologic Analysis

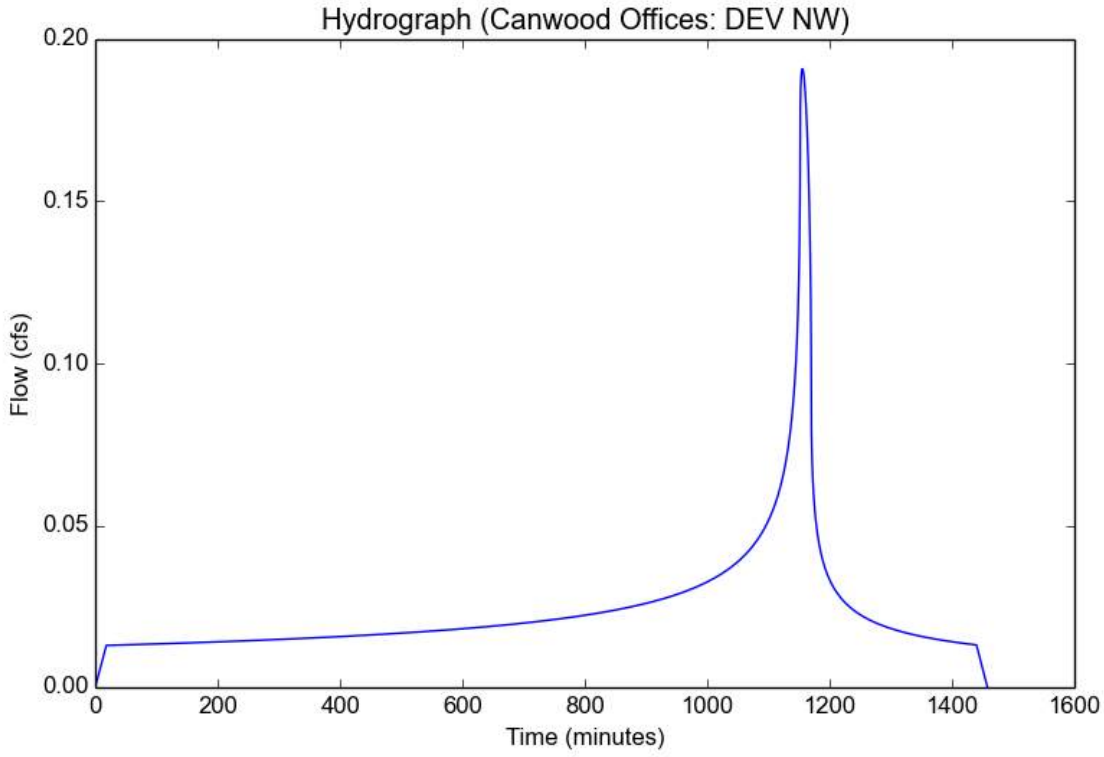
File location: C:/Users/JaySullivan/Cloudstation/DelaneSM/PDATA/0110309/Admin/Reports/Prelim. Drainage Study/App D - WQ/309 - DEV Site (NW) 85
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Canwood Offices
Subarea ID	DEV NW NODE 101
Area (ac)	0.85
Flow Path Length (ft)	360.0
Flow Path Slope (vft/hft)	0.04
85th Percentile Rainfall Depth (in)	0.96
Percent Impervious	0.77
Soil Type	28
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.96
Peak Intensity (in/hr)	0.3137
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.716
Time of Concentration (min)	18.0
Clear Peak Flow Rate (cfs)	0.1909
Burned Peak Flow Rate (cfs)	0.1909
24-Hr Clear Runoff Volume (ac-ft)	0.0483
24-Hr Clear Runoff Volume (cu-ft)	2103.3302



Peak Flow Hydrologic Analysis

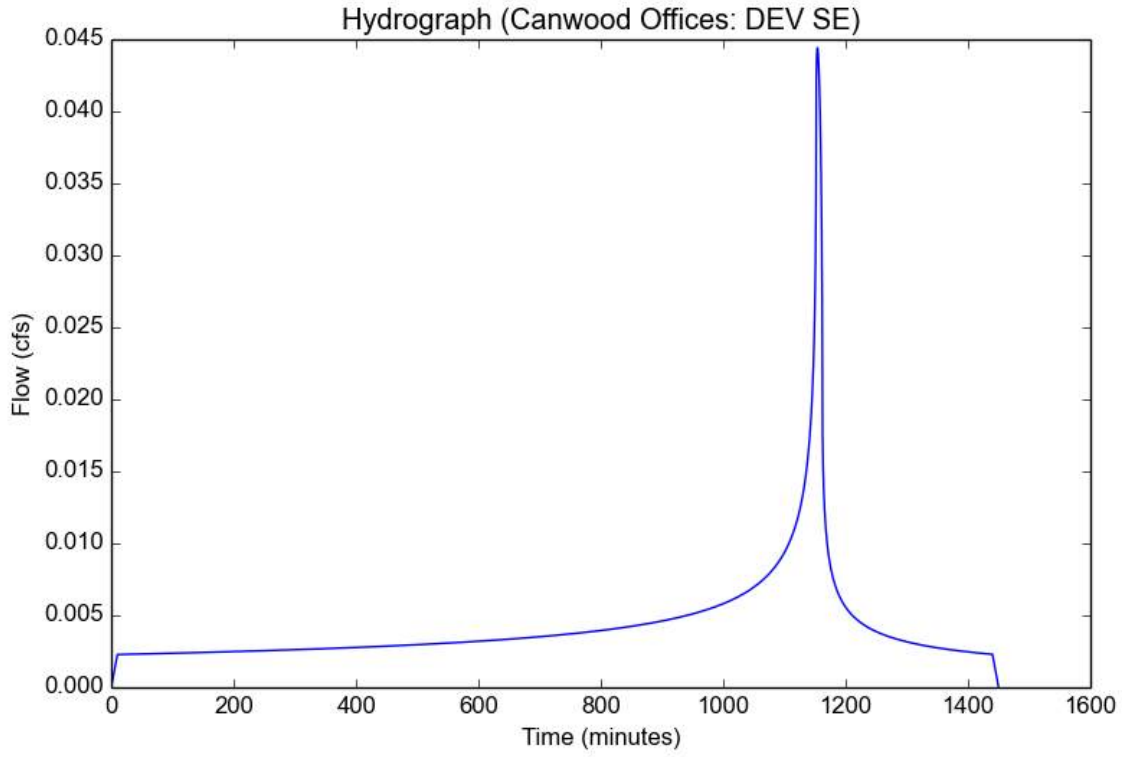
File location: C:/Users/JaySullivan/Cloudstation/DelaneSM/PDATA/0110309/Admin/Reports/Prelim. Drainage Study/App D - WQ/309 - DEV Site (SE) 85t
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Canwood Offices
Subarea ID	DEV SE NODE 104
Area (ac)	0.15
Flow Path Length (ft)	120.0
Flow Path Slope (vft/hft)	0.02
85th Percentile Rainfall Depth (in)	0.96
Percent Impervious	0.77
Soil Type	28
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.96
Peak Intensity (in/hr)	0.4135
Undeveloped Runoff Coefficient (Cu)	0.1
Developed Runoff Coefficient (Cd)	0.716
Time of Concentration (min)	10.0
Clear Peak Flow Rate (cfs)	0.0444
Burned Peak Flow Rate (cfs)	0.0444
24-Hr Clear Runoff Volume (ac-ft)	0.0085
24-Hr Clear Runoff Volume (cu-ft)	371.1749



Peak Flow Hydrologic Analysis

File location: C:/Users/JaySullivan/Cloudstation/DelaneSM/PDATA/0110309/Admin/Reports/Prelim. Drainage Study/App D - WQ/309 - DEV Site (SW) 85
Version: HydroCalc 1.0.3

Input Parameters

Project Name	Canwood Offices
Subarea ID	DEV SW NODE 102
Area (ac)	0.15
Flow Path Length (ft)	120.0
Flow Path Slope (vft/hft)	0.02
85th Percentile Rainfall Depth (in)	0.96
Percent Impervious	0.77
Soil Type	28
Design Storm Frequency	85th percentile storm
Fire Factor	0
LID	True

Output Results

Modeled (85th percentile storm) Rainfall Depth (in)	0.96
Peak Intensity (in/hr)	0.4135
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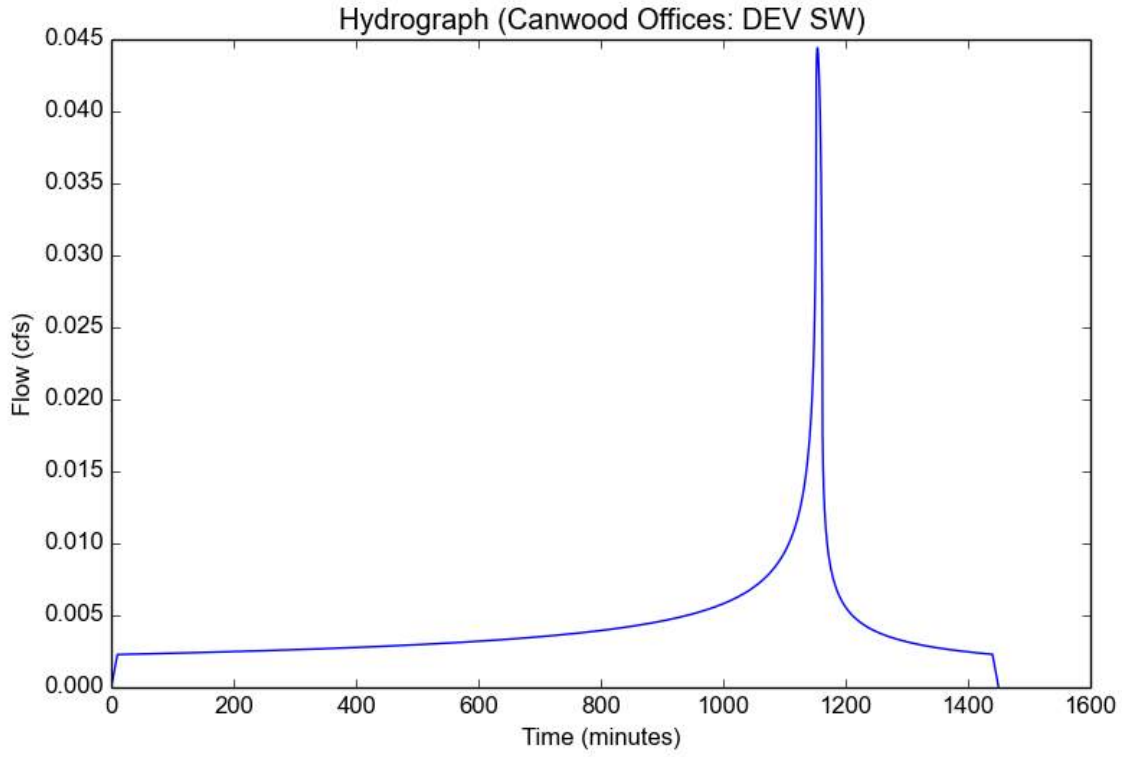
Burned Peak Flow Rate (cfs)	0.0444
24-Hr Clear Runoff Volume (ac-ft)	0.0085
24-Hr Clear Runoff Volume (cu-ft)	371.1749



NODE 101 ON PROPOSED CONDITION WORK MAP IN APPENDIX B

Filterra Sizing Tool

Applicable in the Area Goverened by the Los Angeles County MS4 Permit
(NPDES PERMIT NO. CAS004001; ORDER NO. R4-2012-0175)

For final design please contact:
Tamara Mamon - Stormwater Consultant
tmamon@conteches.com
Phone: 818-519-1781

Contact Information		**Project Information**	
Engineer of Record Name	Jay Sullivan	Project Name	Canwood St. Office Campus
Engineer of Record Company Name	Delane Engineering	Project Location	Agoura Hills
Engineer of Record Office Zip Code	90404	Catchment Name	#1

Drainage Area Inputs		
Drainage Area	**37026**	ft^2
Runoff coefficient	**0.77**	-
Time of concentration	**5**	min
Long term reliable infiltration rate	**0.00**	in/hr
85th percentile, 24-hour depth (see hyperlink below)	**0.96**	in

LA County Rainfall Depth Analysis

Filterra Configuration (Select from Drop-Down)	**Internal Bypass Curb**	

Refer to "Filterra Configurations" tab for descriptions and detail drawings for download.

Constants		
LAX Airport 85th Percentile, 24-hour depth (for reference only)	1.02	in
Filterra hydraulic loading capacity	1.45	gpm/ft^2
Outputs		
Stormwater Quality Design Volume	2,281	ft^3
Design Rainfall Intensity for Equivalent Long Term Capture	0.410	in/hr
Site Scaling Factor	0.94	-
Stormwater Quality Design Flow Rate	0.25	cfs
Design Alternatives Available	**Stand Alone Filterra Permitted**	

Design Recommendations

Primary Recommendation - Stand Alone Filterra

Adjusted Filterra Design Intensity	0.440	in/hr
Stormwater Quality Design Flow Rate	0.27	cfs
Required Filterra Area	85	ft^2
Filterra Model ID	**FTIBC-C 8x12 / 12x8**	

Alternative Recommendation - Filterra + Infiltration Storage

Required Filterra Area	79	ft^2
Filterra Model ID	**FTIBC-C 8x12 / 12x8**	
ChamberMaxx volume	0	ft^3
ChamberMaxx count	**0**	chambers

To be constent with approval of the Filterra Bioretention System as an alternative biofiltration specification granted by the Los Angeles Regional Water Quality Control Board on October 9, 2017, Filterra use is subject to the following conditions:

1. Filterra systems must be designed and sized following the methodology in Section 4 of the August 2015 report prepared by Geosyntec Consultants, entitled "Filterra Equivalency Analysis and Design Criteria" which is the basis for this design tool.
2. Filterra systems use an engineered biofiltration media. Filterra systems, including the engineered biofiltration media, must be provided by the manufacturer. No substitution of materials/media is allowed.
3. Filterra is only applicable as an alternative on-site biofiltration design in situations where a project applicant has demonstrated that it is technically infeasible to retain 100 percent of the SWQDv on-site.
4. Hydromodification requirements of Section VI.D.7.c.iv of the Los Angeles County MS4 Permit must be considered separately regardless of what type of biofiltration is used.
5. Operation and maintenance of Filterra systems must be conducted consistent with the recommendations in the Filterra maintenance manual provided by Contech Engineered Solutions.
6. In the area governed by the Los Angeles Region Phase I stormwater permit, conventional biofilters must be sized to treat 1.5X the SWQDV. This results in an average annual capture rate of 93%. Filterra systems sized using this tool will also treat at least 93% of the average annual runoff volume.

NODE 102 ON PROPOSED CONDITION WORK MAP IN APPENDIX B

Filterra Sizing Tool

Applicable in the Area Goverened by the Los Angeles County MS4 Permit
(NPDES PERMIT NO. CAS004001; ORDER NO. R4-2012-0175)

For final design please contact:
Tamara Mamon - Stormwater Consultant
tmamon@conteches.com
Phone: 818-519-1781

Contact Information		**Project Information**	
Engineer of Record Name	Jay Sullivan	Project Name	Canwood St. Office Campus
Engineer of Record Company Name	Delane Engineering	Project Location	Agoura Hills
Engineer of Record Office Zip Code	90404	Catchment Name	#2

Drainage Area Inputs		
Drainage Area	**6534**	ft^2
Runoff coefficient	**0.77**	-
Time of concentration	**5**	min
Long term reliable infiltration rate	**0.00**	in/hr
85th percentile, 24-hour depth (see hyperlink below)	**0.96**	in

LA County Rainfall Depth Analysis

Filterra Configuration (Select from Drop-Down)	**Peak Diversion**	

Refer to "Filterra Configurations" tab for descriptions and detail drawings for download.

Constants		
LAX Airport 85th Percentile, 24-hour depth (for reference only)	1.02	in
Filterra hydraulic loading capacity	1.45	gpm/ft^2

Outputs		
Stormwater Quality Design Volume	402	ft^3
Design Rainfall Intensity for Equivalent Long Term Capture	0.410	in/hr
Site Scaling Factor	0.94	-
Stormwater Quality Design Flow Rate	0.04	cfs
Design Alternatives Available	**Stand Alone Filterra Permitted**	

Design Recommendations

Primary Recommendation - Stand Alone Filterra

Adjusted Filterra Design Intensity	0.440	in/hr
Stormwater Quality Design Flow Rate	0.05	cfs
Required Filterra Area	15	ft^2
Filterra Model ID	**FTPD 4x4.5**	

Alternative Recommendation - Filterra + Infiltration Storage

Required Filterra Area	14	ft^2
Filterra Model ID	**FTPD 4x4.5**	
ChamberMaxx volume	0	ft^3
ChamberMaxx count	**0**	chambers

To be constent with approval of the Filterra Bioretention System as an alternative biofiltration specification granted by the Los Angeles Regional Water Quality Control Board on October 9, 2017, Filterra use is subject to the following conditions:

1. Filterra systems must be designed and sized following the methodology in Section 4 of the August 2015 report prepared by Geosyntec Consultants, entitled "Filterra Equivalency Analysis and Design Criteria" which is the basis for this design tool.
2. Filterra systems use an engineered biofiltration media. Filterra systems, including the engineered biofiltration media, must be provided by the manufacturer. No substitution of materials/media is allowed.
3. Filterra is only applicable as an alternative on-site biofiltration design in situations where a project applicant has demonstrated that it is technically infeasible to retain 100 percent of the SWQDv on-site.
4. Hydromodification requirements of Section VI.D.7.c.iv of the Los Angeles County MS4 Permit must be considered separately regardless of what type of biofiltration is used.
5. Operation and maintenance of Filterra systems must be conducted consistent with the recommendations in the Filterra maintenance manual provided by Contech Engineered Solutions.
6. In the area governed by the Los Angeles Region Phase I stormwater permit, conventional biofilters must be sized to treat 1.5X the SWQDV. This results in an average annual capture rate of 93%. Filterra systems sized using this tool will also treat at least 93% of the average annual runoff volume.

NODE 103 ON PROPOSED CONDITION WORK MAP IN APPENDIX B

Filterra Sizing Tool

Applicable in the Area Goverened by the Los Angeles County MS4 Permit
(NPDES PERMIT NO. CAS004001; ORDER NO. R4-2012-0175)

For final design please contact:
Tamara Mamon - Stormwater Consultant
tmamon@conteches.com
Phone: 818-519-1781

Contact Information		**Project Information**	
Engineer of Record Name	Jay Sullivan	Project Name	Canwood St. Office Campus
Engineer of Record Company Name	Delane Engineering	Project Location	Agoura Hills
Engineer of Record Office Zip Code	90404	Catchment Name	#3

Drainage Area Inputs		
Drainage Area	**43996**	ft^2
Runoff coefficient	**0.77**	-
Time of concentration	**5**	min
Long term reliable infiltration rate	**0.00**	in/hr
85th percentile, 24-hour depth (see hyperlink below)	**0.96**	in

LA County Rainfall Depth Analysis

Filterra Configuration (Select from Drop-Down)	**Internal Bypass Curb**	
Refer to "Filterra Configurations" tab for descriptions and detail drawings for download.		

Constants		
LAX Airport 85th Percentile, 24-hour depth (for reference only)	1.02	in
Filterra hydraulic loading capacity	1.45	gpm/ft^2
Outputs		
Stormwater Quality Design Volume	2,710	ft^3
Design Rainfall Intensity for Equivalent Long Term Capture	0.410	in/hr
Site Scaling Factor	0.94	-
Stormwater Quality Design Flow Rate	0.30	cfs
Design Alternatives Available	**Stand Alone Filterra Permitted**	

Design Recommendations

Primary Recommendation - Stand Alone Filterra

Adjusted Filterra Design Intensity	0.440	in/hr
Stormwater Quality Design Flow Rate	0.32	cfs
Required Filterra Area	101	ft^2
Filterra Model ID	**FTIBC-C 14x8**	

Alternative Recommendation - Filterra + Infiltration Storage

Required Filterra Area	94	ft^2
Filterra Model ID	**FTIBC-C 8x12 / 12x8**	
ChamberMaxx volume	0	ft^3
ChamberMaxx count	**0**	chambers

To be constent with approval of the Filterra Bioretention System as an alternative biofiltration specification granted by the Los Angeles Regional Water Quality Control Board on October 9, 2017, Filterra use is subject to the following conditions:

1. Filterra systems must be designed and sized following the methodology in Section 4 of the August 2015 report prepared by Geosyntec Consultants, entitled "Filterra Equivalency Analysis and Design Criteria" which is the basis for this design tool.
2. Filterra systems use an engineered biofiltration media. Filterra systems, including the engineered biofiltration media, must be provided by the manufacturer. No substitution of materials/media is allowed.
3. Filterra is only applicable as an alternative on-site biofiltration design in situations where a project applicant has demonstrated that it is technically infeasible to retain 100 percent of the SWQDv on-site.
4. Hydromodification requirements of Section VI.D.7.c.iv of the Los Angeles County MS4 Permit must be considered separately regardless of what type of biofiltration is used.
5. Operation and maintenance of Filterra systems must be conducted consistent with the recommendations in the Filterra maintenance manual provided by Contech Engineered Solutions.
6. In the area governed by the Los Angeles Region Phase I stormwater permit, conventional biofilters must be sized to treat 1.5X the SWQDV. This results in an average annual capture rate of 93%. Filterra systems sized using this tool will also treat at least 93% of the average annual runoff volume.

NODE 104 ON PROPOSED CONDITION WORK MAP IN APPENDIX B

Filterra Sizing Tool

Applicable in the Area Goverened by the Los Angeles County MS4 Permit
(NPDES PERMIT NO. CAS004001; ORDER NO. R4-2012-0175)

For final design please contact:
Tamara Mamon - Stormwater Consultant
tmamon@conteches.com
Phone: 818-519-1781

Contact Information		**Project Information**	
Engineer of Record Name	Jay Sullivan	Project Name	Canwood St. Office Campus
Engineer of Record Company Name	Delane Engineering	Project Location	Agoura Hills
Engineer of Record Office Zip Code	90404	Catchment Name	#4

Drainage Area Inputs		
Drainage Area	**6534**	ft^2
Runoff coefficient	**0.77**	-
Time of concentration	**5**	min
Long term reliable infiltration rate	**0.00**	in/hr
85th percentile, 24-hour depth (see hyperlink below)	**0.96**	in
LA County Rainfall Depth Analysis		
Filterra Configuration (Select from Drop-Down)	**Peak Diversion**	

Refer to "Filterra Configurations" tab for descriptions and detail drawings for download.

Constants		
LAX Airport 85th Percentile, 24-hour depth (for reference only)	1.02	in
Filterra hydraulic loading capacity	1.45	gpm/ft^2
Outputs		
Stormwater Quality Design Volume	402	ft^3
Design Rainfall Intensity for Equivalent Long Term Capture	0.410	in/hr
Site Scaling Factor	0.94	-
Stormwater Quality Design Flow Rate	0.04	cfs
Design Alternatives Available	**Stand Alone Filterra Permitted**	

Design Recommendations

Primary Recommendation - Stand Alone Filterra

Adjusted Filterra Design Intensity	0.440	in/hr
Stormwater Quality Design Flow Rate	0.05	cfs
Required Filterra Area	15	ft^2
Filterra Model ID	**FTPD 4x4.5**	

Alternative Recommendation - Filterra + Infiltration Storage

Required Filterra Area	14	ft^2
Filterra Model ID	**FTPD 4x4.5**	
ChamberMaxx volume	0	ft^3
ChamberMaxx count	**0**	chambers

To be constent with approval of the Filterra Bioretention System as an alternative biofiltration specification granted by the Los Angeles Regional Water Quality Control Board on October 9, 2017, Filterra use is subject to the following conditions:

1. Filterra systems must be designed and sized following the methodology in Section 4 of the August 2015 report prepared by Geosyntec Consultants, entitled "Filterra Equivalency Analysis and Design Criteria" which is the basis for this design tool.
2. Filterra systems use an engineered biofiltration media. Filterra systems, including the engineered biofiltration media, must be provided by the manufacturer. No substitution of materials/media is allowed.
3. Filterra is only applicable as an alternative on-site biofiltration design in situations where a project applicant has demonstrated that it is technically infeasible to retain 100 percent of the SWQDv on-site.
4. Hydromodification requirements of Section VI.D.7.c.iv of the Los Angeles County MS4 Permit must be considered separately regardless of what type of biofiltration is used.
5. Operation and maintenance of Filterra systems must be conducted consistent with the recommendations in the Filterra maintenance manual provided by Contech Engineered Solutions.
6. In the area governed by the Los Angeles Region Phase I stormwater permit, conventional biofilters must be sized to treat 1.5X the SWQDV. This results in an average annual capture rate of 93%. Filterra systems sized using this tool will also treat at least 93% of the average annual runoff volume.

Contech Engineered Solutions LLC
9025 Centre Pointe Drive, Suite 400
West Chester, OH 45069
Phone: (513) 645-7000
Fax: (513) 645-7993
www.ContechES.com

Re: Filterra Sizing and the 1.5 factor for SWQDV

To Whom It May Concern,

The purpose of this memo is to summarize the sizing of Filterra using the equivalency method and the application of the 1.5x Storm Water Quality Design Volume (SWQDV) per the Los Angeles Region Phase 1 Stormwater Permit requirement.

The 1.5x SWQDV results in an average annual capture efficiency rate (the percentage of long term runoff that is treated, not bypassed) of approximately 93% for conventional biofilters that are sized to meet the requirements of Attachment H of the LA Permit. The Contech Filterra equivelancy method sizing worksheet sets this 93% annual capture rate as a baseline level of performance. All Filterra systems sized using this tool will also treat at least 93% of the average annual runoff volume. In addition, to make up for the differences in evapotranspiration and infiltration between a smaller Filterra system and a larger conventional biofiltration system, the Filterra system will either be designed with a supplemental upstream or downstream infiltration volume or will be oversized to treat more than 93% of the average annual runoff volume. The end result is a Filterra system that will achieve an equivalent pollutant load reduction for common pollutants of concern as compared to conventional biofiltration. The Los Angeles Regional Water Quality Control Board has accepted this Filterra sizing methodology as providing equivalent treatment. Please see the attached Geosyntec Report.

In short, the Filterra Equivalency spreadsheet does take into account the 1.5x SWQDV by sizing the Filterra with a 93% annual capture rate, which is an approved equivalent methodology.

Please contact your Contech Representative for additional questions

Sincerely,

Katie Husk, E.I.

Senior Designer - Stormwater Products | Team Lead
Contech Engineered Solutions LLC
11815 NE Glenn Widing Drive | Portland, OR 97220
Office: (503) 258-3149 |Fax: (800) 561-1271
KHusk@conteches.com
www.ContechES.com

EXHIBIT E

HYDRAULIC CALCULATIONS

Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, May 5 2021

309 - Drop Inlet (NE CORNER) CAPTURES OFF-SITE DRAINAGE AT NODE 300

Drop Curb Inlet

Location	= Sag
Curb Length (ft)	= 8.00
Throat Height (in)	= 6.00
Grate Area (sqft)	= -0-
Grate Width (ft)	= -0-
Grate Length (ft)	= -0-

Gutter

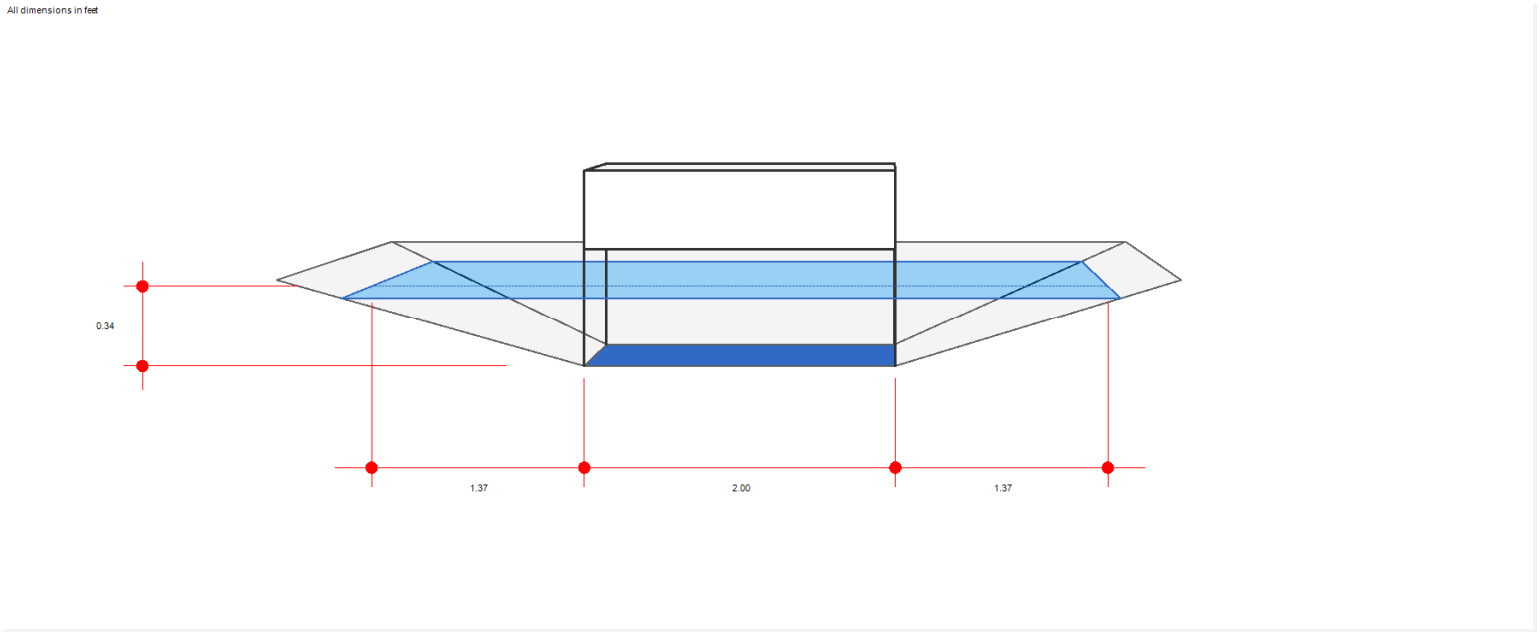
Slope, Sw (ft/ft)	= 0.250
Slope, Sx (ft/ft)	= 0.250
Local Depr (in)	= -0-
Gutter Width (ft)	= -0-
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

Calculations

Compute by:	Known Q
Q (cfs)	= 4.80

Highlighted

Q Total (cfs)	= 4.80
Q Capt (cfs)	= 4.80
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 4.10
Efficiency (%)	= 100
Gutter Spread (ft)	= 1.37
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-



Inlet Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, May 5 2021

309 - Drop Inlet (NW CORNER) CAPTURES OFF-SITE DRAINAGE AT NODE 200

Drop Curb Inlet

Location	= Sag
Curb Length (ft)	= 4.00
Throat Height (in)	= 6.00
Grate Area (sqft)	= -0-
Grate Width (ft)	= -0-
Grate Length (ft)	= -0-

Gutter

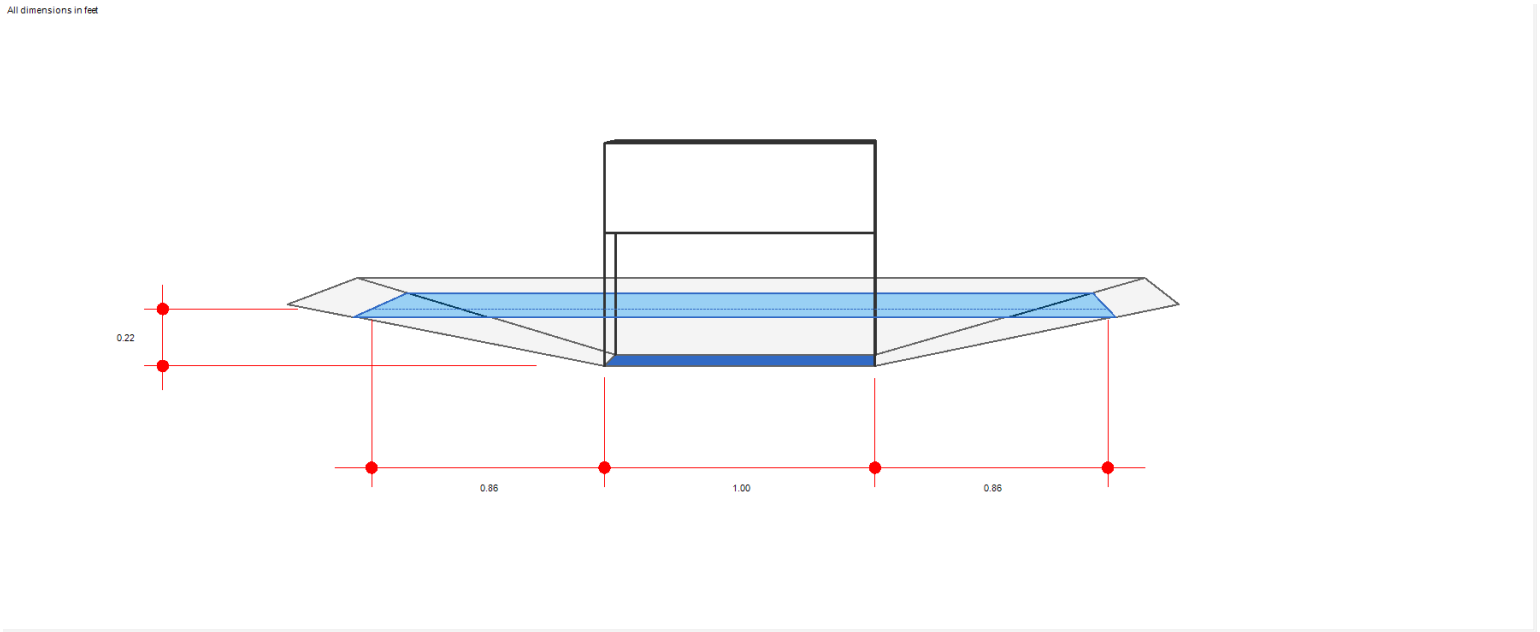
Slope, Sw (ft/ft)	= 0.250
Slope, Sx (ft/ft)	= 0.250
Local Depr (in)	= -0-
Gutter Width (ft)	= -0-
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

Calculations

Compute by:	Known Q
Q (cfs)	= 1.20

Highlighted

Q Total (cfs)	= 1.20
Q Capt (cfs)	= 1.20
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 2.58
Efficiency (%)	= 100
Gutter Spread (ft)	= 0.86
Gutter Vel (ft/s)	= -0-
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-



Inlet Report

309 - Curb Inlet (NE Drainage: Q50) CAPTURES ON-SITE DRAINAGE AT NODE 103

Curb Inlet

Location	=	On grade
Curb Length (ft)	=	9.00
Throat Height (in)	=	4.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

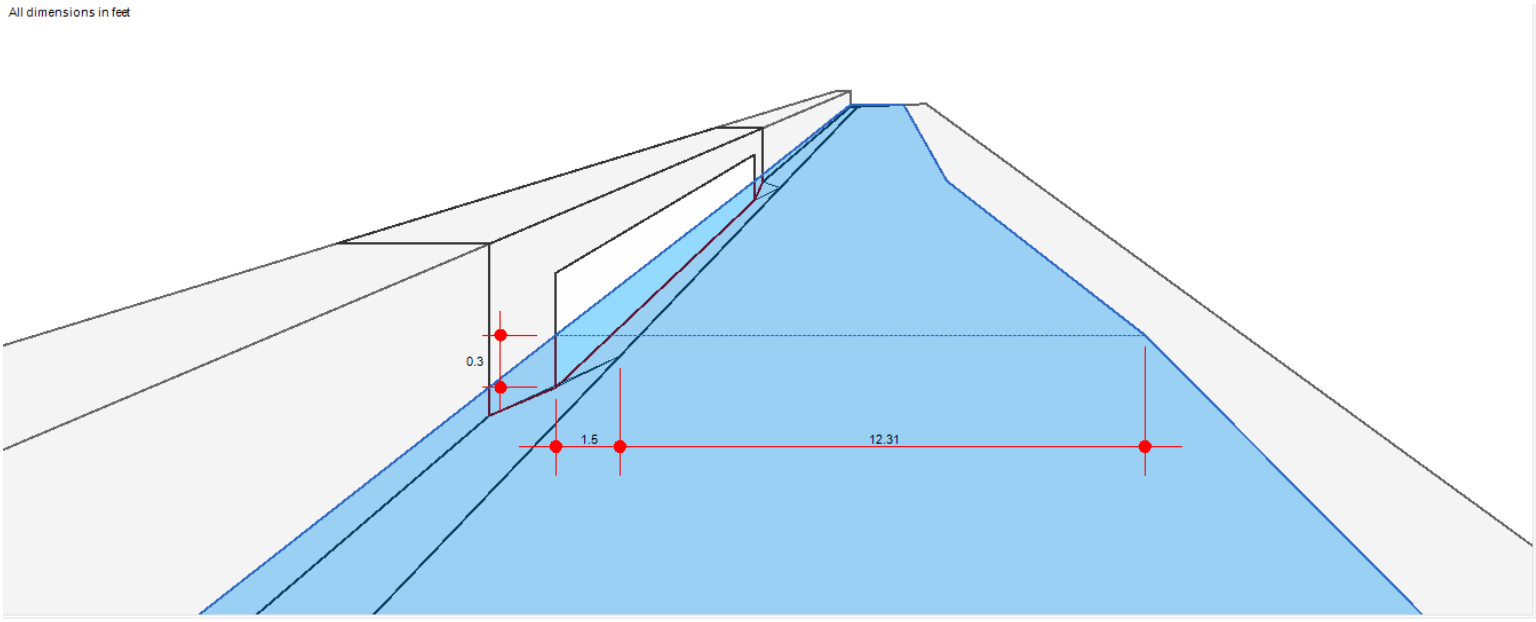
Slope, Sw (ft/ft)	=	0.010
Slope, Sx (ft/ft)	=	0.010
Local Depr (in)	=	2.00
Gutter Width (ft)	=	1.50
Gutter Slope (%)	=	3.00
Gutter n-value	=	0.013

Calculations

Compute by:		Known Q
Q (cfs)	=	3.80

Highlighted

Q Total (cfs)	=	3.80
Q Capt (cfs)	=	1.59
Q Bypass (cfs)	=	2.21
Depth at Inlet (in)	=	3.66
Efficiency (%)	=	42
Gutter Spread (ft)	=	13.81
Gutter Vel (ft/s)	=	3.98
Bypass Spread (ft)	=	11.27
Bypass Depth (in)	=	1.35



Inlet Report

309 - Curb Inlet (NE Drainage: Qpm) CAPTURES ON-SITE DRAINAGE AT NODE 103

Curb Inlet

Location	=	On grade
Curb Length (ft)	=	9.00
Throat Height (in)	=	4.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

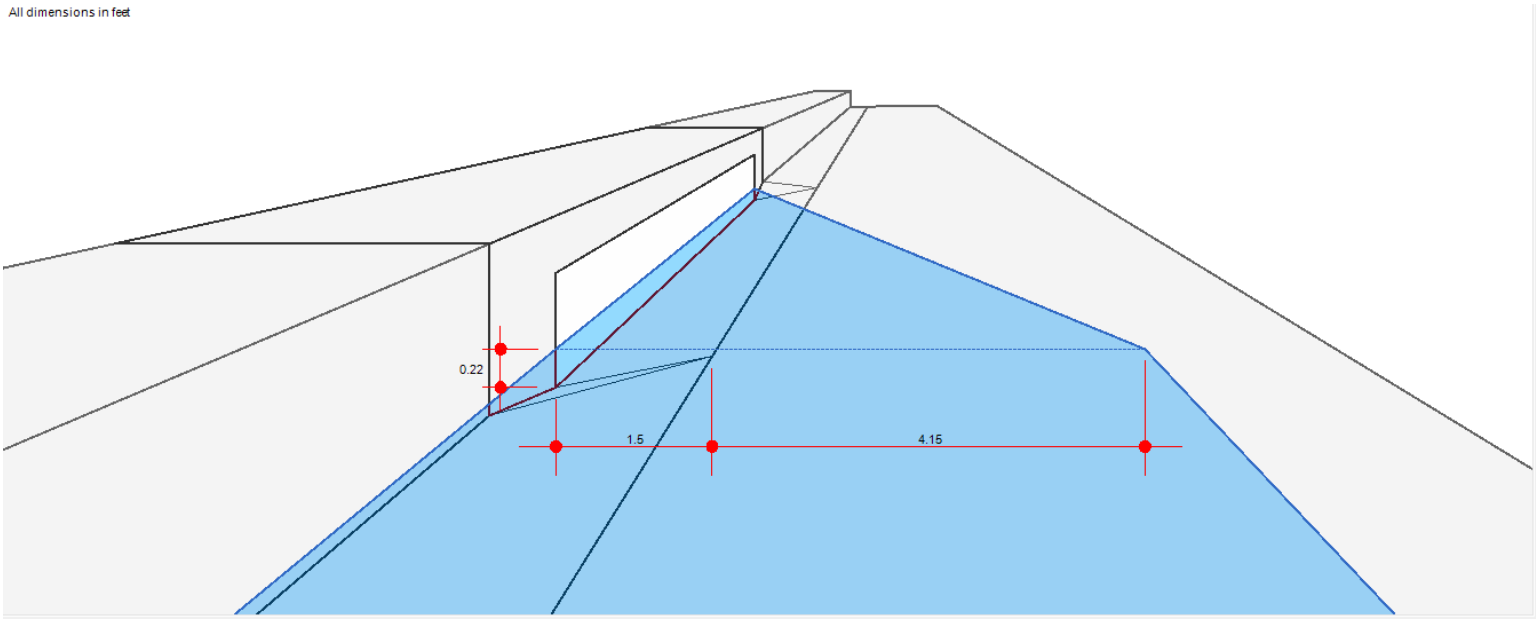
Slope, Sw (ft/ft)	=	0.010
Slope, Sx (ft/ft)	=	0.010
Local Depr (in)	=	2.00
Gutter Width (ft)	=	1.50
Gutter Slope (%)	=	3.00
Gutter n-value	=	0.013

Calculations

Compute by:		Known Q
Q (cfs)	=	0.35

Highlighted

Q Total (cfs)	=	0.35
Q Capt (cfs)	=	0.35
Q Bypass (cfs)	=	-0-
Depth at Inlet (in)	=	2.68
Efficiency (%)	=	100
Gutter Spread (ft)	=	5.65
Gutter Vel (ft/s)	=	2.19
Bypass Spread (ft)	=	-0-
Bypass Depth (in)	=	-0-



Inlet Report

309 - Curb Inlet (NW Drainage: Q50) CAPTURES ON-SITE DRAINAGE AT NODE 101

Curb Inlet

Location	= On grade
Curb Length (ft)	= 8.00
Throat Height (in)	= 4.00
Grate Area (sqft)	= -0-
Grate Width (ft)	= -0-
Grate Length (ft)	= -0-

Gutter

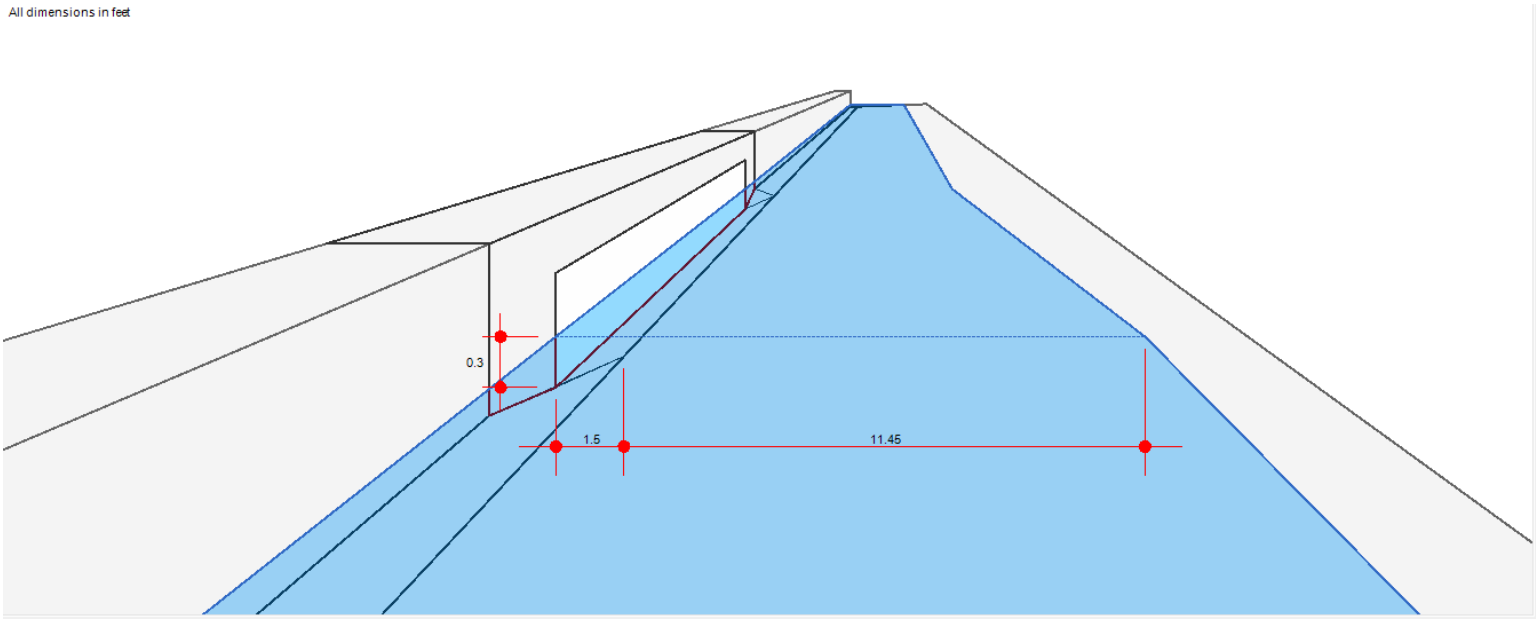
Slope, Sw (ft/ft)	= 0.010
Slope, Sx (ft/ft)	= 0.010
Local Depr (in)	= 2.00
Gutter Width (ft)	= 1.50
Gutter Slope (%)	= 3.00
Gutter n-value	= 0.013

Calculations

Compute by:	Known Q
Q (cfs)	= 3.20

Highlighted

Q Total (cfs)	= 3.20
Q Capt (cfs)	= 1.32
Q Bypass (cfs)	= 1.88
Depth at Inlet (in)	= 3.55
Efficiency (%)	= 41
Gutter Spread (ft)	= 12.95
Gutter Vel (ft/s)	= 3.82
Bypass Spread (ft)	= 10.62
Bypass Depth (in)	= 1.27



Inlet Report

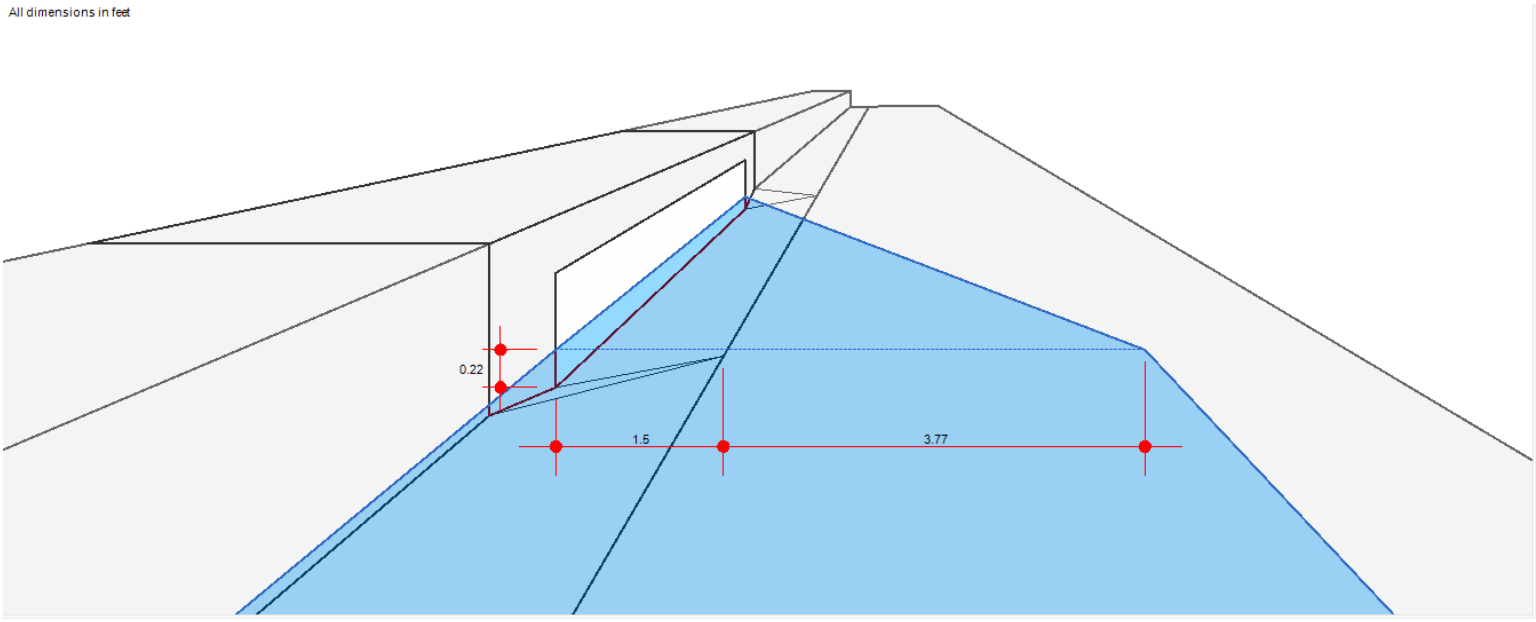
309 - Curb Inlet (NW Drainage: Qpm) CAPTURES ON-SITE DRAINAGE AT NODE 101

Curb Inlet	
Location	= On grade
Curb Length (ft)	= 8.00
Throat Height (in)	= 4.00
Grate Area (sqft)	= -0-
Grate Width (ft)	= -0-
Grate Length (ft)	= -0-

Gutter	
Slope, Sw (ft/ft)	= 0.010
Slope, Sx (ft/ft)	= 0.010
Local Depr (in)	= 2.00
Gutter Width (ft)	= 1.50
Gutter Slope (%)	= 3.00
Gutter n-value	= 0.013

Calculations	
Compute by:	Known Q
Q (cfs)	= 0.29

Highlighted	
Q Total (cfs)	= 0.29
Q Capt (cfs)	= 0.29
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 2.63
Efficiency (%)	= 100
Gutter Spread (ft)	= 5.27
Gutter Vel (ft/s)	= 2.09
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-



Inlet Report

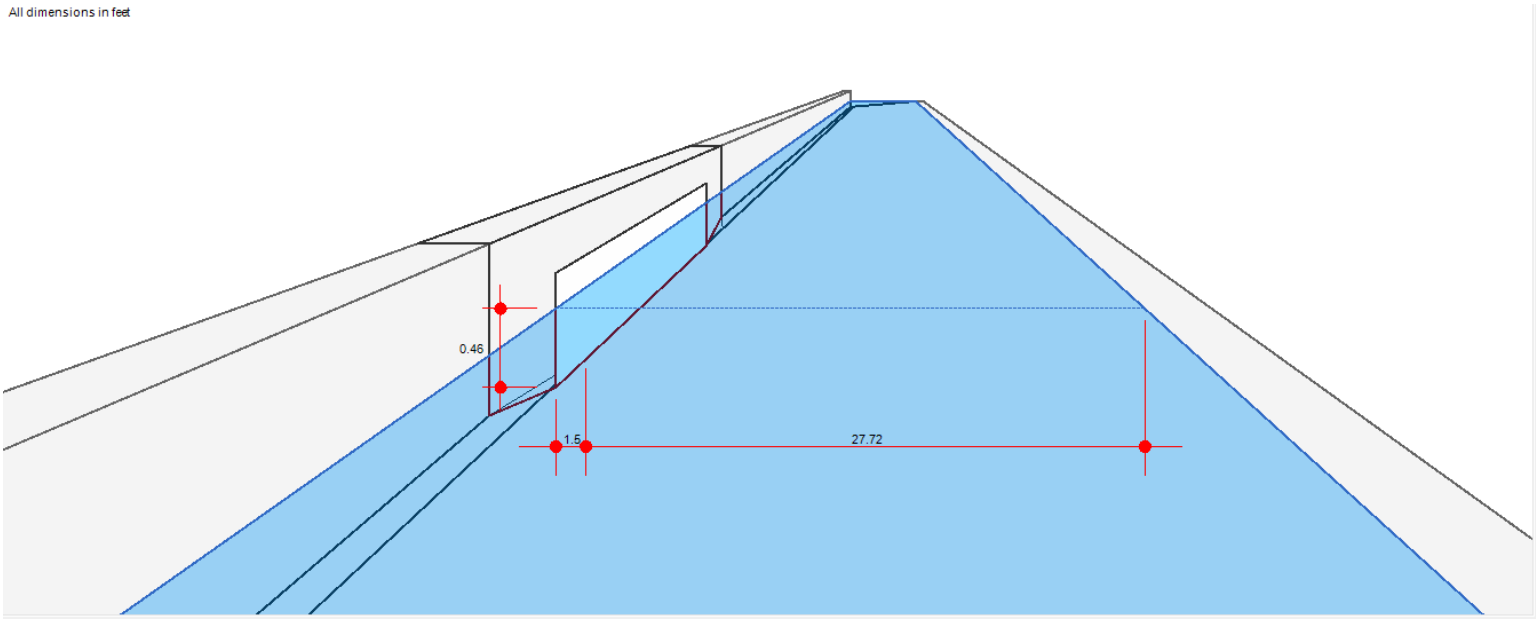
309 - Curb Inlet (SE Drainage: Q50) CAPTURES ON-SITE DRAINAGE AT NODES 104

Curb Inlet	
Location	= Sag
Curb Length (ft)	= 5.00
Throat Height (in)	= 4.00
Grate Area (sqft)	= -0-
Grate Width (ft)	= -0-
Grate Length (ft)	= -0-

Gutter	
Slope, Sw (ft/ft)	= 0.010
Slope, Sx (ft/ft)	= 0.010
Local Depr (in)	= 2.00
Gutter Width (ft)	= 1.50
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

Calculations	
Compute by:	Known Q
Q (cfs)	= 2.80

Highlighted	
Q Total (cfs)	= 2.80
Q Capt (cfs)	= 2.80
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 5.51
Efficiency (%)	= 100
Gutter Spread (ft)	= 29.22
Gutter Vel (ft/s)	= 3.98
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-



Inlet Report

309 - Curb Inlet (SW Drainage: Q50) CAPTURES ON-SITE DRAINAGE AT NODE 102

Curb Inlet

Location	= Sag
Curb Length (ft)	= 4.00
Throat Height (in)	= 4.00
Grate Area (sqft)	= -0-
Grate Width (ft)	= -0-
Grate Length (ft)	= -0-

Gutter

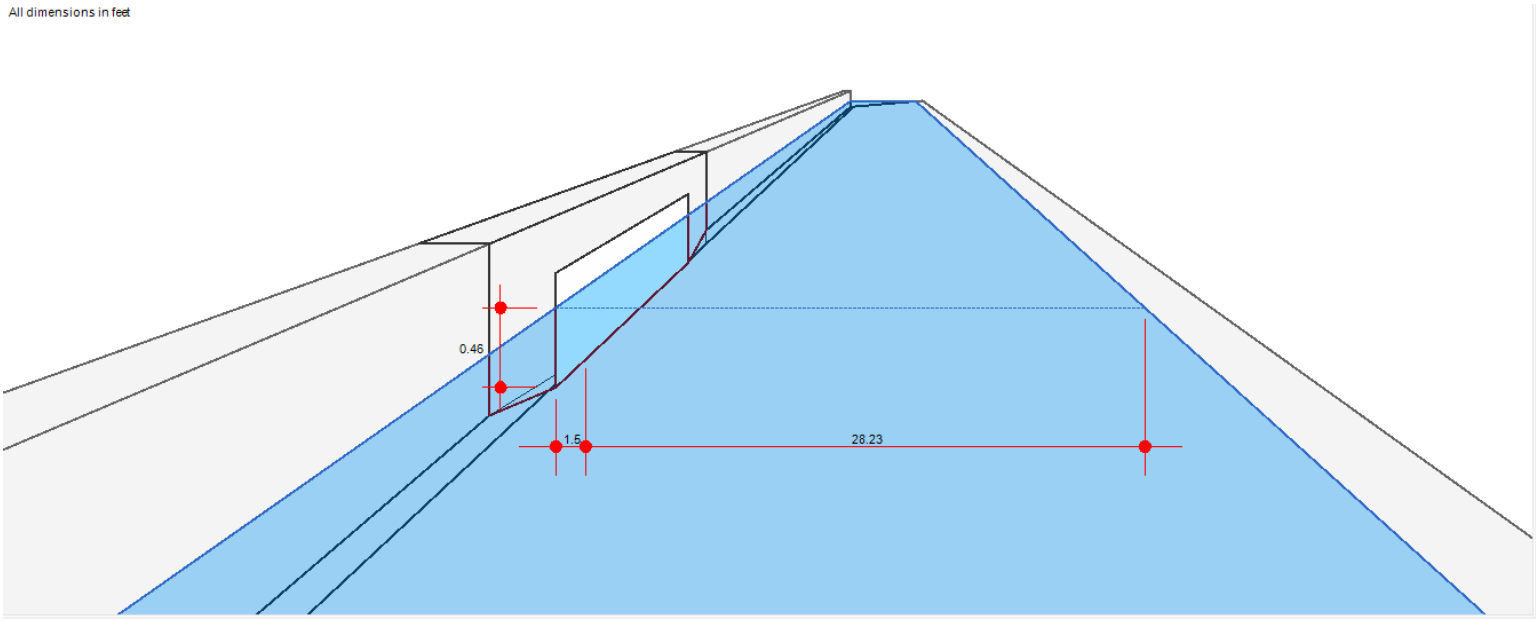
Slope, Sw (ft/ft)	= 0.010
Slope, Sx (ft/ft)	= 0.010
Local Depr (in)	= 2.00
Gutter Width (ft)	= 1.50
Gutter Slope (%)	= -0-
Gutter n-value	= -0-

Calculations

Compute by:	Known Q
Q (cfs)	= 2.50

Highlighted

Q Total (cfs)	= 2.50
Q Capt (cfs)	= 2.50
Q Bypass (cfs)	= -0-
Depth at Inlet (in)	= 5.57
Efficiency (%)	= 100
Gutter Spread (ft)	= 29.73
Gutter Vel (ft/s)	= 3.98
Bypass Spread (ft)	= -0-
Bypass Depth (in)	= -0-



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, May 4 2021

12-Inch Pipe at S=1% CONVEYS Q50 AT NODE 200

Circular

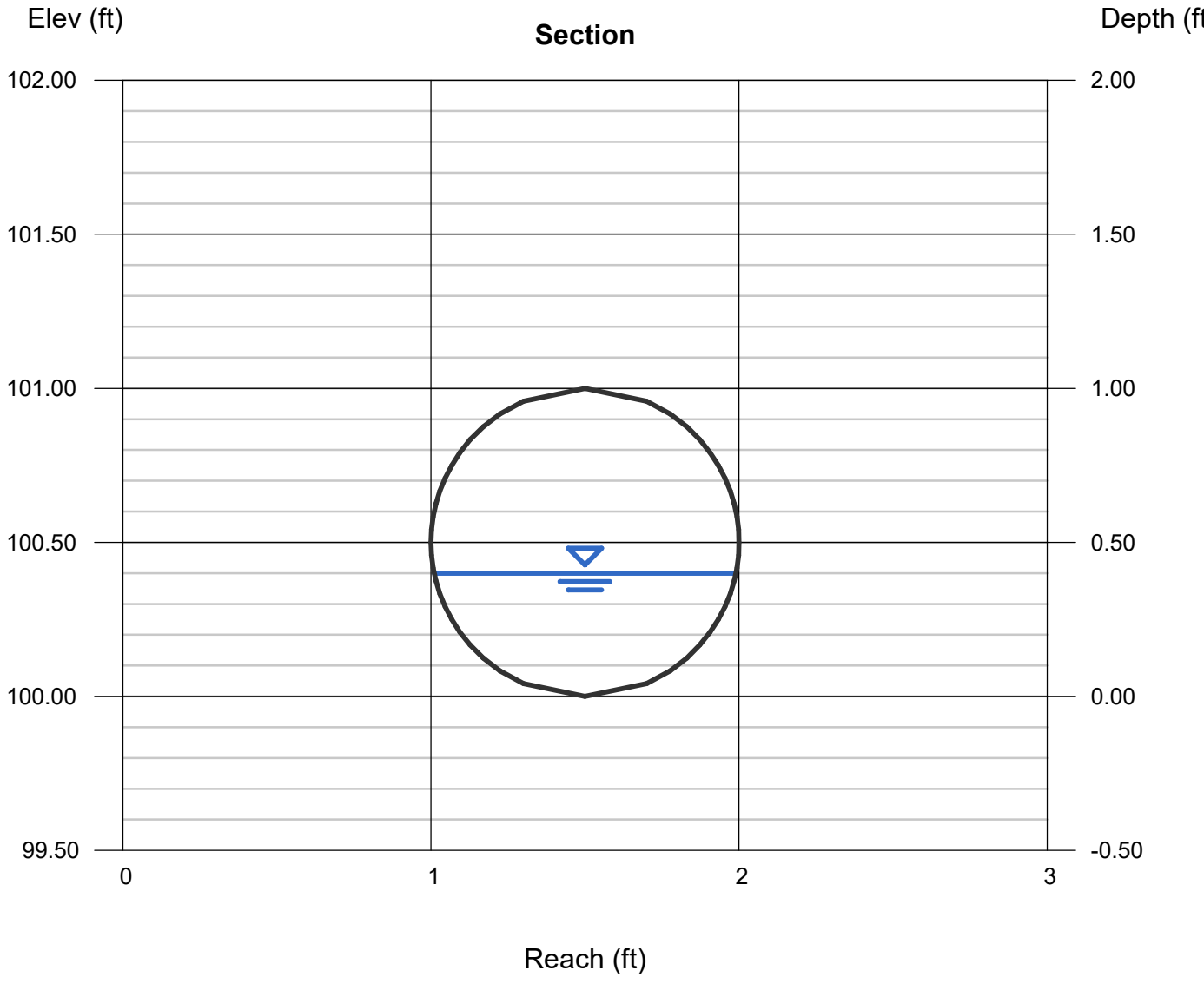
Diameter (ft)	= 1.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.20

Highlighted

Depth (ft)	= 0.40
Q (cfs)	= 1.200
Area (sqft)	= 0.29
Velocity (ft/s)	= 4.09
Wetted Perim (ft)	= 1.37
Crit Depth, Yc (ft)	= 0.46
Top Width (ft)	= 0.98
EGL (ft)	= 0.66



Channel Report

18-Inch Pipe at S=1%

CONVEYS Q50 AT NODE 400 AND
COMBINED Q50 FROM NODES 200 AND 300

Circular

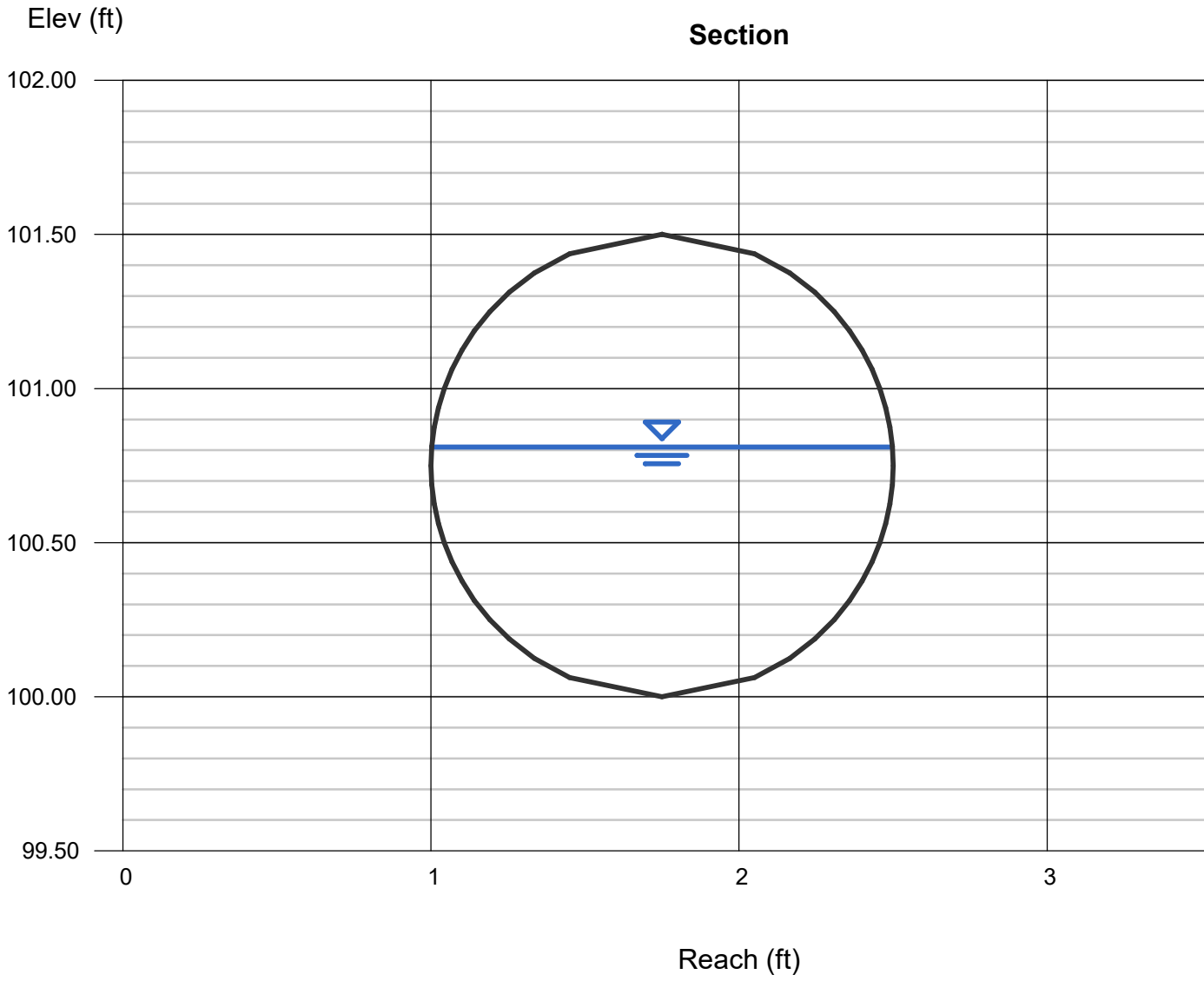
Diameter (ft)	= 1.50
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

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

Highlighted

Depth (ft)	= 0.81
Q (cfs)	= 6.000
Area (sqft)	= 0.98
Velocity (ft/s)	= 6.13
Wetted Perim (ft)	= 2.48
Crit Depth, Yc (ft)	= 0.95
Top Width (ft)	= 1.49
EGL (ft)	= 1.40



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, May 5 2021

24-Inch Pipe at S=1%

CONVEYS TOTAL MITIGATED Q50 DISCHARGE FROM SITE AT NODE 100

Circular

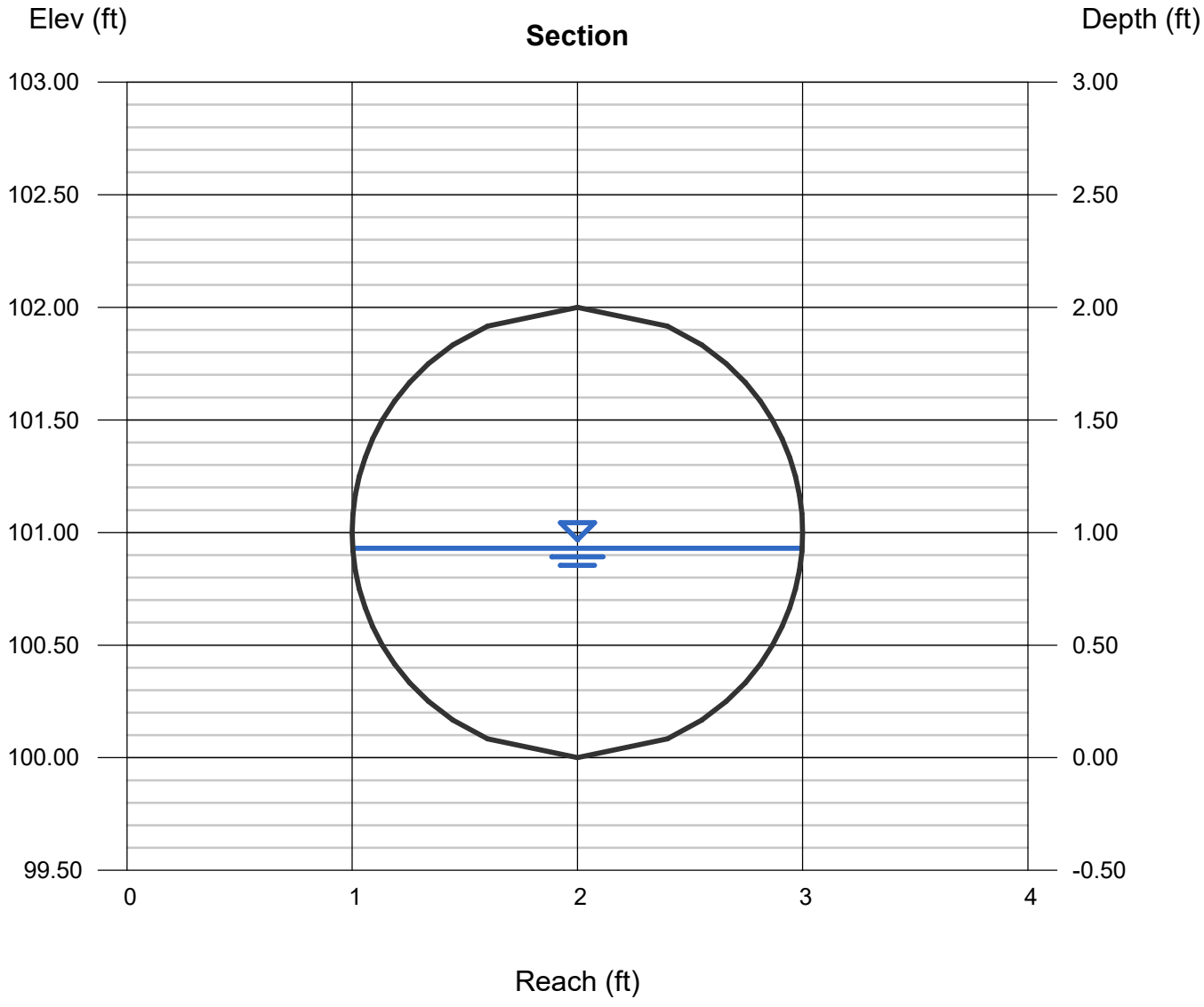
Diameter (ft)	= 2.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 10.00

Highlighted

Depth (ft)	= 0.93
Q (cfs)	= 10.00
Area (sqft)	= 1.44
Velocity (ft/s)	= 6.95
Wetted Perim (ft)	= 3.01
Crit Depth, Yc (ft)	= 1.13
Top Width (ft)	= 2.00
EGL (ft)	= 1.68



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, May 4 2021

12-Inch Pipe at S=1% CONVEYS Q50 AT NODE 103

Circular

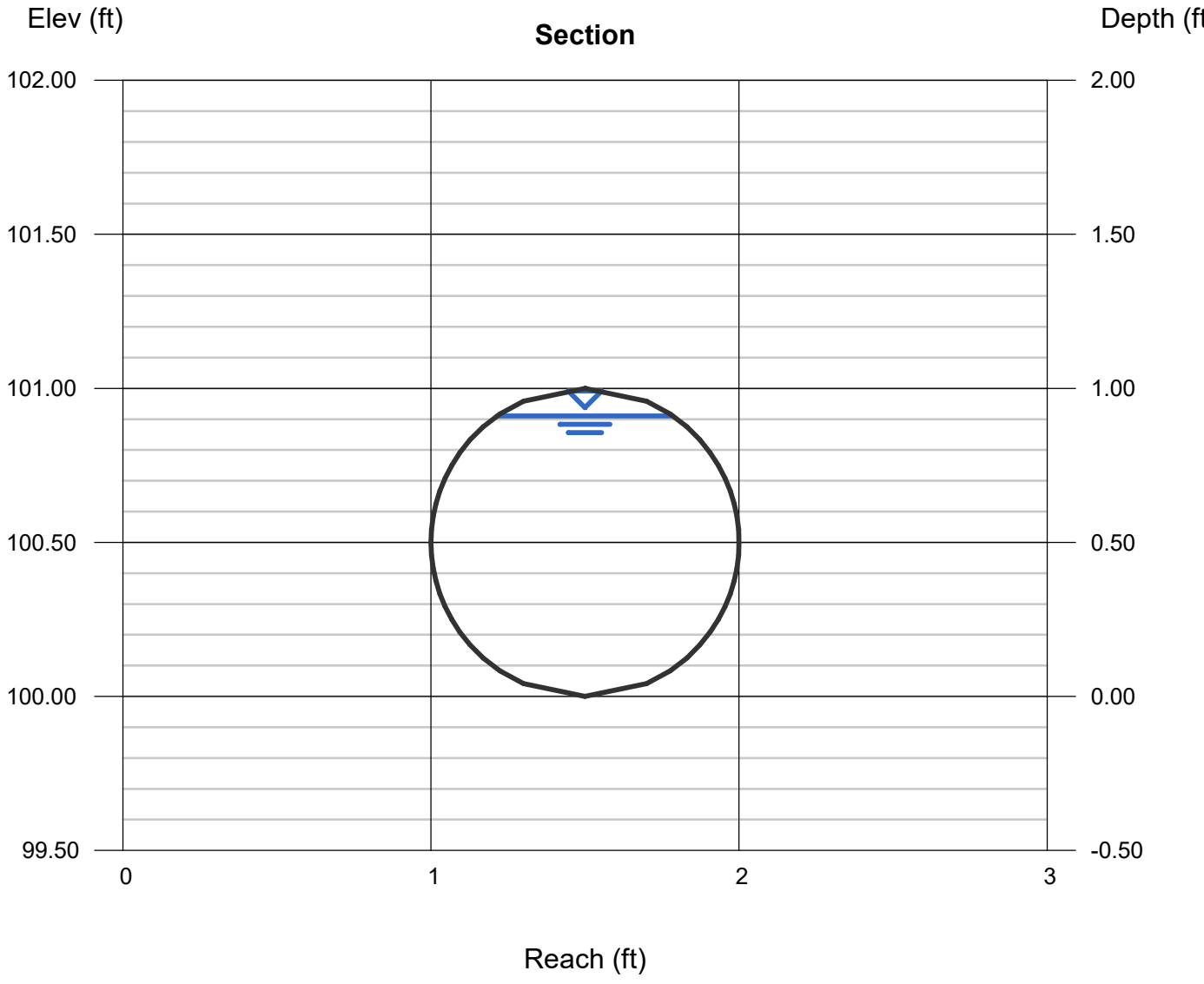
Diameter (ft)	= 1.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 3.80

Highlighted

Depth (ft)	= 0.91
Q (cfs)	= 3.800
Area (sqft)	= 0.75
Velocity (ft/s)	= 5.06
Wetted Perim (ft)	= 2.54
Crit Depth, Yc (ft)	= 0.83
Top Width (ft)	= 0.57
EGL (ft)	= 1.31



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, May 4 2021

12-Inch Pipe at S=1% CONVEYS Q50 AT NODE 101

Circular

Diameter (ft)	= 1.00
Invert Elev (ft)	= 100.00
Slope (%)	= 1.00
N-Value	= 0.013

Calculations

Compute by:	Known Q
Known Q (cfs)	= 3.20

Highlighted

Depth (ft)	= 0.74
Q (cfs)	= 3.200
Area (sqft)	= 0.62
Velocity (ft/s)	= 5.12
Wetted Perim (ft)	= 2.08
Crit Depth, Yc (ft)	= 0.77
Top Width (ft)	= 0.88
EGL (ft)	= 1.15