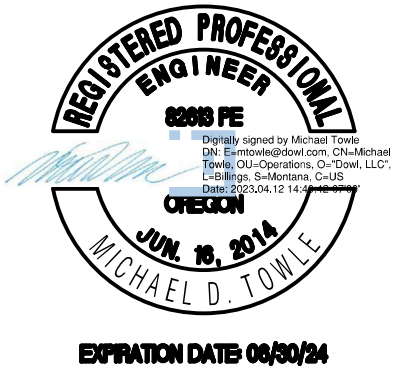
Exhibit I
Drainage Report

DRAINAGE REPORT

Chick-Fil-A Woodburn at Highway 219 & Woodland

2322.14866.01



EXPIRATION DATE: 06/30/24

December 20, 2022

Prepared for:

Chick-fil-A
5200 Buffington Road
Atlanta, GA 30349

Prepared by:

DOWL
309 SW 6th Avenue, Suite 700
Portland, OR 97204

EXECUTIVE SUMMARY

The proposed Chick-Fil-A Woodburn at Highway 219219 & Woodland development will construct a new fast food restaurant located southeast of the corner of South Woodland Avenue and Highway 219219 Woodburn, Oregon. The site will be developed with a drive through, parking areas, and landscaping. New sanitary, water and storm drain utilities will be constructed to service the development.

The purpose of this report is to describe the stormwater management strategy being proposed for the CFA development. The design follows the standards and regulations developed by the City of Woodburn and ODOT. These regulations are described in Chapter 7 and 11 of the City of Woodburn's *Storm Drainage Master Plan*, the *City of Portland 2020 Stormwater Management Manual*, the *City of Portland Sewer and Drainage Facilities Design Manual*, revised in March 2020, and the *ODOT Hydraulics Manual.*

The site runoff will be managed by a combination of green facilities, mechanical treatment, and underground storage. The City of Woodburn requires that runoff from the 25-year stormwater event be detained to the pre-developed 5-year event, as well as treated to remove Total Suspended Solids (TSS) and Organics (oil/grease).

To meet these requirements, runoff will either be collected using Contech Stormfilter Catch Basins and routed to underground ADS Stormtech Chambers, or routed to a Bioretention Pond through the use of curb cuts and sheet flow. Flow control structures will be installed on the Bioretention Pond and both underground ADS Stormtech Chamber galleries to store runoff while releasing at a controlled rate. Runoff will ultimately leave the site through a connection to the public stormwater main in Hillyer Lane.

DESIGNER CERTIFICATION

I hereby certify that this Stormwater Report for Chick-Fil-A Woodburn at Highway 219 & Woodland has been prepared by me or under my supervision and meets minimum standards of the City of Woodburn Master Drainage Plan and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me.

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APPENDICES

1.0 PROJECT OVERVIEW

1.1 Project Overview

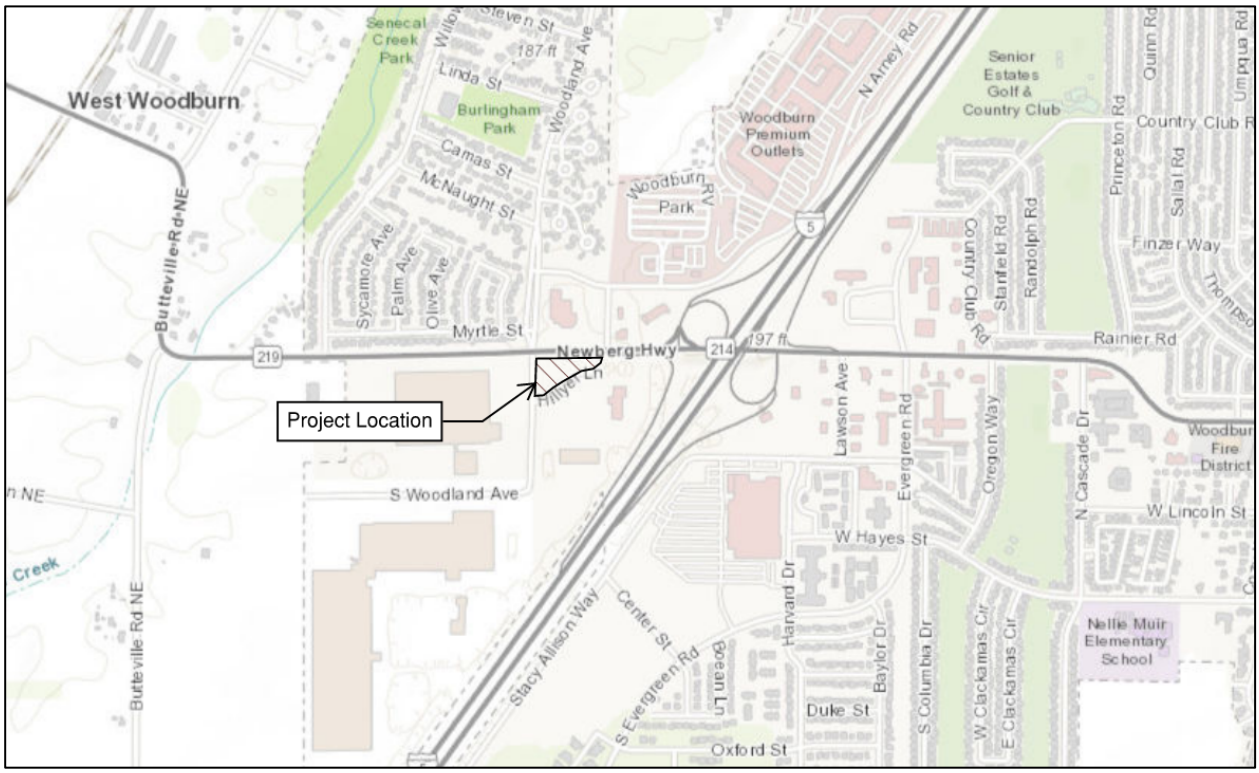
The proposed Chick-Fil-A Woodburn at Highway 219 & Woodland project will construct a fast-food service restaurant with associated drive through, parking, landscaping, and utilities. The project will cover one lot. A small portion of the lot coverage will not be feasible to collect in the onsite drainage system due to the site topography. This area will remain landscaped coverage and continue to drain to its existing discharge point. The property description is as follows:

Parcel 1, PP 2003-33, 1.39 Acres, TL 106, Map 0502W11, Lot 106, Zone CG.

1.2 Location

The project site is located southeast of the intersection of Highway 219 and South Woodland Avenue, see Figure 1-1.

Figure 1: Vicinity Map



1.3 Stormwater Management Requirements

The proposed project must comply with the standards established by the City of Woodburn. The City of Woodburn has deferred their water quality and conveyance requirements to follow the *City of Portland 2020 Stormwater Management Manual* (SWMM) and the *City of Portland Sewer and Drainage Facilities Design Manual* (SDFDM), revised in March 2020. In order to establish the City of Portland water quality requirements a discharge hierarchy assessment was performed. Section 1.3.3 - Infiltration and Discharge Hierarchy was used to evaluate the

stormwater management requirements for the site. The highest technically feasible level must be used, unless otherwise directed by BES.

Level 1: Full on-site infiltration

Due to high fines content of the subgrade, on-site infiltration of the full 10-year storm event is infeasible.

Level 2: Offsite discharge to the separated storm system

The project will be designed under Hierarchy Level 2. Stormwater runoff will be collected, treated, and detained prior to being discharged to an existing stormwater system along Hillyer Lane. Because Hillyer Lane is within ODOT right-of-way, the project must also comply with the stormwater requirements listed in the *ODOT Hydraulics Manual* (April 2014). Table 1-1 below has been provided to summarize the applicable requirements and which jurisdictions have the controlling standard for each.

Table 1-1: Stormwater Management Design Standards

Design Criteria	Jurisdictional Requirement			Controlling Standard
	City of Woodburn	City of Portland	ODOT	
Conveyance	-	10-yr	10-yr	City of Portland / ODOT
Water Quality	-	1.61 in / 24-hr (Volume) 0.19 in / hr (Flowrate)	50% of 2-yr Event	City of Portland
Water Quantity (Pre-Developed)[1]	5-yr	-	10-yr	City of Woodburn
Water Quantity (Post-Developed)[2]	25-yr	-	10-yr	City of Woodburn

[1] *'Pre-Developed' represents the natural condition.*

[2] *Water quantity events listed represent the post-developed peak runoff rates that must be detained to be less than or equal to the rates generated in pre-developed condition at the same recurrence interval.*

2.0 EXISTING CONDITIONS

2.1 Topography

The existing site consists of a parking lot and landscaping areas. The site has gradual slopes between 1 and 5%, generally to the north. Elevations range from approximately 185 feet on the west to 179 feet on the northeast. All elevations are referenced to the North American Datum of 1983/2011 (NAD83/2011).

2.2 Climate

The site is located in Woodburn, Oregon. There is a gradual change in seasons with defined seasonal characteristics. Average daily temperatures range from 35°F to 81°F. Average annual rainfall recorded in this area is 41 inches.

2.3 Geology

The underlying soil type is classified by the USDA Soil Survey of Marion County, Oregon as Woodburn Silt Loam (see Appendix 1: Soil and Floodplain Map). Woodburn Silt Loam has a hydrologic soil group of C.

The geotechnical engineer reported groundwater seepage was observed at 7 to 11 feet below ground surface (see Appendix 2: Excerpts from Geotechnical Report). Infiltration testing was performed and not reported, it has been assumed that infiltration is not practical due to a high percentage of fines and a moderately high groundwater table.

2.4 Hydrology

Stormwater runoff from the existing site flows to the northeast and southeast. There is an existing 12" storm sewer main in Hillyer Lane that flows southwest. The site is located within the Senecal Creek watershed, which does not have any listed TMDL restrictions.

A pre-developed, pervious curve number of 74 has been established. This number has been taken from USDA *Urban Hydrology for Small Watersheds: TR-55*, with an assumed coverage of 'grassland' in good condition and hydrologic soil group C.

A predeveloped time of concentration was calculated to be 27.59 minutes (see Appendix 4).

The existing drainage basin for the site has been summarized in Table 2-1.

Table 2-1: Existing Basin

Basin Name	Impervious Area (ac)	Pervious Area (ac)	Total Area (ac)	Curve Number	Time of Concentration (min)
Existing	0.00	1.39	1.39	74	27.59

3.0 PROPOSED CONDITIONS

Stormwater runoff will be collected in Contech Stormfilter Catch Basins as well as curb inlets that release to a proposed Bioretention Pond. Treated runoff will flow from the catch basins into underground ADS Stormtech Chamber systems equipped with flow control manholes. Runoff entering the Bioretention Pond will be treated by filtering down through an 18-inch deep growing media layer that releases to an underdrain. The Bioretention Pond has been designed with a flow control orifice and emergency overflow. All facilities have been designed to meet the flow control requirements of Chapters 7 and 11 of the City of Woodburn *Storm Drainage Master Plan*, the water quality requirements of the *City of Portland 2020 SWMM*, the conveyance requirements of *City of Portland SDFDM* (March 2020), and has been shown to additionally meet ODOT standards for conveyance, water quality, and flow control.

3.1 Hydrology

The proposed site will have surface slopes that are comparable to the existing condition, with local site grading to direct runoff to catch basins.

Table 3-1 lists the on-site basin areas under pre-development and post-construction conditions for the site. Detailed sub-basin information and drainage area delineations are provided in Appendix 1. The developed lot will be 68.66% impervious. A proposed curve number of 74 for pervious areas and an impervious curve number of 98 were established.

The proposed time of concentration was assumed to be 5 minutes.

Table 3-1: Existing Basin

Basin ID	Impervious Area (ac)	Pervious Area (ac)	Total Area (ac)	Percent Impervious (%)	Pervious CN	Tc (min)
Basin 1	0.101	0.026	0.127	79.42	74	5.0
Basin 2	0.000	0.116	0.116	0.00	74	5.0
Basin 3	0.162	0.034	0.196	82.60	74	5.0
Basin 4	0.063	0.018	0.081	77.36	74	5.0
Basin 5	0.066	0.000	0.066	100.00	74	5.0
Basin 6	0.354	0.133	0.486	72.70	74	5.0
Basin 7	0.078	0.022	0.100	77.85	74	5.0
Basin 8	0.128	0.085	0.213	60.15	74	5.0

3.1.1 Hydrologic Method

The Santa Barbara Urban Hydrograph (SBUH) method was used to temporally distribute precipitation excess. The SBUH method converts the incremental runoff depths into instantaneous hydrographs, which are then routed through an imaginary reservoir with a time delay equal to the basin time of concentration.

The analysis was completed using Autodesk Storm and Sanitary Analysis 2020. The runoff function of Storm and Sanitary Analysis generates surface and subsurface runoff based on design or measured rainfall conditions, land use and topography. The Storm and Sanitary Analysis software is based on the public EPA SWMM program and is an approved method of analysis by City of Portland.

A pervious CN = 74 and an impervious CN = 98 has been used in the Storm and Sanitary Analysis model.

Rainfall dstributions for each event were generated using the NRCS Type 1A hydrograph with the 24 hour rainfall depths provided in the PSMM as shown in Table 3-10.

Table 3-2: Precipitation Depth

Recurrence Interval (years)	24-hour Rainfall Depth (in)
WQ	1.61
5	2.90
10	3.40
25	3.80

3.2 Water Quality

3.2.1 Design Guidelines

The project is designed under Hierarchy Level 2 which requires 70% removal of total suspended solids from the runoff from 90% of the average annual rainfall, per Section 1.3.5 of the Portland

SWMM. Additionally, the selected stormwater management facilities should be capable of reducing the pollutants of concern for 303(d)-listed impaired waters, when possible.

3.2.2 Bioretention Pond

The site has been designed to be partially treated with a proposed Bioretention Pond. The pond has been designed to capture and treat surface runoff from adjacent paved areas in accordance with the City of Portland 2020 SWMM. The pond has been designed with the parameters described in Table 3-2 below.

Table 3-3: Bioretention Parameters

Parameter	Value
Growing Media Depth	24 in.
Media Infiltration Rate	12 in./hr
Infiltration Factor of Safety	4
Underdrain	Yes
Side Slopes	3H:1V
Facility Depth	2.0 ft
Emergency Overflow	Yes
Flow Control Manhole	Yes

The pond will provide detention and flow control for its treatment sub-basin. The flow rate of the growing media was verified to exceed the peak flow rate entering the facility to ensure that the flow-control manhole serves as the limiting rate for the facility, ensuring that the provided detention volume has been accurately determined and the water quality event will not bypass the growing media, see Section 3.3 below for more information.

3.2.3 Contech Systems

Areas of the site not feasible to be treated by bioretention facilities will be collected in Contech Catch basins equipped with media filter cartridges to provide water quality treatment.

The Contech system is designed per the criteria listed in the BES Approved Manufactured Stormwater Treatment Technology document. The proposed Contech cartridges are able to treat up to 7.5 gpm/cartridge for 18 inch tall units, and 11.25 gpm/cartridge for 27 inch tall units, according to the Washington DOE GULD and City of Portland BES approvals.

The water quality flow rate was determined using the below equation (*SWMM A.3.1)*:

$Q = C*I*A$

$Q = 0.90 * 0.19$ in/hr * Impervious area (ac)

A summary of the treatment manhole and catch basin is shown in Table 3-3 below. Standard details of the Contech systems are included in Appendix 3.

Table 3-4: Contech Design Summary

Facility ID	Drainage Area (ac)	Water Quality Flow Rate (cfs)[1]	25-yr Peak Flow Rate (cfs)	Cartridges Required	Cartridge Height (in)
SFCB-1	0.127	0.017	0.100	1	18
SFCB-2	0.196	0.028	0.160	2	18
SFCB-3	0.081	0.011	0.070	1	18
SFCB-4	0.100	0.013	0.080	1	18
SFCB-5	0.213	0.022	0.140	1	27

1. *Water Quality flow rate calculated per Portland SWMM 1.3.5, A.2.4 & A.3.1.*

A summary of the Contech system treatment capacity for the pollutants of concern is listed in **Error! Reference source not found.**-4. Additional treatment capacity information is provided in Appendix 3. Treatment for temperature, while not provided by the Contech system, can be expected to occur through the use of the detention facilities, as discussed in Section 3.3.

Table 3-5: Contech Treatment Capacity

Pollutant of Concern	Removal Efficiency
Total suspended solids	85%
Phosphorous	65%

3.3 Detention and Flow Control

3.3.1 Design Overview

Per Chapter 7 and 11 of the Woodburn *Storm Drainage Master Plan*, any development that doesn't drain to a system previously designed to receive unmitigated flows must detain the 25-year peak runoff rate to the 5-year pre-developed peak runoff rate. In addition, ODOT requires that the 10-year post-developed peak runoff rate be detained to the 10-year pre-developed peak runoff rate. This will be achieved via one Bioretention Pond and two underground ADS Stormtech chamber systems.

3.3.2 Bioretention Pond

The Bioretention Pond has been sized to provide available volume for up to the 25-year storm while maintaining the flow control requirements. Flows exceeding the 25-year storm have been designed to exit the facility through a ditch inlet that will serve as an emergency overflow. Flows entering the facility at the 25-year rate will be restricted by a pond overflow equipped with an orifice plate that has been designed to limit the rate of release leaving the facility to the 5-year pre-developed rate. The growing media in the facility was verified to have a factored drain-down rate of greater than the mitigated peak 25-year release rate leaving the flow control structure, it was determined that the orifice in the pond overflow is the limiting factor for the rate at which flows can pass through the facility. With this assumption in place, the facility was sized using Autodesk Storm and Sanitary Analysis 2022 to determine the elevation and diameter of the orifice in the pond overflow, as well as verify that the proposed geometry of the pond has sufficient capacity to store non-discharged flows as they are restricted during the runoff event, and that flows exceeding the 25-year storm can bypass through the emergency overflow. See Tables 3-5 and 3-8 below for a summary of the bioretention and flow control design.

Table 3-6: Bioretention Design Summary

Facility ID	Facility Bottom Area (sf)	Facility Top Area (sf)	Facility Depth (ft)	Facility Volume (cf)	Growing Media Drain-Down Capacity (cfs)
Bioretention Pond	1,202	2,238	2.0	3,440	0.156

3.3.3 Stormtech Chamber System

Two ADS Stormtech underground chamber systems have been designed to provide flow control mitigation for areas not draining to the proposed Bioretention Pond. Both have been equipped with flow control manholes to restrict runoff leaving the site to meet City of Woodburn standards. Both have been modeled in Autodesk Storm and Sanitary Analysis 2022 to ensure that they provide sufficient storage volume. See Table 3-6 below for chamber configuration. See Appendix 3 for more information.

Table 3-7: ADS Stormtech Design Summary

Facility ID	Chamber Type	No. of Chambers	No. of End Caps	Facility Footprint (sf)	Facility Volume (cf)
Bed 1	MC-3500	24	6	1,404	4,725
Bed 2	SC-740	21	14	867	1,793

3.3.4 Flow Control Manholes

The chamber systems will outlet through flow control manholes that have been designed to meet the City of Woodburn *Storm Drainage Master Plan* Chapters 7, 11, and ODOT flow control requirements, the bioretention pond will outlet through a combination pond overflow and ditch inlet that will be equipped with orifices, also designed to meet City of Woodburn standards. Table 3-6 below lists the pre- and post-developed release rates from the site. Table 3-7, 3-8, and 3-9 below lists the details of the flow control tee design for each manhole. The proposed release rates meet the City of Woodburn flow control criteria. Additional results from the stormwater analysis are included in Appendix 4.

Table 3-8: Existing and Proposed Release Rates

Site Condition	5-yr Flow (cfs)	10-yr Flow (cfs)	25-yr Flow (cfs)
Pre-Developed	0.17	0.27	-
Post-Construction	-	0.13	0.15

Table 3-9: FCMH-1 Design Table

Orifice / Weir	Elevation	Description
1.0” Orifice	175.88	Bottom Orifice
6.0” Stand Pipe	178.88	Emergency Overflow

Table 3-10: Pond Overflow Design Table

Orifice / Weir	Elevation	Description
1.0" Side Orifice	175.76	Bottom Orifice
18" Ditch Inlet	180.12	Emergency Overflow

Table 3-11: FCMH-3 Design Table

Orifice / Weir	Elevation	Description
1.0" Orifice	176.30	Bottom Orifice
6.0" Stand Pipe	178.30	Emergency Overflow

3.4 Conveyance Analysis

3.4.1 Design Overview

The analysis and design criteria to be used for stormwater management described in this section follows the *City of Portland SDFDM* (March 2020). The manual requires storm drainage facilities be designed to pass the 10-year storm event without surcharging and a means to pass the 25-year storm event without damage to property. The conveyance analysis will be provided in a future submittal.

3.4.2 System Performance

The conveyance system will be designed to adequately convey the 10-year storm event. The system will be designed to ensure that backwater ponding does not occur during the 25-yr storm event. Calculations will be provided in a future submittal.

3.5 Operations and Maintenance

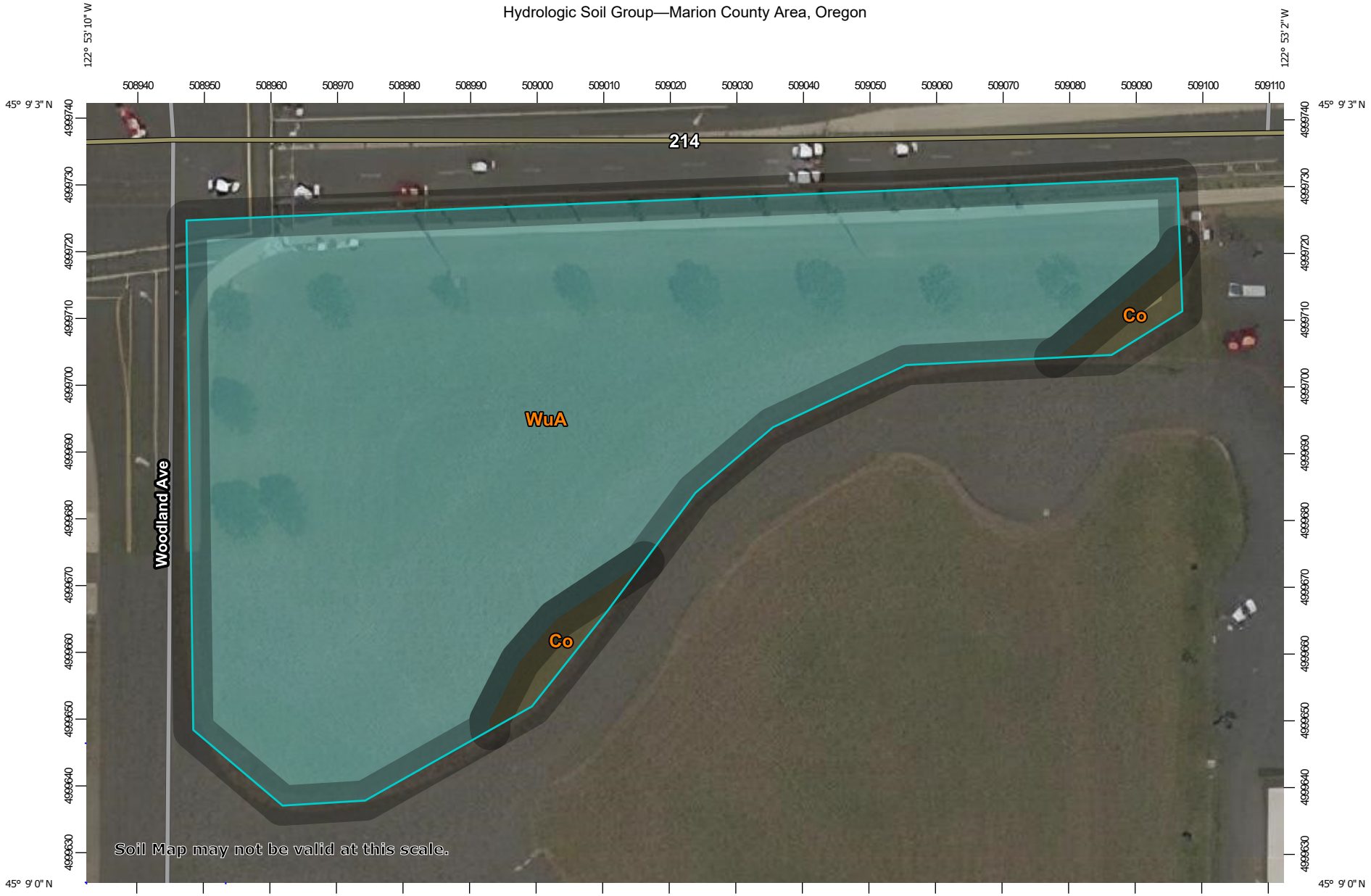
The Operation and Maintenance Manual will be provided in a future submittal.

4.0 SUMMARY

The proposed stormwater infrastructure for the Chick-Fil-A Woodburn development complies with the *City of Portland 2020 SWMM*, *City of Portland SDFDM* (March 2020), Chapters 7 and 11 of the City of Woodburn *Storm Drainage Master Plan*, and the *ODOT Hydraulics Manual* (April 2014). The proposed mitigation measures include Contech catch basins, a bioretention pond, and two ADS Stormtech underground chamber systems. Runoff has been designed to meet the flow control requirements of the City of Woodburn Master Plan and the water quality treatment requirements of the City of Portland. Treated and detained runoff will be discharged from the site at two locations in Hillyer Lane along the south and southeast of the site.

APPENDIX 1:

SOIL AND FLOODPLAIN MAPS



Map Scale: 1:822 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 10 20 40 60

Feet: 0 35 70 140 210

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N 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 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Marion County Area, Oregon
Survey Area Data: Version 19, Oct 27, 2021

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

Date(s) aerial images were photographed: Aug 19, 2015—Sep 13, 2016

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
Co	Concord silt loam	C/D	0.1	3.0%
WuA	Woodburn silt loam, 0 to 3 percent slopes	C	1.9	97.0%
Totals for Area of Interest			**1.9**	**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.

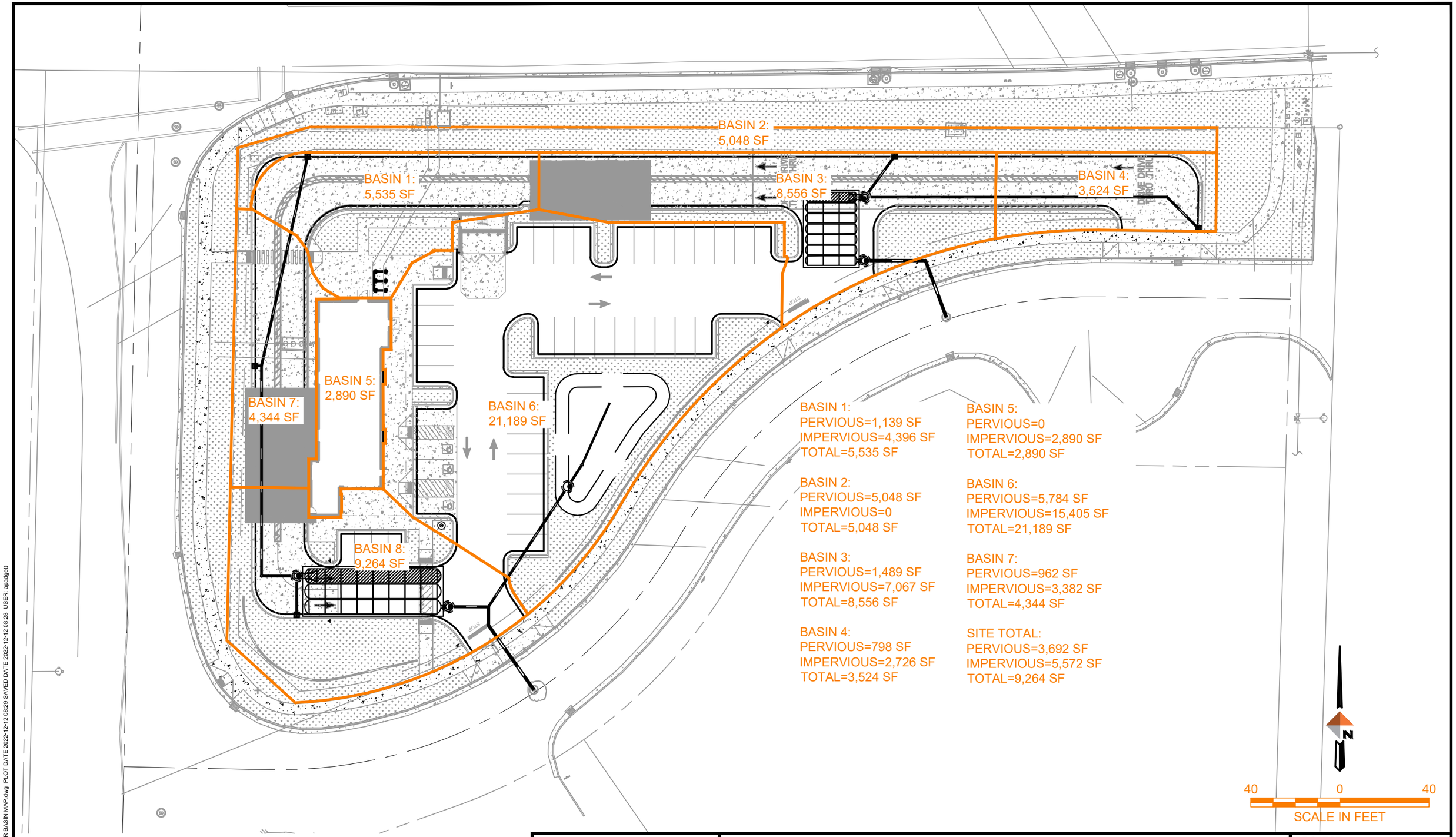
If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher



BASIN 1:
PERVIOUS=1,139 SF
IMPERVIOUS=4,396 SF
TOTAL=5,535 SF

BASIN 2:
PERVIOUS=5,048 SF
IMPERVIOUS=0
TOTAL=5,048 SF

BASIN 3:
PERVIOUS=1,489 SF
IMPERVIOUS=7,067 SF
TOTAL=8,556 SF

BASIN 4:
PERVIOUS=798 SF
IMPERVIOUS=2,726 SF
TOTAL=3,524 SF

BASIN 5:
PERVIOUS=0
IMPERVIOUS=2,890 SF
TOTAL=2,890 SF

BASIN 6:
PERVIOUS=5,784 SF
IMPERVIOUS=15,405 SF
TOTAL=21,189 SF

BASIN 7:
PERVIOUS=962 SF
IMPERVIOUS=3,382 SF
TOTAL=4,344 SF

SITE TOTAL:
PERVIOUS=3,692 SF
IMPERVIOUS=5,572 SF
TOTAL=9,264 SF

N

40 0 40
SCALE IN FEET

DOWL
WWW.DOWL.COM

CHICK-FIL-A WOODBURN
PROPOSED BASIN MAP

PROJECT	14866-01
DATE	12/12/2022

EXHIBIT 1

LONGEST FLOW PATH = 482 LF

TIME OF CONCENTRATION = 27.59 MIN.

PRE-DEVELOPED BASIN:
PERVIOUS=60,350 SF
IMPERVIOUS=0 SF
TOTAL=60,350 SF

N

40 0 40

SCALE IN FEET

DOWL
WWW.DOWL.COM

CHICK-FIL-A WOODBURN
EXISTING BASIN MAP

PROJECT	14866-01
DATE	12/12/2022

EXHIBIT 1

APPENDIX 2:

EXCERPTS FROM

GEOTECHNICAL REPORT

Red

Geotechnical Engineering Report

Chick-Fil-A' Restaurant #05192
Woodburn, Marion County, OR
June 7, 2022
Terracon Project No. 82225043

Prepared for:
Chick-Fil-A' Inc.
Irvine, CA

Prepared by:
Terracon Consultants, Inc.
Portland, Oregon

Newberg fault (Class A) No. 717

Information	Description
Slip-rate Category	Less than 0.2 mm/yr
Most recent prehistoric deformation	Undifferentiated Quaternary (<1.6 Ma)
Distance from Fault	16 km NW

Canby Molalla Fault (Class A) No. 715

Information	Description
Length	50 km
Strike (degrees)	N34°W
Sense of Movement	Right Lateral
Dip Direction	Vertical
Slip-rate Category	Less than 0.2 mm/yr
Most recent prehistoric deformation	Middle and late Quaternary (<750 ka)
Distance from Fault	22 km NE

Based on our review of the available fault information, the depth to bedrock, and the site's proximity to the nearest known faults, and the activity of mapped faults, it is our opinion that the risk of surface rupture at the site due to ground faulting is low.

Groundwater Conditions

We observed our explorations while drilling and after completion for the presence and level of groundwater. The water levels observed in the explorations are provided on the boring logs in **Exploration Results**, and are summarized below.

Boring Number	Approximate Ground Surface Elevation (feet) [1]	Approximate Depth to Groundwater after Drilling (feet) [1]
B-1	184	6.5
B-2	187	9.3
B-6	185	8.3

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

GeoModel

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, geologic setting and our understanding of

EXPLORATION PLAN

FSU #05192 – CFA Woodburn ■ Woodburn, OR

May 17, 2022 ■ Terracon Project No. 82225043

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

BORING LOG NO. B-6

PROJECT: FSU #05192 - CFA Woodburn

CLIENT: Chick-fil-A Inc.
Irvine, CA

SITE: 300 Woodlawn Ave
Woodburn, OR

LOCATION See Exploration Plan

Latitude: 45.1506° Longitude: -122.8854°

Surface Elev.: 185 (Ft.)

MODEL LAYER	GRAPHIC LOG	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	UNCONFINED COMPRESSIVE STRENGTH (psf)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI	PERCENT FINES
1		0.2	185									
							3.5 (HP)		17.3			
							3.5 (HP)		35.4			
				5								
							1.0 (HP)		35.6			
2					▽		1.5 (HP)					
							1.0 (HP)		34.6			
		9.8	175	10			0 (HP)					
							0.5 (HP)					
		15.0	170	15								

FILL - ORGANIC SILT (OL), moist, soft, (grass and rootlet zone)

SILT (ML), trace sand, low plasticity, dark brown, moist

light brown

wet

2" sand lens

SANDY SILT (ML), low plasticity, light brown, wet

Boring Terminated at 15 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Continuous/Macrocore

Abandonment Method:
Boring backfilled with bentonite chips upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from aerial photographs using Google Earth Pro

Notes:

WATER LEVEL OBSERVATIONS

▽ *While sampling*

Terracon
700 NE 55th Ave
Portland, OR

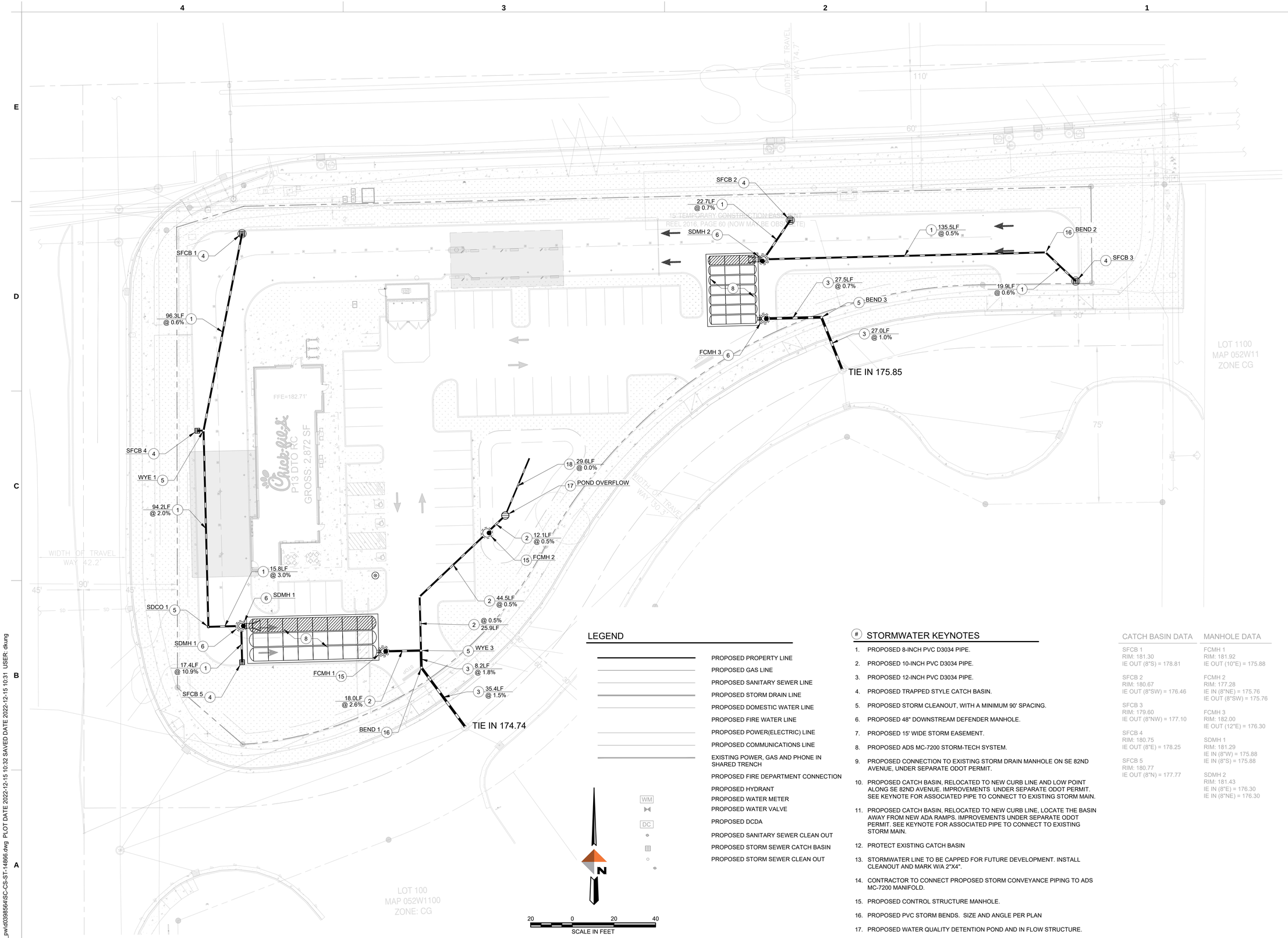
Boring Started: 04-18-2022 | Boring Completed: 04-18-2022

Drill Rig: Geoprobe | Driller: OGE

Project No.: 82225043

APPENDIX 3:

STORMWATER PLANS & DETAILS



LEGEND

- PROPOSED PROPERTY LINE
- PROPOSED GAS LINE
- PROPOSED SANITARY SEWER LINE
- PROPOSED STORM DRAIN LINE
- PROPOSED DOMESTIC WATER LINE
- PROPOSED FIRE WATER LINE
- PROPOSED POWER(ELECTRIC) LINE
- PROPOSED COMMUNICATIONS LINE
- EXISTING POWER, GAS AND PHONE IN SHARED TRENCH
- PROPOSED FIRE DEPARTMENT CONNECTION
- PROPOSED HYDRANT
- PROPOSED WATER METER
- PROPOSED WATER VALVE
- PROPOSED DCDA
- PROPOSED SANITARY SEWER CLEAN OUT
- PROPOSED STORM SEWER CATCH BASIN
- PROPOSED STORM SEWER CLEAN OUT

STORMWATER KEYNOTES

1. PROPOSED 8-INCH PVC D3034 PIPE.
2. PROPOSED 10-INCH PVC D3034 PIPE.
3. PROPOSED 12-INCH PVC D3034 PIPE.
4. PROPOSED TRAPPED STYLE CATCH BASIN.
5. PROPOSED STORM CLEANOUT, WITH A MINIMUM 90' SPACING.
6. PROPOSED 48" DOWNSTREAM DEFENDER MANHOLE.
7. PROPOSED 15' WIDE STORM EASEMENT.
8. PROPOSED ADS MC-7200 STORM-TECH SYSTEM.
9. PROPOSED CONNECTION TO EXISTING STORM DRAIN MANHOLE ON SE 82ND AVENUE, UNDER SEPARATE ODOT PERMIT.
10. PROPOSED CATCH BASIN, RELOCATED TO NEW CURB LINE AND LOW POINT ALONG SE 82ND AVENUE. IMPROVEMENTS UNDER SEPARATE ODOT PERMIT. SEE KEYNOTE FOR ASSOCIATED PIPE TO CONNECT TO EXISTING STORM MAIN.
11. PROPOSED CATCH BASIN, RELOCATED TO NEW CURB LINE, LOCATE THE BASIN AWAY FROM NEW ADA RAMPS. IMPROVEMENTS UNDER SEPARATE ODOT PERMIT. SEE KEYNOTE FOR ASSOCIATED PIPE TO CONNECT TO EXISTING STORM MAIN.
12. PROTECT EXISTING CATCH BASIN
13. STORMWATER LINE TO BE CAPPED FOR FUTURE DEVELOPMENT. INSTALL CLEANOUT AND MARK W/A 2"X4".
14. CONTRACTOR TO CONNECT PROPOSED STORM CONVEYANCE PIPING TO ADS MC-7200 MANIFOLD.
15. PROPOSED CONTROL STRUCTURE MANHOLE.
16. PROPOSED PVC STORM BENDS. SIZE AND ANGLE PER PLAN
17. PROPOSED WATER QUALITY DETENTION POND AND IN FLOW STRUCTURE.
18. PROPOSED 6" PERFORATED PVC D3034 PIPE.

CATCH BASIN DATA

SFCB 1
RIM: 181.30
IE OUT (8"S) = 178.81

SFCB 2
RIM: 180.67
IE OUT (8"SW) = 176.46

SFCB 3
RIM: 179.60
IE OUT (8"NW) = 177.10

SFCB 4
RIM: 180.75
IE OUT (8"E) = 178.25

SFCB 5
RIM: 180.77
IE OUT (8"N) = 177.77

MANHOLE DATA

FCMH 1
RIM: 181.92
IE OUT (10"E) = 175.88

FCMH 2
RIM: 177.28
IE IN (8"NE) = 175.76
IE OUT (8"SW) = 175.76

FCMH 3
RIM: 182.00
IE OUT (12"E) = 176.30

SDMH 1
RIM: 181.29
IE IN (8"W) = 175.88
IE IN (8"S) = 175.88

SDMH 2
RIM: 181.43
IE IN (8"E) = 176.30
IE IN (8"NE) = 176.30

Chick-fil-A
5200 Buffington Road
Atlanta, Georgia
30349-2998

DOWL
309 SW 6TH AVENUE, #700
PORTLAND, OREGON 97204
971-280-8641

REGISTERED PROFESSIONAL ENGINEER
93841PE
OREGON
JULY 10, 2015
DAVID C. KING
EXPIRATION DATE: 06/30/23

CHICK-FIL-A
219 AND WOODLAND
WOODBURN, OREGON

FSR# 05192

REVISION SCHEDULE

NO.	DATE	DESCRIPTION

CIVIL'S PROJECT # 14866.01
PRINTED FOR LAND USE
DATE 12/16/2022
DRAWN BY JLG

SHEET
STORM PLAN

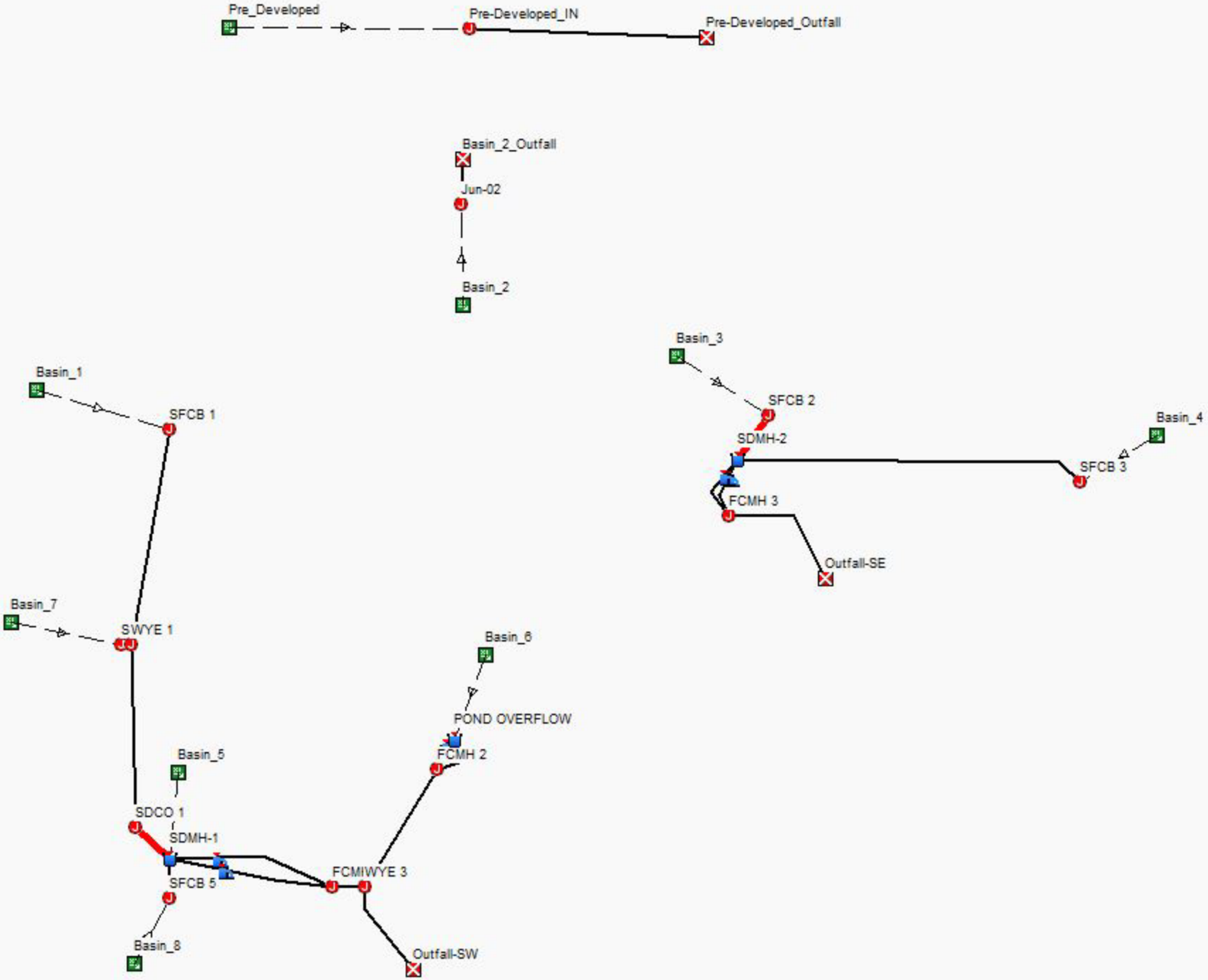
SHEET NUMBER
C4.0

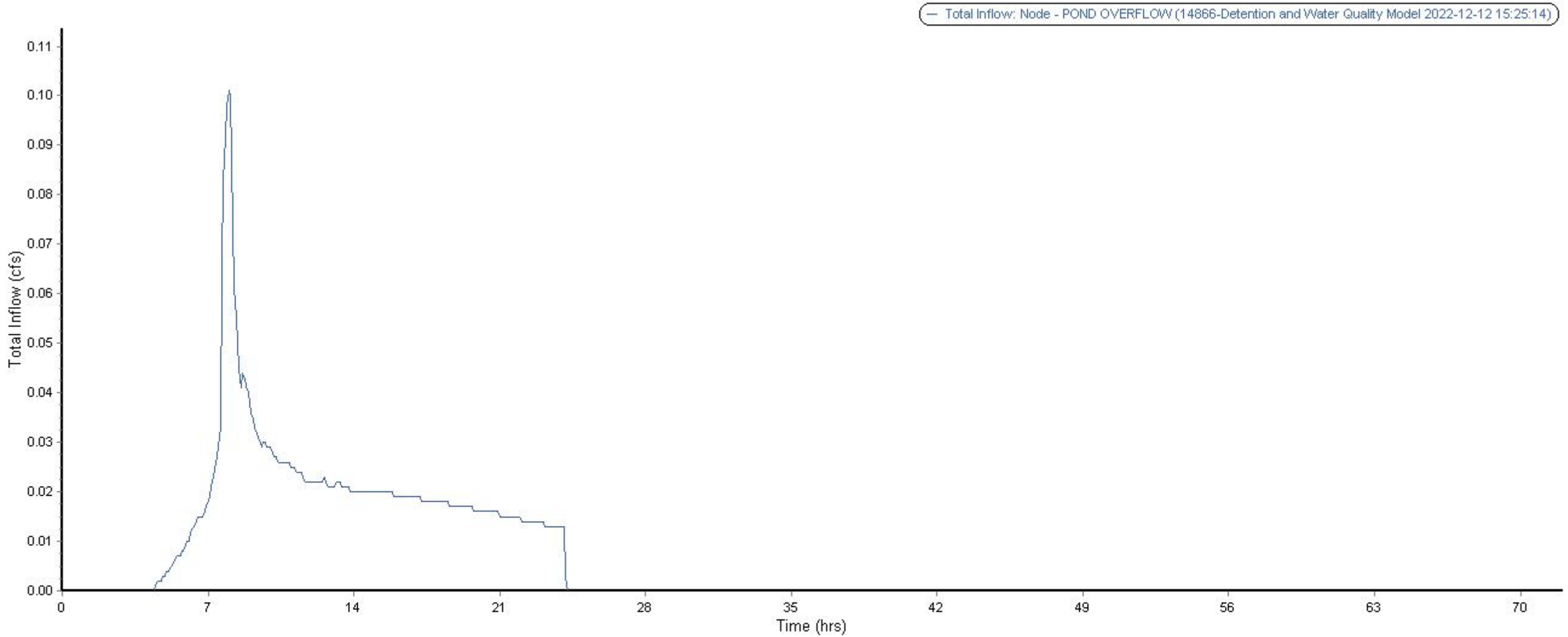
C:\dowl_pw\d0398564\SC-CS-ST-14866.dwg PLOT DATE 2022-12-15 10:32 SAVED DATE 2022-12-15 10:31 USER: dkung

APPENDIX 4:

STORMWATER MODEL INPUT & OUTPUT

Autodesk Storm and Sanitary Analysis Link-Node Schematic





Total Inflow Summary Table

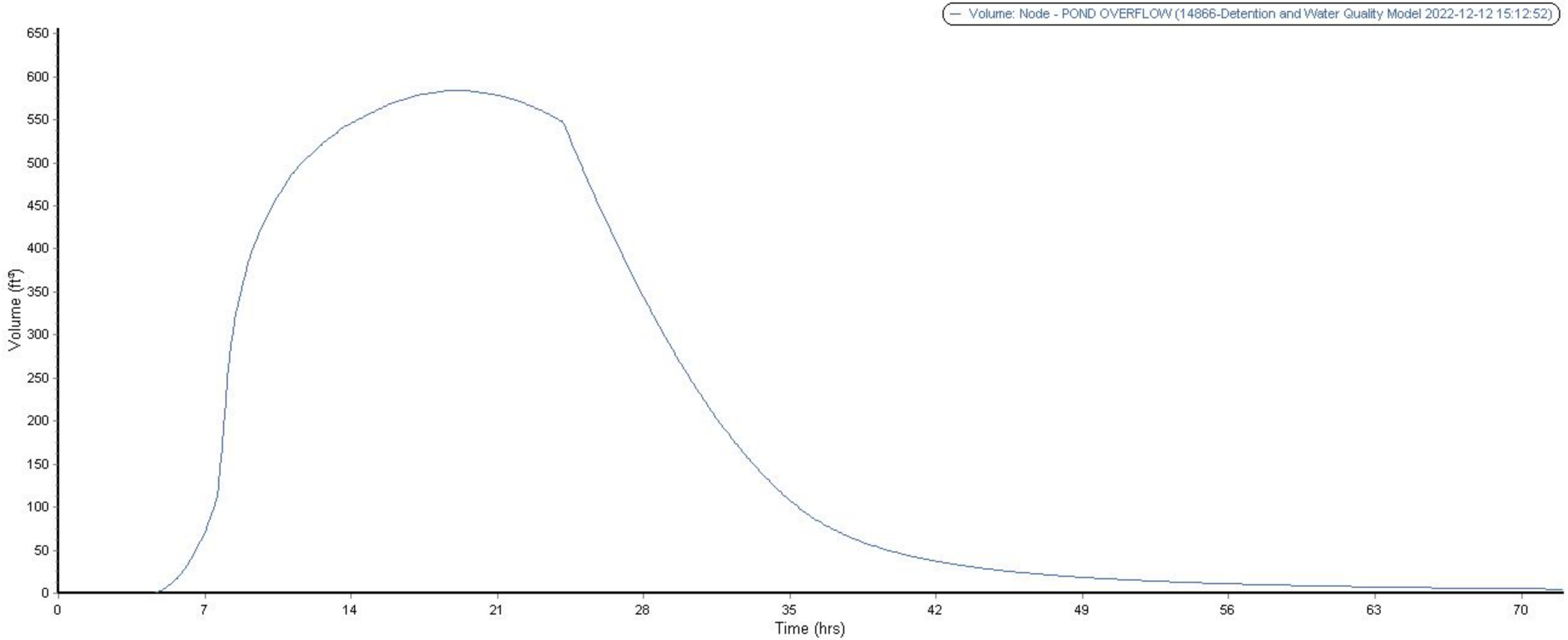
Time period
From: 11/11/2022, 12:00:00 AM
To: 11/14/2022, 12:00:00 AM

Thresholds
Exceedance: 0
Deficit: 0

Detention storage
Max flow: 0

Element ID	POND OVERFLOW
Maximum Total Inflow (cfs)	0.10
Minimum Total Inflow (cfs)	0.00
Event Mean Total Inflow (cfs)	0.01
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A
Volume of Exceedance (ft³)	N/A
Volume of Deficit (ft³)	N/A
Total Inflow Volume (ft³)	1513.69
Detention Storage (ft³)	N/A

Pond Peak Water Quality Inflow



Volume Summary Table

Time period

From: 11/11/2022, 12:00:00 AM

To: 11/14/2022, 12:00:00 AM

Thresholds

Exceedance: 0

Deficit: 0

Detention storage

Max flow: 0

Element ID	POND OVERFLOW
Maximum Volume (ft³)	583.49
Minimum Volume (ft³)	0.00
Event Mean Volume (ft³)	177.11
Duration of Exceedances (hrs)	N/A
Duration of Deficits (hrs)	N/A
Number of Exceedances	N/A
Number of Deficits	N/A

Pond Water Quality Volume Per BES Appendix A

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.4.133 (Build 0)

****
Project Description
****
File Name ..... 14866-Detention and Water Quality Model.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-55
Time of Concentration..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. Constant flow
Starting Date NOV-11-2022 00:00:00
Ending Date NOV-14-2022 00:00:00
Report Time Step 00:05:00

****
Element Count
****
Number of rain gages 0
Number of subbasins 9
Number of nodes 20
Number of links 19

****
Subbasin Summary
****

Subbasin ID	Total Area acres	Peak Rate Factor
Basin_1	0.13	484.00
Basin_2	0.12	484.00
Basin_3	0.20	484.00
Basin_4	0.08	484.00
Basin_5	0.07	484.00
Basin_6	0.49	484.00
Basin_7	0.10	484.00
Basin_8	0.21	484.00
Pre_Developed	1.39	484.00

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
FCMH 1	JUNCTION	175.88	181.97	0.00	
FCMH 2	JUNCTION	175.76	187.56	0.00	
FCMH 3	JUNCTION	176.30	181.98	0.00	
Jun-02	JUNCTION	101.00	111.00	0.00	
Pre-Developed_IN	JUNCTION	101.00	111.00	0.00	
SDCO 1	JUNCTION	176.35	181.17	0.00	
SFCB 1	JUNCTION	178.81	181.18	0.00	
SFCB 2	JUNCTION	176.46	180.67	0.00	
SFCB 3	JUNCTION	177.11	179.48	0.00	
SFCB 4	JUNCTION	178.25	180.77	0.00	

SFCB 5	JUNCTION	177.77	180.77	0.00
WYE 1	JUNCTION	178.23	180.78	0.00
WYE 3	JUNCTION	175.44	182.17	0.00
Basin_2_Outfall	OUTFALL	100.00	102.00	0.00
Outfall-SE	OUTFALL	175.85	176.85	0.00
Outfall-SW	OUTFALL	174.74	175.74	0.00
Pre-Developed_Outfall	OUTFALL	100.00	102.00	0.00
POND OVERFLOW	STORAGE	178.32	180.32	0.00
SDMH-1	STORAGE	175.88	181.02	0.00
SDMH-2	STORAGE	176.30	182.30	0.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
CB 4 STUB	SFCB 4	WYE 1	CONDUIT	3.0	0.6753	0.0130
LINK 1	SFCB 1	WYE 1	CONDUIT	96.3	0.6022	0.0130
LINK 10	SFCB 2	SDMH-2	CONDUIT	22.7	0.6995	0.0130
LINK 13	SFCB 3	SDMH-2	CONDUIT	155.4	0.5199	0.0130
LINK 15	FCMH 3	Outfall-SE	CONDUIT	54.5	0.8341	0.0130
LINK 2	WYE 1	SDCO 1	CONDUIT	94.2	1.9947	0.0130
LINK 3	SDCO 1	SDMH-1	CONDUIT	15.8	2.9785	0.0130
LINK 5	FCMH 1	WYE 3	CONDUIT	14.4	3.0515	0.0130
LINK 6	WYE 3	Outfall-SW	CONDUIT	42.9	1.6334	0.0130
LINK 9	FCMH 2	WYE 3	CONDUIT	64.6	0.4954	0.0130
Link-01	Pre-Developed_IN	Pre-Developed_Outfall	CONDUIT	10.0	10.0000	0.0130
Link-02	Jun-02	Basin_2_Outfall	CONDUIT	10.0	10.0000	0.0130
Pipe - (16)	SFCB 5	SDMH-1	CONDUIT	17.4	10.8558	0.0130
Low-Flow-Orifice-Pond	POND OVERFLOW	FCMH 2	ORIFICE			
Orifice-01	SDMH-2	FCMH 3	ORIFICE			
Orifice-02	SDMH-2	FCMH 3	ORIFICE			
Orifice-04	SDMH-1	FCMH 1	ORIFICE			
Orifice-06	SDMH-1	FCMH 1	ORIFICE			
Emergency-Overflow-Pond	POND OVERFLOW	FCMH 2	WEIR			

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
CB 4 STUB	CIRCULAR	0.67	0.67	1	0.35	0.17	0.99
LINK 1	CIRCULAR	0.67	0.67	1	0.35	0.17	0.94
LINK 10	CIRCULAR	0.67	0.67	1	0.35	0.17	1.01
LINK 13	CIRCULAR	0.67	0.67	1	0.35	0.17	0.87
LINK 15	CIRCULAR	1.00	1.00	1	0.79	0.25	3.25
LINK 2	CIRCULAR	0.67	0.67	1	0.35	0.17	1.71
LINK 3	CIRCULAR	0.67	0.67	1	0.35	0.17	

2.09						
LINK 5	CIRCULAR	0.83	0.83	1	0.55	0.21
3.83						
LINK 6	CIRCULAR	1.00	1.00	1	0.79	0.25
4.55						
LINK 9	CIRCULAR	0.83	0.83	1	0.55	0.21
1.54						
Link-01	CIRCULAR	2.00	2.00	1	3.14	0.50
71.54						
Link-02	CIRCULAR	2.00	2.00	1	3.14	0.50
71.54						
Pipe - (16)	CIRCULAR	0.67	0.67	1	0.35	0.17
3.98						

********** Runoff Quantity Continuity **********	Volume acre-ft	Depth inches
Total Precipitation	0.669	2.894
Surface Runoff	0.001	0.005
Continuity Error (%)	-0.000	

********** Flow Routing Continuity **********	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	0.325	0.106
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.001	0.000
Continuity Error (%)	0.000	

****
Composite Curve Number Computations Report
****

Subbasin Basin_1

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.03	-	74.00
-	0.10	-	98.00
Composite Area & Weighted CN	0.13		93.09

Subbasin Basin_2

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.12	-	74.00
Composite Area & Weighted CN	0.12		74.00

Subbasin Basin_3

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.03	-	74.00
-	0.16	-	98.00
Composite Area & Weighted CN	0.20		93.84

Subbasin Basin_4

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.02	-	74.00
-	0.06	-	98.00
Composite Area & Weighted CN	0.08		92.67

Subbasin Basin_5

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.00	-	74.00
-	0.07	-	98.00
Composite Area & Weighted CN	0.07		98.00

Subbasin Basin_6

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.13	-	74.00
-	0.35	-	98.00
Composite Area & Weighted CN	0.49		91.43

Subbasin Basin_7

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.02	-	74.00
-	0.08	-	98.00
Composite Area & Weighted CN	0.10		92.72

Subbasin Basin_8

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.09	-	74.00
-	0.13	-	98.00
Composite Area & Weighted CN	0.21		88.42

Subbasin Pre_Developed

Soil/Surface Description	Area (acres)	Soil Group	CN
-	1.39	-	74.00
Composite Area & Weighted CN	1.39		74.00

****
SCS TR-55 Time of Concentration Computations Report
****

Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

```
        Where:

        Tc = Time of Concentration (hrs)
        n  = Manning's Roughness
        Lf = Flow Length (ft)
        P  = 2 yr, 24 hr Rainfall (inches)
        Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation
----------------------------------

        V  = 16.1345 * (Sf^0.5) (unpaved surface)
        V  = 20.3282 * (Sf^0.5) (paved surface)
        V  = 15.0 * (Sf^0.5) (grassed waterway surface)
        V  = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
        V  = 9.0 * (Sf^0.5) (cultivated straight rows surface)
        V  = 7.0 * (Sf^0.5) (short grass pasture surface)
        V  = 5.0 * (Sf^0.5) (woodland surface)
        V  = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)

Channel Flow Equation
---------------------

        V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
        R  = Aq / Wp
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        R  = Hydraulic Radius (ft)
        Aq = Flow Area (ft²)
        Wp = Wetted Perimeter (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)
        n  = Manning's Roughness

-------------------
Subbasin Basin_1
-------------------

        User-Defined TOC override (minutes):      5.00

-------------------
Subbasin Basin_2
-------------------

        User-Defined TOC override (minutes):      5.00

-------------------
Subbasin Basin_3
-------------------

        User-Defined TOC override (minutes):      5.00

-------------------
Subbasin Basin_4
```

User-Defined TOC override (minutes): 5.00

Subbasin Basin_5

User-Defined TOC override (minutes): 5.00

Subbasin Basin_6

User-Defined TOC override (minutes): 5.00

Subbasin Basin_7

User-Defined TOC override (minutes): 5.00

Subbasin Basin_8

User-Defined TOC override (minutes): 5.00

Subbasin Pre_Developed

Sheet Flow Computations

	Subarea A	Subarea B	Subarea C
Manning's Roughness:	0.40	0.00	0.00
Flow Length (ft):	100.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
2 yr, 24 hr Rainfall (in):	2.40	0.00	0.00
Velocity (ft/sec):	0.07	0.00	0.00
Computed Flow Time (minutes):	24.80	0.00	0.00

Shallow Concentrated Flow Computations

	Subarea A	Subarea B	Subarea C
Flow Length (ft):	382.00	0.00	0.00
Slope (%):	2.00	0.00	0.00
Surface Type:	Unpaved	Unpaved	Unpaved
Velocity (ft/sec):	2.28	0.00	0.00
Computed Flow Time (minutes):	2.79	0.00	0.00

==========

Total TOC (minutes): 27.59

==========

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
Basin_1	2.90	2.17	0.07	93.090	0	00:05:00
Basin_2	2.90	0.84	0.02	74.000	0	00:05:00
Basin_3	2.90	2.24	0.12	93.840	0	00:05:00
Basin_4	2.90	2.12	0.05	92.670	0	00:05:00
Basin_5	2.90	2.67	0.04	98.000	0	00:05:00
Basin_6	2.90	2.02	0.25	91.430	0	00:05:00
Basin_7	2.90	2.13	0.06	92.720	0	00:05:00
Basin_8	2.90	1.76	0.09	88.420	0	00:05:00
Pre_Developed	2.90	0.84	0.17	74.000	0	00:27:35

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
FCMH 1	0.03	0.05	175.93	0	20:39	0	0	0:00:00
FCMH 2	0.05	0.08	175.84	0	21:50	0	0	0:00:00
FCMH 3	0.03	0.07	176.37	0	13:26	0	0	0:00:00
Jun-02	0.00	0.02	101.02	0	08:04	0	0	0:00:00
Pre-Developed_IN	0.01	0.08	101.08	0	08:19	0	0	0:00:00
SDCO 1	0.31	1.11	177.46	0	20:39	0	0	0:00:00
SFCB 1	0.02	0.13	178.94	0	08:00	0	0	0:00:00
SFCB 2	0.23	0.93	177.39	0	13:25	0	0	0:00:00
SFCB 3	0.05	0.28	177.39	0	13:25	0	0	0:00:00
SFCB 4	0.02	0.13	178.38	0	07:55	0	0	0:00:00
SFCB 5	0.01	0.07	177.84	0	08:00	0	0	0:00:00
WYE 1	0.02	0.13	178.36	0	07:54	0	0	0:00:00
WYE 3	0.05	0.08	175.52	0	21:17	0	0	0:00:00
Basin_2_Outfall	0.00	0.02	100.02	0	08:04	0	0	0:00:00
Outfall-SE	0.03	0.06	175.91	0	13:26	0	0	0:00:00
Outfall-SW	0.05	0.08	174.82	0	21:17	0	0	0:00:00
Pre-Developed_Outfall	0.01	0.07	100.07	0	08:20	0	0	0:00:00
POND OVERFLOW	0.47	1.23	179.55	0	21:49	0	0	0:00:00
SDMH-1	0.56	1.58	177.46	0	20:39	0	0	0:00:00
SDMH-2	0.30	1.09	177.39	0	13:24	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
FCMH 1	JUNCTION	0.00	0.03	0	20:39	0.00		

FCMH 2	JUNCTION	0.00	0.03	0	21:49	0.00
FCMH 3	JUNCTION	0.00	0.03	0	13:24	0.00
Jun-02	JUNCTION	0.02	0.02	0	08:00	0.00
Pre-Developed_IN	JUNCTION	0.17	0.17	0	08:19	0.00
SDCO 1	JUNCTION	0.00	0.29	0	08:04	0.00
SFCB 1	JUNCTION	0.07	0.07	0	08:00	0.00
SFCB 2	JUNCTION	0.12	0.12	0	07:55	0.00
SFCB 3	JUNCTION	0.05	0.05	0	07:55	0.00
SFCB 4	JUNCTION	0.06	0.06	0	07:55	0.00
SFCB 5	JUNCTION	0.09	0.09	0	08:00	0.00
WYE 1	JUNCTION	0.00	0.13	0	08:00	0.00
WYE 3	JUNCTION	0.00	0.06	0	21:16	0.00
Basin_2_Outfall	OUTFALL	0.00	0.02	0	08:04	0.00
Outfall-SE	OUTFALL	0.00	0.03	0	13:26	0.00
Outfall-SW	OUTFALL	0.00	0.06	0	21:17	0.00
Pre-Developed_Outfall	OUTFALL	0.00	0.17	0	08:20	0.00
POND OVERFLOW	STORAGE	0.25	0.25	0	08:00	0.00
SDMH-1	STORAGE	0.04	0.52	0	08:03	0.00
SDMH-2	STORAGE	0.00	0.16	0	08:00	0.00

****
Storage Node Summary
****

Storage Node ID	Maximum Ponded Volume 1000 ft³	Maximum Ponded (%)	Time of Max Ponded days hh:mm	Average Ponded Volume 1000 ft³	Average Ponded (%)	Maximum Storage Node Outflow cfs	Maximum Exfiltration Rate cfm	Total Exfiltrated Volume 1000 ft³
POND OVERFLOW	1.865	54	0 21:49	0.683	20	0.03	0.00	0.000
SDMH-1	1.805	40	0 20:39	0.644	14	0.19	0.00	0.000
SDMH-2	0.715	27	0 13:24	0.198	7	0.03	0.00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Basin_2_Outfall	23.60	0.01	0.02
Outfall-SE	49.33	0.02	0.03
Outfall-SW	82.87	0.03	0.06
Pre-Developed_Outfall	25.02	0.07	0.17
System	45.20	0.12	0.25

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow	Total Time minutes	Reported Condition
CB 4 STUB	CONDUIT	0 07:55	1.23	1.00	0.06	0.99	0.06	0.19	0	Calculated
LINK 1	CONDUIT	0 08:00	1.59	1.00	0.07	0.94	0.08	0.19	0	Calculated
LINK 10	CONDUIT	0 07:55	1.16	1.00	0.11	1.01	0.11	1.00	944	SURCHARGED
LINK 13	CONDUIT	0 08:00	0.51	1.00	0.05	0.87	0.05	0.71	0	Calculated
LINK 15	CONDUIT	0 13:26	1.25	1.00	0.03	3.25	0.01	0.07	0	Calculated
LINK 2	CONDUIT	0 07:56	3.01	1.00	0.13	1.71	0.08	0.55	0	Calculated
LINK 3	CONDUIT	0 08:03	1.59	1.00	0.38	2.09	0.18	1.00	1100	SURCHARGED
LINK 5	CONDUIT	0 20:39	1.54	1.00	0.03	3.83	0.01	0.08	0	Calculated
LINK 6	CONDUIT	0 21:17	2.02	1.00	0.06	4.55	0.01	0.08	0	Calculated
LINK 9	CONDUIT	0 21:50	1.06	1.00	0.03	1.54	0.02	0.10	0	Calculated
Link-01	CONDUIT	0 08:20	4.51	1.00	0.17	71.54	0.00	0.04	0	Calculated
Link-02	CONDUIT	0 08:04	2.29	1.00	0.02	71.54	0.00	0.01	0	Calculated
Pipe - (16)	CONDUIT	0 08:00	0.60	1.00	0.09	3.98	0.02	0.55	0	Calculated
Low-Flow-Orifice-Pond	ORIFICE	0 21:49			0.03			1.00		
Orifice-01	ORIFICE	0 13:24			0.03			1.00		
Orifice-02	ORIFICE	0 00:00			0.00			0.00		
Orifice-04	ORIFICE	0 00:00			0.00			0.00		
Orifice-06	ORIFICE	0 20:39			0.03			1.00		
Emergency-Overflow-Pond	WEIR	0 00:00			0.00			0.00		

****
Highest Flow Instability Indexes
****
All links are stable.

WARNING 108 : Surcharge elevation defined for Junction WYE 3 is below junction maximum

```
elevation. Assumed surcharge elevation equal to maximum elevation.
  WARNING 118 : Orifice crest elevation defined for Orifice Low-Flow-Orifice-Pond is below
upstream node invert elevation.
               Assumed orifice crest elevation equal to upstream node invert elevation.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height
dimensions for Node FCMH 2.

  Analysis began on:  Tue Dec 20 14:01:05 2022
  Analysis ended on:  Tue Dec 20 14:01:14 2022
  Total elapsed time: 00:00:09
```

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.4.133 (Build 0)

****
Project Description
****
File Name ..... 14866-Detention and Water Quality Model.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-55
Time of Concentration..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. Constant flow
Starting Date NOV-11-2022 00:00:00
Ending Date NOV-14-2022 00:00:00
Report Time Step 00:05:00

****
Element Count
****
Number of rain gages 0
Number of subbasins 9
Number of nodes 20
Number of links 19

****
Subbasin Summary
****

Subbasin ID	Total Area acres	Peak Rate Factor
Basin_1	0.13	484.00
Basin_2	0.12	484.00
Basin_3	0.20	484.00
Basin_4	0.08	484.00
Basin_5	0.07	484.00
Basin_6	0.49	484.00
Basin_7	0.10	484.00
Basin_8	0.21	484.00
Pre_Developed	1.39	484.00

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
FCMH 1	JUNCTION	175.88	181.97	0.00	
FCMH 2	JUNCTION	175.76	187.56	0.00	
FCMH 3	JUNCTION	176.30	181.98	0.00	
Jun-02	JUNCTION	101.00	111.00	0.00	
Pre-Developed_IN	JUNCTION	101.00	111.00	0.00	
SDCO 1	JUNCTION	176.35	181.17	0.00	
SFCB 1	JUNCTION	178.81	181.18	0.00	
SFCB 2	JUNCTION	176.46	180.67	0.00	
SFCB 3	JUNCTION	177.11	179.48	0.00	
SFCB 4	JUNCTION	178.25	180.77	0.00	

SFCB 5	JUNCTION	177.77	180.77	0.00
WYE 1	JUNCTION	178.23	180.78	0.00
WYE 3	JUNCTION	175.44	182.17	0.00
Basin_2_Outfall	OUTFALL	100.00	102.00	0.00
Outfall-SE	OUTFALL	175.85	176.85	0.00
Outfall-SW	OUTFALL	174.74	175.74	0.00
Pre-Developed_Outfall	OUTFALL	100.00	102.00	0.00
POND OVERFLOW	STORAGE	178.32	180.32	0.00
SDMH-1	STORAGE	175.88	181.02	0.00
SDMH-2	STORAGE	176.30	182.30	0.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
CB 4 STUB	SFCB 4	WYE 1	CONDUIT	3.0	0.6753	0.0130
LINK 1	SFCB 1	WYE 1	CONDUIT	96.3	0.6022	0.0130
LINK 10	SFCB 2	SDMH-2	CONDUIT	22.7	0.6995	0.0130
LINK 13	SFCB 3	SDMH-2	CONDUIT	155.4	0.5199	0.0130
LINK 15	FCMH 3	Outfall-SE	CONDUIT	54.5	0.8341	0.0130
LINK 2	WYE 1	SDCO 1	CONDUIT	94.2	1.9947	0.0130
LINK 3	SDCO 1	SDMH-1	CONDUIT	15.8	2.9785	0.0130
LINK 5	FCMH 1	WYE 3	CONDUIT	14.4	3.0515	0.0130
LINK 6	WYE 3	Outfall-SW	CONDUIT	42.9	1.6334	0.0130
LINK 9	FCMH 2	WYE 3	CONDUIT	64.6	0.4954	0.0130
Link-01	Pre-Developed_IN	Pre-Developed_Outfall	CONDUIT	10.0	10.0000	0.0130
Link-02	Jun-02	Basin_2_Outfall	CONDUIT	10.0	10.0000	0.0130
Pipe - (16)	SFCB 5	SDMH-1	CONDUIT	17.4	10.8558	0.0130
Low-Flow-Orifice-Pond	POND OVERFLOW	FCMH 2	ORIFICE			
Orifice-01	SDMH-2	FCMH 3	ORIFICE			
Orifice-02	SDMH-2	FCMH 3	ORIFICE			
Orifice-04	SDMH-1	FCMH 1	ORIFICE			
Orifice-06	SDMH-1	FCMH 1	ORIFICE			
Emergency-Overflow-Pond	POND OVERFLOW	FCMH 2	WEIR			

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
CB 4 STUB	CIRCULAR	0.67	0.67	1	0.35	0.17	0.99
LINK 1	CIRCULAR	0.67	0.67	1	0.35	0.17	0.94
LINK 10	CIRCULAR	0.67	0.67	1	0.35	0.17	1.01
LINK 13	CIRCULAR	0.67	0.67	1	0.35	0.17	0.87
LINK 15	CIRCULAR	1.00	1.00	1	0.79	0.25	3.25
LINK 2	CIRCULAR	0.67	0.67	1	0.35	0.17	1.71
LINK 3	CIRCULAR	0.67	0.67	1	0.35	0.17	

2.09						
LINK 5	CIRCULAR	0.83	0.83	1	0.55	0.21
3.83						
LINK 6	CIRCULAR	1.00	1.00	1	0.79	0.25
4.55						
LINK 9	CIRCULAR	0.83	0.83	1	0.55	0.21
1.54						
Link-01	CIRCULAR	2.00	2.00	1	3.14	0.50
71.54						
Link-02	CIRCULAR	2.00	2.00	1	3.14	0.50
71.54						
Pipe - (16)	CIRCULAR	0.67	0.67	1	0.35	0.17
3.98						

********** Runoff Quantity Continuity **********	Volume acre-ft	Depth inches
Total Precipitation	0.784	3.392
Surface Runoff	0.001	0.006
Continuity Error (%)	-0.000	

********** Flow Routing Continuity **********	Volume acre-ft	Volume Mgallons
External Inflow	0.000	0.000
External Outflow	0.416	0.136
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.001	0.000
Continuity Error (%)	0.000	

****
Composite Curve Number Computations Report
****

Subbasin Basin_1

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.03	-	74.00
-	0.10	-	98.00
Composite Area & Weighted CN	0.13		93.09

Subbasin Basin_2

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.12	-	74.00
Composite Area & Weighted CN	0.12		74.00

Subbasin Basin_3

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.03	-	74.00
-	0.16	-	98.00
Composite Area & Weighted CN	0.20		93.84

Subbasin Basin_4

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.02	-	74.00
-	0.06	-	98.00
Composite Area & Weighted CN	0.08		92.67

Subbasin Basin_5

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.00	-	74.00
-	0.07	-	98.00
Composite Area & Weighted CN	0.07		98.00

Subbasin Basin_6

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.13	-	74.00
-	0.35	-	98.00
Composite Area & Weighted CN	0.49		91.43

Subbasin Basin_7

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.02	-	74.00
-	0.08	-	98.00
Composite Area & Weighted CN	0.10		92.72

Subbasin Basin_8

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.09	-	74.00
-	0.13	-	98.00
Composite Area & Weighted CN	0.21		88.42

Subbasin Pre_Developed

Soil/Surface Description	Area (acres)	Soil Group	CN
-	1.39	-	74.00
Composite Area & Weighted CN	1.39		74.00

****
SCS TR-55 Time of Concentration Computations Report
****

Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

```
        Where:

        Tc = Time of Concentration (hrs)
        n  = Manning's Roughness
        Lf = Flow Length (ft)
        P  = 2 yr, 24 hr Rainfall (inches)
        Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation
----------------------------------

        V  = 16.1345 * (Sf^0.5) (unpaved surface)
        V  = 20.3282 * (Sf^0.5) (paved surface)
        V  = 15.0 * (Sf^0.5) (grassed waterway surface)
        V  = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
        V  = 9.0 * (Sf^0.5) (cultivated straight rows surface)
        V  = 7.0 * (Sf^0.5) (short grass pasture surface)
        V  = 5.0 * (Sf^0.5) (woodland surface)
        V  = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)

Channel Flow Equation
---------------------

        V  = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
        R  = Aq / Wp
        Tc = (Lf / V) / (3600 sec/hr)

        Where:

        Tc = Time of Concentration (hrs)
        Lf = Flow Length (ft)
        R  = Hydraulic Radius (ft)
        Aq = Flow Area (ft²)
        Wp = Wetted Perimeter (ft)
        V  = Velocity (ft/sec)
        Sf = Slope (ft/ft)
        n  = Manning's Roughness

-------------------
Subbasin Basin_1
-------------------

        User-Defined TOC override (minutes):      5.00

-------------------
Subbasin Basin_2
-------------------

        User-Defined TOC override (minutes):      5.00

-------------------
Subbasin Basin_3
-------------------

        User-Defined TOC override (minutes):      5.00

-------------------
Subbasin Basin_4
```

```
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Basin_5
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Basin_6
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Basin_7
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Basin_8
  --------------------

          User-Defined TOC override (minutes):      5.00

  -------------------------
  Subbasin Pre_Developed
  -------------------------

  Sheet Flow Computations
  -----------------------
                                              Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                    0.40                0.00
0.00
          Flow Length (ft):                     100.00                0.00
0.00
          Slope (%):                              2.00                0.00
0.00
          2 yr, 24 hr Rainfall (in):              2.40                0.00
0.00
          Velocity (ft/sec):                      0.07                0.00
0.00
          Computed Flow Time (minutes):          24.80                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                              Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                     382.00                0.00
0.00
          Slope (%):                              2.00                0.00
0.00
          Surface Type:                         Unpaved             Unpaved
Unpaved
          Velocity (ft/sec):                      2.28                0.00
0.00
          Computed Flow Time (minutes):           2.79                0.00
0.00

=============================================================================================
          Total TOC (minutes):                   27.59
```

==========

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
Basin_1	3.40	2.65	0.09	93.090	0	00:05:00
Basin_2	3.40	1.17	0.03	74.000	0	00:05:00
Basin_3	3.40	2.72	0.14	93.840	0	00:05:00
Basin_4	3.40	2.60	0.06	92.670	0	00:05:00
Basin_5	3.40	3.16	0.05	98.000	0	00:05:00
Basin_6	3.40	2.49	0.32	91.430	0	00:05:00
Basin_7	3.40	2.61	0.07	92.720	0	00:05:00
Basin_8	3.40	2.21	0.12	88.420	0	00:05:00
Pre_Developed	3.40	1.17	0.27	74.000	0	00:27:35

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
FCMH 1	0.04	0.06	175.94	0	20:58	0	0	0:00:00
FCMH 2	0.06	0.08	175.84	0	22:57	0	0	0:00:00
FCMH 3	0.03	0.07	176.37	0	13:39	0	0	0:00:00
Jun-02	0.00	0.03	101.03	0	08:05	0	0	0:00:00
Pre-Developed_IN	0.01	0.10	101.10	0	08:15	0	0	0:00:00
SDCO 1	0.48	1.61	177.96	0	20:58	0	0	0:00:00
SFCB 1	0.02	0.14	178.95	0	08:00	0	0	0:00:00
SFCB 2	0.33	1.27	177.73	0	13:38	0	0	0:00:00
SFCB 3	0.12	0.62	177.73	0	13:38	0	0	0:00:00
SFCB 4	0.02	0.15	178.40	0	08:00	0	0	0:00:00
SFCB 5	0.03	0.21	177.98	0	20:55	0	0	0:00:00
WYE 1	0.02	0.14	178.37	0	08:00	0	0	0:00:00
WYE 3	0.06	0.09	175.53	0	21:53	0	0	0:00:00
Basin_2_Outfall	0.00	0.03	100.03	0	08:05	0	0	0:00:00
Outfall-SE	0.03	0.07	175.92	0	13:39	0	0	0:00:00
Outfall-SW	0.05	0.09	174.83	0	21:53	0	0	0:00:00
Pre-Developed_Outfall	0.01	0.09	100.09	0	08:15	0	0	0:00:00
POND OVERFLOW	0.64	1.54	179.86	0	22:56	0	0	0:00:00
SDMH-1	0.77	2.08	177.96	0	20:58	0	0	0:00:00
SDMH-2	0.41	1.43	177.73	0	13:38	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
FCMH 1	JUNCTION	0.00	0.04	0	20:58	0.00		

FCMH 2	JUNCTION	0.00	0.03	0	22:56	0.00
FCMH 3	JUNCTION	0.00	0.03	0	13:38	0.00
Jun-02	JUNCTION	0.03	0.03	0	08:05	0.00
Pre-Developed_IN	JUNCTION	0.27	0.27	0	08:15	0.00
SDCO 1	JUNCTION	0.00	0.32	0	07:51	0.00
SFCB 1	JUNCTION	0.09	0.09	0	08:00	0.00
SFCB 2	JUNCTION	0.14	0.14	0	07:55	0.00
SFCB 3	JUNCTION	0.06	0.06	0	08:00	0.00
SFCB 4	JUNCTION	0.07	0.07	0	07:55	0.00
SFCB 5	JUNCTION	0.12	0.12	0	08:00	0.00
WYE 1	JUNCTION	0.00	0.16	0	08:00	0.00
WYE 3	JUNCTION	0.00	0.07	0	21:52	0.00
Basin_2_Outfall	OUTFALL	0.00	0.03	0	08:05	0.00
Outfall-SE	OUTFALL	0.00	0.03	0	13:39	0.00
Outfall-SW	OUTFALL	0.00	0.07	0	21:53	0.00
Pre-Developed_Outfall	OUTFALL	0.00	0.27	0	08:15	0.00
POND OVERFLOW	STORAGE	0.32	0.32	0	08:00	0.00
SDMH-1	STORAGE	0.05	0.60	0	07:51	0.00
SDMH-2	STORAGE	0.00	0.19	0	08:01	0.00

****
Storage Node Summary
****

Storage Node ID	Maximum Ponded Volume 1000 ft³	Maximum Ponded (%)	Time of Max Ponded days hh:mm	Average Ponded Volume 1000 ft³	Average Ponded (%)	Maximum Storage Node Outflow cfs	Maximum Exfiltration Rate cfm	Total Exfiltrated Volume 1000 ft³
POND OVERFLOW	2.459	71	0 22:56	0.960	28	0.03	0.00	0.000
SDMH-1	2.342	52	0 20:58	0.877	20	0.19	0.00	0.000
SDMH-2	0.919	35	0 13:38	0.266	10	0.03	0.00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Basin_2_Outfall	24.51	0.01	0.03
Outfall-SE	53.33	0.02	0.03
Outfall-SW	90.42	0.04	0.07
Pre-Developed_Outfall	25.99	0.09	0.27
System	48.56	0.15	0.36

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow	Total Time minutes	Reported Condition
CB 4 STUB	CONDUIT	0 07:59	1.30	1.00	0.07	0.99	0.07	0.21	0	Calculated
LINK 1	CONDUIT	0 08:00	1.68	1.00	0.09	0.94	0.09	0.21	0	Calculated
LINK 10	CONDUIT	0 08:01	1.22	1.00	0.14	1.01	0.14	1.00	1114	SURCHARGED
LINK 13	CONDUIT	0 08:00	0.57	1.00	0.06	0.87	0.07	0.97	0	Calculated
LINK 15	CONDUIT	0 13:39	1.30	1.00	0.03	3.25	0.01	0.07	0	Calculated
LINK 2	CONDUIT	0 08:00	2.90	1.00	0.16	1.71	0.09	0.57	0	Calculated
LINK 3	CONDUIT	0 07:51	1.75	1.00	0.43	2.09	0.21	1.00	1446	SURCHARGED
LINK 5	CONDUIT	0 20:58	1.62	1.00	0.04	3.83	0.01	0.09	0	Calculated
LINK 6	CONDUIT	0 21:53	2.09	1.00	0.07	4.55	0.02	0.09	0	Calculated
LINK 9	CONDUIT	0 22:57	1.10	1.00	0.03	1.54	0.02	0.10	0	Calculated
Link-01	CONDUIT	0 08:15	5.11	1.00	0.27	71.54	0.00	0.05	0	Calculated
Link-02	CONDUIT	0 08:05	2.65	1.00	0.03	71.54	0.00	0.02	0	Calculated
Pipe - (16)	CONDUIT	0 08:00	0.60	1.00	0.12	3.98	0.03	0.65	0	Calculated
Low-Flow-Orifice-Pond	ORIFICE	0 22:56			0.03			1.00		
Orifice-01	ORIFICE	0 13:38			0.03			1.00		
Orifice-02	ORIFICE	0 00:00			0.00			0.00		
Orifice-04	ORIFICE	0 00:00			0.00			0.00		
Orifice-06	ORIFICE	0 20:58			0.04			1.00		
Emergency-Overflow-Pond	WEIR	0 00:00			0.00			0.00		

****
Highest Flow Instability Indexes
****
All links are stable.

WARNING 108 : Surcharge elevation defined for Junction WYE 3 is below junction maximum

```
elevation. Assumed surcharge elevation equal to maximum elevation.
  WARNING 118 : Orifice crest elevation defined for Orifice Low-Flow-Orifice-Pond is below
upstream node invert elevation.
                Assumed orifice crest elevation equal to upstream node invert elevation.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height
dimensions for Node FCMH 2.

  Analysis began on:  Tue Dec 20 14:06:01 2022
  Analysis ended on:  Tue Dec 20 14:06:11 2022
  Total elapsed time: 00:00:10
```

Autodesk® Storm and Sanitary Analysis 2016 - Version 13.4.133 (Build 0)

****
Project Description
****
File Name ..... 14866-Detention and Water Quality Model.SPF

****
Analysis Options
****
Flow Units ..... cfs
Subbasin Hydrograph Method. SCS TR-55
Time of Concentration..... SCS TR-55
Link Routing Method ..... Hydrodynamic
Storage Node Exfiltration.. Constant flow
Starting Date NOV-11-2022 00:00:00
Ending Date NOV-14-2022 00:00:00
Report Time Step 00:05:00

****
Element Count
****
Number of rain gages 0
Number of subbasins 9
Number of nodes 20
Number of links 19

****
Subbasin Summary
****

Subbasin ID	Total Area acres	Peak Rate Factor
Basin_1	0.13	484.00
Basin_2	0.12	484.00
Basin_3	0.20	484.00
Basin_4	0.08	484.00
Basin_5	0.07	484.00
Basin_6	0.49	484.00
Basin_7	0.10	484.00
Basin_8	0.21	484.00
Pre_Developed	1.39	484.00

****
Node Summary
****

Node ID	Element Type	Invert Elevation ft	Maximum Elev. ft	Ponded Area ft²	External Inflow
FCMH 1	JUNCTION	175.88	181.97	0.00	
FCMH 2	JUNCTION	175.76	187.56	0.00	
FCMH 3	JUNCTION	176.30	181.98	0.00	
Jun-02	JUNCTION	101.00	111.00	0.00	
Pre-Developed_IN	JUNCTION	101.00	111.00	0.00	
SDCO 1	JUNCTION	176.35	181.17	0.00	
SFCB 1	JUNCTION	178.81	181.18	0.00	
SFCB 2	JUNCTION	176.46	180.67	0.00	
SFCB 3	JUNCTION	177.11	179.48	0.00	
SFCB 4	JUNCTION	178.25	180.77	0.00	

SFCB 5	JUNCTION	177.77	180.77	0.00
WYE 1	JUNCTION	178.23	180.78	0.00
WYE 3	JUNCTION	175.44	182.17	0.00
Basin_2_Outfall	OUTFALL	100.00	102.00	0.00
Outfall-SE	OUTFALL	175.85	176.85	0.00
Outfall-SW	OUTFALL	174.74	175.74	0.00
Pre-Developed_Outfall	OUTFALL	100.00	102.00	0.00
POND OVERFLOW	STORAGE	178.32	180.32	0.00
SDMH-1	STORAGE	175.88	181.02	0.00
SDMH-2	STORAGE	176.30	182.30	0.00

****
Link Summary
****

Link ID	From Node	To Node	Element Type	Length ft	Slope %	Manning's Roughness
CB 4 STUB	SFCB 4	WYE 1	CONDUIT	3.0	0.6753	0.0130
LINK 1	SFCB 1	WYE 1	CONDUIT	96.3	0.6022	0.0130
LINK 10	SFCB 2	SDMH-2	CONDUIT	22.7	0.6995	0.0130
LINK 13	SFCB 3	SDMH-2	CONDUIT	155.4	0.5199	0.0130
LINK 15	FCMH 3	Outfall-SE	CONDUIT	54.5	0.8341	0.0130
LINK 2	WYE 1	SDCO 1	CONDUIT	94.2	1.9947	0.0130
LINK 3	SDCO 1	SDMH-1	CONDUIT	15.8	2.9785	0.0130
LINK 5	FCMH 1	WYE 3	CONDUIT	14.4	3.0515	0.0130
LINK 6	WYE 3	Outfall-SW	CONDUIT	42.9	1.6334	0.0130
LINK 9	FCMH 2	WYE 3	CONDUIT	64.6	0.4954	0.0130
Link-01	Pre-Developed_IN	Pre-Developed_Outfall	CONDUIT	10.0	10.0000	0.0130
Link-02	Jun-02	Basin_2_Outfall	CONDUIT	10.0	10.0000	0.0130
Pipe - (16)	SFCB 5	SDMH-1	CONDUIT	17.4	10.8558	0.0130
Low-Flow-Orifice-Pond	POND OVERFLOW	FCMH 2	ORIFICE			
Orifice-01	SDMH-2	FCMH 3	ORIFICE			
Orifice-02	SDMH-2	FCMH 3	ORIFICE			
Orifice-04	SDMH-1	FCMH 1	ORIFICE			
Orifice-06	SDMH-1	FCMH 1	ORIFICE			
Emergency-Overflow-Pond	POND OVERFLOW	FCMH 2	WEIR			

****
Cross Section Summary
****

Link ID	Shape	Depth/ Diameter ft	Width ft	No. of Barrels	Cross Sectional Area ft²	Full Flow Hydraulic Radius ft	Design Flow Capacity cfs
CB 4 STUB	CIRCULAR	0.67	0.67	1	0.35	0.17	0.99
LINK 1	CIRCULAR	0.67	0.67	1	0.35	0.17	0.94
LINK 10	CIRCULAR	0.67	0.67	1	0.35	0.17	1.01
LINK 13	CIRCULAR	0.67	0.67	1	0.35	0.17	0.87
LINK 15	CIRCULAR	1.00	1.00	1	0.79	0.25	3.25
LINK 2	CIRCULAR	0.67	0.67	1	0.35	0.17	1.71
LINK 3	CIRCULAR	0.67	0.67	1	0.35	0.17	

2.09						
LINK 5	CIRCULAR	0.83	0.83	1	0.55	0.21
3.83						
LINK 6	CIRCULAR	1.00	1.00	1	0.79	0.25
4.55						
LINK 9	CIRCULAR	0.83	0.83	1	0.55	0.21
1.54						
Link-01	CIRCULAR	2.00	2.00	1	3.14	0.50
71.54						
Link-02	CIRCULAR	2.00	2.00	1	3.14	0.50
71.54						
Pipe - (16)	CIRCULAR	0.67	0.67	1	0.35	0.17
3.98						

**********	Volume	Depth
Runoff Quantity Continuity	acre-ft	inches
**********	---------	-------
Total Precipitation	0.877	3.791
Surface Runoff	0.002	0.007
Continuity Error (%)	-0.000	

**********	Volume	Volume
Flow Routing Continuity	acre-ft	Mgallons
**********	---------	---------
External Inflow	0.000	0.000
External Outflow	0.491	0.160
Initial Stored Volume	0.000	0.000
Final Stored Volume	0.001	0.000
Continuity Error (%)	0.000	

****
Composite Curve Number Computations Report
****

Subbasin Basin_1

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.03	-	74.00
-	0.10	-	98.00
Composite Area & Weighted CN	0.13		93.09

Subbasin Basin_2

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.12	-	74.00
Composite Area & Weighted CN	0.12		74.00

Subbasin Basin_3

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.03	-	74.00
-	0.16	-	98.00
Composite Area & Weighted CN	0.20		93.84

Subbasin Basin_4

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.02	-	74.00
-	0.06	-	98.00
Composite Area & Weighted CN	0.08		92.67

Subbasin Basin_5

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.00	-	74.00
-	0.07	-	98.00
Composite Area & Weighted CN	0.07		98.00

Subbasin Basin_6

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.13	-	74.00
-	0.35	-	98.00
Composite Area & Weighted CN	0.49		91.43

Subbasin Basin_7

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.02	-	74.00
-	0.08	-	98.00
Composite Area & Weighted CN	0.10		92.72

Subbasin Basin_8

Soil/Surface Description	Area (acres)	Soil Group	CN
-	0.09	-	74.00
-	0.13	-	98.00
Composite Area & Weighted CN	0.21		88.42

Subbasin Pre_Developed

Soil/Surface Description	Area (acres)	Soil Group	CN
-	1.39	-	74.00
Composite Area & Weighted CN	1.39		74.00

****
SCS TR-55 Time of Concentration Computations Report
****

Sheet Flow Equation

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where:

Tc = Time of Concentration (hrs)
n = Manning's Roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hrs)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's Roughness

Subbasin Basin_1

User-Defined TOC override (minutes): 5.00

Subbasin Basin_2

User-Defined TOC override (minutes): 5.00

Subbasin Basin_3

User-Defined TOC override (minutes): 5.00

Subbasin Basin_4

```
  --------------------
          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Basin_5
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Basin_6
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Basin_7
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------
  Subbasin Basin_8
  --------------------

          User-Defined TOC override (minutes):      5.00

  --------------------------
  Subbasin Pre_Developed
  --------------------------

  Sheet Flow Computations
  -----------------------
                                              Subarea A           Subarea B           Subarea
C
          Manning's Roughness:                     0.40                0.00
0.00
          Flow Length (ft):                      100.00                0.00
0.00
          Slope (%):                               2.00                0.00
0.00
          2 yr, 24 hr Rainfall (in):               2.40                0.00
0.00
          Velocity (ft/sec):                       0.07                0.00
0.00
          Computed Flow Time (minutes):           24.80                0.00
0.00

  Shallow Concentrated Flow Computations
  --------------------------------------
                                              Subarea A           Subarea B           Subarea
C
          Flow Length (ft):                      382.00                0.00
0.00
          Slope (%):                               2.00                0.00
0.00
          Surface Type:                          Unpaved             Unpaved
Unpaved
          Velocity (ft/sec):                       2.28                0.00
0.00
          Computed Flow Time (minutes):            2.79                0.00
0.00

================================================================================================
          Total TOC (minutes):                    27.59
```

==========

****
Subbasin Runoff Summary
****

Subbasin ID	Total Precip in	Total Runoff in	Peak Runoff cfs	Weighted Curve Number	Time of Concentration days	Time of Concentration hh:mm:ss
Basin_1	3.80	3.03	0.10	93.090	0	00:05:00
Basin_2	3.80	1.45	0.04	74.000	0	00:05:00
Basin_3	3.80	3.11	0.16	93.840	0	00:05:00
Basin_4	3.80	2.99	0.07	92.670	0	00:05:00
Basin_5	3.80	3.56	0.06	98.000	0	00:05:00
Basin_6	3.80	2.87	0.37	91.430	0	00:05:00
Basin_7	3.80	3.00	0.08	92.720	0	00:05:00
Basin_8	3.80	2.58	0.14	88.420	0	00:05:00
Pre_Developed	3.80	1.45	0.36	74.000	0	00:27:35

****
Node Depth Summary
****

Node ID	Average Depth Attained ft	Maximum Depth Attained ft	Maximum HGL Attained ft	Time of Max Occurrence days	Time of Max Occurrence hh:mm	Total Flooded Volume acre-in	Total Time Flooded minutes	Retention Time hh:mm:ss
FCMH 1	0.04	0.06	175.94	0	21:44	0	0	0:00:00
FCMH 2	0.06	0.09	175.85	0	23:29	0	0	0:00:00
FCMH 3	0.03	0.07	176.38	0	14:26	0	0	0:00:00
Jun-02	0.00	0.04	101.04	0	08:02	0	0	0:00:00
Pre-Developed_IN	0.02	0.11	101.11	0	08:15	0	0	0:00:00
SDCO 1	0.65	2.06	178.41	0	21:44	0	0	0:00:00
SFCB 1	0.02	0.15	178.96	0	08:00	0	0	0:00:00
SFCB 2	0.43	1.59	178.05	0	14:26	0	0	0:00:00
SFCB 3	0.20	0.94	178.05	0	14:26	0	0	0:00:00
SFCB 4	0.03	0.16	178.41	0	08:00	0	0	0:00:00
SFCB 5	0.11	0.64	178.41	0	21:44	0	0	0:00:00
WYE 1	0.03	0.18	178.41	0	21:44	0	0	0:00:00
WYE 3	0.06	0.09	175.53	0	22:01	0	0	0:00:00
Basin_2_Outfall	0.00	0.03	100.03	0	08:03	0	0	0:00:00
Outfall-SE	0.03	0.07	175.92	0	14:26	0	0	0:00:00
Outfall-SW	0.06	0.09	174.83	0	22:01	0	0	0:00:00
Pre-Developed_Outfall	0.01	0.10	100.10	0	08:15	0	0	0:00:00
POND OVERFLOW	0.79	1.78	180.10	0	23:28	0	0	0:00:00
SDMH-1	0.96	2.53	178.41	0	21:44	0	0	0:00:00
SDMH-2	0.51	1.75	178.05	0	14:26	0	0	0:00:00

****
Node Flow Summary
****

Node ID	Element Type	Maximum Lateral Inflow cfs	Peak Inflow cfs	Time of Peak Inflow Occurrence days	Time of Peak Inflow Occurrence hh:mm	Maximum Flooding Overflow cfs	Time of Peak Flooding Occurrence days	Time of Peak Flooding Occurrence hh:mm
FCMH 1	JUNCTION	0.00	0.04	0	21:44	0.00		

FCMH 2	JUNCTION	0.00	0.04	0	23:28	0.00
FCMH 3	JUNCTION	0.00	0.03	0	14:26	0.00
Jun-02	JUNCTION	0.04	0.04	0	08:00	0.00
Pre-Developed_IN	JUNCTION	0.36	0.36	0	08:15	0.00
SDCO 1	JUNCTION	0.00	0.30	0	07:42	0.00
SFCB 1	JUNCTION	0.10	0.10	0	08:00	0.00
SFCB 2	JUNCTION	0.16	0.16	0	07:55	0.00
SFCB 3	JUNCTION	0.07	0.07	0	07:55	0.00
SFCB 4	JUNCTION	0.08	0.08	0	07:55	0.00
SFCB 5	JUNCTION	0.14	0.14	0	08:00	0.00
WYE 1	JUNCTION	0.00	0.18	0	08:00	0.00
WYE 3	JUNCTION	0.00	0.08	0	22:01	0.00
Basin_2_Outfall	OUTFALL	0.00	0.04	0	08:04	0.00
Outfall-SE	OUTFALL	0.00	0.03	0	14:26	0.00
Outfall-SW	OUTFALL	0.00	0.08	0	22:01	0.00
Pre-Developed_Outfall	OUTFALL	0.00	0.36	0	08:15	0.00
POND OVERFLOW	STORAGE	0.36	0.36	0	08:00	0.00
SDMH-1	STORAGE	0.06	0.57	0	07:44	0.00
SDMH-2	STORAGE	0.00	0.23	0	07:57	0.00

****
Storage Node Summary
****

*Post-Developed Flow = 0.04 cfs + 0.03 cfs + 0.08 cfs = 0.15 cfs

Storage Node ID	Maximum Ponded Volume 1000 ft³	Maximum Ponded (%)	Time of Max Ponded days hh:mm	Average Ponded Volume 1000 ft³	Average Ponded (%)	Maximum Storage Node Outflow cfs	Maximum Exfiltration Rate cfm	Total Exfiltrated Volume 1000 ft³
POND OVERFLOW	2.964	86	0 23:28	1.213	35	0.04	0.00	0.000
SDMH-1	2.778	62	0 21:44	1.080	24	0.18	0.00	0.000
SDMH-2	1.098	41	0 14:26	0.326	12	0.03	0.00	0.000

****
Outfall Loading Summary
****

Outfall Node ID	Flow Frequency (%)	Average Flow cfs	Peak Inflow cfs
Basin_2_Outfall	25.25	0.01	0.04
Outfall-SE	56.08	0.02	0.03
Outfall-SW	96.09	0.04	0.08
Pre-Developed_Outfall	26.68	0.11	0.36
System	51.03	0.18	0.46

****
Link Flow Summary
****

Link ID	Element Type	Time of Peak Flow Occurrence days hh:mm	Maximum Velocity Attained ft/sec	Length Factor	Peak Flow during Analysis cfs	Design Flow Capacity cfs	Ratio of Maximum /Design Flow	Ratio of Maximum Flow	Total Time minutes	Reported Condition
CB 4 STUB	CONDUIT	0 07:59	1.35	1.00	0.08	0.99	0.08	0.25	0	Calculated
LINK 1	CONDUIT	0 08:00	1.75	1.00	0.10	0.94	0.11	0.22	0	Calculated
LINK 10	CONDUIT	0 08:00	1.27	1.00	0.16	1.01	0.16	1.00	1225	SURCHARGED
LINK 13	CONDUIT	0 07:57	0.57	1.00	0.06	0.87	0.07	1.00	809	SURCHARGED
LINK 15	CONDUIT	0 14:26	1.34	1.00	0.03	3.25	0.01	0.07	0	Calculated
LINK 2	CONDUIT	0 08:00	2.36	1.00	0.18	1.71	0.11	0.63	0	Calculated
LINK 3	CONDUIT	0 07:43	1.60	1.00	0.41	2.09	0.19	1.00	1660	SURCHARGED
LINK 5	CONDUIT	0 21:44	1.67	1.00	0.04	3.83	0.01	0.09	0	Calculated
LINK 6	CONDUIT	0 22:01	2.14	1.00	0.08	4.55	0.02	0.09	0	Calculated
LINK 9	CONDUIT	0 23:29	1.12	1.00	0.04	1.54	0.02	0.11	0	Calculated
Link-01	CONDUIT	0 08:15	5.52	1.00	0.36	71.54	0.01	0.05	0	Calculated
Link-02	CONDUIT	0 08:04	2.87	1.00	0.04	71.54	0.00	0.02	0	Calculated
Pipe - (16)	CONDUIT	0 08:00	0.69	1.00	0.14	3.98	0.04	0.98	0	Calculated
Low-Flow-Orifice-Pond	ORIFICE	0 23:28			0.04			1.00		
Orifice-01	ORIFICE	0 14:26			0.03			1.00		
Orifice-02	ORIFICE	0 00:00			0.00			0.00		
Orifice-04	ORIFICE	0 00:00			0.00			0.00		
Orifice-06	ORIFICE	0 21:44			0.04			1.00		
Emergency-Overflow-Pond	WEIR	0 00:00			0.00			0.00		

****
Highest Flow Instability Indexes
****
All links are stable.

WARNING 108 : Surcharge elevation defined for Junction WYE 3 is below junction maximum

```
elevation. Assumed surcharge elevation equal to maximum elevation.
  WARNING 118 : Orifice crest elevation defined for Orifice Low-Flow-Orifice-Pond is below
upstream node invert elevation.
               Assumed orifice crest elevation equal to upstream node invert elevation.
  WARNING 002 : Max/rim elevation (depth) increased to account for connecting conduit height
dimensions for Node FCMH 2.

  Analysis began on:  Tue Dec 20 14:04:56 2022
  Analysis ended on:  Tue Dec 20 14:05:04 2022
  Total elapsed time: 00:00:08
```