C.O'Sullivan 7314

PRELIMINARY DRAINAGE REPORT
FOR

Hawk's Ridge Apartments Phase 3
Salem, Oregon
Pre-App No. 21-113574-PA

Prepared For:
KCH Enterprises, LLC
10355 Liberty Road S
Salem, Oregon 97306

February 7, 2022

MULTI/TECH
ENGINEERING SERVICES, INC.

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Salem OR 97302

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Contents

INTRODUCTION

The Hawks Ridge Apartments Phase 3 is a proposed 396-unit apartment complex adjacent to the existing Reserve At Hawk's Ridge to the Northeast. The location of the site is northwest of Cordon Road and north of N Santiam Hwy. The parcel of land to be developed are Tax Lots 200, 300, 400, 401, and 500 of Marion County Assessor's Map 08 2W 05. A vicinity map and supporting maps are located in Appendix A of this report. An aerial image is below.

Project Site

The development consists of 396 apartments on approximately 23.73-acres. The proposed development will be connected to public water and public sewer. Green Stormwater Infrastructure (GSI) to the Maximum Extent Feasible (MEF) is being used for the new developed areas per City of Salem Administrative Rules, Chapter 109, Division 004, Stormwater System, Appendix 4E and Ordinance Bill No. 8-20 (Standards). All facilities will be constructed to meet the City of Salem standards.

Existing Conditions

The parcel is irregular in shape. Surface conditions consists of grass, cultivated crops, and trees. There are no identified wetlands, sensitive areas or waterways located on the property. The site has flat to rolling slopes running northeasterly and northwesterly. The topographic relief is approximately 11-feet with a high point elevation of approximately 226.5-feet. The abutting properties are single family residences with public improvements that include storm water conveyance systems or apartment complexes. Appendix A contains a drainage map of existing and proposed conditions.

Soils

The Soil Conservation Service Soil Survey of Marion County identifies the predominate soils on the site as a: Woodburn silt loam, 0 to 3 percent slopes (map unit WuA) and Dayton silt loam (map unit Da). The Woodburn silt loam is in the hydrologic soil group C and Dayton silt loam is in hydrologic soil group D. Appendix B contains the NRCS soil survey for the site.

Water Quality Analysis

Water quality flow rates will be calculated with HydroCAD 10.10-7a. The SCS TR-20 Unit Hydrograph method will be used to generate the hydrographs. A Type 1A storm and a 24-hour rainfall depth of 1.38 inches per hour will be used to determine the water quality flow rate.

Water Quality Design

The proposed vegetative swale will provide water quality treatment by slowing the stormwater down, allowing for the removal of pollutants through sedimentation, adsorption onto surrounding vegetation, and biological uptake. The facility will be designed per the City of Salem designed standards.

Stormwater Quantity Analysis

Stormwater quantity (Flow Control) is proposed to be handled by on-site detention. Runoff from the developed right-of-way will be routed to the facility that ultimately controls runoff to pre-developed flow rates.

Per Subsection 4.2(p)(3)(A) of the standards, one-half of the post development peak runoff rate of the two-year storm must be equal to or less than one-half of the peak runoff rate of the pre-developed two-year, 24-hour storm. This also applies to the 10-year, 25-year, and 100-year, 24-hour storm events.

The pre-developed flow rates were calculated using HydroCAD 10.10-6a. Table 1 below lists the 24-hour rainfall depths used for the analysis of each storm event. Please note that the 2-year event was halved and then analyzed.

Table 1

Storm Event	24-hour Rainfall Depth (in)
2	2.2
10	3.2
25	3.6
100	4.4

For the pre-developed conditions, a time of concentration of 90 minutes was calculated for the site. The time of concentration data is in Appendix C. The calculations are incorporated in the HydroCAD output located in Appendix D. On-site areas were classified as "City of Salem Pre-Development, HSG C" and "City of Salem Pre-Development, HSG D" with a Curve Number (CN) of 72 and 79 respectively. A pre-developed basin map is in Appendix A.

The SCS TR-20 Unit Hydrograph method was used to generate the hydrographs. A Type 1A rainfall distribution was used with the above rainfall depths. Table 2 below identifies the allowable pre-developed release rate for each storm event.

Table 2

Storm Event	Total Allowable Release Rate (cfs)
Half of 2-year	0.09
10-year	2.30
25-year	3.18
100-year	5.18

The post-developed flow rates were calculated using HydroCAD 10.10-7a. An initial time of concentration of 15 minutes was assumed for the developed subdivision. The calculations are incorporated in the HydroCAD output located in Appendix C. The developed site was classified as 64 percent "Impervious, HSG C" with a CN of 98, 32 percent "> 75% Grass cover, HSG C" with a CN of 74, and 4 percent "> 75% Grass cover, HSG D" with a CN of 80. Table 3 below lists the CN values for the

developed areas that will contribute storm water runoff to the detention systems. A developed basin map is in Appendix A.

Table 3

Basin	Impervious Area (Ac) CN = 98	Landscape Area, HSG C (Ac) CN = 74	Landscape Area, HSG D (Ac) CN = 80	TOTAL Area (Ac)	Composite CN
Basin	15.13	7.74	0.86	23.73	90

DETENTION SYSTEM

In the detention analysis, the entire development was considered a single basin draining into the drainage facilities. Based on the above design parameters, runoff from developed conditions will be controlled to or below half of the 2-year, 10-year, 25-year, and 100-year pre-developed release rates. The release rates and detention requirements were generated from the HydroCAD software, which can be seen in Appendix D. Table 4 below summarizes the requirements for the storm events.

Table 4

Storm Event	Release Rate (cfs)	Allowable Release Rate (cfs)	Required Detention Volume (ft^3)	Provided Detention Volume (ft^3)
Half of 2-year	0.09	0.09	29,132	73,690
10-year	2.26	2.30	65,367	73,690
25-year	3.12	3.19	66,810	73,690
100-year	5.16	5.19	72,661	73,690

(Detention Summary)

Flow control is achieved using a series of orifices combined with overflow weirs inside a control structure located within the basin. The sizing of the orifice uses the standard orifice equation provided in the City of Salem Stormwater Management Manual. Table 5 below identifies orifice sizes, elevations, and the water surface elevations. Control Orifice #1 is less than two inches in size so it will need to be contained within a section of well screen or slotted pipe in order to comply with Salem Standards.

Table 5

Storm Event	Control Orifice (#)	Release Rate (cfs)	Orifice Diameter (inches)	Elevation (feet)	W.S. Elevation (feet)
Half of 2-year	1	0.09	1.75	215.60	216.97
10-year	2	2.26	7.25	215.60	218.59
25-year	3	3.12	8.50	215.60	218.65
100-year	4	5.16	10.75	215.60	218.92

(Orifice Summary)

In the event the control structure experiences a failure, a secondary emergency overflow escape route has been incorporated into the facility that outlets into an existing drainage way via a weir in the southeast corner. This overflow is at an elevation of 219 and the control structure also contains an overflow weir that is at an elevation of 218.95.

Water Quality Design

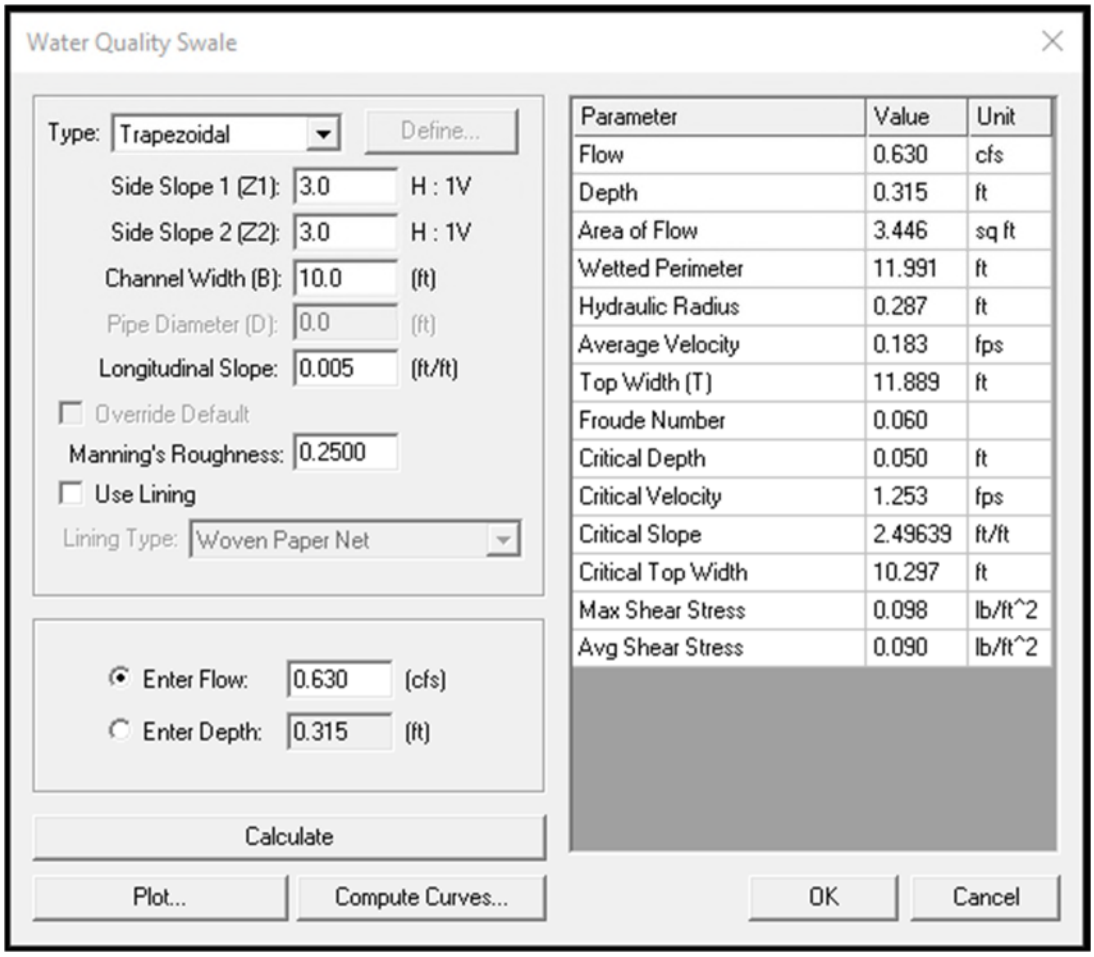
Water quality treatment for the proposed development will be via a vegetative swale. The flow rate was calculated with HydroCAD 10.10-7a. The SCS TR-20 Unit Hydrograph method was used to generate the hydrographs. A Type 1A storm and a 24-hour rainfall depth of 1.38 inches per hour was used to determine the water quality flow rate of 0.63 cfs from the control structure. The release rate was generated from the HydroCAD software, which can be seen in Appendix E. The water quality system will treat 80 percent of the annual rainfall.

Vegetative Swale Analysis

The proposed vegetative swale is approximately 100 feet in length. It provides water quality treatment by slowing the stormwater down, allowing for the removal of pollutants through sedimentation, adsorption onto surrounding vegetation, and biological uptake. The swale was designed per the city designed standards using the following criteria:

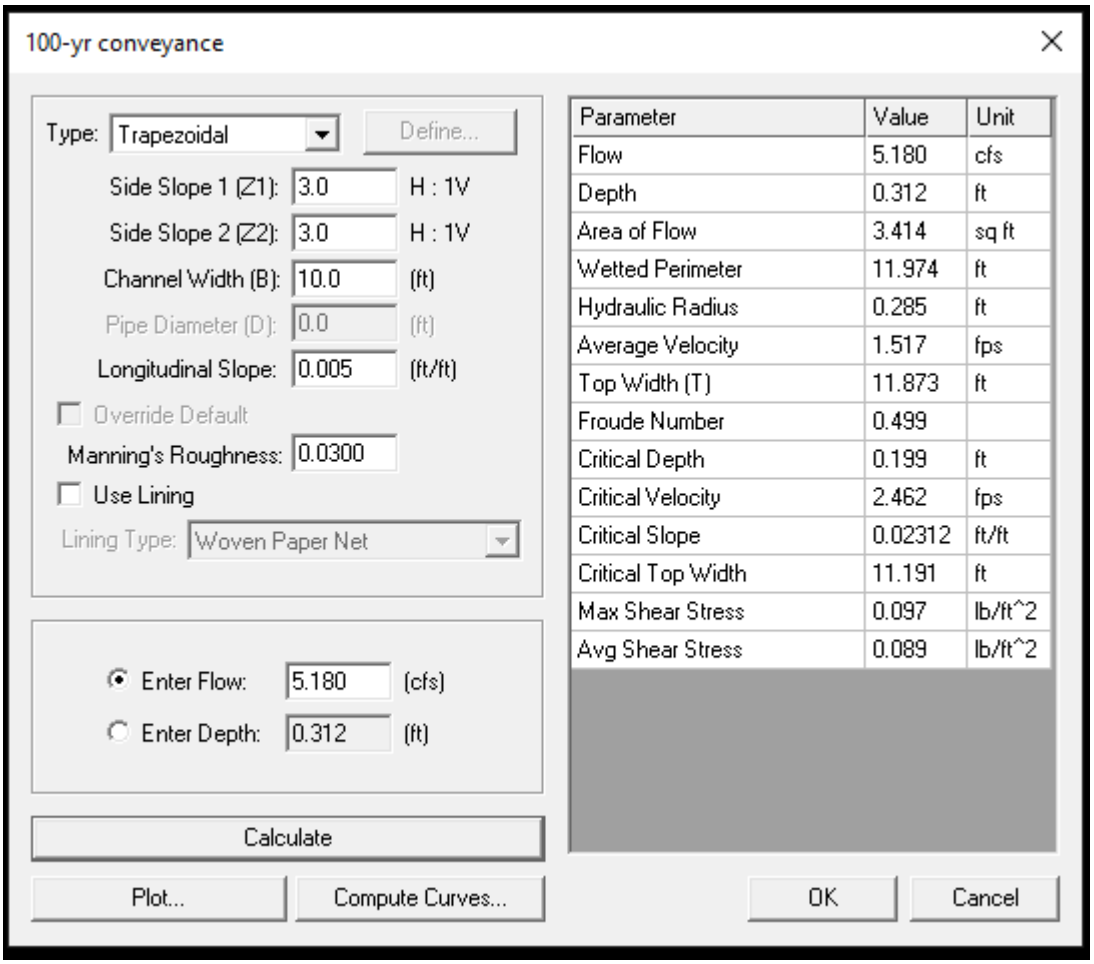
Bottom Width – Minimum	2 feet
Maximum Water Depth - Treatment	4 inches
Maximum Water Depth - Conveyance	12 inches
Side Slopes	3 : 1
Manning's "n" Treatment	0.25
Mannings's "n" Conveyance	0.030
Minimum & Maximum Slope	0.5% - 6%
Maximum Velocity	0.9 feet per second
Hydraulic Residence Time	> 9 minutes

The program Hydraulic Toolbox 4.4 from the Federal Highway Administration (FHWA) was used to analyze the swale. The analysis yields an average velocity of 0.183 feet per second. With a 100-foot-long swale, a hydraulic residence time is calculated to be 546 seconds or 9.1 minutes, which exceeds the required 9-minute residence time. Both the average velocity and the hydraulic residence time meet the parameters established in the City of Salem Design Standards. Below contains the computer program generated output table.



Parameter	Value	Unit
Flow	0.630	cfs
Depth	0.315	ft
Area of Flow	3.446	sq ft
Wetted Perimeter	11.991	ft
Hydraulic Radius	0.287	ft
Average Velocity	0.183	fps
Top Width (T)	11.889	ft
Froude Number	0.060	
Critical Depth	0.050	ft
Critical Velocity	1.253	fps
Critical Slope	2.49639	ft/ft
Critical Top Width	10.297	ft
Max Shear Stress	0.098	lb/ft^2
Avg Shear Stress	0.090	lb/ft^2

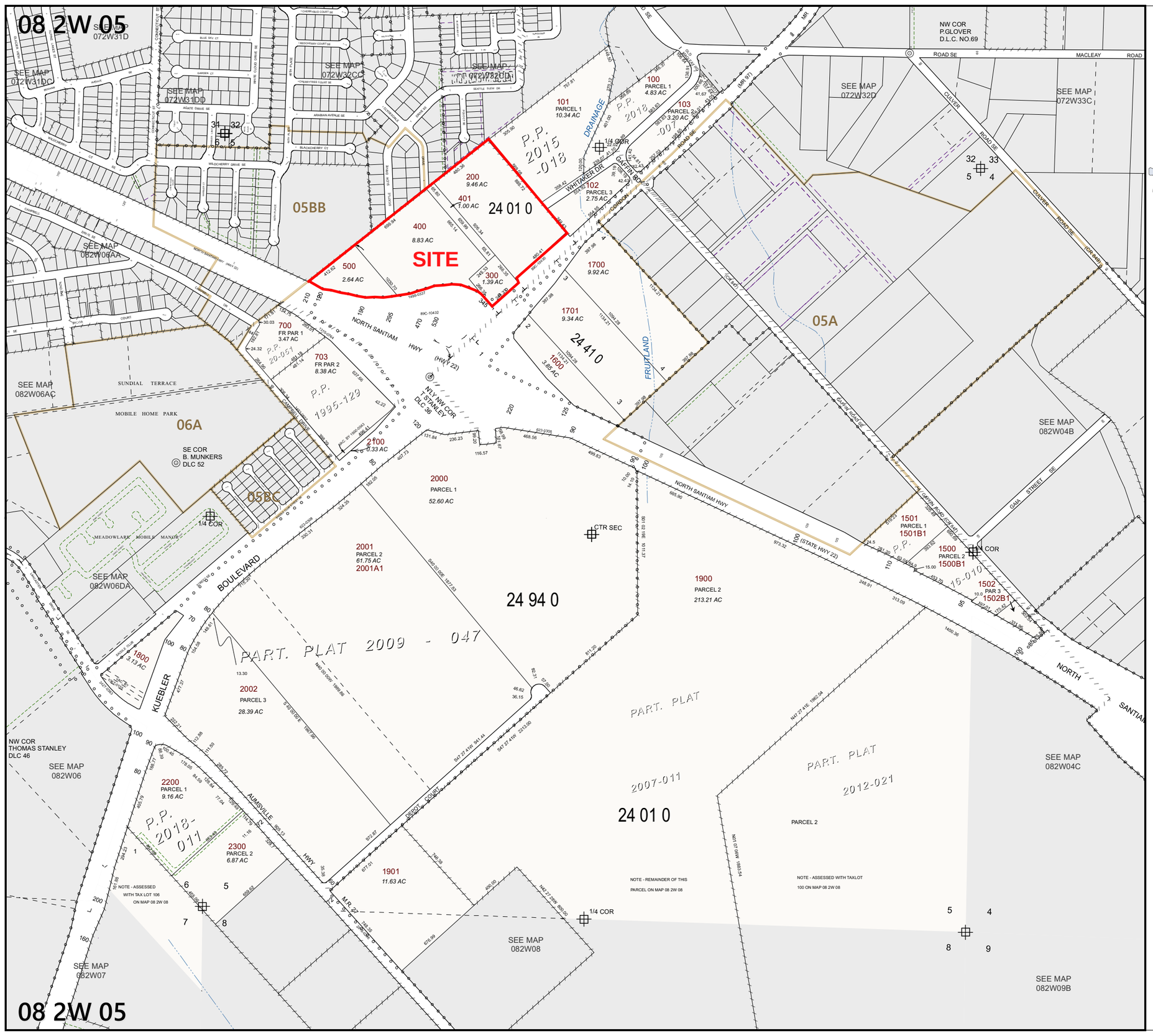
The swale was also analyzed for conveyance using the City of Salem design parameters. The allowable 100-year outflow of 5.18 cfs was used to determine the swale capacity requirements. Below contains the computer program generated output table. The design is exceeding the standards.



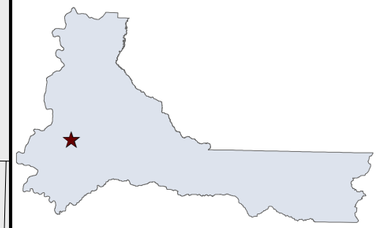
CONCLUSION

Based on the presented information, the proposed design will meet the water quality and quantity standards. If there are any questions regarding this analysis or the design, please contact Matthew Hendrick at Multi/Tech Engineering by phone at (503) 363-9227 or via e-mail at mhendrick@mtengineering.net.

Appendix A



08 2W 05
SALEM



MARION COUNTY, OREGON

SEC 5 T8S R2W W.M.
SCALE 1" = 400'

LEGEND

LINE TYPES

- Taxlot Boundary
- Historical Boundary
- Road Right-of-Way
- Easement
- Railroad Right-of-Way
- Railroad Centerline
- Private Road ROW
- Taxcode Line
- Subdivision/Plat Bndry
- Map Boundary
- Waterline - Taxlot Bndry
- Waterline - Non Bndry

CORNER TYPES

- + 1/16TH Section Cor.
- 1/4 Section Cor.
- DLC Corner
- 16 15 / 21 22 Section Corner

NUMBERS

Tax Code Number
00 00 0

Acreage
0.25 AC

All acres listed are Net Acres, excluding any portions of the taxlot within public ROWs

NOTES

Tick Marks: A tick mark in the road indicates that the labeled dimension extends into the public ROW

200.00
175.00

CANCELLED NUMBERS

201	1899		
301			
402			
501			
701			
702			
704			
800			
1000			
1001			
1100			
1200			
1300			
1400			
1601			
1702			
1703			

DISCLAIMER: THIS MAP WAS PREPARED FOR ASSESSMENT PURPOSES ONLY

Marion County OREGON — Assessors Office Cartography Dept

FOR ADDITIONAL MAPS VISIT OUR WEBSITE AT www.co.marion.or.us

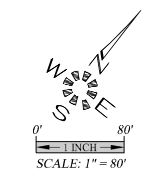
PLOT DATE: 9/8/2021

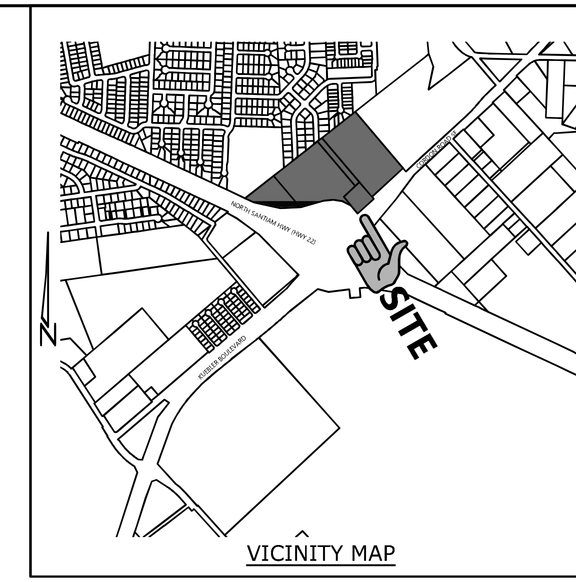
SALEM
08 2W 05

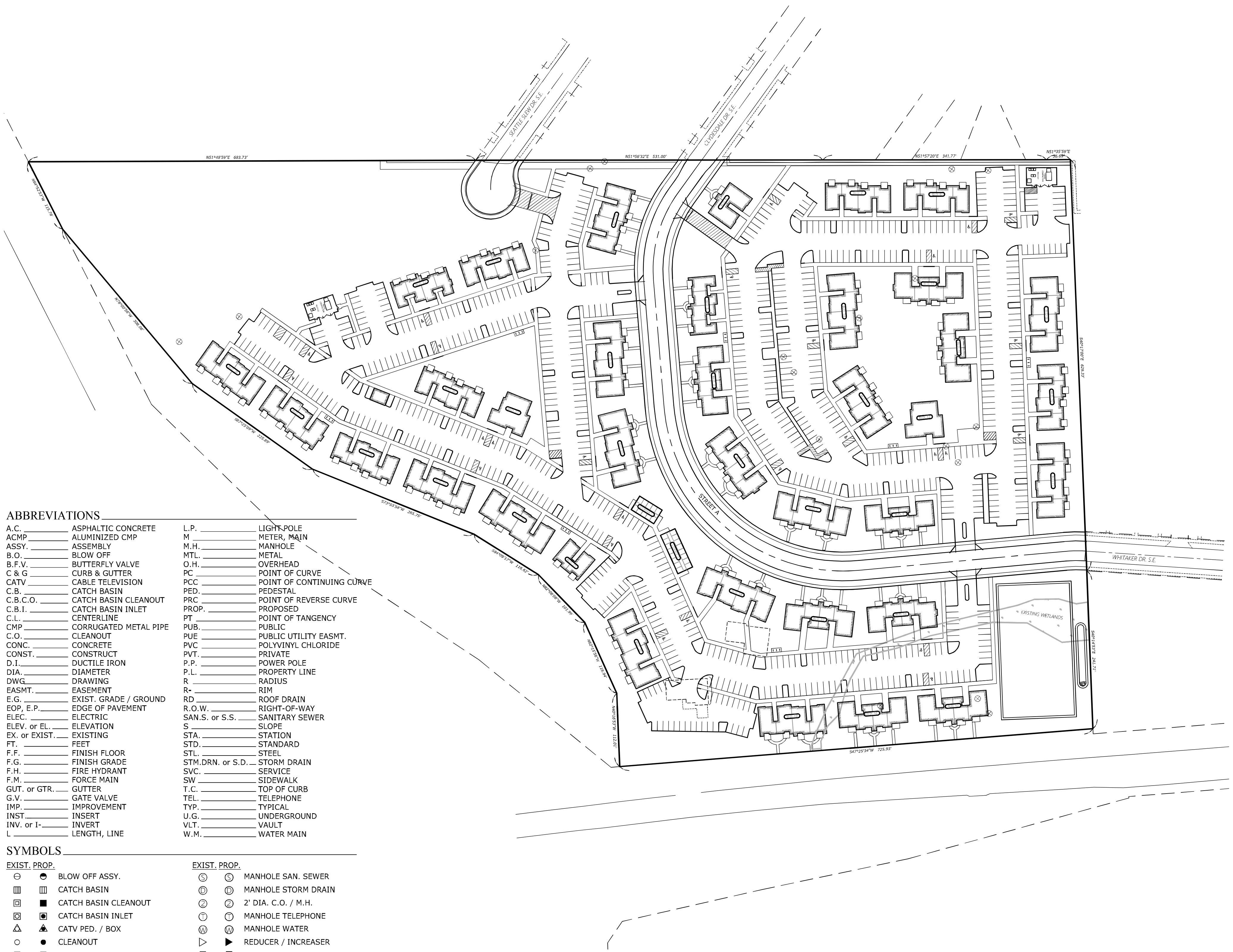
Drawing is NOT to scale

HAWK'S RIDGE APARTMENTS PH. 3

SEC. 5, T. 8 S., R. 2 W., W.M.
CITY OF SALEM
MARION COUNTY, OREGON







T.B.M. 100.00
THIS IS THE DESCRIPTION & LOCATION OF THE T.B.M. ELEVATION MARKER.
THIS IS THE DESCRIPTION & LOCATION OF THE NEAREST B.M. ELEVATION MARKER WITH THE ELEVATION OF THAT B.M.

Owner / Developer:

KCH ENTERPRISES. LLC
10355 LIBERTY ROAD S
SALEM, OREGON 97306

ABBREVIATIONS

A.C.	ASPHALTIC CONCRETE	L.P.	LIGHT POLE
ACMP	ALUMINIZED CMP	M	METER, MAIN
ASSY.	ASSEMBLY	M.H.	MANHOLE
B.O.	BLOW OFF	MTL.	METAL
B.F.V.	BUTTERFLY VALVE	O.H.	OVERHEAD
C & G	CURB & GUTTER	PC	POINT OF CURVE
CATV	CABLE TELEVISION	PCC	POINT OF CONTINUING CURVE
C.B.	CATCH BASIN	PED.	PEDESTAL
C.B.C.O.	CATCH BASIN CLEANOUT	PRC	POINT OF REVERSE CURVE
C.B.I.	CATCH BASIN INLET	PROP.	PROPOSED
C.L.	CENTERLINE	PT	POINT OF TANGENCY
CMP	CORRUGATED METAL PIPE	PUB.	PUBLIC
C.O.	CLEANOUT	PUE	PUBLIC UTILITY EASMT.
CONC.	CONCRETE	PVC	POLYVINYL CHLORIDE
CONST.	CONSTRUCT	PVT.	PRIVATE
D.I.	DUCTILE IRON	P.P.	POWER POLE
DIA.	DIAMETER	P.L.	PROPERTY LINE
DWG.	DRAWING	R	RADIUS
EASMT.	EASEMENT	R-	RIM
E.G.	EXIST. GRADE / GROUND	RD	ROOF DRAIN
EOP, E.P.	EDGE OF PAVEMENT	R.O.W.	RIGHT-OF-WAY
ELEC.	ELECTRIC	SAN.S. or S.S.	SANITARY SEWER
ELEV. or EL.	ELEVATION	S	SLOPE
EX. or EXIST.	EXISTING	STA.	STATION
FT.	FEET	STD.	STANDARD
F.F.	FINISH FLOOR	STL.	STEEL
F.G.	FINISH GRADE	STM.DRN. or S.D.	STORM DRAIN
F.H.	FIRE HYDRANT	SVC.	SERVICE
F.M.	FORCE MAIN	SW	SIDEWALK
GUT. or GTR.	GUTTER	T.C.	TOP OF CURB
G.V.	GATE VALVE	TEL.	TELEPHONE
IMP.	IMPROVEMENT	TYP.	TYPICAL
INST.	INSERT	U.G.	UNDERGROUND
INV. or I-	INVERT	VLT.	VAULT
L	LENGTH, LINE	W.M.	WATER MAIN

SYMBOLS

EXIST. PROP.

- BLOW OFF ASSY.
- CATCH BASIN
- CATCH BASIN CLEANOUT
- CATCH BASIN INLET
- CATV PED. / BOX
- CLEANOUT
- ELEC. PED. / BOX
- FIRE HYDRANT
- GAS LOCATION MARKER
- GAS VALVE
- MAIL BOX

EXIST. PROP.

- MANHOLE SAN. SEWER
- MANHOLE STORM DRAIN
- 2' DIA. C.O. / M.H.
- MANHOLE TELEPHONE
- MANHOLE WATER
- REDUCER / INCREASER
- TEL. PED. / BOX
- TRAFFIC PED. / BOX
- UTILITY / POWER POLE
- WATER METER
- WATER VALVE

- CABLE TELEVISION
- CENTERLINE
- DITCH C.L.
- ELECTRICAL LINE
- GAS MAIN
- TELEPHONE LINE

- SANITARY SEWER EXIST.
- SANITARY SEWER PROP.
- STORM DRAIN EXIST.
- STORM DRAIN PROP.
- WATER MAIN EXIST.
- WATER MAIN PROP.

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SHEET INDEX

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COVER SHEET

HAWK'S RIDGE APARTMENTS PH. 3

NO CHANGES, MODIFICATIONS OR REPRODUCTIONS TO BE MADE TO THESE DRAWINGS WITHOUT WRITTEN AUTHORIZATION FROM THE DESIGN ENGINEER.

DIMENSIONS & NOTES TAKE PRECEDENCE OVER GRAPHICAL REPRESENTATION.

7314p SDR1-COV
Design: M.D.G.
Drawn: A.R.T.
Checked: B.M.G.
Date: SEPT. 2021
Scale: AS SHOWN

REGISTERED PROFESSIONAL ENGINEER 19654 OREGON JULY 14, 1978 MARK D. GRENZ
EXPIRES: 06-30-2023

JOB # 7314

SDR1

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SDR2	EXPIRES: 06-30-2023 JOB # 7314	7314p SDR2-XCOND Design: M.D.G. Drawn: A.R.T. Checked: B.M.G. Date: SEPT. 2021 Scale: AS SHOWN	NO CHANGES, MODIFICATIONS OR REPRODUCTIONS TO BE MADE TO THESE DRAWINGS WITHOUT WRITTEN AUTHORIZATION FROM THE DESIGN ENGINEER. DIMENSIONS & NOTES TAKE PRECEDENCE OVER GRAPHICAL REPRESENTATION.	**HAWK'S RIDGE APARTMENTS PH. 3**	**EXISTING CONDITIONS PLAN**

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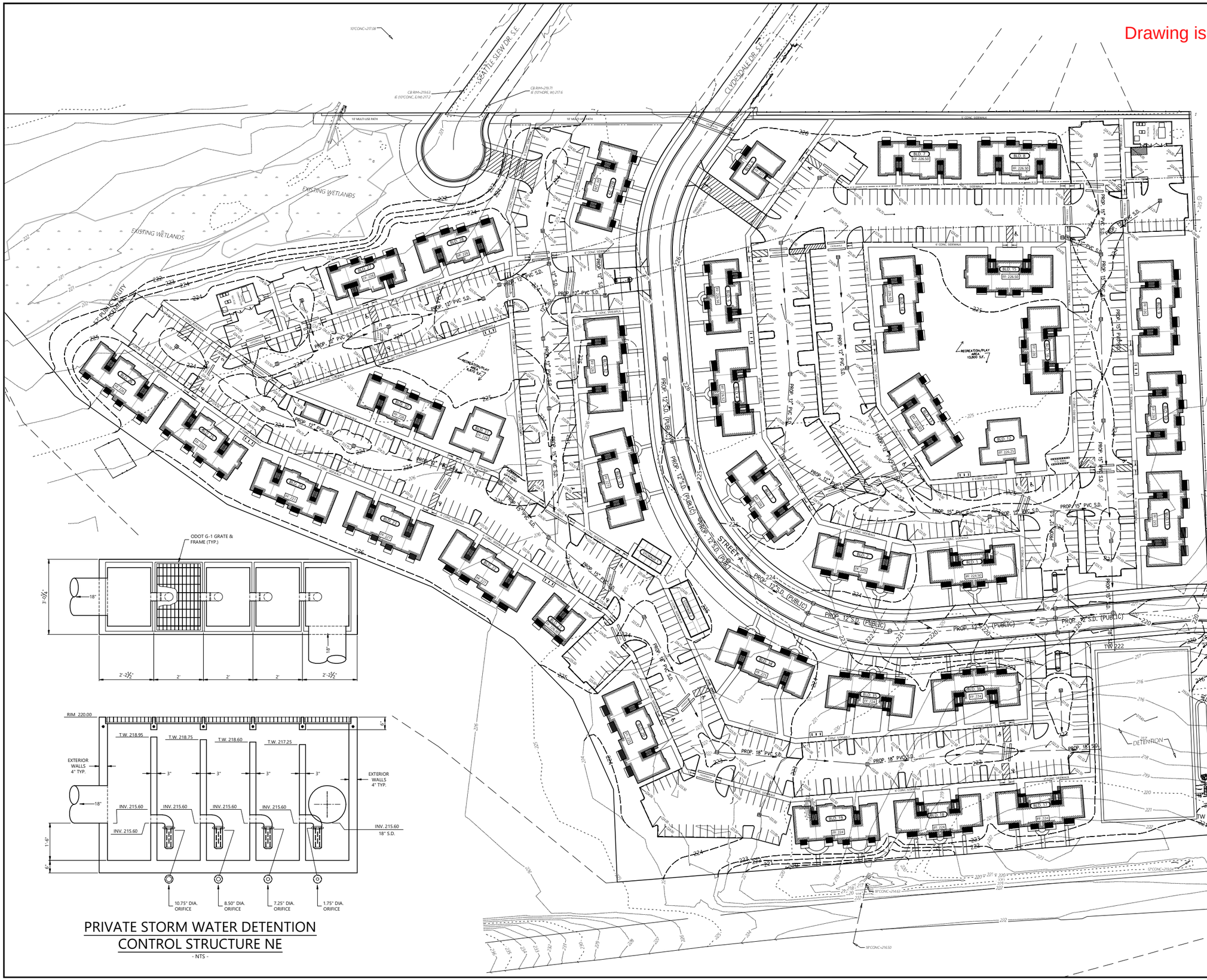
Drawing is NOT to scale



ODOT G-1 GRATE & FRAME (TYP.)

PRIVATE STORM WATER DETENTION
CONTROL STRUCTURE NE
- NTS -

MULTI/TECH
ENGINEERING SERVICES, INC.
1155 13th ST. S.E. SALEM, OR. 97302
PH. (503) 363-9227 FAX (503) 364-1260
www.cmtengineering.net office@cmtengineering.net

SCALE: 1" = 50'

DRAINAGE PLAN

HAWK'S RIDGE APARTMENTS PH. 3

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7314p SDR6-SD

Design: M.D.G.
Drawn: A.R.T.
Checked: B.M.G.
Date: SEPT. 2021
Scale: AS SHOWN

REGISTERED PROFESSIONAL ENGINEER
OREGON
JULY 14, 1978
MARK D. GRENZ
EXPIRES: 06-30-2023

JOB # 7314

SDR6

Appendix B

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Marion County Area, Oregon

Hawks Ridge Apts.

December 2, 2021

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:3,790 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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 Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

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 1, 2018—Aug 31, 2018

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Da	Dayton silt loam	2.6	9.4%
WuA	Woodburn silt loam, 0 to 3 percent slopes	25.2	90.6%
Totals for Area of Interest		**27.9**	**100.0%**

Soil Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group (Hawks Ridge Apts)

Map—Hydrologic Soil Group (Hawks Ridge Apts)

Map Scale: 1:3,790 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 50 100 200 300

Feet: 0 150 300 600 900

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 1, 2018—Aug 31, 2018

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

Table—Hydrologic Soil Group (Hawks Ridge Apts)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Da	Dayton silt loam	D	2.6	9.4%
WuA	Woodburn silt loam, 0 to 3 percent slopes	C	25.2	90.6%
Totals for Area of Interest			**27.9**	**100.0%**

Rating Options—Hydrologic Soil Group (Hawks Ridge Apts)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Appendix C

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)

Project	By	Date
Hawks Ridge Apts. Phase 3	C. O'Sullivan	11/2021
Location	**Checked**	**Date**
Salem, Oregon		

Check one: ☑ Present ☐ Developed

Check one: ☑ T_c ☐ T_t through subarea

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to Tc only)

Segment ID	A-B	
1. Surface description (Table 4D-4)	Pre-Developed Mixed	
2. Manning's roughness coefficient, n (Table 4D-4)	0.30	
3. Flow length, L (total L † 300 ft) ft	270	
4. Two-year 24-hour rainfall, P_2 in	2.2	
5. Land slope, s ft/ft	0.0056	
6. $T_t = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t hr	1.300	+ = 1.300

Shallow concentrated flow

Segment ID	B-C	C-D	
7. Surface description (paved or unpaved)	Cultivated crops	Cultivated crops	
8. Flow length, L ft	480	200	
9. Watercourse slope, s ft/ft	0.018	0.006	
10. Average velocity, V (figure 3-1) ft/s	1.2	0.65	
11. $T_t = \frac{L}{3600\ V}$ Compute T_t hr	0.111	+ 0.085	= 0.196

Channel flow

Segment ID		
12. Cross sectional flow area, a ft^2		
13. Wetted perimeter, p_w ft		
14. Hydraulic radius, $r = \frac{a}{p_w}$ Compute r ft		
15 Channel slope, s ft/ft		
16. Manning's roughness coefficient, n		
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V ft/s		
18. ~~Flow~~ length, L ft		
19. $T_t = \frac{L}{3600\ V}$ Compute T_t hr		+ =
20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) Hr		1.496

1.50 Hrs = 90 Minutes

Drawing is NOT to scale

N78°00'56"W 308.06'

S87°25'09"W 225.89'

S73°55'58"W 265.75'

S84°09'17"W 116.62'

N82°08'08"W 101.99'

N62°15'56"W 118.94'

N40°16'53"W 112.01'

N51°57'20"E 341.77'

S47°25'34"W 775.95'

Point A
Elev. 226.5

Point B
Elev. 225

Point C
Elev. 216.25

Point D
Elev. 215

L = 270'

L = 480'

L = 200'

SCALE: 1" = 50'

EXISTING WETLANDS

SEATTLE SLUM DR. S.E.

ELMOSDALE DR. S.E.

WHITAKER DR. S.E.

24" WATERLINE PER ASBUILT MAPPING

24" WATERLINE FIELD MARKED ANGLE POINT AT THIS LOCATION

8" WATERLINE PER ASBUILT MAPPING

24" WATERLINE FIELD MARKING STOPS AT THIS LOCATION

EXISTING CONDITIONS PLAN

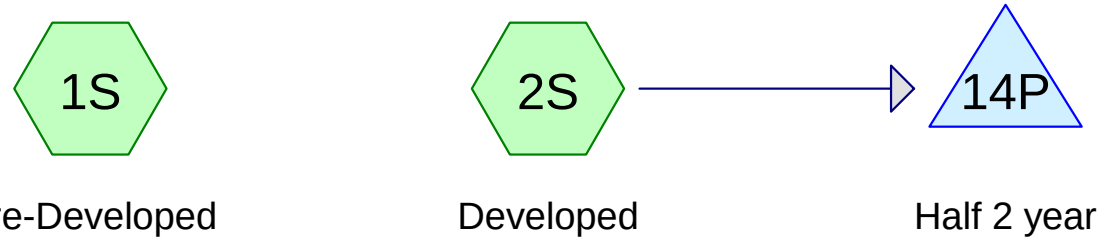
HAWK'S RIDGE APARTMENTS PH. 3

Design: M.D.G.
Drawn: A.R.T.
Checked: B.M.G.
Date: SEPT. 2021
Scale: AS SHOWN

JOB # 7314

SDR2

Appendix D



Subcat Reach Pond Link

Routing Diagram for Prelim HydroCAD Model
Prepared by Multi/Tech Engineering Services, Inc., Printed 2/4/2022

Summary for Subcatchment 1S: Pre-Developed

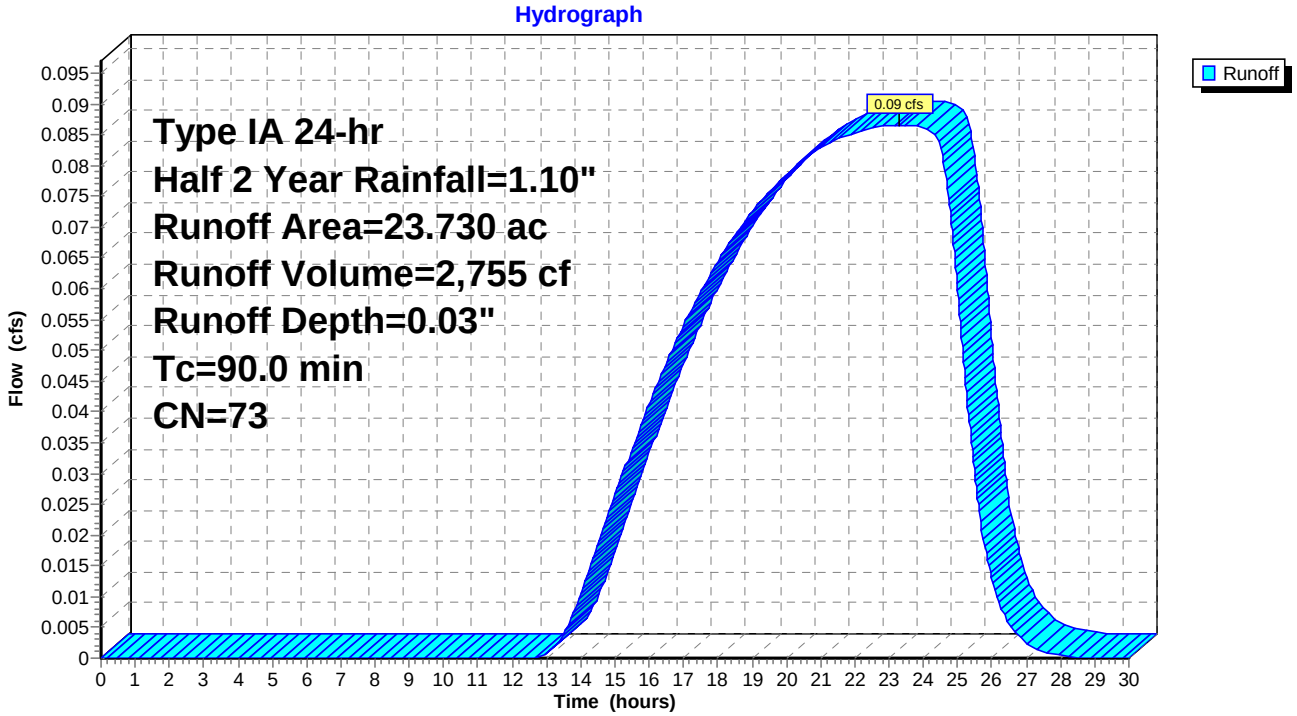
Runoff = 0.09 cfs @ 23.30 hrs, Volume= 2,755 cf, Depth= 0.03"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type IA 24-hr Half 2 Year Rainfall=1.10"

	Area (ac)	CN	Description
*	21.100	72	COS Pre-Developed, HSG C
*	2.630	79	COS Pre-Developed, HSG D
	23.730	73	Weighted Average
	23.730		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
90.0					**Direct Entry, TR-55 Worksheet**

Subcatchment 1S: Pre-Developed



Summary for Subcatchment 2S: Developed

Impervious and total area from AutoCAD

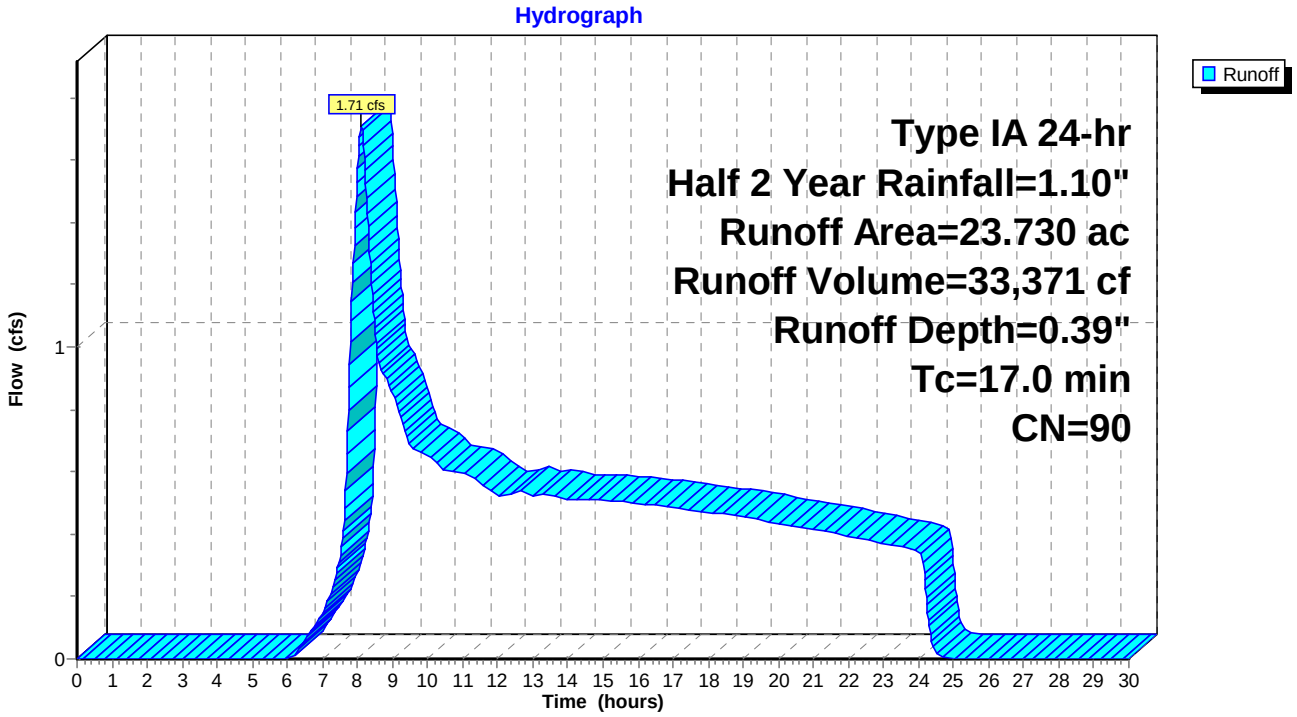
Runoff = 1.71 cfs @ 8.11 hrs, Volume= 33,371 cf, Depth= 0.39"
Routed to Pond 14P : Half 2 year

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type IA 24-hr Half 2 Year Rainfall=1.10"

Area (ac)	CN	Description
15.130	98	Paved parking, HSG D
0.860	80	>75% Grass cover, Good, HSG D
7.740	74	>75% Grass cover, Good, HSG C
23.730	90	Weighted Average
8.600		36.24% Pervious Area
15.130		63.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0					**Direct Entry, Direct Entry**

Subcatchment 2S: Developed



Summary for Pond 14P: Half 2 year

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 1,033,679 sf, 63.76% Impervious, Inflow Depth = 0.39" for Half 2 Year event
Inflow = 1.71 cfs @ 8.11 hrs, Volume= 33,371 cf
Outflow = 0.09 cfs @ 24.32 hrs, Volume= 6,048 cf, Atten= 95%, Lag= 972.3 min
Primary = 0.09 cfs @ 24.32 hrs, Volume= 6,048 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Peak Elev= 216.97' @ 24.32 hrs Surf.Area= 22,434 sf Storage= 29,132 cf

Plug-Flow detention time= 723.1 min calculated for 6,043 cf (18% of inflow)
Center-of-Mass det. time= 347.1 min (1,209.5 - 862.3)

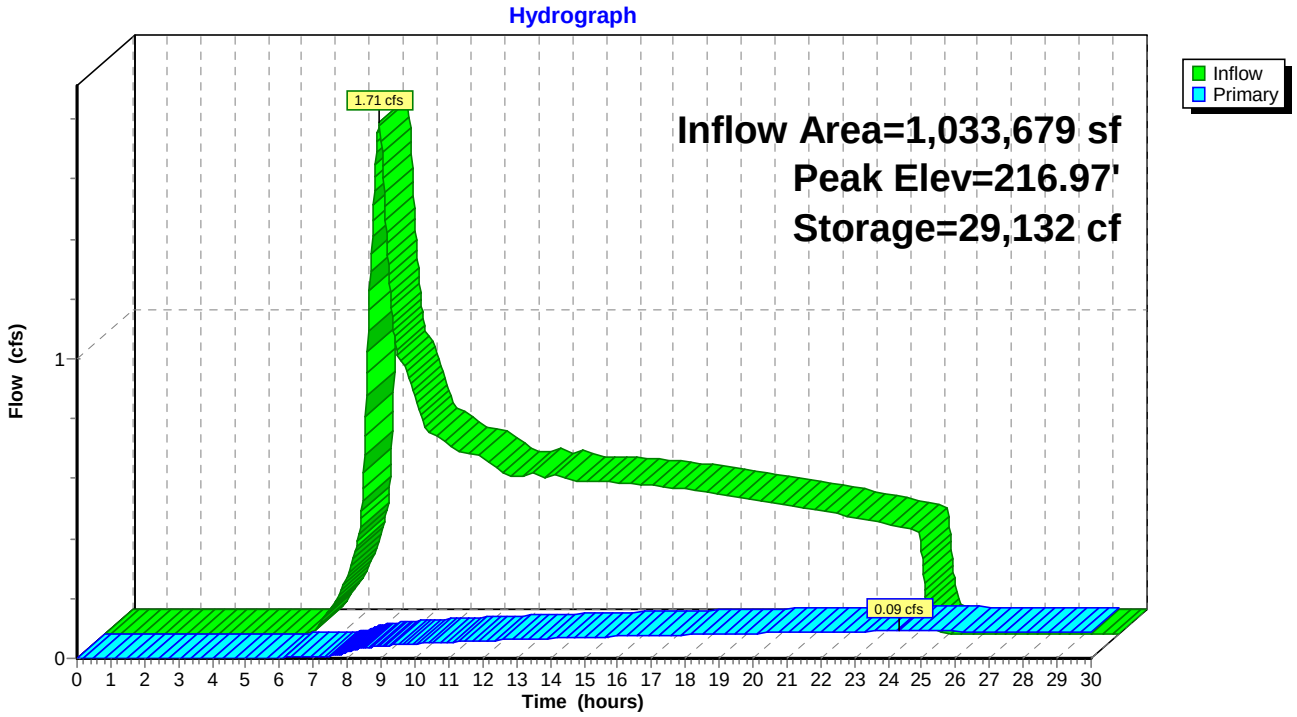
Volume	Invert	Avail.Storage	Storage Description
#1	215.65'	95,868 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	215.66'	839 cf	**18.000" Round Pipe Storage** L= 475.0' S= 0.0035 '/'
		96,708 cf	Total Available Storage

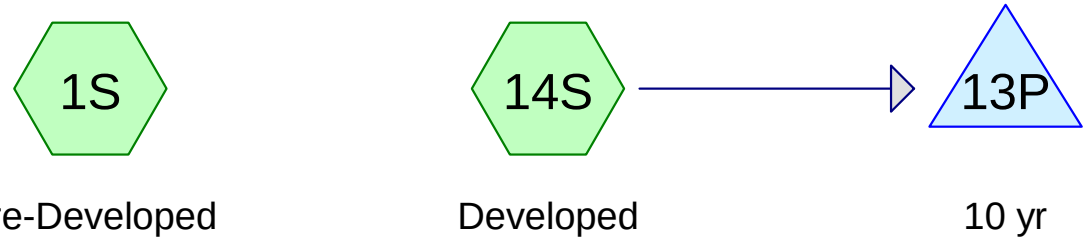
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
215.65	21,855	0	0
216.00	21,887	7,655	7,655
217.00	21,970	21,929	29,583
218.00	22,053	22,012	51,595
219.00	22,137	22,095	73,690
220.00	22,220	22,179	95,868

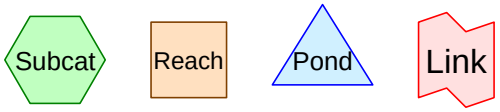
Device	Routing	Invert	Outlet Devices
#1	Primary	215.60'	**18.000" Round Culvert** L= 12.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 215.60' / 215.58' S= 0.0017 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	215.60'	**1.750" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	217.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.09 cfs @ 24.32 hrs HW=216.97' (Free Discharge)
└**1=Culvert** (Passes 0.09 cfs of 5.49 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.09 cfs @ 5.48 fps)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 14P: Half 2 year







Routing Diagram for Prelim HydroCAD Model
Prepared by Multi/Tech Engineering Services, Inc., Printed 2/4/2022

Summary for Subcatchment 1S: Pre-Developed

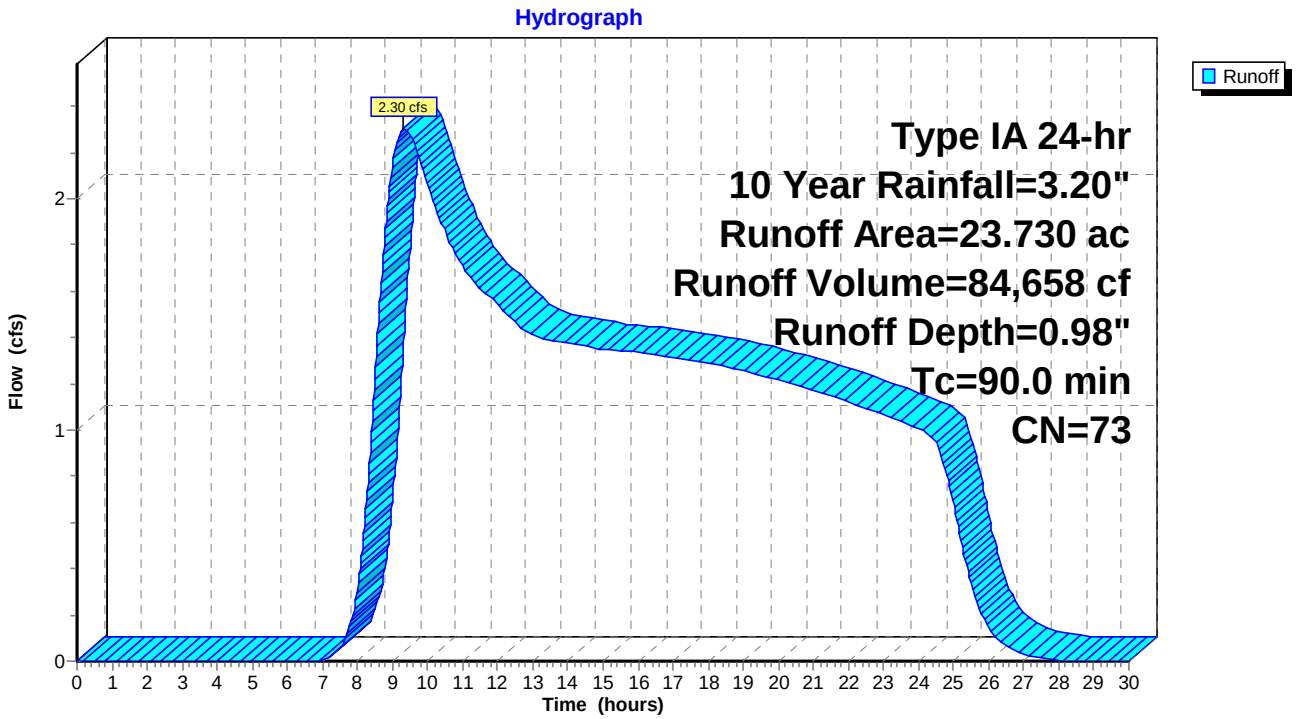
Runoff = 2.30 cfs @ 9.31 hrs, Volume= 84,658 cf, Depth= 0.98"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type IA 24-hr 10 Year Rainfall=3.20"

	Area (ac)	CN	Description
*	21.100	72	COS Pre-Developed, HSG C
*	2.630	79	COS Pre-Developed, HSG D
	23.730	73	Weighted Average
	23.730		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
90.0					**Direct Entry, TR-55 Worksheet**

Subcatchment 1S: Pre-Developed



Summary for Subcatchment 14S: Developed

Impervious and total area from AutoCAD

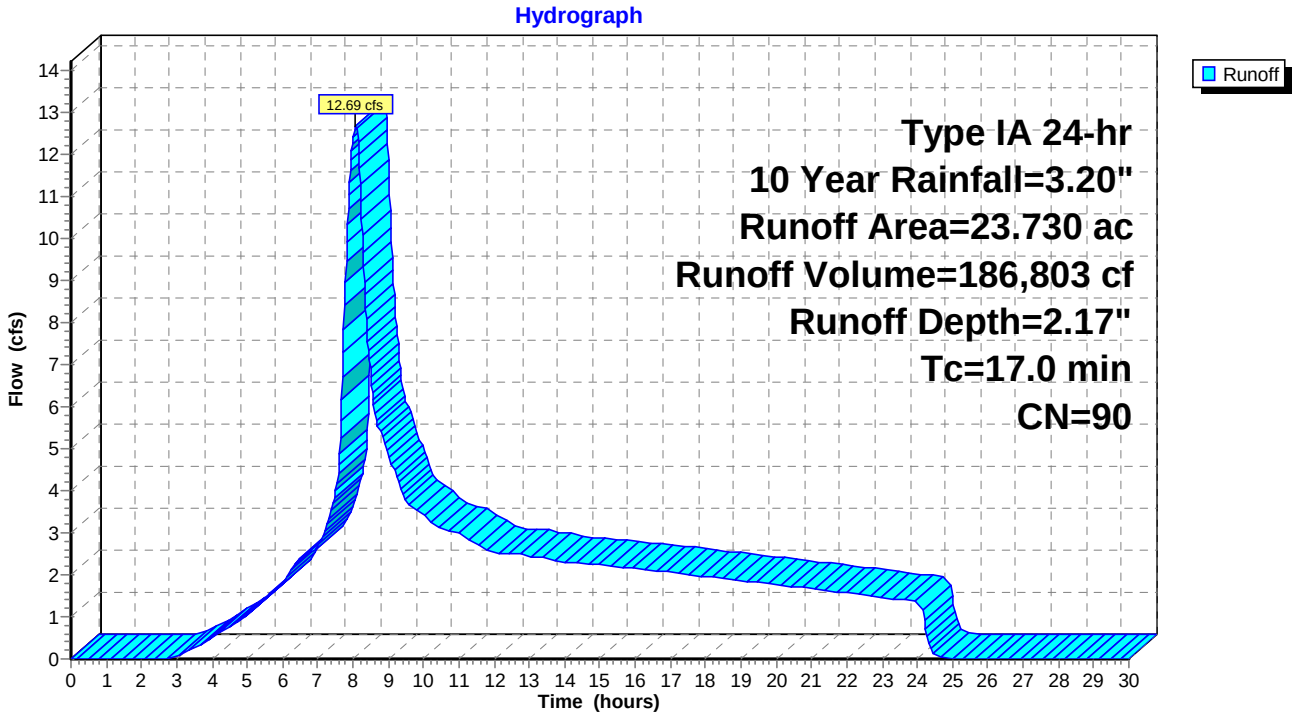
Runoff = 12.69 cfs @ 8.07 hrs, Volume= 186,803 cf, Depth= 2.17"
Routed to Pond 13P : 10 yr

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type IA 24-hr 10 Year Rainfall=3.20"

Area (ac)	CN	Description
15.130	98	Paved parking, HSG D
0.860	80	>75% Grass cover, Good, HSG D
7.740	74	>75% Grass cover, Good, HSG C
23.730	90	Weighted Average
8.600		36.24% Pervious Area
15.130		63.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0					**Direct Entry, Direct Entry**

Subcatchment 14S: Developed



Summary for Pond 13P: 10 yr

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 1,033,679 sf, 63.76% Impervious, Inflow Depth = 2.17" for 10 Year event
Inflow = 12.69 cfs @ 8.07 hrs, Volume= 186,803 cf
Outflow = 2.26 cfs @ 14.70 hrs, Volume= 166,461 cf, Atten= 82%, Lag= 397.9 min
Primary = 2.26 cfs @ 14.70 hrs, Volume= 166,461 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Peak Elev= 218.59' @ 14.70 hrs Surf.Area= 22,153 sf Storage= 65,367 cf

Plug-Flow detention time= 383.9 min calculated for 166,461 cf (89% of inflow)
Center-of-Mass det. time= 312.7 min (1,070.3 - 757.5)

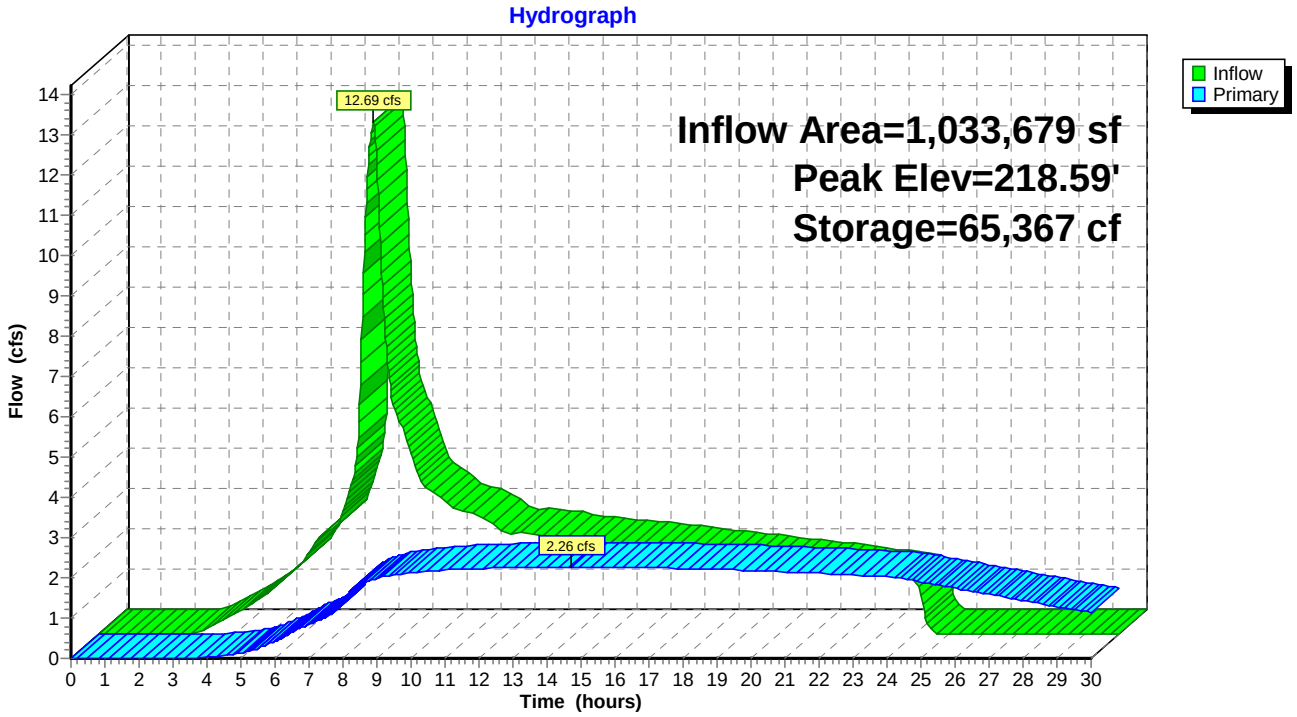
Volume	Invert	Avail.Storage	Storage Description
#1	215.65'	95,868 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	215.66'	839 cf	**18.000" Round Pipe Storage** L= 475.0' S= 0.0035 '/'
		96,708 cf	Total Available Storage

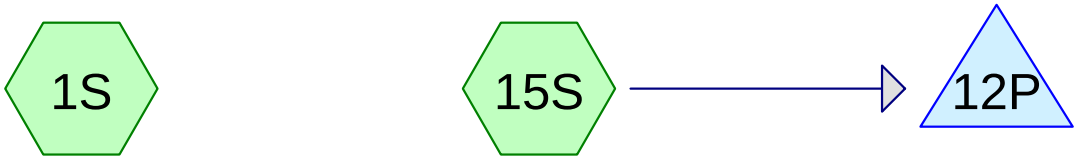
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
215.65	21,855	0	0
216.00	21,887	7,655	7,655
217.00	21,970	21,929	29,583
218.00	22,053	22,012	51,595
219.00	22,137	22,095	73,690
220.00	22,220	22,179	95,868

Device	Routing	Invert	Outlet Devices
#1	Primary	215.60'	**18.000" Round Culvert** L= 12.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 215.60' / 215.58' S= 0.0017 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	215.60'	**7.250" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	218.60'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=2.26 cfs @ 14.70 hrs HW=218.59' (Free Discharge)
└**1=Culvert** (Passes 2.26 cfs of 15.15 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 2.26 cfs @ 7.89 fps)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 13P: 10 yr





Pre-Developed

Developed

25 yr

Subcat Reach Pond Link

Routing Diagram for Prelim HydroCAD Model

Prepared by Multi/Tech Engineering Services, Inc., Printed 2/4/2022

Summary for Subcatchment 1S: Pre-Developed

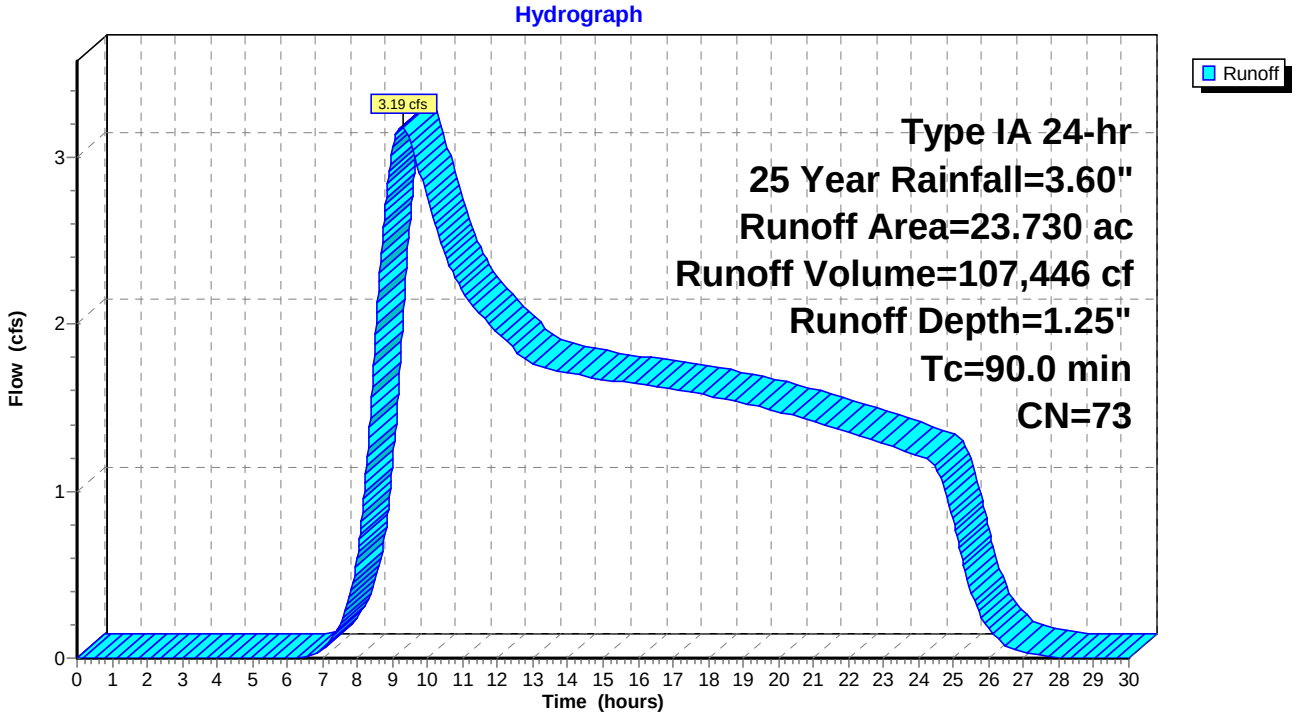
Runoff = 3.19 cfs @ 9.29 hrs, Volume= 107,446 cf, Depth= 1.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type IA 24-hr 25 Year Rainfall=3.60"

	Area (ac)	CN	Description
*	21.100	72	COS Pre-Developed, HSG C
*	2.630	79	COS Pre-Developed, HSG D
	23.730	73	Weighted Average
	23.730		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
90.0					**Direct Entry, TR-55 Worksheet**

Subcatchment 1S: Pre-Developed



Summary for Subcatchment 15S: Developed

Impervious and total area from AutoCAD

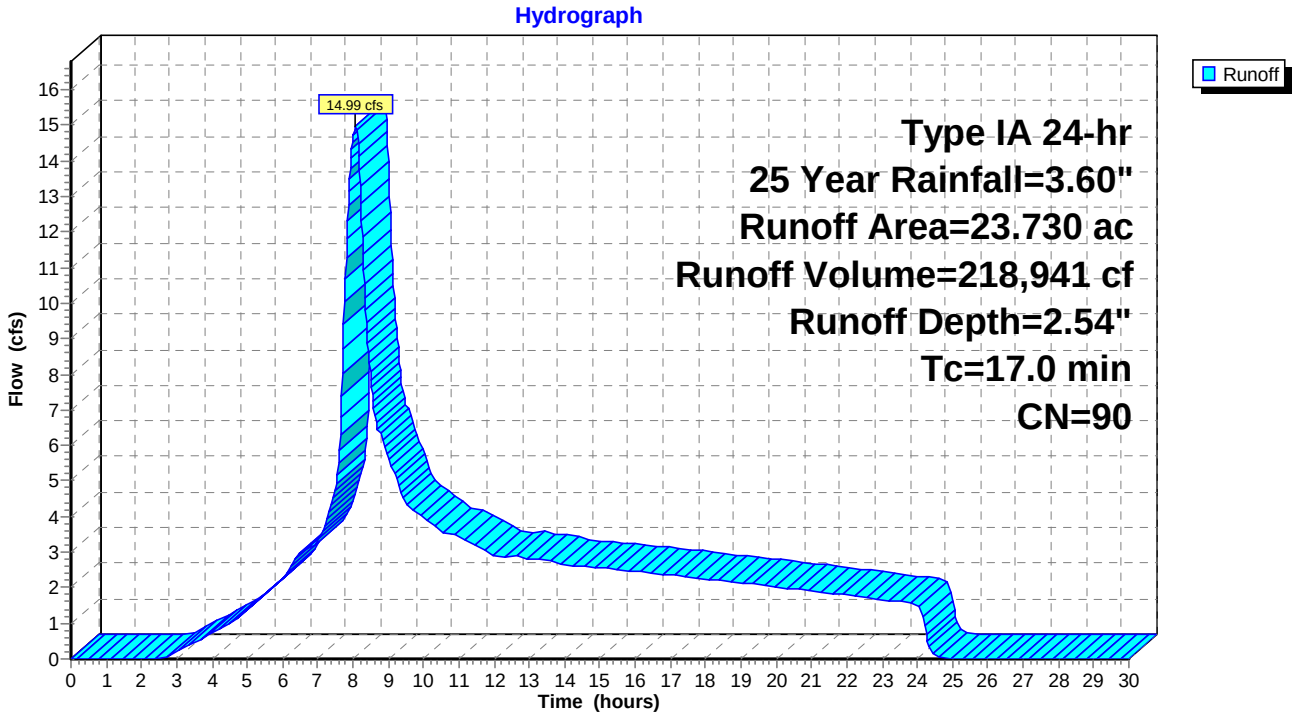
Runoff = 14.99 cfs @ 8.06 hrs, Volume= 218,941 cf, Depth= 2.54"
Routed to Pond 12P : 25 yr

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type IA 24-hr 25 Year Rainfall=3.60"

Area (ac)	CN	Description
15.130	98	Paved parking, HSG D
0.860	80	>75% Grass cover, Good, HSG D
7.740	74	>75% Grass cover, Good, HSG C
23.730	90	Weighted Average
8.600		36.24% Pervious Area
15.130		63.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0					**Direct Entry, Direct Entry**

Subcatchment 15S: Developed



Summary for Pond 12P: 25 yr

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 1,033,679 sf, 63.76% Impervious, Inflow Depth = 2.54" for 25 Year event
Inflow = 14.99 cfs @ 8.06 hrs, Volume= 218,941 cf
Outflow = 3.12 cfs @ 11.61 hrs, Volume= 209,491 cf, Atten= 79%, Lag= 212.7 min
Primary = 3.12 cfs @ 11.61 hrs, Volume= 209,491 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Peak Elev= 218.65' @ 11.61 hrs Surf.Area= 22,140 sf Storage= 66,810 cf

Plug-Flow detention time= 298.6 min calculated for 209,351 cf (96% of inflow)
Center-of-Mass det. time= 269.0 min (1,018.1 - 749.1)

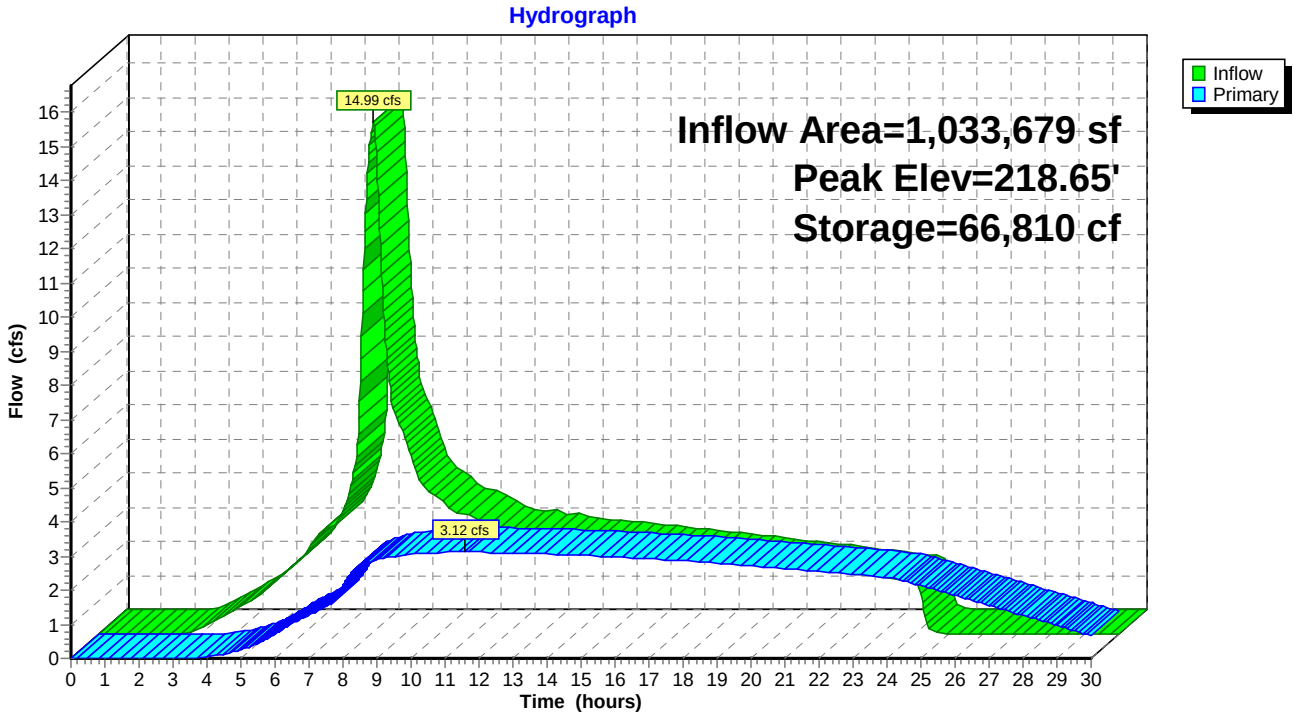
Volume	Invert	Avail.Storage	Storage Description
#1	215.65'	95,868 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	215.66'	839 cf	**18.000" Round Pipe Storage** L= 475.0' S= 0.0035 '/'
		96,708 cf	Total Available Storage

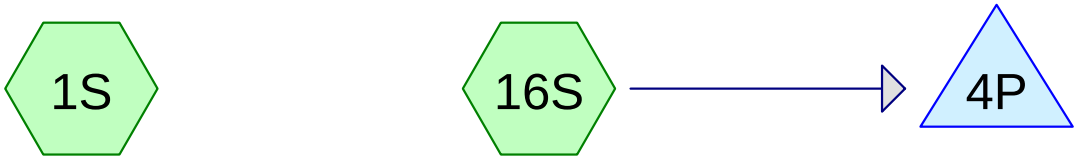
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
215.65	21,855	0	0
216.00	21,887	7,655	7,655
217.00	21,970	21,929	29,583
218.00	22,053	22,012	51,595
219.00	22,137	22,095	73,690
220.00	22,220	22,179	95,868

Device	Routing	Invert	Outlet Devices
#1	Primary	215.60'	**18.000" Round Culvert** L= 12.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 215.60' / 215.58' S= 0.0017 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	215.60'	**8.500" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	218.75'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=3.12 cfs @ 11.61 hrs HW=218.65' (Free Discharge)
└**1=Culvert** (Passes 3.12 cfs of 15.47 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 3.12 cfs @ 7.91 fps)
└**3=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 12P: 25 yr





Pre-Developed

Developed

100 yr

Subcat Reach Pond Link

Routing Diagram for Prelim HydroCAD Model

Prepared by Multi/Tech Engineering Services, Inc., Printed 2/4/2022

Summary for Subcatchment 1S: Pre-Developed

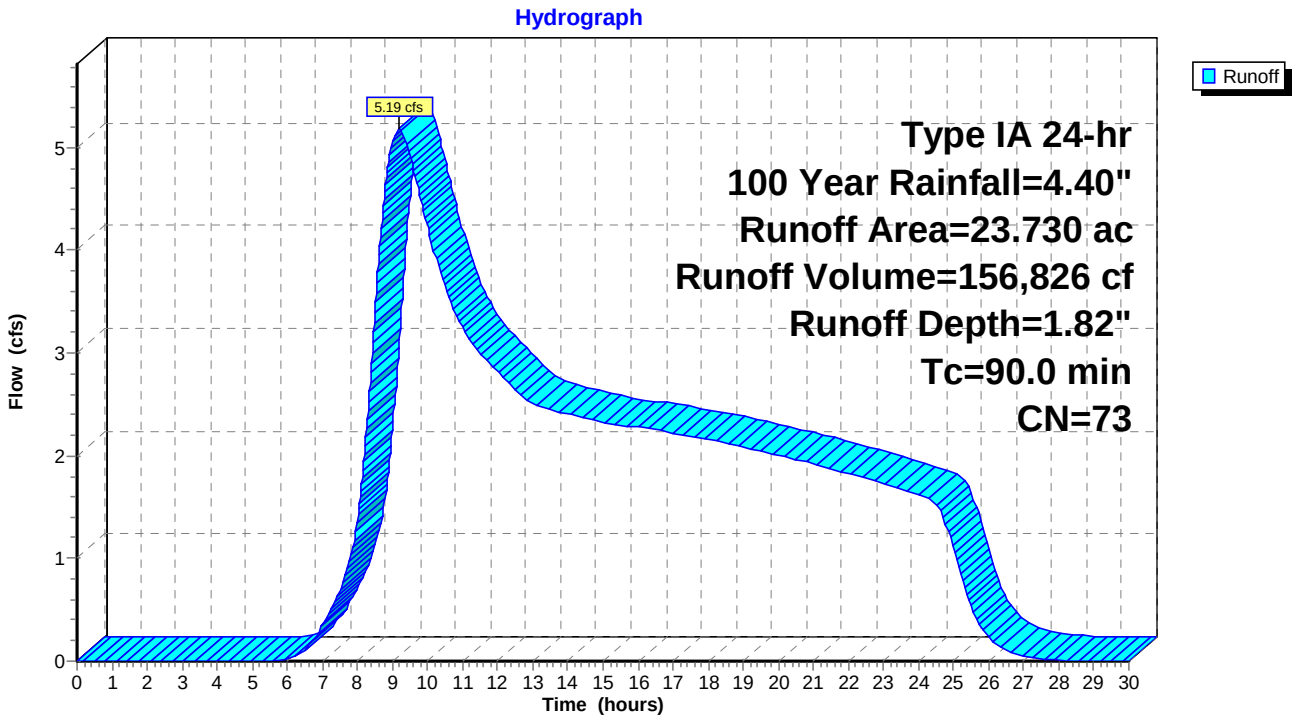
Runoff = 5.19 cfs @ 9.19 hrs, Volume= 156,826 cf, Depth= 1.82"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type IA 24-hr 100 Year Rainfall=4.40"

	Area (ac)	CN	Description
*	21.100	72	COS Pre-Developed, HSG C
*	2.630	79	COS Pre-Developed, HSG D
	23.730	73	Weighted Average
	23.730		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
90.0					**Direct Entry, TR-55 Worksheet**

Subcatchment 1S: Pre-Developed



Summary for Subcatchment 16S: Developed

Impervious and total area from AutoCAD

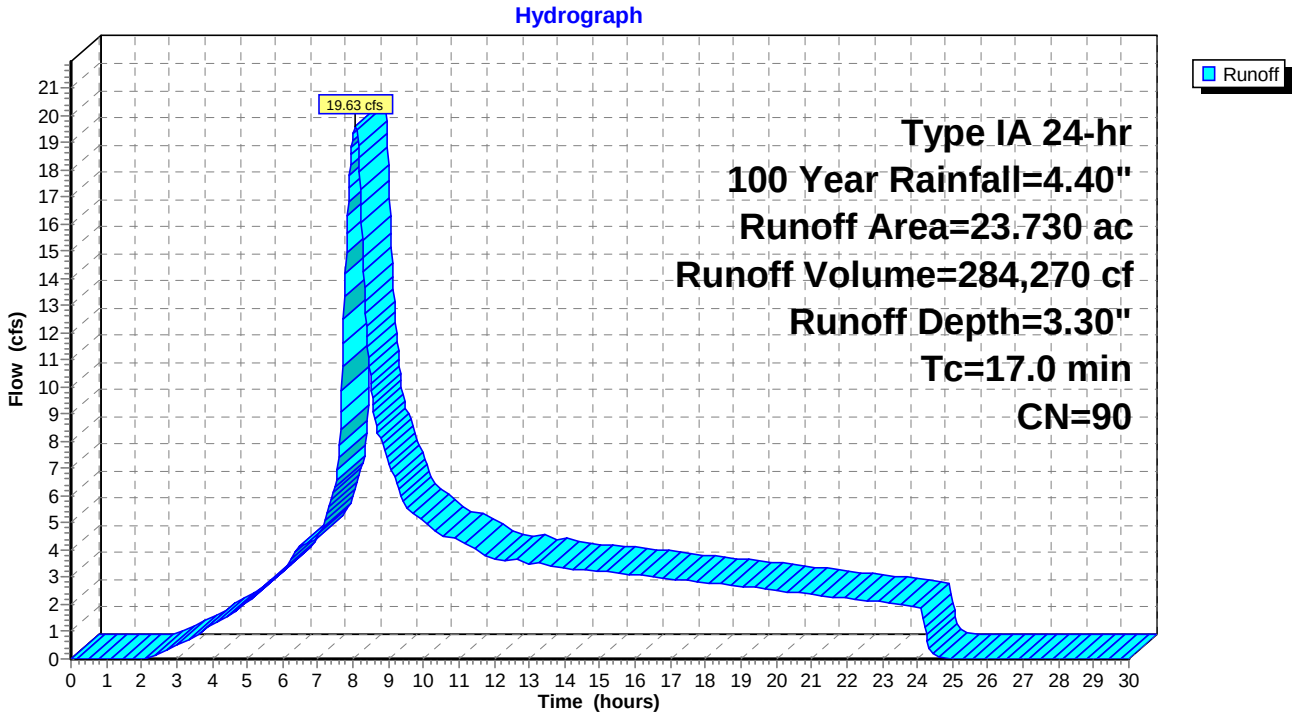
Runoff = 19.63 cfs @ 8.06 hrs, Volume= 284,270 cf, Depth= 3.30"
Routed to Pond 4P : 100 yr

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type IA 24-hr 100 Year Rainfall=4.40"

Area (ac)	CN	Description
15.130	98	Paved parking, HSG D
0.860	80	>75% Grass cover, Good, HSG D
7.740	74	>75% Grass cover, Good, HSG C
23.730	90	Weighted Average
8.600		36.24% Pervious Area
15.130		63.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0					**Direct Entry, Direct Entry**

Subcatchment 16S: Developed



Summary for Pond 4P: 100 yr

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 1,033,679 sf, 63.76% Impervious, Inflow Depth = 3.30" for 100 Year event
Inflow = 19.63 cfs @ 8.06 hrs, Volume= 284,270 cf
Outflow = 5.16 cfs @ 9.90 hrs, Volume= 279,587 cf, Atten= 74%, Lag= 110.5 min
Primary = 5.16 cfs @ 9.90 hrs, Volume= 279,587 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Peak Elev= 218.92' @ 9.90 hrs Surf.Area= 22,130 sf Storage= 72,661 cf

Plug-Flow detention time= 195.6 min calculated for 279,587 cf (98% of inflow)
Center-of-Mass det. time= 183.9 min (919.7 - 735.8)

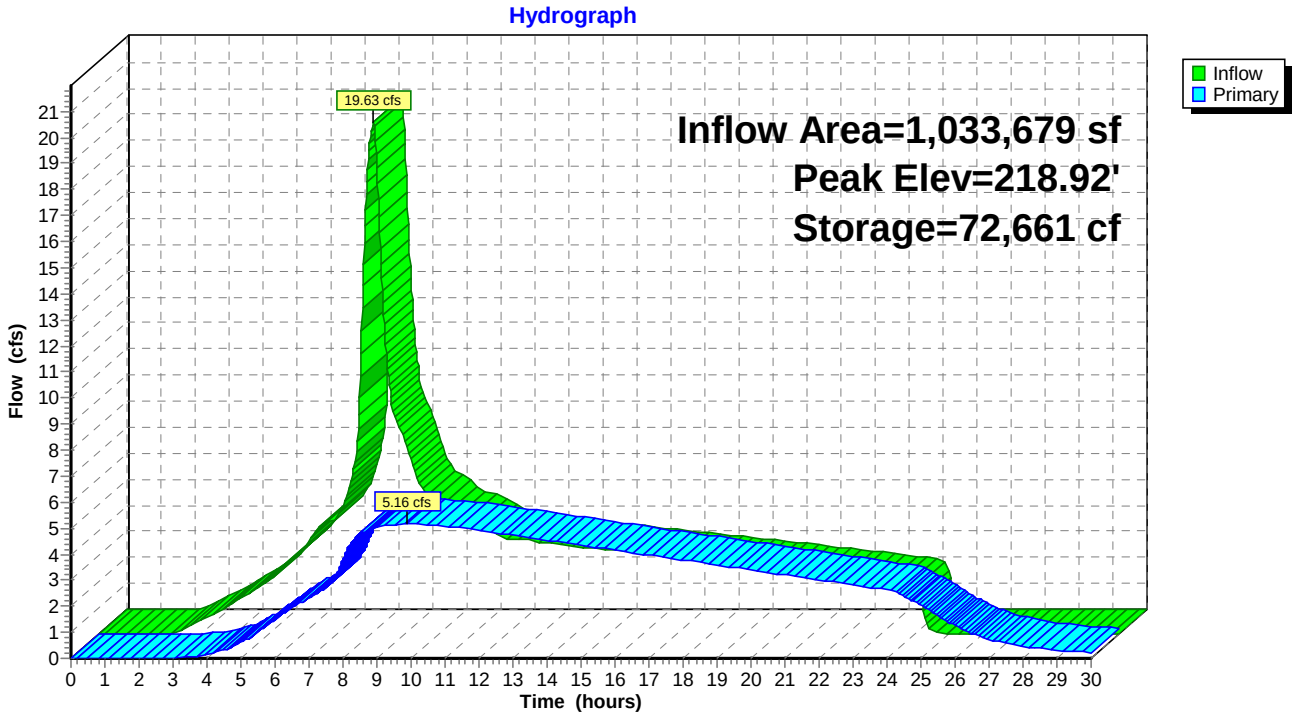
Volume	Invert	Avail.Storage	Storage Description
#1	215.65'	95,868 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	215.66'	839 cf	**18.000" Round Pipe Storage** L= 475.0' S= 0.0035 '/'
		96,708 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
215.65	21,855	0	0
216.00	21,887	7,655	7,655
217.00	21,970	21,929	29,583
218.00	22,053	22,012	51,595
219.00	22,137	22,095	73,690
220.00	22,220	22,179	95,868

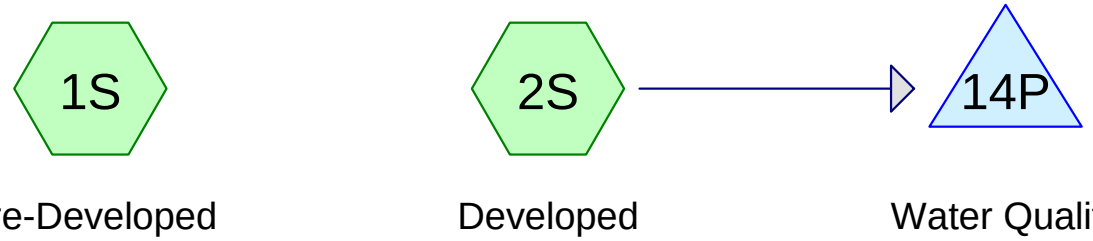
Device	Routing	Invert	Outlet Devices
#1	Primary	215.60'	**18.000" Round Culvert** L= 12.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 215.60' / 215.58' S= 0.0017 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	215.60'	**10.750" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	218.90'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

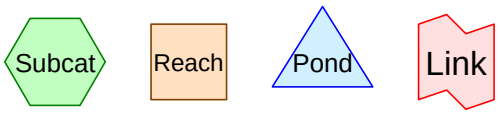
Primary OutFlow Max=5.16 cfs @ 9.90 hrs HW=218.92' (Free Discharge)
↑—**1=Culvert** (Passes 5.16 cfs of 16.73 cfs potential flow)
↑—**2=Orifice/Grate** (Orifice Controls 5.14 cfs @ 8.15 fps)
—**3=Broad-Crested Rectangular Weir** (Weir Controls 0.02 cfs @ 0.35 fps)

Pond 4P: 100 yr



Appendix E





Routing Diagram for Prelim HydroCAD Model

Prepared by Multi/Tech Engineering Services, Inc., Printed 2/4/2022

Summary for Subcatchment 1S: Pre-Developed

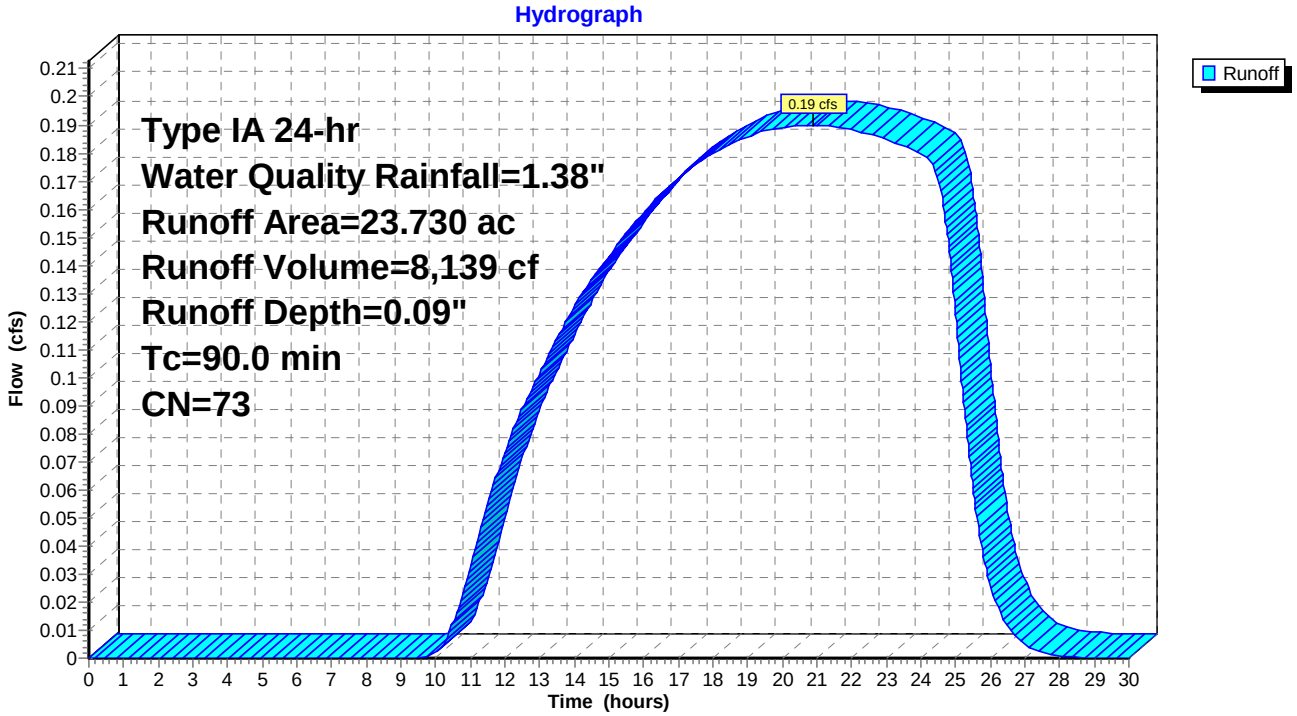
Runoff = 0.19 cfs @ 20.90 hrs, Volume= 8,139 cf, Depth= 0.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

	Area (ac)	CN	Description
*	21.100	72	COS Pre-Developed, HSG C
*	2.630	79	COS Pre-Developed, HSG D
	23.730	73	Weighted Average
	23.730		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
90.0					**Direct Entry, TR-55 Worksheet**

Subcatchment 1S: Pre-Developed



Summary for Subcatchment 2S: Developed

Impervious and total area from AutoCAD

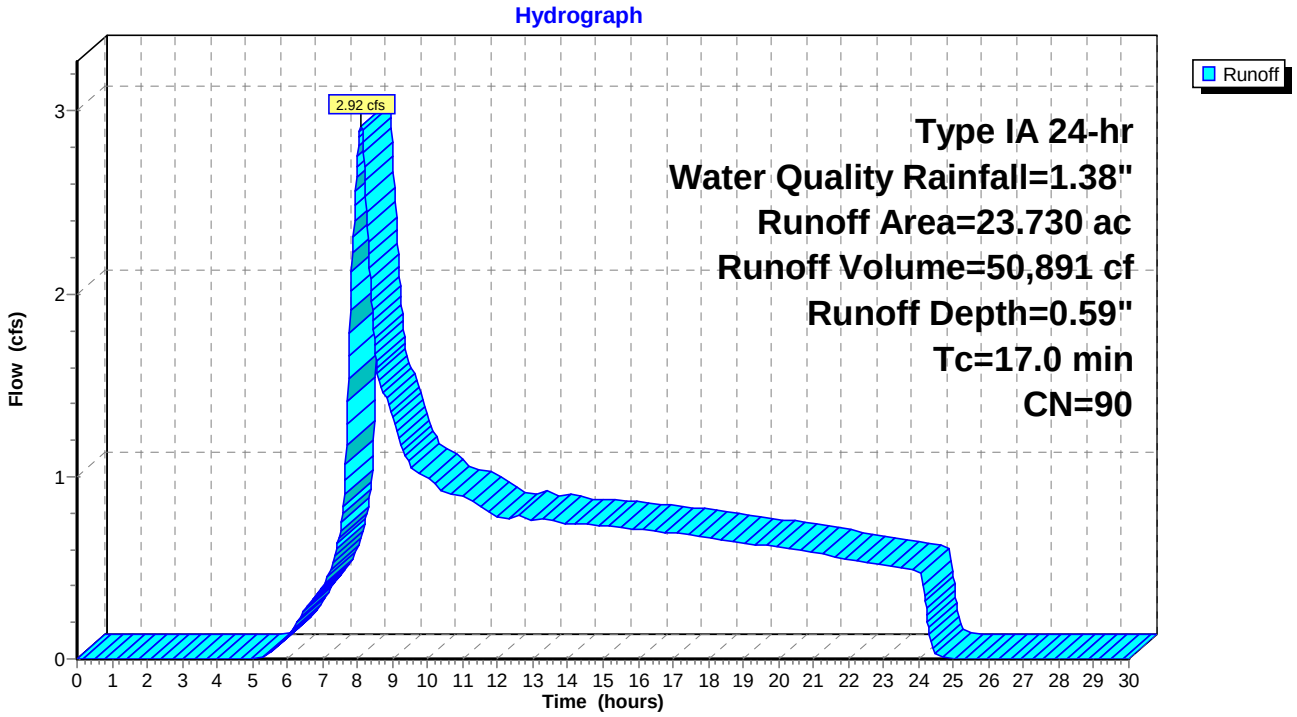
Runoff = 2.92 cfs @ 8.10 hrs, Volume= 50,891 cf, Depth= 0.59"
Routed to Pond 14P : Water Quality

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Type IA 24-hr Water Quality Rainfall=1.38"

Area (ac)	CN	Description
15.130	98	Paved parking, HSG D
0.860	80	>75% Grass cover, Good, HSG D
7.740	74	>75% Grass cover, Good, HSG C
23.730	90	Weighted Average
8.600		36.24% Pervious Area
15.130		63.76% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.0					**Direct Entry, Direct Entry**

Subcatchment 2S: Developed



Summary for Pond 14P: Water Quality

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 1,033,679 sf, 63.76% Impervious, Inflow Depth = 0.59" for Water Quality event
Inflow = 2.92 cfs @ 8.10 hrs, Volume= 50,891 cf
Outflow = 0.63 cfs @ 19.43 hrs, Volume= 21,765 cf, Atten= 79%, Lag= 680.1 min
Primary = 0.63 cfs @ 19.43 hrs, Volume= 21,765 cf

Routing by Dyn-Stor-Ind method, Time Span= 0.00-30.00 hrs, dt= 0.02 hrs
Peak Elev= 217.13' @ 19.43 hrs Surf.Area= 22,484 sf Storage= 32,818 cf

Plug-Flow detention time= 677.6 min calculated for 21,765 cf (43% of inflow)
Center-of-Mass det. time= 385.7 min (1,220.3 - 834.7)

Volume	Invert	Avail.Storage	Storage Description
#1	215.65'	95,868 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)
#2	215.66'	839 cf	**18.000" Round Pipe Storage** L= 475.0' S= 0.0035 '/'
		96,708 cf	Total Available Storage

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
215.65	21,855	0	0
216.00	21,887	7,655	7,655
217.00	21,970	21,929	29,583
218.00	22,053	22,012	51,595
219.00	22,137	22,095	73,690
220.00	22,220	22,179	95,868

Device	Routing	Invert	Outlet Devices
#1	Primary	215.60'	**18.000" Round Culvert** L= 12.0' RCP, rounded edge headwall, Ke= 0.100 Inlet / Outlet Invert= 215.60' / 215.58' S= 0.0017 '/' Cc= 0.900 n= 0.013, Flow Area= 1.77 sf
#2	Device 1	215.60'	**1.750" Vert. Orifice/Grate** C= 0.600 Limited to weir flow at low heads
#3	Device 1	217.00'	**4.0' long x 0.5' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 Coef. (English) 2.80 2.92 3.08 3.30 3.32

Primary OutFlow Max=0.63 cfs @ 19.43 hrs HW=217.13' (Free Discharge)
└**1=Culvert** (Passes 0.63 cfs of 6.56 cfs potential flow)
└**2=Orifice/Grate** (Orifice Controls 0.10 cfs @ 5.81 fps)
└**3=Broad-Crested Rectangular Weir** (Weir Controls 0.53 cfs @ 1.01 fps)

Pond 14P: Water Quality