Joint Permit Application

This is a joint application, and must be sent to both agencies, who administer separate permit programs. Alternative forms of permit applications may be acceptable; contact the Corps and DSL for more information.

DATE STAMP

U.S. Army Corps of Engineers Portland District	Oregon Department of State Lands	Oregon Department of Environmental Quality
Action ID Number	DSL Number	

(1) TYPE OF PERMIT(S) IF KNOWN (check all that apply)

Corps: ☐ Individual ☒ Nationwide No.: 29 ☐ Regional General ☐ Other (Specify)

DSL: ☒ Individual ☐ GP Trans ☐ GP Min Wet ☐ GP Maint Dredge ☐ GP Ocean Energy ☐ No Permit ☐ Waiver

(2) APPLICANT AND LANDOWNER CONTACT INFORMATION

	Applicant	Property Owner (if different)	Authorized Agent (if applicable) ☒ Consultant ☐ Contractor
Name (Required) Business Name Mailing Address 1 Mailing Address 2 City, State, Zip	Don Jensen Jensen Consulting and Development LLC 5190 Kale St NE Salem, OR 97305		John van Staveren Pacific Habitat Services, Inc. 9450 SW Commerce Circle, Suite 180 Wilsonville, OR 97070
Business Phone Cell Phone Fax Email	503-364-4004		503-570-0800 503-570-0855 jvs@pacifichabitat.com

(3) PROJECT INFORMATION

A. Provide the project location

Project Name	Latitude & Longitude*
Belle Plaine Estates	44.938896/-122.971441

Project Address / Location	City (nearest)	County
4560 Center Street NE	Salem	Marion

Township	Range	Section	Quarter/Quarter	Tax Lot
7S	2W	30 AA	NE ¼, NE ¼	8000

Brief Directions to the Site:

From DSL office: go south on Summer Street NE; turn left onto Center St. NE; the site is about 1 mile east of I-5, on the right (across from Sphinx Court).

From I-5: Take exit 256 (Market Street exit) turn east on Market to 45th Avenue NE, turn south until Center Street, turn east on Center Street. Property will be on the right (south side) of street.

B. What types of waterbodies or wetlands are present in your project area? (Check all that apply.)

☐ River / Stream ☒ Non-Tidal Wetland ☐ Lake / Reservoir / Pond

☐ Estuary or Tidal Wetland ☐ Other ☐ Pacific Ocean

Waterbody or Wetland Name**	River Mile	6th Field HUC Name	6th Field HUC (*12 digits*)
Wetland A and Wetland B	n/a	Upper Little Pudding River	170900090108

* In decimal format (e.g., 44.9399, -123.0283)

** If there is no official name for the wetland or waterbody, create a unique name (such as "Wetland 1" or "Tributary A").

C. Indicate the project category. (check all that apply.)		
☐ Commercial Development	☐ Industrial Development	☒ Residential Development
☐ Institutional Development	☐ Agricultural	☐ Recreational
☐ Transportation	☐ Restoration	☐ Bridge
☐ Dredging	☐ Utility lines	☐ Survey or Sampling
☐ In- or Over-Water Structure	☐ Maintenance	☐ Other:

(4) PROJECT DESCRIPTION

A. Summarize the overall project, including work in areas both in and outside of waters or wetlands.

The project is a proposed development is a subdivision in the City of Salem along Center Street NE (Figures 1-3; all Figures are in Attachment 1 and listed in Table 1 below). This subdivision development proposes approximately 24 lots that will include flat, buildable areas for single-family homes, front and back yards, as well as driveways. A new road will connect Center Street NE to 46th Avenue NE, providing two ingress/egress points for the homes and for emergency vehicles (fire, ambulance, police). Figure 4 shows existing site conditions, while Figure 5 shows the proposed site plan.

To meet SLOPES V criteria, stormwater from the new impervious surfaces will be directed into an on-site stormwater facility (detention pond), and all stormwater from impervious surfaces will be treated prior to discharging into the City of Salem's stormwater treatment system. An analysis of the downstream systems has shown that they have adequate capacity to convey the proposed runoff, however, SLOPES V criteria requires a stormwater detention pond be constructed on the site. The stormwater plan will also adhere to City of Salem's stormwater requirements. Figure 6 shows the stormwater plan and Attachment 2* (Corps and DEQ only) contains the stormwater report from Project Development Group. Currently, stormwater flows into Wetland A via an outfall culvert at 46th Avenue NE. The development as proposed will not capture this stormwater for treatment; rather, it will be piped underneath the new development, and outfall into Wetland A as under existing conditions.

Table 1. Figures and Attachments

Attachment 1 – Figures			
Figure	**Description**	**Figure**	**Description**
1	Location Maps (USGS and Road)	7	Grading Plan and Cross Section Locations
2	Tax Lot Map	7A	Cross Sections
3	Recent Aerial Photo	8	Erosion Control Plan
4	Existing Conditions	9A	Alternative Site Plan 1
5	Proposed Site Plan	9B	Alternative Site Plan 2
6	Stormwater Plan		
Attachment 2 – Stormwater Report (Corps and DEQ)			
Attachment 3 – ORWAP Assessment			
Attachment 4 – Mitigation Accountability and Eligibility Worksheet			

B. Describe work within waters and wetlands

Construction of the proposed lots for single family homes and new roads will result in permanent impacts to Wetlands A and B (see below and removal/fill table for individual wetland impacts) for a total of 0.36 acres, with 801 cubic yards of fill, consisting of rock and gravel.

Wetland A	New lots (#15, 16, and 17 and new road) and stormwater outfall
Wetland B	New road

* Only being provided to Corps of Engineers and DEQ, as DSL neither needs nor wants it.

C. Construction Methods. Describe how the removal and/or fill activities will be accomplished to minimize impacts to waters and wetlands.

Construction access to the site will be from Center Street NE and 46th Avenue NE (Figure 8). The construction entrances will be installed at the beginning of construction and maintained for the duration of the project. A staging/stockpile area will be located on the east side of the site (Figure 8). Construction will include all site grading, utility infrastructure, underdrains, storm sewers, curbs and gutters, paving, and work necessary to build the subdivision. Typical equipment used for construction will include an excavator, backhoe, loader, dump truck, bulldozer, grader, or compactor.

Site construction will commence with the implementation of the erosion control plan (Figure 8) followed by site clearing and grubbing. The next steps will be to cut, fill, rough grade, and establish final grades for the newly constructed roads, residential housing, and stormwater facility. During final grading, the below ground utilities will be installed, as will the underground stormwater pipes. Following site grading and installation of utilities, the roadways, housing, and stormwater facilities will be constructed. The final construction step will be to install landscaping.

Erosion and Sediment Control: The Erosion and Sediment Control Plan (Figure 8) illustrates some of the measures that will be used to ensure that impacts to wetlands and waterways are minimized to the maximum extent practicable. Erosion controls on site will consist of sediment fencing, inlet protection, compost berms, temporary seeding, and straw waddles for any adjacent slopes exceeding 10%. The following components of the erosion control plan and project design will protect against erosion and prevent the transport of sediments to downstream receiving waters and ensure that impacts are minimized.

- All base erosion and sediment control measures including inlet protection, perimeter sediment control, gravel construction entrances, etc., must be in place, functional, and approved in an initial inspection prior to commencement of construction activities.
- All sediment barriers shall be installed immediately following establishment of finished grade.
- The stormwater facilities shall be constructed and landscaped prior to the stormwater system functioning and site paving.
- Approved inlet protection measures shall be in place immediately following paving activities and are to be regularly inspected and maintained as needed.
- BMP's such as compost berms, straw wattles, and inlet protection will be used to prevent run-off from reaching discharge points.
- Temporary stabilization measures will be employed on slopes, inactive areas, and areas subject to wind erosion.
- Areas to be vegetated will be permanently stabilized as they are brought to final grade.

Additional measures including tire washes, street sweeping, and vacuuming may be required to ensure that all paved areas are kept clean during active construction.

D. Describe source of fill material and disposal locations if known.

The contractor will source all fill material and disposal locations. Disposal locations are unknown, and may not be necessary; however, if needed will be in an upland area chosen by the contractor.

E. Construction timeline.

What is the estimated project start date?: Summer 2021

What is the estimate project completion date? Fall 2022

As the onsite wetlands are not associated with an adjacent waterway, proposed work will not be confined to an in-water work period.

Is any of the work underway or already complete? ☐ Yes ☒ No
If yes, describe.

F. Removal Volumes and Dimensions (if more than 7 impact sites, include a summary table as an attachment)

Wetland / Waterbody Name *	Removal Dimensions					Time Removal is to Remain**	Material***
	Length (ft.)	Width (ft.)	Depth (ft)	Area (sq.ft. or acres)	Volume (c.y.)		
N/A							

G. Total Removal Volumes and Dimensions

Total Removal to Wetland and Other Waters		Length (ft)	Area (sq. ft. or ac.)	Volume (c.y.)
Total Removal to Wetlands				
Total Removal Below Ordinary High Water				
Total Removal Below Highest Measured Tide				
Total Removal Below High Tide Line				
Total Removal Below Mean High Water Tidal Elevation				

H. Fill Volumes and Dimensions (if more than 7 impact sites, include a summary table as an attachment)

Wetland / Waterbody Name *	Fill Dimensions					Time Fill is to Remain**	Material***
	Length (ft.)	Width (ft.)	Depth (ft)	Area (sq.ft. or acres)	Volume (c.y.)		
Wetland A	200	170	0.635	0.36	800	Permanent	Rock, gravel
Wetland B	10	10	0.27	0.001	1	Permanent	Rock, gravel

I. Total Fill Volumes and Dimensions

Total Fill to Wetland and Other Waters		Length (ft)	Area (sq. ft. or ac.)	Volume (c.y.)
Total Fill to Wetlands		210	0.36	801
Total Fill Below Ordinary High Water				
Total Fill Below Highest Measured Tide				
Total Fill Below High Tide Line				
Total Fill Below Mean High Water Tidal Elevation				

* If there is no official name for the wetland or waterbody, create a unique name (such as "Wetland 1" or "Tributary A").

** Indicate whether the proposed area of removal or fill is permanent or, if you are proposing temporary impacts, specify the days, months, or years the fill or removal is to remain.

*** Example: soil, gravel, wood, concrete, pilings, rock etc.)

(5) PROJECT PURPOSE AND NEED

Provide a statement of the purpose and need for the overall project.

Project Purpose: The purpose of the project is to construct a residential subdivision and connecting roads in close proximity to retail centers, public transportation, and public schools in Salem. The new subdivision will consist of 24 lots and a new residential street, with associated stormwater treatment. The proposed lots are similarly sized, and will appeal to a variety of buyers looking to own homes within the City of Salem.

Project Need: The need for the project is to meet the demand for single-family housing within the most popular residential housing market in Marion, Linn and Polk counties and to provide market rate housing within close proximity to nearby commercial and retail businesses, as well as schools and other infrastructure. The need for housing within this area is documented by the Willamette Valley Multiple Listing Service. The data shows that throughout this tri-county area, housing sales have increased at their greatest rate (a +29.7% increase over the previous year) since before the 2008 recession. With the population increase in Oregon, the number of vacant houses and newly constructed houses available for sale has not been this low since 2007. In addition, the subdivision is located within an area where houses are on the market for the least amount of time compared to all other areas within the tri-county area. As such, it is anticipated that the newly constructed houses will sell very quickly and fulfill a need that is substantiated by the data.

(6) DESCRIPTION OF RESOURCES IN PROJECT AREA

A. Describe the existing physical, chemical, and biological characteristics of each wetland or waterbody. Reference the wetland and waters delineation report if one is available. Include the list of items provided in the instructions.

PHS delineated two wetlands within the study area (Wetlands A and B). Additional information can be found in the Wetland Delineation Report (WD# 2021-0166) for Belle Plaine Estates, which has been submitted to the Department of State Lands for a concurrence, and will be submitted to the Corps of Engineers as a separate report at the time of application submittal.

Wetlands A and B

Wetlands A and B are similar in vegetation structure, soils, and hydrology. The following table outlines Wetlands A and B.

Table 2. Summary of Wetland Areas within the Study Area

Wetland	Size (sq. ft. /acres)	Cowardin Class	Hydrogeomorphic (HGM) Class	Dominant Vegetation
A	22,272 / 0.51	Palustrine/emergent/ seasonally saturated (PEMC)	Slope	Tall false ryegrass (*Schedonorus arundinaceus*, FAC), lesser poverty rush (*Juncus tenuis*, FAC), and Colonial bentgrass (*Agrostis capillaris*, FAC)
B	61 / 0.001	PEMC	Slope	Tall false ryegrass, Colonial bentgrass, and bluegrass (*Poa* sp., FAC)

Functional Assessment: Per OAR 181-185-0685(4)(a), the ORWAP was conducted for Wetlands A and B. Due to the small size (0.001 acre) of Wetland B, as well as its proximity to Wetland A (<50 feet), one ORWAP was used to assess both wetlands. Table 1 shows the group scores for the functions and values within the wetlands. See Attachment 3 for the complete assessment of Wetland A and Wetland B, including the CoverPg, OF, F, S and Scores worksheets, and ORWAP Maps.

Table 1. Group Functions and Values of Wetlands A and B

GROUPS	Selected Function	Function Rating	Rating Break Proximity	Values Rating	Rating Break Proximity
Hydrologic Function (WS)	Water Storage & Delay (WS)	Lower		Higher	
Water Quality Support (SR, PR, or NR)	Sediment Retention & Stabilization (SR)	Moderate		Lower	
Fish Habitat (FA or FR)	Anadromous Fish Habitat (FA)	Lower		Lower	

GROUPS	Selected Function	Function Rating	Rating Break Proximity	Values Rating	Rating Break Proximity
Aquatic Habitat (AM, WBF, or WBN)	Amphibian & Reptile Habitat (AM)	Higher		Moderate	
Ecosystem Support (WC, INV, PD, POL, SBM, or OE)	Native Plant Diversity (PD)	Moderate		Higher	

Other Attributes:	Score	Rating	Rating Break Proximity
Wetland Sensitivity (SEN)	Moderate		
Wetland Ecological Condition (EC)	Lower		
Wetland Stressors (STR)	Higher		
Carbon Sequestration (CS)	Lower		
Public Use & Recognition (PU)			

The selected functions outlined above receive lower, moderate, or higher scores as overall function ratings, with lower value for hydrologic function and fish habitat; moderate values for water quality support and ecosystem support; and higher values for aquatic habitat. As both Wetland A and Wetland B have seasonal hydrologic regimes (large areas ponding water are absent), are dominated by non-native grasses, and do not have sites for basking, it is likely that these wetlands provide little to no habitat for amphibians or reptiles. In addition, the wetlands are dominated by non-native grasses therefore the function rating for native plant diversity should be considered lower.

Fish and Wildlife Species Habitat, Use and Endangered Species Act (ESA): Due to the small size of the wetlands, lack of permanent water, and their location in an urban area, it is unlikely the wetlands provide habitat for wildlife. Small mammals such as rodents, rabbits, raccoon, etc. may use the wetlands for foraging or cover, but larger mammals such as deer and coyote are not likely to be found in the wetlands.

The wetlands lack permanent water and are not connected to a fish-bearing stream; as such, there is no fish habitat within the wetlands. There are no listed species within the project site. No critical habitat[†] or Essential Salmonid Habitat (ESH)[‡] is mapped within the site. The closest designated critical habitat is for Willamette daisy (*Erigeron decumbens*) approximately 12 miles southeast of the project area or the streaked horned lark (*Eremophila alpestris strigata*) approximately 11 miles southwest of the project area. There is no habitat within or adjacent to the project area for either of these species.

Archeological and Historic Resources: No known archaeological survey has been conducted on the property. If any archaeological resources and/or artifacts are encountered during construction, all construction activity will immediately cease, and the State Historic Preservation Office will be contacted.

100-Year Floodplain: The project is not located within the 100-year floodplain.

B. Describe the existing navigation, fishing and recreational use of the waterway or wetland.

There is no existing navigation, fishing, or recreational use of the wetlands on site.

[†] United State Fish & Wildlife Service (USFWS). Critical Habitat for Threatened & Endangered Species [USFWS]. Vector digital data, 2015. Site accessed: January 12, 2021. Internet: http://services.arcgis.com/QVENGdaPbd4LUkLV/arcgis/rest/services/USFWS_Critical_Habitat/FeatureServer

[‡] Rempel, M., P. Adamus, and J. Kagan. 2021. Oregon Explorer - Oregon Rapid Wetland Assessment Protocol (ORWAP) Map Viewer: an internet tool for ORWAP wetland assessment support and data archiving. Oregon State University Library and Institute for Natural Resources, Oregon State University, Corvallis, OR. Internet: http://tools.oregonexplorer.info/oe_map_viewer_2_0/Viewer.html?Viewer=orwap

(7) PROJECT SPECIFIC CRITERIA AND ALTERNATIVES ANALYSIS

Describe project-specific criteria necessary to achieve the project purpose. Describe alternative sites and project designs that were considered to avoid or minimize impacts to the waterbody or wetland.*

Project specific criteria includes:

- Property large enough to support a multiple lot residential subdivision
- Close proximity to transportation access
- Zoned residential
- Proximity to schools and shopping areas

The proposed development property is 4.71 acres. The property will be subdivided into 24 single-family residential lots. Access to main transportation routes is located to the west (Lancaster Drive) and east (Cordon Road) with easy access to I-5. The site is currently zoned Residential Agriculture (RA). Since this is an infill development, utilities are accessible from either Center Street or 46th Avenue. The Auburn Elementary School is located 600 feet to the south.

The property is owned by the applicant. The applicant did look at developing a comparably sized property directly to the east; however, that property, which includes a church in the northern half of the parcel, is not for sale and contains a larger acreage of wetlands.

Three alternative site designs were considered for the site.

Alternative 1

Alternative 1 (Figure 9A) creates 21 single-family residential lots. It is possible that a house could be sited on Lot 16 to the north of Wetland A and avoid impacting the wetland; however, the layout does not meet the City's comprehensive land use plan as it only has one vehicular entrance into the subdivision. The City is requiring vehicular and pedestrian connectivity to 46th Avenue NE at the southern end of the property.

Alternative 2

Alternative 2 (Figure 9B) creates 24 single-family residential lots, and includes vehicular and pedestrian connectivity to 46th Avenue NE at the southern end of the property. This development scenario, however, also includes an access road to the adjacent church property to the east. The City initially requested that this connection be constructed, although there are no plans to develop that property at this time. The applicant, in an effort to reduce wetland impacts, requested this road not be included in the proposed development, and the City agreed.

Alternative 3 (Preferred)

Alternative 3 is the preferred alternative (Figure 5). This alternative creates 24 singly family residential lots and provides access to 46th Avenue NE but not access to the lot to the east, avoiding 0.15 acre of wetland.

Currently, stormwater leaves the proposed development site untreated, and eventually flows into the Little Pudding River. The proposed development plan will treat this stormwater to SLOPES V Standards, ensuring improved water quality conditions for salmonids. As stated above, 0.15 acre of wetland will be avoided and this area will not be affected by the surrounding development, as currently, stormwater flows into Wetland A via an outfall culvert at 46th Avenue NE. As stated above, the development as proposed will not capture this stormwater for treatment; rather, it will be piped underneath the new development, and outfall into Wetland A as under existing conditions, ensuring that the remaining portion of Wetland A will not be dewatered. The existing shallow groundwater table underneath Wetland A will also continue to contribute hydrology to the remaining wetland.

*Not required by the Corps for a complete application, but is necessary for individual permits before a permit decision can be rendered.

(8) ADDITIONAL INFORMATION

Are there any state or federally listed species on the project site?	☐ Yes	☒ No	☐ Unknown
Is the project site within designated or proposed critical habitat?	☐ Yes	☒ No	☐ Unknown
Is the project site within a national Wild and Scenic River?	☐ Yes	☒ No	☐ Unknown
Is the project site within a State Scenic Waterway?	☐ Yes	☒ No	☐ Unknown
Is the project site within the 100-year floodplain?	☐ Yes	☒ No	☐ Unknown

If yes to any of the above, explain in Block 6 and describe measures to minimize adverse effects to these resources in Block 7.

Is the project site within the Territorial Sea Plan (TSP) Area? **If yes, attach TSP review as a separate document for DSL.**	☐ Yes	☒ No	☐ Unknown
Is the project site within a designated Marine Reserve? **If yes, certain additional DSL restrictions will apply.**	☐ Yes	☒ No	☐ Unknown
Will the overall project involve ground disturbance of one acre or more?	☒ Yes	☐ No	☐ Unknown

If yes, you may need a 1200-C permit from the Oregon Department of Environmental Quality (DEQ).

Is the fill or dredged material a carrier of contaminants from on-site or off-site spills?	☐ Yes	☒ No	☐ Unknown
Has the fill or dredged material been physically and/or chemically tested? **If yes, explain in Block 6 and provide references to any physical/chemical testing report(s).**	☐ Yes	☒ No	☐ Unknown
Has a cultural resource (archaeological and/or built environment) survey been performed on the project area?	☐ Yes	☒ No	☐ Unknown
Do you have any additional archaeological or built environment documentation, or correspondence from tribes or the State Historic Preservation Office? **If yes, provide a copy of the survey and/or documentation of correspondence with this application to the Corps only. Do not describe any resources in this document. Do not provide the survey or documentation to DSL.**	☐ Yes	☒ No	☐ Unknown

Is the project part of a DEQ Cleanup Site? ☐ Yes ☒ No Permit number_____ DEQ Contact_____

Will the project result in new impervious surfaces or the redevelopment of existing surfaces? Yes ☐ No ☐

If yes, the Applicant must submit a post-construction stormwater management plan to DEQ's 401 WQC program for review and approval, see http://www.deq.state.or.us/wq/sec401cert/docs/stormwaterGuidelines.pdf

Identify any other federal agency that is funding, authorizing or implementing the project.

Agency Name	Contact Name	Phone Number	Most Recent Date of Contact

List other certificates or approvals/denials required or received from other federal, state or local agencies for work described in this application.

Agency	Certificate / approval / denial description	Date Applied
DEQ	1200-C	Winter/Spring 2021
DEQ	401 Water Quality Certification	TBD
Corps	Nationwide Permit for residential Development	Winter/Spring 2021
City of Salem	Commercial Building Structural Permit	Winter/Spring 2021

Other DSL and/or Corps Actions Associated with this Site (Check all that apply):

☐ Work proposed on or over lands owned by or leased from the Corps (may require authorization pursuant to 33 USC 408). These could include the federal navigation channel, structures, levees, real estate, dikes, dams and other Corps project.

☐ State Owned Waterway DSL Waterway Lease # _____

☐ Other Corps or DSL Permits Corps # _____ DSL # _____

☐ Violation for Unauthorized Activity Corps # _____ DSL # _____

☒ Wetland and Waters Delineation Corps # _____ DSL # WD 2015-0037 / WD 2021-0166

Submit the entire delineation report to the Corps; submit only the concurrence letter (if complete) and approved maps to DSL. If not previously submitted to DSL, send under a separate cover letter.

(9) IMPACTS, RESTORATION/REHABILITATION, COMPENSATORY MITIGATION

A. Describe unavoidable environmental impacts that are likely to result from the proposed project. Include permanent, temporary, direct and indirect impacts.

As discussed above, construction of the proposed lots for 24 single family homes, new roads, and stormwater facilities will result in permanent impacts to Wetlands A and B for a total of 0.36 acres, with approximately 801 cubic yards of fill.

The loss of wetlands will result in the loss of water quality functions; however, the wetlands have been routinely disturbed by logging, agricultural production, and mowing. An analysis of the wetlands to be impacted shows that the affected wetlands score low or moderate for most functions and values evaluated. In addition, site stormwater will be directed to water quality facilities and treated through privately owned and maintained stormwater detention basins to detain the stormwater to pre-development rates and SLOPES V criteria.

B. For temporary removal or fill or disturbance of vegetation in waterways, wetlands or riparian (i.e., streamside) areas, discuss how the site will be restored after construction.

The proposed project will not result in any temporary fill or disturbance.

Compensatory Mitigation

C. Proposed mitigation approach. Check all that apply:

☐ Permittee-responsible Onsite Mitigation	☐ Permittee-responsible Offsite Mitigation	☒ Mitigation Bank or in-lieu fee program	☐ Payment to Provide (not approved for use with Corps permits)

D. Provide a brief description of mitigation approach and the rationale for choosing that approach. If you believe mitigation should not be required, explain why.

The adverse effects of this project include the placement of 801 cubic yards of material in 0.36 acre of degraded PEM wetlands. Onsite mitigation is not practical due the lack of hydrology on the site. As such, mitigation for impacts to 0.36 acre of wetland will be mitigated through the purchase of 0.36 acre of credit at either the Garret Creek or Marion wetland mitigation banks. Attachment 4 contains the Accounting Eligibility Worksheet for the project.

The purchase of 0.36 acre of wetland credits from a wetland mitigation bank meets DSL's Principle Objectives, as discussed below.

(A) Replace functions and values lost at the removal-fill site

The purchase of 0.36 acre of credit at a wetland mitigation bank will more than replace the functions and values lost at the impact site. As discussed above, the wetlands to be impacted are of low quality. Wetlands A and B are emergent class, and both banks that service this area have emergent credits for purchase. Wetland mitigation banks, through the DSL mitigation bank approval process, ensures that the wetland bank's functions and values are such that removal fill activities within the bank's service area will offset any functions lost through the permitting process.

(B) Provide local replacement for locally important functions and values, where appropriate

Wetlands within the study area do not provide any locally important functions and values, however, the impact site is located within the service area of two wetland mitigation banks. As such, any functions and values lost at the development site will be replaced by the purchase of wetland credit at one of these banks.

***(C) Enhance, restore, create or preserve wetlands or tidal areas that are self-sustaining and minimize long-term maintenance needs*:**

As discussed above, the mitigation banks have been designed to be self-sustaining and should require very little long term maintenance. Through the mitigation bank approval process, the agencies ensure that mitigation banks are self-sustaining, and that long-term maintenance is minimized.

***(D) Ensure the siting of CWM in ecologically suitable locations considering: local watershed needs and priorities; appropriate landscape position for the wetland types, functions, and values sought; connectivity to other habitats and protected resources; and the absence of contaminants or conflicting adjacent land uses that would compromise wetland functions*:**

Through the mitigation banking approval process, PHS presumes that the siting of mitigation banks, and the determination of their service areas, ensures that the bank has been sited in an ecologically suitable location, that its approved mitigation plan follows all of the principle objectives, and that the wetland types within the Bank are suitable for the location of the site and there are no conflicting land uses.

***(E) Minimize temporal loss of wetlands and tidal waters and their functions and values*:**

The purchase of 0.36 acres of credit at a wetland mitigation bank prior to the issuance of the DSL permit ensures that there will be no temporal loss of wetland functions or values.

Mitigation Bank / In-Lieu Fee Information:

Name of mitigation bank or in-lieu fee project: Garret Creek or Marion

Type of credits to be purchased: PEM/Slope

If you are proposing permittee-responsible mitigation, have you prepared a compensatory mitigation plan?

☐ **Yes.** Submit the plan with this application and complete the remainder of this section.

☐ **No.** A mitigation plan will need to be submitted (*for DSL, this plan is required for a complete application*).

Mitigation Location Information (Fill out only if permittee-responsible mitigation is proposed)

Mitigation Site Name/Legal Description	Mitigation Site Address	Tax Lot #
County	**City**	**Latitude & Longitude** (in DD.DDDD format)

Township	Range	Section	Quarter/Quarter

(10) ADJACENT PROPERTY OWNERS FOR PROJECT AND MITIGATION SITE*

☒ **Pre-printed mailing labels of adjacent property owners attached**

BRENDA M MARTIN &
MARK B GUZMAN
4553 CENTER ST NE
SALEM OR 97301

HILL-MOORE HOLDINGS LLC
8146 LAKESIDE DR NE
SALEM OR 97305

RICHARD L BABBITT JR
883 MITCHELL RD
FALLS CITY OR 97344

MICHAEL TIEU
4108 SUNNYSIDE AVE N
SEATTLE WA 98103

LT FRY & SHARON L FRY, TRE
708 SPHINX CT NE
SALEM OR 97301

SALEM COMMUNITY OF CHRIST
REORGANIZED CHURCH OF JESUS
C/O VENESSA GODFREY
1908 MICHIGAN CITY LN NW
SALEM OR 97304

JAIME L TIERNEY
4550 CENTER ST NE
SALEM OR 97301

PATRICK D STUMP &
LYNN M TRAN-STUMP
686 45TH PL NE
SALEM OR 97301

CHRISTINE STEVENS
676 45TH PL NE
SALEM OR 97301

JASON W MILLER
656 45TH PL NE
SALEM OR 97301

MAYETTA BUSHNELL
646 45TH PL NE
SALEM OR 97301

JERNALINE G LACSINA
626 45TH PL NE
SALEM OR 97301

MIGUEL A JORGE, &
MARIA DE JESUS JORGE
606 45TH PL NE
SALEM OR 97301

STEVEN & GAY LAWRENCE
596 45TH PL NE
SALEM OR 97301

ALLAN & VICTORIA SCHWARZ
4565 BANTER CT NE
SALEM OR 97301

ALDO AND KEREN AUSTIN
1335 TITAN DR NW
SALEM OR 97304

7TH AVENUE PROPERTIES LLC
1911 SW DICKINSON LN
PORTLAND OR 97219

HANK C GIETEMA
4627 BALDWIN PL NE
SALEM OR 97301

(11) CITY/COUNTY PLANNING DEPARTMENT LAND USE AFFIDAVIT
(TO BE COMPLETED BY LOCAL PLANNING OFFICIAL)

I have reviewed the project described in this application and have determined that:

- ☐ This project is not regulated by the comprehensive plan and land use regulations.
- ☐ This project is consistent with the comprehensive plan and land use regulations.
- ☐ This project is consistent with the comprehensive plan and land use regulations with the following:
  - ☐ Conditional Use Approval
  - ☐ Development Permit
  - ☐ Other Permit (explain in comment section below)
- ☐ This project is not currently consistent with the comprehensive plan and land use regulations. To be consistent requires:
  - ☐ Plan Amendment
  - ☐ Zone Change
  - ☐ Other Approval or Review (see comment section)

An application or variance request has ☐ has not ☐ been filed for approvals required above.

Local planning official name (print)	Title	City / County

Signature	Date

Comments:

(12) COASTAL ZONE CERTIFICATION

If the proposed activity described in your permit application is within the Oregon Coastal Zone, the following certification is required before your application can be processed. The signed statement will be forwarded to the Oregon Department of Land Conservation and Development (DLCD) for its concurrence or objection. For additional information on the Oregon Coastal Zone Management Program and consistency reviews of federally permitted projects, contact DLCD at 635 Capitol Street NE, Suite 150, Salem, Oregon 97301 or call 503-373-0050 or click here.

CERTIFICATION STATEMENT

I certify that, to the best of my knowledge and belief, the proposed activity described in this application complies with the approved Oregon Coastal Zone Management Program and will be completed in a manner consistent with the program.

Print/Type Applicant Name	Title

Applicant Signature	Date

(13) SIGNATURES

Application is hereby made for the activities described herein. I certify that I am familiar with the information contained in the application, and, to the best of my knowledge and belief, this information is true, complete and accurate. I further certify that I possess the authority to undertake the proposed activities. By signing this application I consent to allow Corps or DSL staff to enter into the above-described property to inspect the project location and to determine compliance with an authorization, if granted. I hereby authorize the person identified in the authorized agent block below to act in my behalf as my agent in the processing of this application and to furnish supplemental information in support of this permit application. I understand that the granting of other permits by local, county, state or federal agencies does not release me from the requirement of obtaining the permits requested before commencing the project. I understand that payment of the required state processing fee does not guarantee permit issuance.

To be considered complete, the fee must accompany the application to DSL. The fee is not required for submittal of an application to the Corps.

Fee Amount Enclosed	$

Applicant Signature (required) Must match name in Block 2	
Print Name Don Jensen	Title President
Signature	Date

Authorized Agent Signature	
Print Name John van Staveren	Title Senior Scientist
Signature	Date

Landowner Signature(s)* **Landowner of the Project Site (if different from applicant)**	
Print Name	Title
Signature	Date

Landowner of the Mitigation Site (if different from applicant)	
Print Name	Title
Signature	Date

Department of State Lands, Property Manager (to be completed by DSL)	
If the project is located on state-owned submerged and submersible lands, DSL staff will obtain a signature from the Land Management Division of DSL. A signature by DSL for activities proposed on state-owned submerged/submersible lands only grants the applicant consent to apply for a removal-fill permit. A signature for activities on state-owned submerged and submersible lands grants no other authority, express or implied and a separate proprietary authorization may be required.	
Print Name	Title
Signature	Date

* Not required by the Corps.

INCUMBENCY CERTIFICATE

Jensen Consulting and Development LLC (entity name as recorded with the Secretary of State, Oregon)

I, Donald C. L. Jensen (name of registered agent or authorized representative), do hereby certify that:

1. I am the duly elected and acting Managing Member (position) of Jensen Consulting and Development LLC (entity name as recorded with the Secretary of State, Oregon), a Limited Liability Corporation (entity type) organized and existing in good standing under the laws of the State of Oregon (the "Entity"); and

2. I have the authority to submit, on behalf of the Entity, this application for a permit to conduct removal-fill within waters of the state (as evidenced by my signature on the application) and to commit the Entity to comply with all resulting permit conditions, including any mitigation obligations, resulting from the issuance of the permit.

_____, this 24 day of November, 2020
Signature of Registered Agent or Authorized Representative

(14) ATTACHMENTS

☒ **Drawings (Attachment 1)**
- ☒ Location map with roads identified
- ☒ U.S.G.S. topographic map
- ☒ Tax lot map
- ☒ Site plan(s)
- ☒ Cross section drawing(s)
- ☒ Recent aerial photo
- ☐ Project photos
- ☒ Erosion and Pollution Control Plan(s), if applicable
- ☐ DSL/Corps Wetland Concurrence letter and map, if approved and applicable

☒ Pre-printed labels for adjacent property owners (Required if more than 5)

☒ Incumbency certificate if applicant is a partnership or corporation

☐ Restoration plan or rehabilitation plan for temporary impacts

☐ Mitigation plan

☒ Wetland functional assessment, if applicable
- ☒ Cover Page
- ☒ Score Sheets
- ☒ ORWAP OR , F, T, & S forms
- ☒ ORWAP Reports
- ☒ Assessment Maps
- ☒ ORWAP Reports: Soils, Topo, Assessment area, Contributing area

☐ Stream Functional Assessment, if applicable
- ☐ Cover Page
- ☐ Score Sheets
- ☐ SFAM PA, PAA, & EAA forms
- ☐ SFAM Report
- ☐ Assessment Maps
  - ☐ Aerial Photo, Site Map, and Topo Site Map (Both maps should document the PA, PAA, & EAA)

☒ Compensatory Mitigation (CM) Eligibility & Accounting Worksheet
- ☐ Matching Quickguide Sheet(s)
- ☒ CM Eligibility & Accounting Sheet

☐ Alternatives analysis

☐ Biological assessment (if requested by Corps project manager during pre-application coordination)

☒ Stormwater management plan (may be required by the Corps or DEQ)

☒ Other: Please Describe:

☒ **Wetland Delineation Report (Corps of Engineers)**

☐ _____

For U.S. Army Corps of Engineers send application to:

USACE Portland District
ATTN: CENWP-ODG-P
PO Box 2946
Portland, OR 97208-2946
503-808-4373
portlandpermits@usace.army.mil

Counties:
Baker, Benton, Clackamas, Clatsop, Columbia, Gilliam, Grant, Hood River, Jefferson Lincoln, Linn, Malheur, Marion, Morrow, Multnomah, Polk, Sherman, Tillamook, Umatilla, Union, Wallowa, Wasco, Washington, Wheeler, Yamhill

U.S. Army Corps of Engineers
ATTN: CENWP-ODG-E
211 E. Seventh Ave., Suite 105
Eugene, OR 97401-2722
541-465-6868

portlandpermits@usace.army.mil

Counties:
Coos, Crook, Curry, Deschutes, Douglas, Jackson, Josephine, Harney, Klamath, Lake, Lane

For Department of State Lands send application to:

West of the Cascades:
Department of State Lands
775 Summer Street NE, Suite 100
Salem, OR 97301-1279
503-986-5200

East of the Cascades:
Department of State Lands
1645 NE Forbes Road, Suite 112
Bend, Oregon 97701
541-388-6112

For Department of Environmental Quality email application to:

ATTN: DEQ 401 Certification Program
Water Quality
700 NE Multnomah St, Suite 600
Portland, OR 97232
401applications@deq.state.or.us

Attachment 1

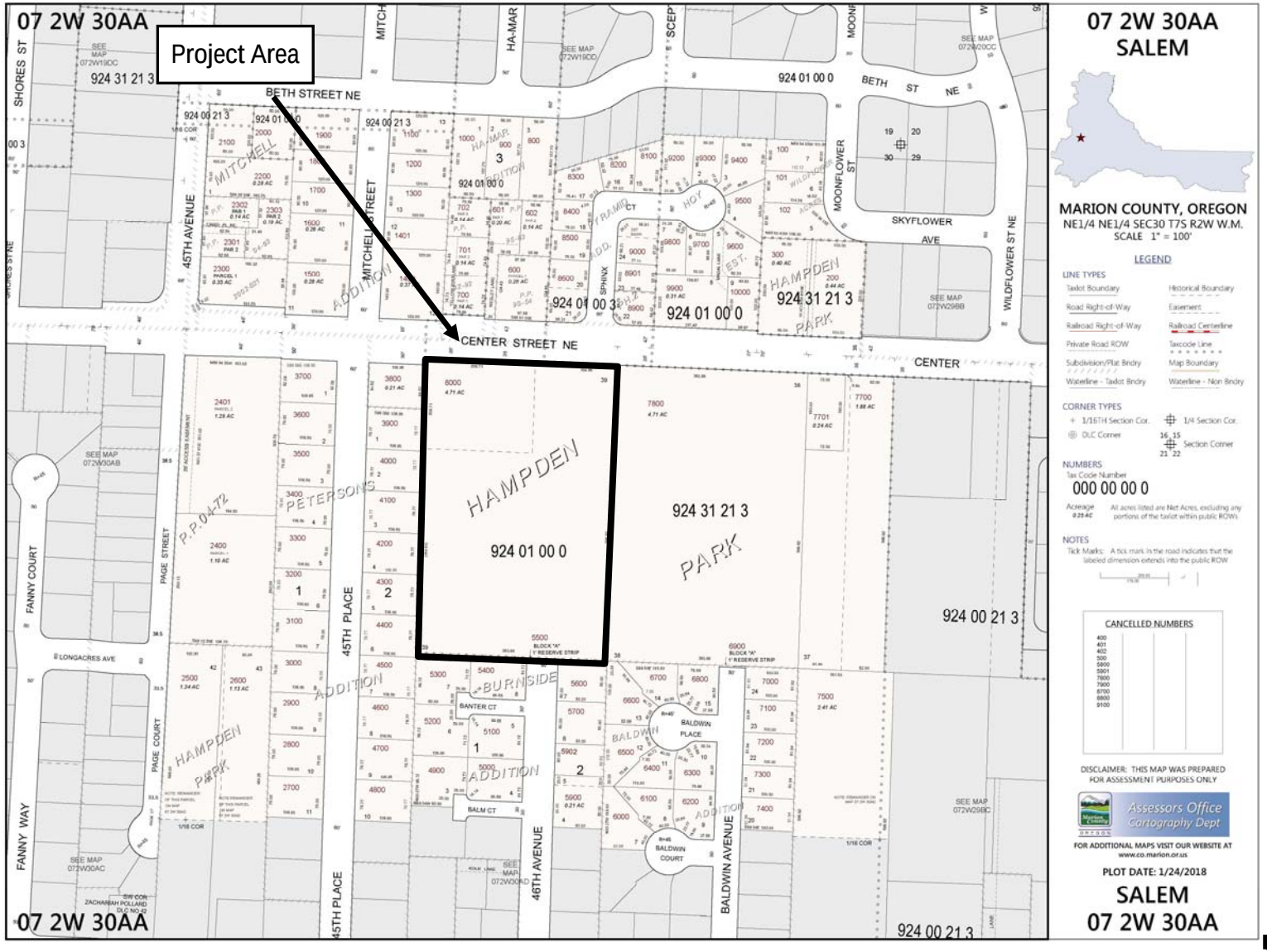
Figures

Project #5769
1/14/2021

Pacific Habitat Services, Inc.
9450 SW Commerce Circle, Suite 180
Wilsonville, OR 97070

General Location and Topography
Belle Plaine Estates - Salem, Oregon
United States Geological Survey (USGS) Salem East, Oregon 7.5 quadrangle, 2020
(viewer.nationalmap.gov/basic)

FIGURE
1



Project #5769
1/14/2021

PHS

Pacific Habitat Services, Inc.
9450 SW Commerce Circle, Suite 180
Wilsonville, OR 97070

Tax Lot Map
Belle Plaine Estates - Salem, Oregon
The Oregon Map (ormap.net)

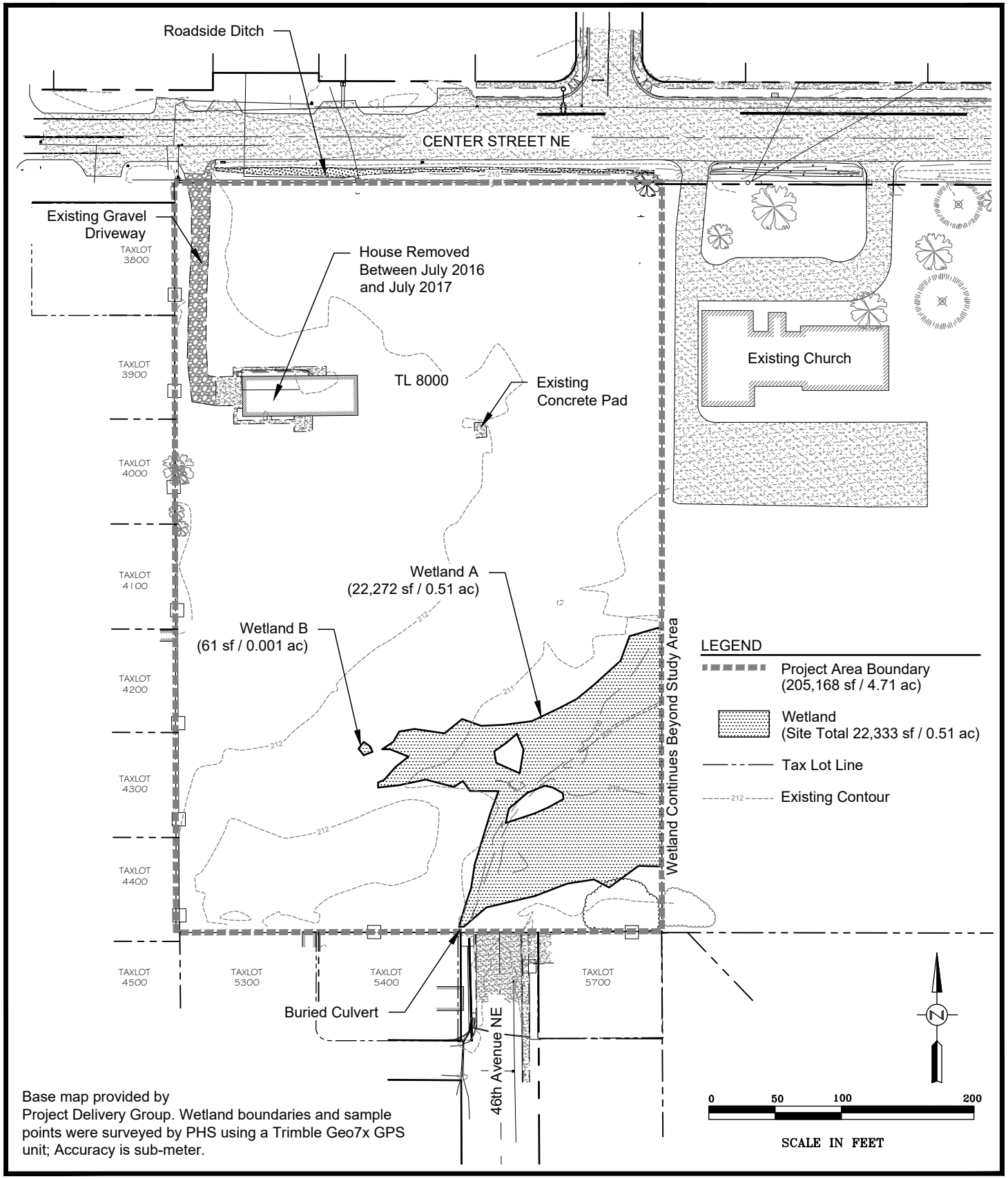
FIGURE
2

Project #5769
1/14/2021

Pacific Habitat Services, Inc.
9450 SW Commerce Circle, Suite 180
Wilsonville, OR 97070

Aerial Photo
Belle Plaine Estates - Salem, Oregon
GoogleEarth, 2020

FIGURE
3



Base map provided by Project Delivery Group. Wetland boundaries and sample points were surveyed by PHS using a Trimble Geo7x GPS unit; Accuracy is sub-meter.

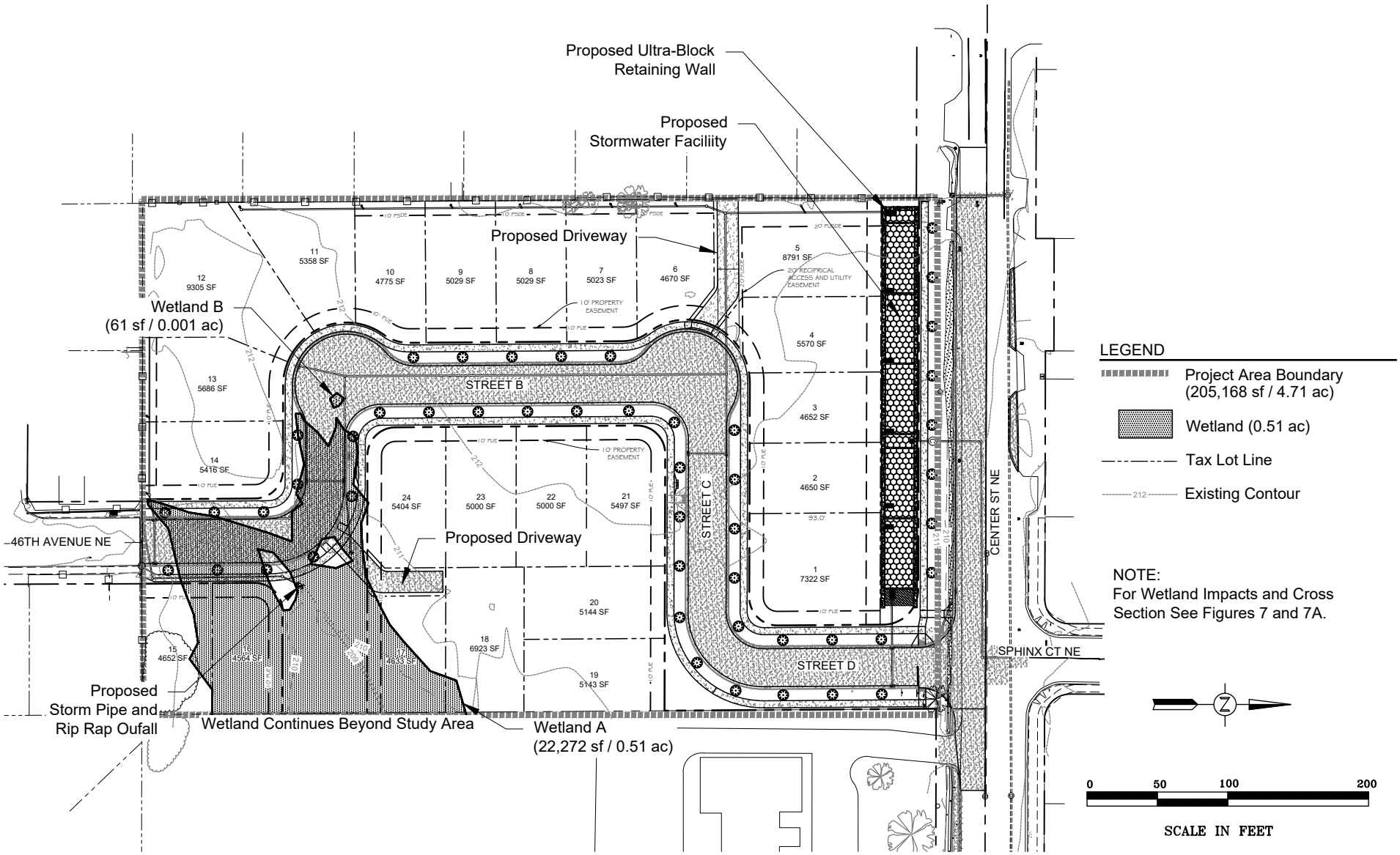
Pacific Habitat Services,Inc.
9450 SW Commerce Circle, Suite 180 Wilsonville, Oregon 97070
Phone: (503) 570-0800 Fax (503) 570-0855

Existing Conditions

Belle Plaine Estates - Salem, Oregon

FIGURE 4

6-2-2021



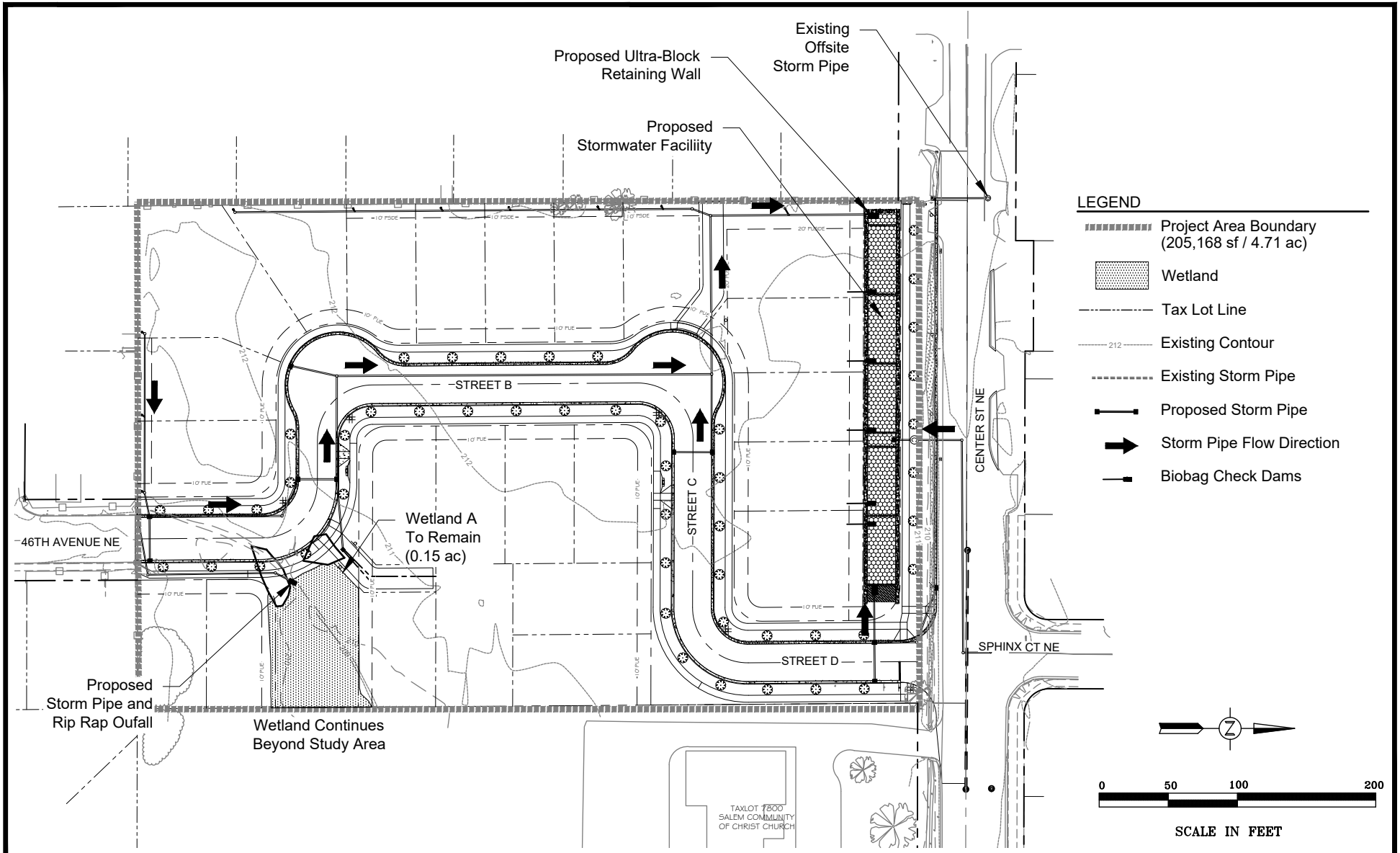
Pacific Habitat Services,Inc.
9450 SW Commerce Circle, Suite 180 Wilsonville, Oregon 97070
Phone: (503) 570-0800 Fax (503) 570-0855

Plans Provided by
Project Delivery Group

Site Plan
Belle Plaine Estates - Salem, Oregon

FIGURE
5

6-2-2021



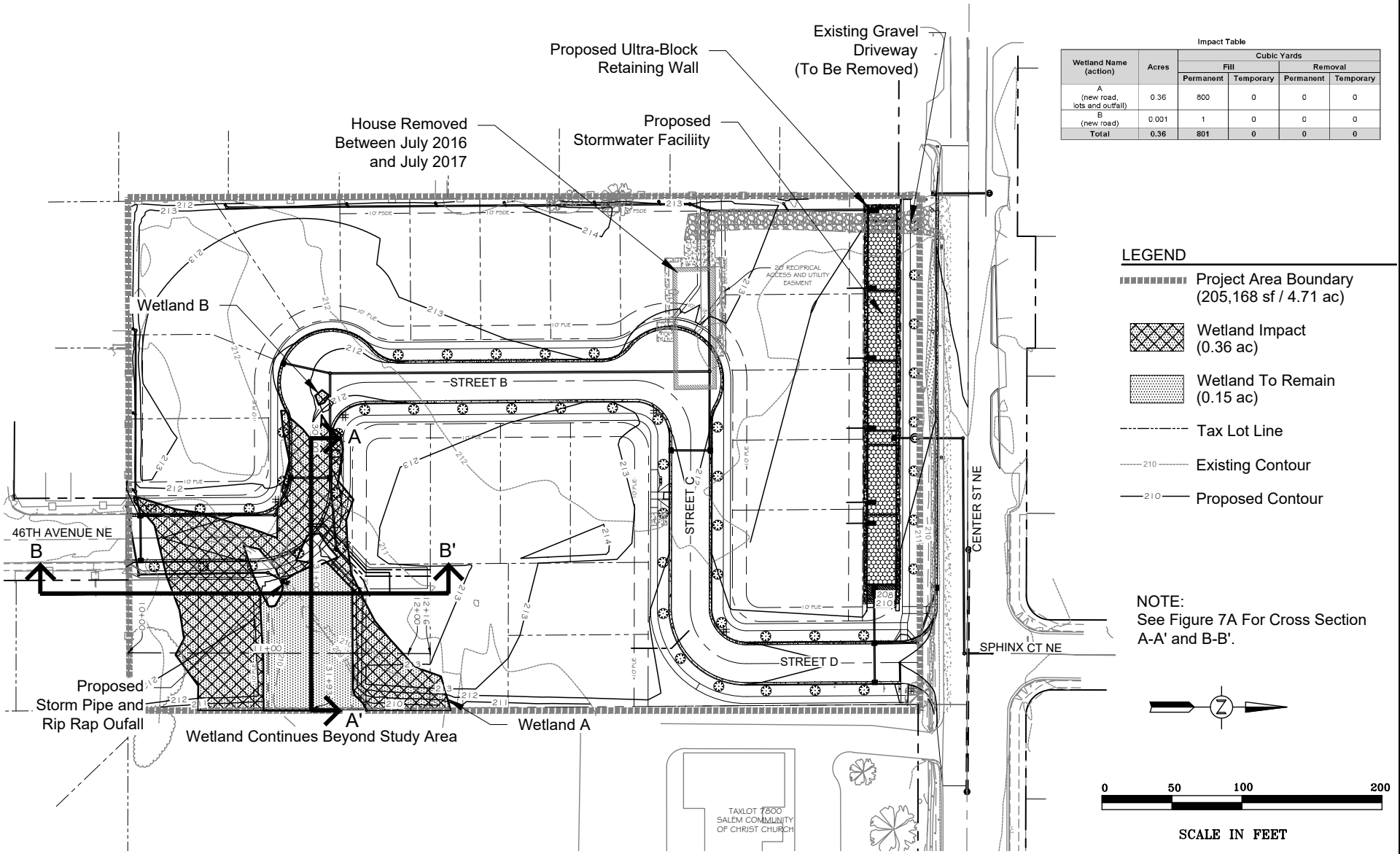
PHS
Pacific Habitat Services,Inc.
9450 SW Commerce Circle, Suite 180 Wilsonville, Oregon 97070
Phone: (503) 570-0800 Fax (503) 570-0855

Plans Provided by
Project Delivery Group

Storm Plan
Belle Plaine Estates - Salem, Oregon

FIGURE
6

6-2-2021



Impact Table

Wetland Name (action)	Acres	Cubic Yards			
		Fill		Removal	
		Permanent	Temporary	Permanent	Temporary
A (new road, lots and outfall)	0.36	800	0	0	0
B (new road)	0.001	1	0	0	0
Total	0.36	801	0	0	0

LEGEND

- Project Area Boundary (205,168 sf / 4.71 ac)
- Wetland Impact (0.36 ac)
- Wetland To Remain (0.15 ac)
- Tax Lot Line
- 210 Existing Contour
- 210 Proposed Contour

NOTE:
See Figure 7A For Cross Section A-A' and B-B'.

0 50 100 200

SCALE IN FEET

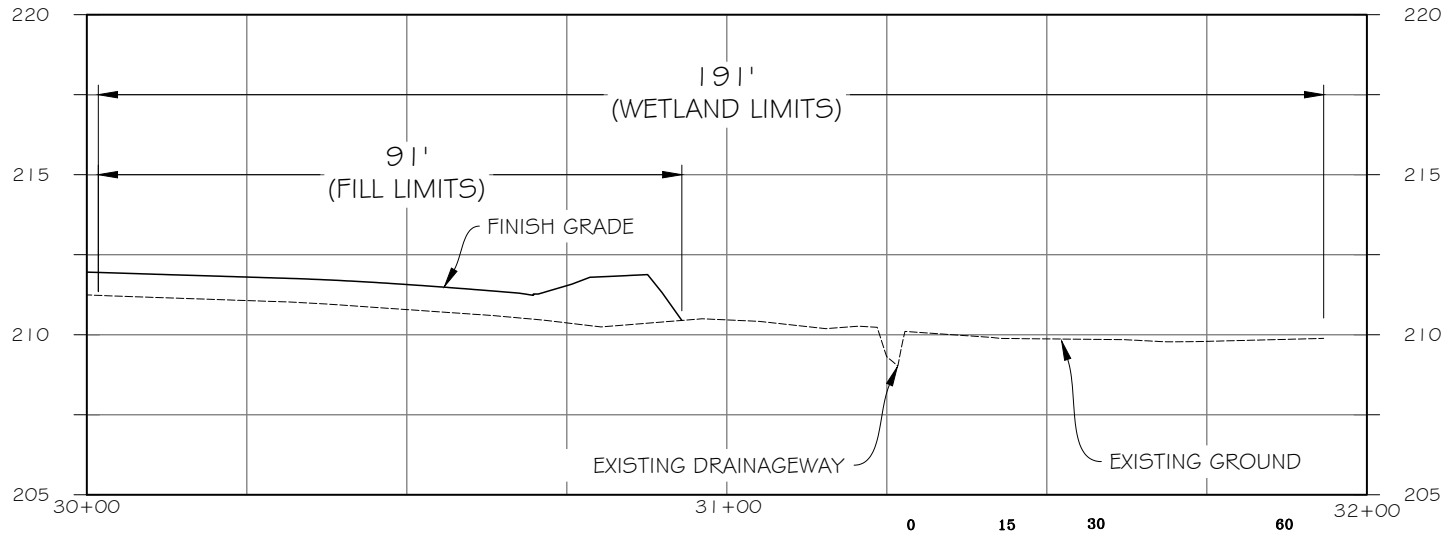
Pacific Habitat Services,Inc.
9450 SW Commerce Circle, Suite 180 Wilsonville, Oregon 97070
Phone: (503) 570-0800 Fax (503) 570-0855

Plans Provided by
Project Delivery Group

Grading Plan and Cross Section Locations
Belle Plaine Estates - Salem, Oregon

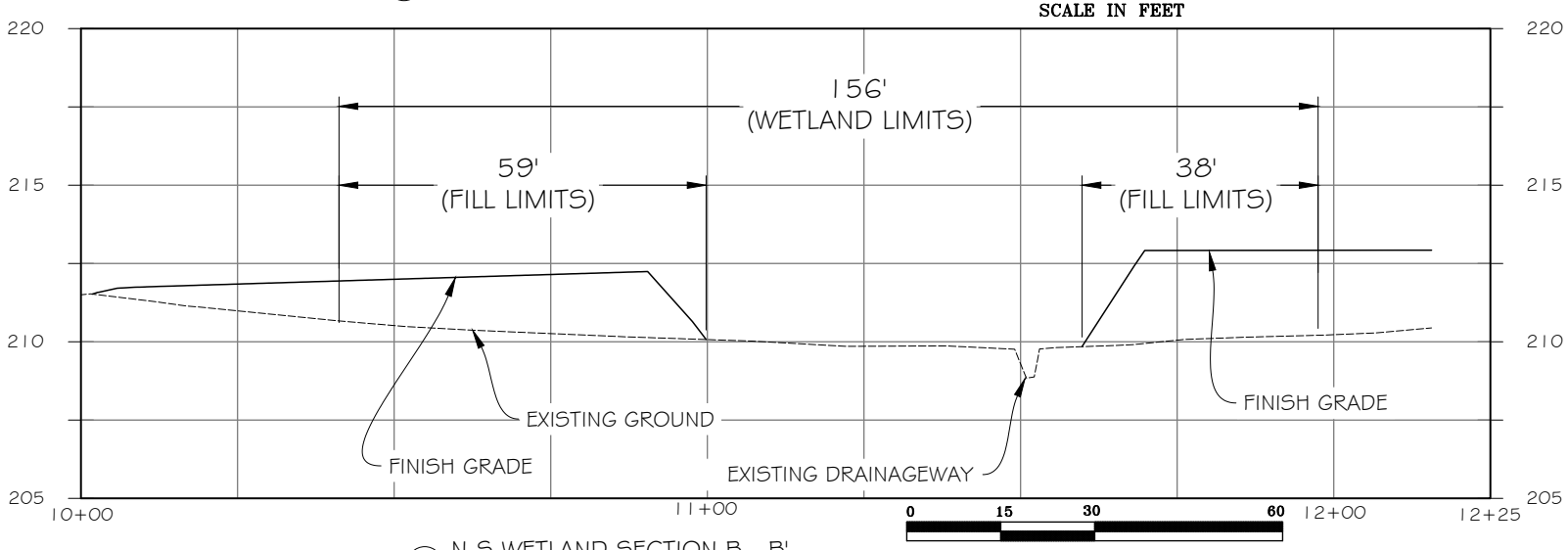
FIGURE 7

6-2-2021



1 E-W WETLAND SECTION A - A'
HORIZONTAL SCALE: 1" = 30' VERTICAL SCALE: 1" = 5'

SCALE IN FEET



2 N-S WETLAND SECTION B - B'
HORIZONTAL SCALE: 1" = 30' VERTICAL SCALE: 1" = 5'

SCALE IN FEET

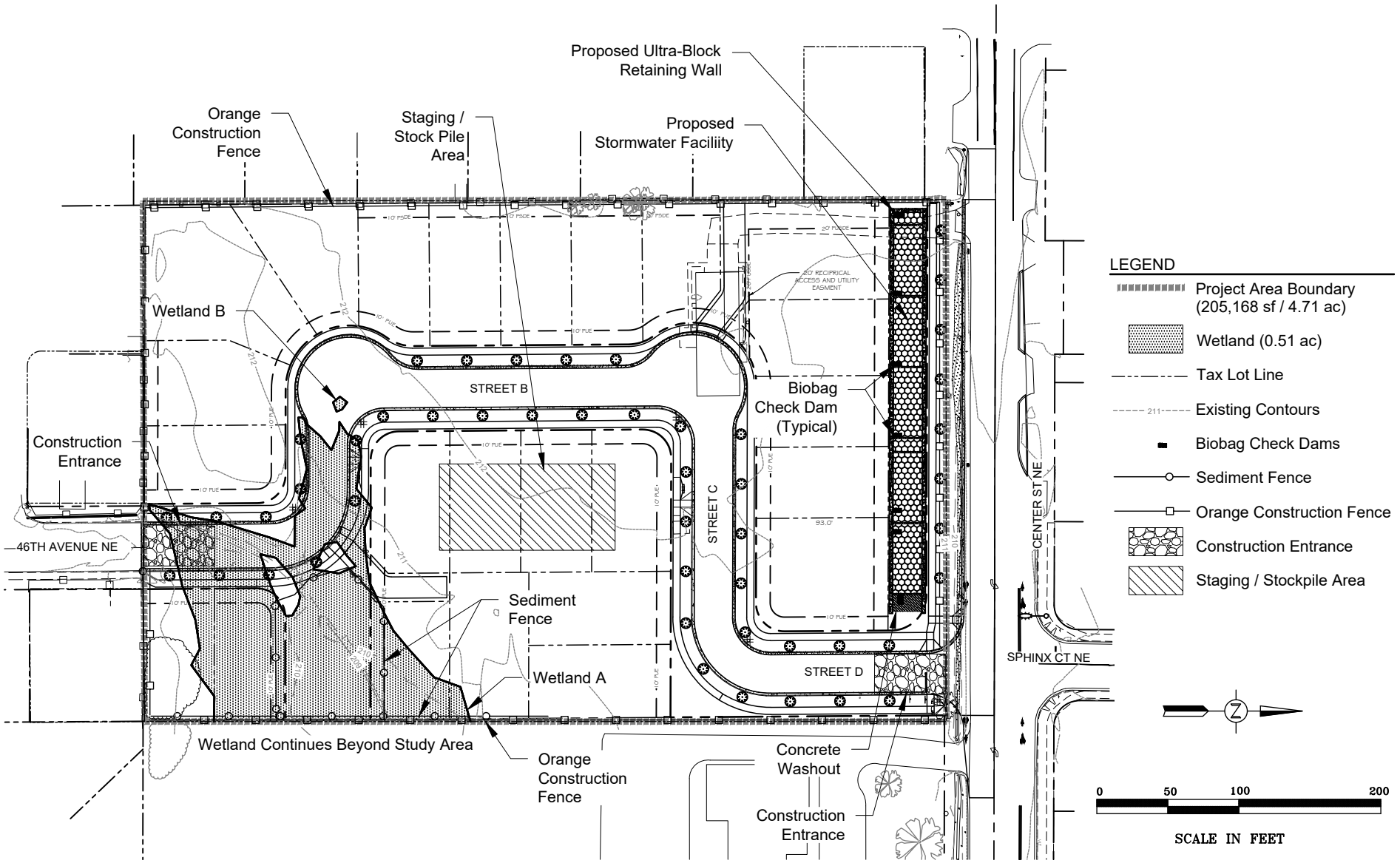
PHS
Pacific Habitat Services,Inc.
9450 SW Commerce Circle, Suite 180 Wilsonville, Oregon 97070
Phone: (503) 570-0800 Fax (503) 570-0855

Plans Provided by
Project Delivery Group

Wetland Impact Cross Sections A-A' and B-B'
Belle Plaine Estates - Salem, Oregon

FIGURE
7A

5-27-2021



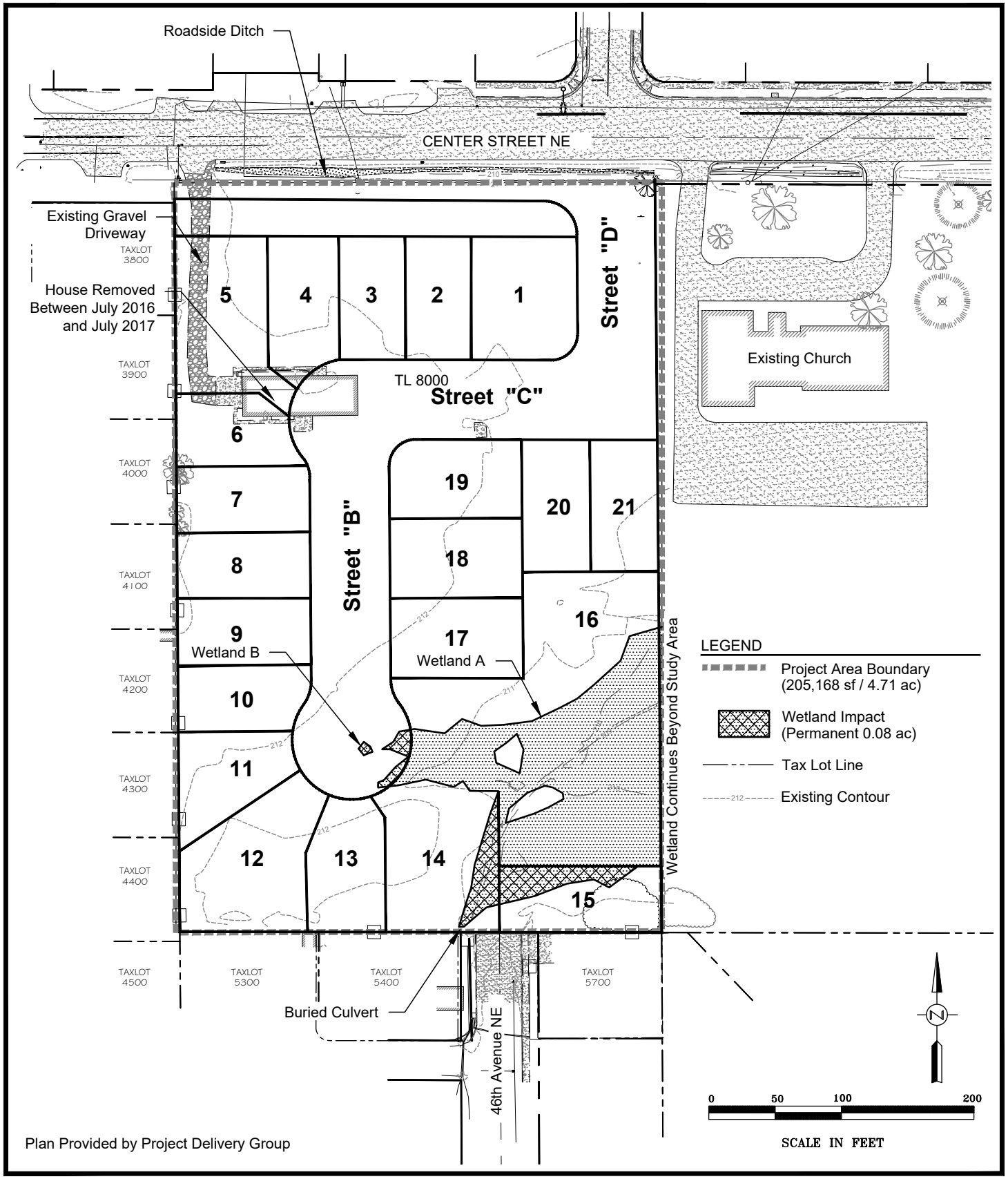
Pacific Habitat Services,Inc.
9450 SW Commerce Circle, Suite 180 Wilsonville, Oregon 97070
Phone: (503) 570-0800 Fax (503) 570-0855

Plans Provided by
Project Delivery Group

Erosion / Sediment Control Plan
Belle Plaine Estates - Salem, Oregon

FIGURE
8

6-2-2021



Plan Provided by Project Delivery Group

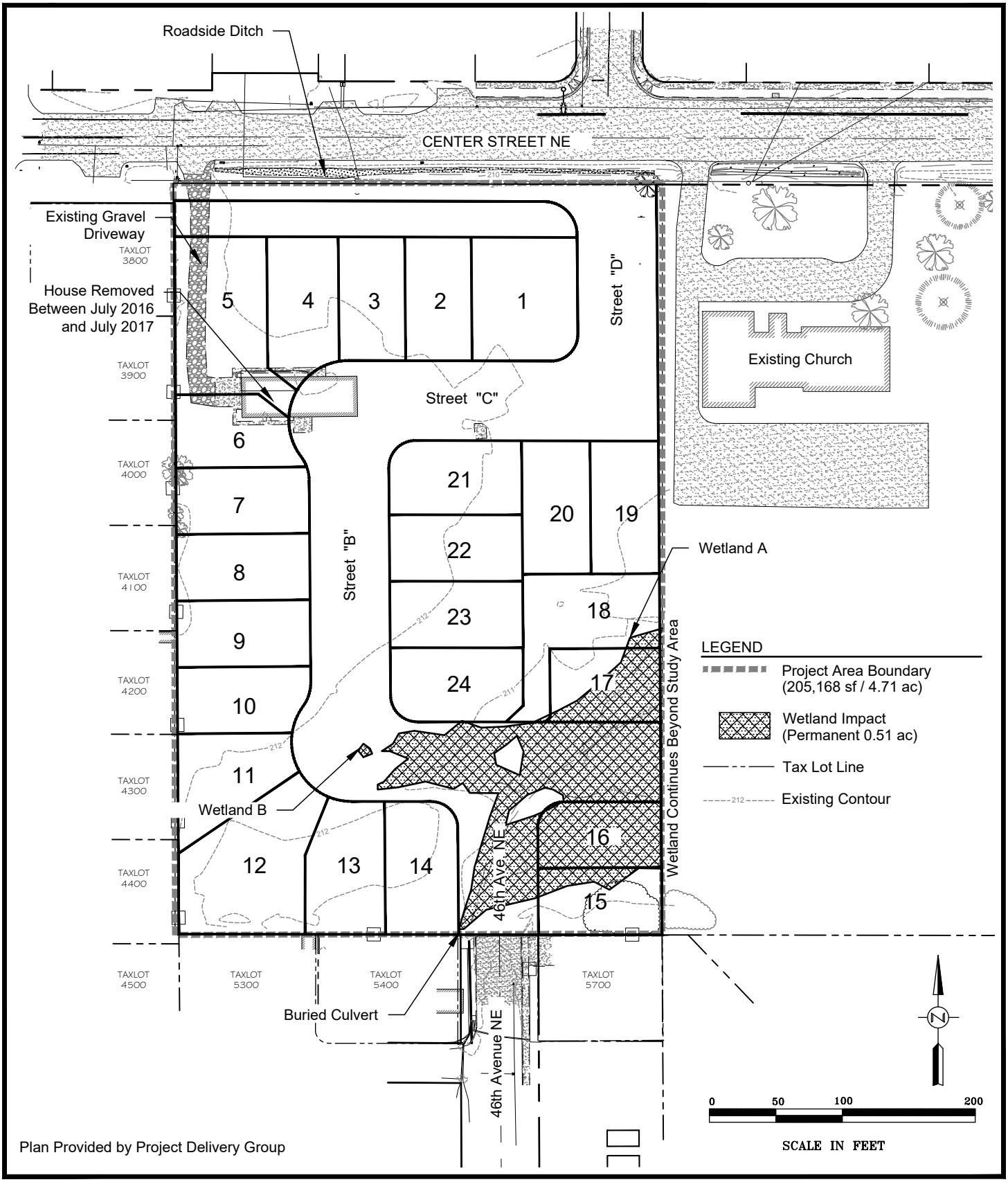
Pacific Habitat Services,Inc.
9450 SW Commerce Circle, Suite 180 Wilsonville, Oregon 97070
Phone: (503) 570-0800 Fax (503) 570-0855

Site Plan - Alternative Option 1

Belle Plaine Estates - Salem, Oregon

FIGURE 9A

6-2-2021



Plan Provided by Project Delivery Group

Pacific Habitat Services,Inc.
9450 SW Commerce Circle, Suite 180 Wilsonville, Oregon 97070
Phone: (503) 570-0800 Fax (503) 570-0855

Site Plan - Alternative Option 2

Belle Plaine Estates - Salem, Oregon

FIGURE 9B

6-2-2021

Attachment 2

Stormwater Report
(Corps and DEQ)

SLOPES for Stormwater, Transportation and Utilities

(NMFS# NWR-2013-10411)

Stormwater Information Form

If you are submitting a project that includes a stormwater plan for review under SLOPES for Stormwater, Transportation and Utilities please fill out the following cover sheet **to be included with** stormwater management plan, and any other supporting materials.

Also include a drawing of the stormwater treatment area including drainage areas, direction of flow, BMP locations and types, contributing areas, other drainage features, receiving water/location, etc.

	Project Information	
	Corps of Engineers permit #	
	Name of Project:	
	Type of project (i.e., residential, commercial, industrial, or combination)	Residential
	Nearest receiving water occupied by ESA-listed species or designated critical habitat	
	Lat/Long (DDD.dddd) of Project Location:	
	Have you contacted anyone at NMFS regarding this project?	
	Applicant/Consultant name:	
	Applicant/Consultant email:	
	Stormwater Designer and/or Engineer Contact Information	
	Name:	Project Delivery Group, LLC, Lee Brennan
	Phone:	503 364-4004
	Email:	leeb@pdgNW.com
	Summary of Design Elements	
1.	24-hour design storm: Inches 1.38 ← City of Salem Required	50%* of 2-yr, 24-hr storm fully treated: Yes (X) No ( ) If no, project may not meet the SLOPES programmatic criteria *May be greater than 50% - see PDC 36.e. for geographically based percentage
2.	2 year, 24 hour storm from NOAA Precipitation Atlas: Inches http://www.nws.noaa.gov/ohd/hdsc/noaaatlas2.htm	2.2
3.	**Total** contributing impervious area including all contiguous surface (e.g. roads, driveways, parking lots, sidewalks, roofs, and similar surfaces)	2.707 Acres
	Proposed new	2.531 Acres
	Existing	0.176 Acres
	Acres of total impervious area 2.707 x 1.38 in design storm =	13,560 ft^3 to be treated
4.	Peak discharge of design storm:	0.06 cfs
5.	Total stormwater to be treated:	13,560 ft^3 0.06 cfs
6.	Stormwater Design Manual Used and Year/Version: (example: City of Portland, Clean Water Services, King County, Western Washington) City of Salem Describe which elements of your stormwater plan came from this manual: USE OF, DOWNSTREAM DEFENDER PRE-TREATMENT MANHOLE, VEGETATED SWALES & DET. BASIN; OUTLET CONTROL MANHOLE,	

7.	Have you treated all stormwater to the design storm within the contributing impervious area? Yes (X) No ( ) If no, why not and how will you offset the effects from remaining stormwater? All treated.
	Water Quality
8.	Low Impact Development methods incorporated? Yes (X) No ( ) (e.g. site layout, vegetation and soil protection, reforestation, integrated management practices such as amended soils, bioretention, permeable pavement, rainwater collection, tree retention) Please describe: Vegetated Swales and detention basin How much of total stormwater is treated using LID: 100%
9.	Treatment train, including pretreatment and bioretention methods used to treat water quality: Downstream Defender, vegetated swale/ Detention basin Why this treatment train was chosen for the project site: Relatively flat terrain and high receiving public stormwater pipe invert Page in stormwater plan where more details can be found: 2 - 8
	Water Quantity
10.	Does the project discharge directly into a major water body (see PDC 36.c.iii)? Yes ( ) No (X)
11.	Pre-development runoff rate (i.e., before human-induced changes to the unimproved property) 2-yr, 24-hour storm: 0.15 cfs 10-yr storm: 0.69 cfs Post-development runoff rate (i.e., after proposed developments) 2-yr, 24-hour storm: 0.15 cfs 10-yr storm: 0.53 cfs
	Post-development runoff rate must be less than or equal to pre-development runoff rate
12.	Methods used to treat water quantity: Detention basin with Outlet Flow Control Manhole. Page in stormwater plan where more details can be found: Pages 2 to 8

	Maintenance and Inspection Plan
13.	Have you included a stormwater maintenance plan with a description of the onsite stormwater system, inspection schedule and process, maintenance activities, legal and financial responsibility, and inspection and maintenance logs? Yes (✓) No* ( ) *Projects cannot be submitted for review under SLOPES without a maintenance and inspection plan. Page in stormwater plan where plan can be found:
14.	Contact information for the party/parties that will be legally responsible for performing the inspections and maintenance or the stormwater facilities: Name: Don Jensen, Jensen Consulting & Dev, LLC Phone number: 503-932-2259 Email: don.jensen@jensenco llc.com Name: City of Salem, Public Works Department Phone number: 503 588 6211 Email: _____ Name: _____ Phone number: _____ Email: _____ Page in stormwater plan where more details can be found: Appendix E, Inspection & Maintenance Plan

DRAINAGE DESIGN REPORT and STORMWATER MANAGEMENT PLAN

For

Belle Plaine Estates

Jensen Consulting and Development, LLC
Salem, Oregon

Prepared for:

CITY OF Salem AT YOUR SERVICE

City of Salem
555 Liberty St SE
Salem, OR 97301

Date:
March 2021
Site Location:
4560 Center Street NE
072W30AA/8000 –4.9 Acres

Prepared by:

Project Delivery Group, LLC
3772 Portland Road NE
Salem, Oregon 97301

REGISTERED PROFESSIONAL ENGINEER
15716
OREGON
JANUARY 21, 1992
LEE NORTH BRENNAN

RENEWS: 12/31/2021

Table of Contents

Project Overview and Description

Size and Location of Project

The proposed project encompasses approximately 4.9 acres and is located at 4560 Center Street NE, in Salem, Marion County, Oregon (Site). Tax map and lot number is 072W30AA 8000.

Refer to the infrastructure improvement drawings for the Site map.

Brief Description of Project Scope and Proposed Improvements

The Belle Plaine Estates Project consists of a 24-lot single-family residential subdivision with public streets and public utilities. The project is being designed to January 2016 City of Salem (City) Stormwater Design Standards. In addition to the City's design standards, the project will be designed to meet the U.S. Army Corps of Engineers Standard Local Operating Procedures for Endangered Species (SLOPES) requirements as part of the wetland fill-removal permitting processes associated with Site. The development incorporates a detention basin and vegetated swales to provide for stormwater flow control, detention, and water quality enhancement.

Contaminants of Concern

Pollutants of concern for residential developments, as listed in the DEQ Stormwater Management Submission Guidelines for Removal/Fill Permit, include the following:

- Sediment
- Metals (zinc, copper, lead, etc.)
- Oil, Grease and Other Petroleum
- Nutrients (nitrogen, phosphorous, other fertilizer ingredients)
- Pesticides, herbicides, fungicides
- Chloride
- Fecal Coliform
- Hydrocarbons

Description and size of the watershed draining to the site

The Site is located in Southwest Salem along the south side of Center Street NE, and west side of 45th Place NE. The Site slopes to the southeast with grades ranging from 0 to 3%. The majority area of the Site however is very flat, with a grade of approximately 0.3% from south to north. The Site encompasses approximately 5.02 acres.

The adjoining existing residential development to the south discharges stormwater runoff into an open channel on the Site through an existing culvert. The size of the Off-Site drainage basin draining to this point is approximately 5.0 acres in size. With the extension of 46th Avenue NE, the off-site drainage basin will be piped directly to the existing wetland to maintain hydrology flows to the wetlands; therefore, the off-site basin will not be accounted for in the proposed stormwater design.

The existing site contains a single-family residence with associated landscaping, paved patios, and gravel accessways. The remainder of the site include open areas and a small portion of a wetland (0.13 acres). The existing residence

and the existing gravel accessway will be removed with the development of the subdivision. The impermeable surfaces of the existing residence have not been included in the pre-development hydrology analysis of the site.

There is an existing underground stormwater collection and conveyance system located in Center Street NE, which is located to the north of the site. For purposed of this report, it is assumed that this system has adequate capacity to convey the pre-development flows from the site. The public storm sewer system in Center Street NE is shallow in depth, which limits the pipe connection to it from this Project. It also limits the low-impact development alternatives available for treatment of the collected stormwater.

It is the intent of the design of the Project to have the Site operate under two drainage areas: Drainage Basin A and Drainage Basin B, as illustrated in the drainage basin maps provided in Appendix A. The northerly basin (hereinafter referred to as "Drainage Basin A") encompasses approximately 145,757 square feet (3.35 acres) and is the majority of the Site. Drainage Basin A drains primarily to the north towards Center Street NE where any flows enter the existing stormwater management system. The second drainage area (Drainage Basin B) encompasses approximately 61,573 square feet (1.41 acres) and drains primarily to Center Street NE. There is a third drainage basin located in the southwesterly portion of the Site which includes the wetland and adjoining areas (both in pre-and post-development) that drain into the wetland, which do not contain any impermeable surfaces, and which encompasses approximately 11,504 square feet (0.26 acres). Currently, the drainage flow through this drainage basin is via a small open channel (1'-2' wide) in a northeasterly direction through the wetlands and into the public piped stormwater system in Center Street NE. This third basin (including the wetland area) was not included in the areas of stormwater run-off to be collected treated and detained, and thus is not discussed further in this drainage report.

Drainage Basin A is designed for collected run-off to flow through a vegetated swale (with 6" wide concrete check dams for flow attenuation/spreading purposes) that is part of the westerly portion of the swale/detention basin located parallel with and along the frontage of Center Street NE, where it will be treated before being discharged out of the swale/detention basin and into the existing stormwater management system in Center Street, NE. This westerly vegetated swale portion of the swale/detention basin is approximately 162 feet in length. The collected stormwater from Drainage Basin B (which also includes the collection of stormwater run-off along Center Street NE) being conveyed through a vegetated swale with the same type of concrete check dams that is part of the easterly portion of the swale/detention basin; this easterly vegetated swale portion of the swale/detention basin is approximately 104 feet in length.

The flow out of the vegetated swale/detention basin is regulated by an outlet control manhole located out in the Center Street NE right-of-way. The manhole is equipped with four orifices for flow control, and an overflow riser pipe to address very large storm event flows without overtopping of the swale/detention basin.

Summary of the Manner in which Existing Trees and Native Vegetation are Impacted and/or Preserved

The site has an existing single-family dwelling, paved patios and graveled accessways. There are no significant trees. The vegetation is predominately planted grasses. The grass cover will be maintained until the development of the subdivision occurs which will require removal of the vegetated cover.

Summary of the Extent in which GSI/MEF criteria are met

This project is classified as a Large Project because of land disturbance over 10,000 square feet in area. Large projects are required to use Green Stormwater Infrastructure (GSI) to the City's maximum extent feasible (MEF)

criteria to meet flow control and treatment performance standards. All the collected stormwater of the two drainage basins will be passed through pre-treatment manholes followed by vegetated swales passage prior to discharge. The vegetated swale will utilize ¾" to 2-inch river rock placed 2.5 to 3 inches deep on high density coconut matting over 12 inches of native topsoil. The bottom of the swale will be planted with species such as rushes and other forbs, as well as shrubs, that are well-suited for wet-to-moist soil conditions.

Regulatory Permits Required

A 1200-C permit from the Oregon Department of Environmental Quality (DEQ) is required along with City of Salem permits. A Section 404 permit will be applied for and obtained from the Oregon Department of State Lands (DSL) and the U.S. Army Corps of Engineers (ACOE) to fill in the existing ditch and adjoining wetland areas to extend 46 th Avenue NE and complete the access to and the formation of the associated lots. There will be no work within the wetland until the appropriate fill-removal permit is obtained.

Escape route for the 100-year storm

The escape route for the stormwater runoff from the site due to a 100-year storm event will be via surface overflow conveyance out the northerly end of the Project where any floodwaters will flow to the existing piped public underground system in Center Street NE, being conveyed to the north in underground piping and open ditches through residential neighborhoods. The City identifies the drainage ditch/underground piping as the "East Fork Little Pudding". The flow continues in the underground piping/open ditch conveyance system until the system discharges into the West Fork Little Pudding River located approximately 2.0 miles to the northeast of the Site. The West Fork Little Pudding River discharges into the Little Pudding River at a point located approximately 4.3 miles to the northeast of the Site.

Methodology

Depth to Groundwater

A geotechnical investigation is currently being conducted for the development of Belle Plaines Estates. Groundwater elevations are expected to fluctuate seasonally in accordance with rainfall conditions and are not expected to approach surface elevation. Thus, groundwater presence was not included in the hydrology calculations of this report.

Delineation of Existing Trees and Native Vegetation

The Project site, as previously discussed, has a planted grass cover. There are no significant streets or native vegetation presence.

Description of Soil Types and Any Other Geologic Features Impacting Stormwater Infrastructure Design

Per the Natural Resource Conservation Service (NRCS) Soil Survey, the site consists predominately (75.7%) of Woodburn Silt loam (WuA, hydrologic soil group C) and (approximately 24.3%) of Concord Silt Loam (Co, hydrologic soil group C/D). A copy of the NRCS soils report for this site is provided in Appendix B. There are no other geological features impacting stormwater infrastructure design for the site. For the purposes of this report, the Site soils are considered to all be in group C.

Identification of any hazardous materials based on past use of the project Site

No hazardous materials are expected on this Site.

Analysis

Computational methods utilized and software utilized

In accordance with City of Salem January 2016 Stormwater Design Standards, the TR-55 method Hydrograph Type 1A, 24-hour storm was used to model the required design storms. HydroCAD modeling software was used to size the stormwater facilities. The design storms used were:

- Salem water quality storm (1.38 inches)
- ½ of the 2-year 24-hour storm (1.80 inches)
- 2-year 24-hour storm (2.2 inches) (SLOPES requirements)
- 10-year 24-hour storm (3.2 inches)
- 25-year 24-hour storm (3.6 inches) (used for water quality Max. Velocity)
- 100-year 24-hour storm (4.4 inches) Used for outflow restriction and freeboard in swale/basin during storm event)

For the Site, the pre-development peak 2 year storm event flow rate was determined to be 0.15 cfs. For design purposes, half of that flow rate was 0.08 cfs. Using the hydrograph method and the HydroCAd modeling software, this equated to a 1.80 inch storm event.

Design Assumptions

As per the City of Salem requirements, the water quality design storm event is 1.38 inches of rainfall. SLOPES utilizes the less intense ½ of the 2-year, 24-hour event (1.1 inches of rainfall). For the purposes of this report, the City of Salem water quality storm event of 1.38 inches of rainfall was used for the water quality parameters of this report and the storm water management system for the Site.

As previously discussed, the site has been divided up into 2 drainage basins:

- Drainage Basin A: Collects storm water from approximately 3.35 acres (1.76 acres impervious) which flows through a pre-treatment manhole (Downstream Defender®) before being conveyed through a vegetated swale (with concrete check dams for flow spreading purposes) that is part of the westerly portion of the swale/detention basin located parallel with and along the frontage of Center Street NE; it will be treated for water quality utilizing bio-retention and phytoremediation through the vegetated bottom and shallow slopes of the westerly vegetated swale portion of the swale/detention basin (approximately 162 feet in length) before being discharged out of the swale/detention basin and into the existing stormwater management system in Center Street, NE. Outflow from the swale/detention basin is controlled by an outlet control manhole which discharges into the existing piped underground conveyance system within Center Street NE.

- Drainage Basin B: Collects storm water from approximately 1.41 acres (0.77 acres impervious) which flows through a separate pre-treatment manhole (Downstream Defender®) before being conveyed through a vegetated swale (with concrete check dams for flow spreading purposes) that is part of the easterly portion of the swale/detention basin located parallel with and along the frontage of Center Street NE; it will be

treated for water quality utilizing bio-retention and phytoremediation through the vegetated bottom and shallow slopes of the easterly vegetated swale portion of the swale/detention basin (approximately 104 feet in length) before being discharged out of the swale/detention basin and into the existing stormwater management system in Center Street, NE. Outflow from the swale/detention basin is controlled by an outlet control manhole which discharges into the existing piped underground conveyance system within Center Street NE.

The drainage basins are illustrated on the drainage basin maps provided in Appendix A.

The swale detention basin will have a bottom elevation ranging from 207.81 to 207.63 with a top of basin minimum elevation of 211.0. A City specified orifice outflow control manhole structure, located between the detention basin outlet and the inlet to the existing stormwater management system in Center Street NE, will control outflows from the swale/detention basin such that the combined peak discharge flows from the north and south basins during the design storm events will not exceed the calculated peak pre-design combined flow for these two basins.

A Site-specific percolation/infiltration test has not been performed. For purposes of this study, an assumed percolation/infiltration rate of 0.5 inches per hour was assumed, which is a conservative value for the type C hydrologic soils of the Site. For design purposes, it was assumed to utilize 50% of this assumed rate or 0.3 inches per hour. In the HydroCAD model and associated results, this outflow is labelled "discarded"

Hydrology Calculations

Run-off Curve Numbers (CN) and Time of Concentration (Tc)

For run-off estimation, a pre-and post-development flow path was determined for the Drainage Basins A and B, as illustrated in the drainage basin maps provided in Appendix A. The pre-developed runoff CN for the site was the City required 72 for soils within hydrologic group C, with the exception of the existing paved street portion of Center Street (which will be retained as part of the proposed development) with a CN of 98. The post-developed runoff CN used for the site is based on the following assumptions:

- Paved Streets: 98
- Sidewalks: 98
- New House Roof Areas (assumed 2,000 s.f./lot): 98
- New House Driveway Areas (assumed 400 s.f.): 98
- Landscaped Yard Areas; all other pervious areas: 74.

Drainage Basin A: The pre-development flow path consists of sheet flow across the lot for approximately 300 feet, and then transitions into shallow concentrated flow when it enters the existing drainage swale along the frontage of Center Street NE. The post-development flow path is aligned as sheet flow across the assumed grassed portion of one of the lots for approximately 85 feet, where it is collected by a private area drain for conveyance though a 6-inch-diameter pipe to a new curb inlet to be developed in the extension of 46th Ave. NE. It then flows though the underground piped storm water conveyance system; passes though the pre-treatment manhole; and then is discharged into the westerly end of the westerly portion of the swale/detention basin. No delay time was accounted for in the pre-treatment manhole nor in the flow through the swale/basin. The pre-and post-development flow paths (which does not include a 5-minute delay from when the storm starts to when surface water run-off occurs [as per the methodology of the 2011 Oregon Department of Transportation Hydrology Manual] parameters were input

into the HydroCAD program which determined a pre-development Tc of 22.9 minutes, and a post-development Tc of 22.4 minutes.

Drainage Basin B: The pre-development flow path consists of sheet flow for approximately 267 feet. The post-development flow path consists of sheet flow across the assumed grassed side of one of the lots for approximately 88 feet; then across the sidewalk and landscape strip areas before discharging into the street gutter. The street gutter flows (shallow concentrated flow) south and then north and into the new curb inlet at the intersection with Center St. NE. It then flows though the underground piped storm water conveyance system; passes though the pre-treatment manhole; and then is discharged into the easterly end of the easterly portion of the swale/detention basin. No delay time was accounted for in the pre-treatment manhole nor in the flow through the swale/basin. The pre- and post-development flow paths (which does not include a 5-minute delay from when the storm starts to when surface water run-off occurs [as per the methodology of the 2011 Oregon Department of Transportation Hydrology Manual] parameters were input into the HydroCAD program which determined a pre-development Tc of 24.5 minutes, and a post-development Tc of 24.0 minutes.

The Hydro CAD model results for the basins in a pre- and post-development scenario are provided in Appendix C.

Using the derived Tc's, weighted CNs, and other drainage basin parameters, the combined peak pre-and post-development flow rates (with and without flow control) for ½ of the 2-year, 2-year (SLOPES), 10-year, 25-year, and 100-year design storm event peak flows are summarized in Table 2 below.

Table 1: Combined Drainage Basins A and B Pre-and Post-Development Calculated Peak Stormwater Flows

Storm Event	Pre-Development (cfs)	Post-Development (cfs)	
		No Controls	With Controls
½ of 2-year	0.08	0.66	0.08
2-year	0.15	1.02	0.15
10-year	0.72	2.03	0.53
25-year	1.01	2.46	0.81
100-year	1.66	3.33	1.65

The combined drainage basin outflow model results for the predevelopment (Reach 5R) and Post Development (Reach 7R) scenarios, are provided in Appendix C.

Treatment and flow control sizing calculations

Swale/Detention Basin and Outflow Control Structure

The swale/detention basin details are provided in the infrastructure improvement drawings. In general, the swale/detention basin consists of a reinforced concrete retaining wall along the northerly, westerly and southerly sides of the swale/basin, with a 25-foot-wide flat bottom, and a 5:1 access slope on the easterly end of the

swale/basin. Swale/detention basin has a bottom design elevation of 207.81 at its westerly end and 207.76 at the easterly end, and a bottom elevation at the ditch inlet outlet structure grate elevation of 207.63. The minimum top surface elevation of the swale/basin's top of slope or top of wall is 211.0. The outlet for the swale/basin is a City Type 3 catch basin (ditch inlet) with a downgradient outlet flow control manhole. The outlet flow control structure has a lower 1.8-inch-diameter orifice set an elevation of 207.62 (1/2 of the 2-year orifice); a second 2.0-inch-diameter orifice with an invert elevation of 208.55 (2-year orifice); 2 each 8.0-inch-diameter orifices with inverts of 208.90; an overflow riser pipe (10-inch-diameter) rim elevation of 210.00; and a manhole rim (with the outlet control manhole placed in the landscape strip between the back of curb and the sidewalk) elevation of 212.17.

During the "1/2 the 2-year" design storm event, the peak water surface elevation in the basin was modeled to be 208.59, with a peak outflow rate of 0.08 cubic feet per second (cfs), and a required storage volume of approximately 5,992 cubic feet. During the "2-year" design storm event (modeled for SLOPES requirements), the peak water surface elevation in the basin was modeled to be 208.93, with a peak outflow rate of 0.15 cfs, and a required storage volume of 8,309 cubic feet; there is approximately 2.07 feet of freeboard in the basin during the 2-year event. During the "10-year" design storm event, the peak water surface elevation in the basin was modeled to be 209.14, with a peak outflow rate of 0.53 cfs, and a required storage volume of 9,786 cubic feet; there is approximately 1.86 feet of freeboard in the basin during the 10-year event. During the "25-year" design storm event, the peak water surface elevation in the basin was modeled to be 209.23, with a peak outflow rate of 0.81 cfs, and a required storage volume of 10,407 cf; there is approximately 1.77 feet of freeboard in the swale/basin during the 25-year event. During the "100-year" design storm event, the peak water surface elevation in the basin was modeled to be 209.43, with a peak outflow rate of 1.65 cfs, and a required storage volume of 11,833 cf; there is approximately 1.57 feet of freeboard in the basin during the 100-year event. The basins full capacity to the minimum top surface elevation of 211.00 is approximately 22,974 cubic feet.

Thus, the calculated post-development controlled peak outflows for the modeled storm events do not exceed the peak calculated pre-development outflow rates, as summarized in Table 1 above. The Hydro CAD model results of the routing of the various design storm events through the detention basin are provided in Appendix C

Drainage Basin A: Vegetated Swale (Water Quality)

The run-off from Drainage Basin A flows through the vegetated swale located along the westerly portion of the swale/detention basin along the frontage of Center Street NE. It is designed so that low-flow storm water run-offs will flow through the vegetated swale and either percolate or be captured within the growing medium or will be enhanced by the vegetative swale's phytoremediation processes. Per the January 2016 City of Salem Stormwater Design Standards, the westerly vegetated swale City of Salem requirements and the modeling results are summarized in Table 2 below.

Table 2: Vegetated Swale Requirements/Modeling Results for Drainage Basin A (West Vegetated Swale)

Code Requirement	Water Quality Required	Water Quality Designed	Conveyance Required	Conveyance Designed	Meets Design Requirements
Minimum Hydraulic Residence Time: (min)	9	56.0	~	~	YES
Maximum Water Design Depth: (ft)	0.33	0.12	1	0.15	YES
Minimum Freeboard (for facilities not protected from high flows): (ft)	~	~	1	3.0	YES
Manning "n" Value:	0.25	0.25	0.03	0.03	YES
Maximum Velocity (fps)	0.9	0.05	3	0.46	YES
Minimum Length of Swale: (ft)	100	163	100	163	YES

Drainage Basin B: Vegetated Swale (Water Quality)

Similar to the vegetated swale of Drainage Basin A, the collected storm water run-off from Drainage Basin B flows through the pre-treatment manhole, and then continues through the vegetated swale located along the easterly portion of the swale/detention basin along the frontage of Center Street NE, which is designed similar to the westerly vegetated swale: it is designed so that low-flow storm water run-offs will flow through the vegetated swale and either percolate or be captured within the growing medium or will be enhanced by the vegetative swale's phytoremediation processes. Per the January 2016 City of Salem Stormwater Design Standards, the easterly vegetated swale Hydrocar model results area are summarized in Table 3 below.

Table 3 – Vegetated Swale Requirements/Modeling Results for Drainage Basin B

Code Requirement	Water Quality Required	Water Quality Designed	Conveyance Required	Conveyance Designed	Meets Design Requirements
Minimum Hydraulic Residence Time: (min)	9	52.1	~	~	YES
Maximum Water Design Depth: (ft)	0.33	0.07	1	0.09	YES
Minimum Freeboard (for facilities not protected from high flows): (ft)	~	~	1	3.1	YES
Manning "n" Value:	0.25	0.25	0.03	0.03	YES
Maximum Velocity (fps)	0.9	0.04	3	0.34	YES
Minimum Length of Swale: (ft)	100	111	100	111	YES

The Hydro CAD model results for the vegetated swales for the two drainage basins are provided in Appendix D.

Outlet Conveyance Pipe Capacity Calculations

The greatest outflow rate for the pipes would be at the outflow pipe from the control structure for Drainage Basins A and B, during the 100-year storm event. The outflow pipe is limited to a 10" diameter to avoid interference with other existing utilities in Center Street. The peak outflow from the detention basin's outlet control structure during the modeled 10-year design storm event is 0.54 cfs, with the 10" pipe having a capacity of 0.65 cfs. During the 25- and 100-year year design storm events the peak flow rate exceed the gravity flow capacity of the 10" pipe, but the additional head is reflected in the detention basin head required for outlet flow under a surcharged condition during these events. The Hydro CAD model conveyance results for the outlet pipe from the flow control manhole (Reach 7R) is provided in Appendix C.

GSI Analysis

Implementation of GSI to Maximum Extent Feasible

With the incorporation of the pre-treatment manholes with the vegetated swales, this project implements Green Stormwater Infrastructure (GSI) to 100% of the Maximum Extent Feasible (MEF). Thus, the stormwater management system has been designed with the utilization of GSI to the MEF.

Stormwater Facility Details/Exhibits

The drainage basin maps for the pre-and post-development scenarios are provided in Appendix A. The maps illustrate the drainage basins and flow paths utilized in the analysis. The infrastructure improvement drawings illustrate the vegetated swale/detention basin, and outlet flow control structure details.

Source Control / Downstream Analysis Report / Open Channel Hydraulic Modeling / Floodway and Floodplain Analysis

Source control, downstream analysis, open channel hydraulic modeling, and floodway and floodplain analysis are not required for this project. Potential pollution sources are expected to be those typical for residential developments as summarized above in Contaminants of Concern. A downstream analysis report is not required as it is assumed that the downgradient system has adequate capacity to address pre-development flows from the Site and the peak flows from the Site are being limited to be at or below the calculated pre-development flow rates for the ½ of the 2-year and 10-year design storm events. There are no significant open channels in proximity to the Site, which would require modeling for downstream analysis purposes. No floodway or floodplain analysis will be required for this Project since the property is not in a mapped FEMA area of special flood hazard.

SLOPES

Provided below is a response to each item listed in the SLOPES response form:

Describe all low-impact development practices that will be used to infiltrate or evaporate runoff from the project area.

In order to protect endangered species and other fauna within the Project area, during the development of Belle Plaine Estates, some low-impact development practices will be used as part of the stormwater management system. These practices include bio-retention and phytoremediation through swales with a vegetated bottom.

Clearly document the amount of post construction runoff (PCR) that would be treated.

The Post Construction Runoff (PCR) volumes for a design storm of 50% of the 2-yr 24-hr storm (1.1 inches); the total impervious area (2.53 acres) multiplied by the 2-yr 24-hour design storm in feet (0.092 feet) calculates a PCR volume for the site of 0.023 acre-feet.

Detail how and where water quality treatment would be provided for the PCR.

The pretreatment manholes and the vegetated swales will act as both a low-impact development practice and water quality treatment for 0.23 acre-ft of PCR. The vegetated swales will use a layer of growing medium to facilitate bioretention, bio-accumulation, biodegradation, and the use of native grasses, rushes, and other forbs and shrubs established within the growing medium for both bio-attenuation and phytoremediation (bio-uptake) processes. During the water quality design event, the run-off will be filter through the growing medium, with any overflow discharging into the ditch inlet.

Provide the specific stormwater manual reference for the design.

The Project is being designed to January 2016 City of Salem Design Standards pertaining to storm water management standards, which are modeled after the City of Portland Bureau of Environmental Service's Stormwater Management Manual (SWMM, 2016 version) and associated design standards and details.

Specify the BMPs that will be used to ensure the stormwater conveyance maintains natural drainage patterns, allows water quality treatment before mingling with stormwater run-on from adjacent area, and prevents erosion along the flow path to receiving water.

Rather than let stormwater runoff flow directly from the streets or lots into the existing underground stormwater piped conveyance system with eventual discharge into an unnamed tributary of Fruitland Creek, the runoff will be passed through pre-treatment manholes and the filtered through the vegetated swales before it enters the public underground piped conveyance system in Center Street NE. The detention basin will provide the required peak flow rate outlet control before the stormwater is discharged into the existing underground storm drain system within Center Street NE, where it will eventually discharge into the "East Fork Little Pudding" underground piped and open ditch conveyance system. By treating the water at the source, the toxicity and flow rates of the water flowing into the City's "East Fork Little Pudding" storm water conveyance system, then into the West Fork Little Pudding River, then into Little Pudding River, and eventually into the Willamette River will be greatly reduced. A vegetated swale with low flow velocities will also provide opportunity for the water to be infiltrated into the ground. Additionally, best management practices from the erosion control plan will continue to be implemented during infrastructure and residence development within the Belle Plaine Estates residential subdivision, implementing these BMP items as a minimum:

Erosion Control
- Preserve Natural Vegetation
- Dust Control
- Temporary/Permanent Seeding

Sediment Control
- Sediment Fence (Perimeter)
- Inlet Protection
- Construction Entrance

Pollution Control
- Proper Signage
- Hazardous Waste Management
- Spill Kit on site
- Designated Fueling Area
- Concrete Washout Area
- Recycle Materials
- Paving Operations Controls

Provide detail regarding the amount, type and location of mitigation for any untreated PCR.

Approximately 100% of the drainage area will be treated within the vegetated swales. As designed, there will be no untreated PCR.

Operate, inspect and maintain each stormwater facility in accordance with the maintenance plan, including scheduled inspections recorded in a maintenance log and timely correction of any deficiencies noted.

The vegetated swales will be maintained to provide a minimum of 80% of vegetative cover. An inspection and maintenance plan along with a copy of the maintenance logs for the vegetated swales, detention basin, catch basins and manholes, and the outflow control structure have been provided in Appendix F. The party responsible for the detention basin and the storm water management system inspection, operation, and maintenance will initially be the Developer of Belle Plaine Estates as part of the infrastructure warranty process within the City of Salem (1 year) During this warranty period, the Developer is legally and financially responsible for the pre-treatment manholes, vegetated swales, detention basin, and flow control outlet manhole, and will be responsible to provide inspection and timely correction of any deficiencies noted with these and other components of the stormwater management system. At the end of this period, the operation, maintenance, inspection, inspection logging, and legal and fiscal responsibility for these noted storm water management system components will be transferred to the City of Salem upon acceptance of the infrastructure improvements completed by the Developer; as such, the City will maintain the financial and legal responsibility of the stormwater management system, including the pre-treatment manholes, vegetates swales, detention basin, and outflow control manhole.

Conclusion

The stormwater treatment and flow control for the Site have been designed and sized to be in compliance with the January 2016 City of Salem Stormwater Design Standards.

A summary of design features of the designed stormwater management system is as follows:

Pre- and Post-Development Calculated Peak Stormwater Outflows, Combined Drainage Basins A and B

Storm Event	Pre-Development (cfs)	Post-Development (cfs)	
		No Controls	With Controls
½ of 2-year	0.08	0.66	0.08
2-year	0.15	1.02	0.15
10-year	0.72	2.03	0.53
25-year	1.01	2.46	0.81
100-year	1.66	3.33	1.65

Vegetated Swale Requirements/Modeling Results for Drainage Basin A

Code Requirement	Water Quality Required	Water Quality Designed	Conveyance Required	Conveyance Designed	Meets Design Requirements
Minimum Hydraulic Residence Time: (min)	9	56.0	~	~	YES
Maximum Water Design Depth: (ft)	0.33	0.12	1	0.15	YES
Minimum Freeboard (for facilities not protected from high flows): (ft)	~	~	1	3.0	YES
Manning "n" Value:	0.25	0.25	0.03	0.03	YES
Maximum Velocity: (fps)	0.9	0.05	3	0.46	YES
Minimum Length of Swale: (ft)	100	163	100	163	YES

Vegetated Swale Requirements/Modeling Results for Drainage Basin B

Code Requirement	Water Quality Required	Water Quality Designed	Conveyance Required	Conveyance Designed	Meets Design Requirements
Minimum Hydraulic Residence Time: (min)	9	52.1	~	~	YES
Maximum Water Design Depth: (ft)	0.33	0.07	1	0.09	YES
Minimum Freeboard (for facilities not protected from high flows): (ft)	~	~	1	3.1	YES
Manning "n" Value:	0.25	0.25	0.03	0.03	YES
Maximum Velocity: (fps)	0.9	0.04	3	0.34	YES
Minimum Length of Swale: (ft)	100	111	100	111	YES

Peak Static Heads within System:

During the 10-year design storm event: 209.14
During the 25-year design storm event: 209.23
During the 100-year design storm event: 209.43

Outlet Control Structure Overflow Riser Elev.: 210.00
Minimum Top Surface Elev. of Detention Basin: 211.00

APPENDIX A—DRAINAGE BASIN MAPS

DRAINAGE
BASIN A
145,757 SF

205,218 SF

DRAINAGE
BASIN B
61,573 SF

FLOW PATH

46TH AVE NE

CENTER ST NE

SPHINX CT NE

TAXLOT 7800
SALEM COMMUNITY OF
CHRIST CHURCH

WETLANDS

50.00'

55.79'

0 30' 60' 90'

PROJECT DELIVERY GROUP
Engineers | Land Surveyors | Project Managers

REGISTERED PROFESSIONAL ENGINEER
62679PE
OREGON
NOV. 13, 1998
KEITH W. HISENHUNT
EXPIRES: JUNE 30, 2020

PRELIMINARY; NOT FOR CONSTRUCTION

DATE SIGNED:

BELLE PLAINE ESTATES SUBDIVISION

JENSEN CONSULTING & DEVELOPMENT

SALEM, OREGON

REVISIONS

NO.	DESCRIPTION	DATE	BY

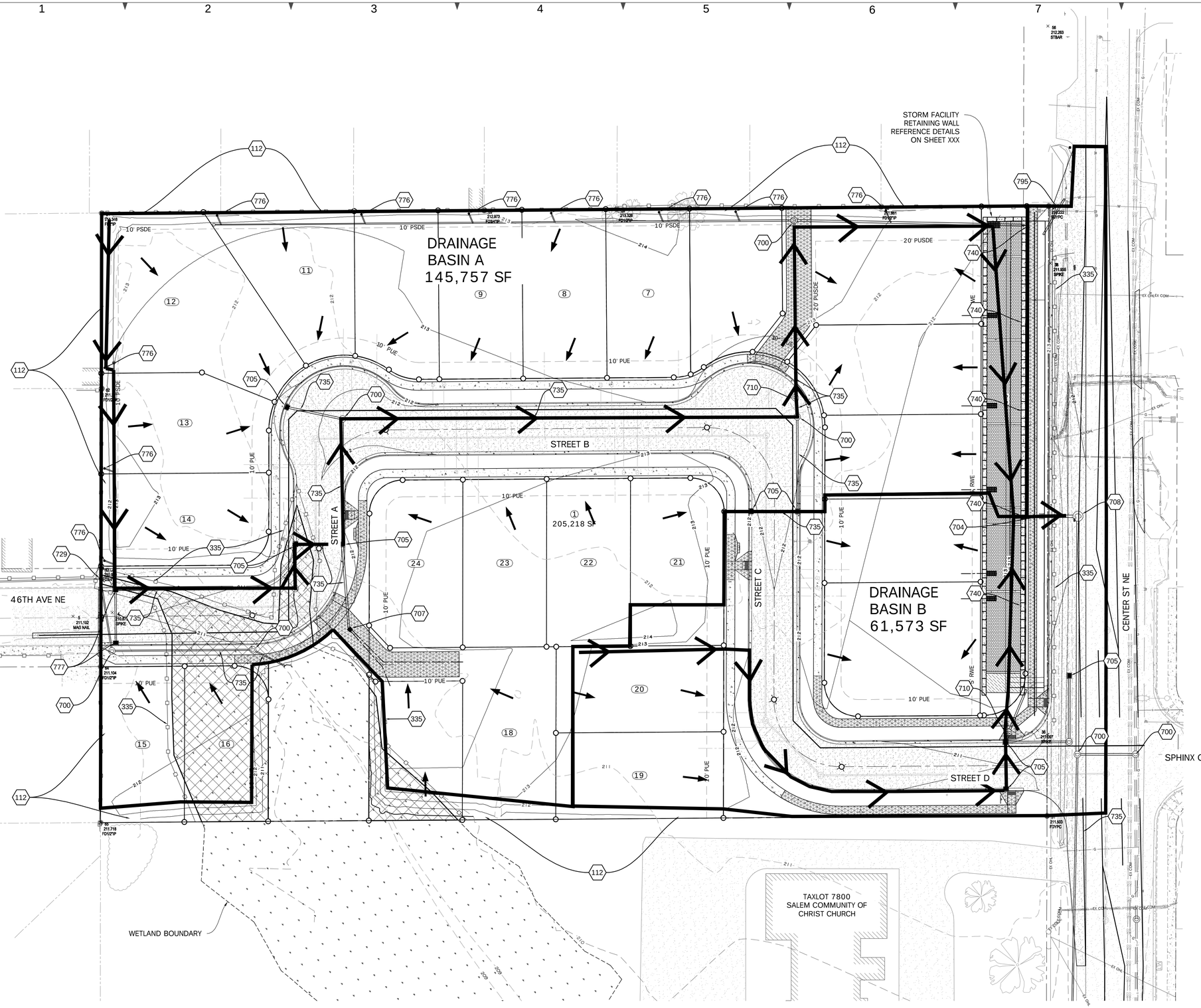
PROJECT NO:	13080
HORIZ DATUM:	NAD 83-SPCS
VERT DATUM:	NGVD 1929(47)
HORIZ SCALE:	AS SHOWN
VERT SCALE:	AS SHOWN
DESIGN:	KW
DRAWN:	JSL
CHECKED:	KW
APPROVED:	

SHEET TITLE

PRE-DEVELOPMENT DRAINAGE BASINS AND FLOW PATHS

EXHIBIT A

P:\2013 Project\13080 Belle Plain Estates - Center Street\The CAD\Civil\Exhibits\13080_Stormwater Pre Development20191205.dwg 12/5/2019 1:07:33 PM



1 OVERALL GRADING AND DRAINAGE
HORIZONTAL SCALE: 1" = 30'

PROJECT DELIVERY GROUP
Engineers | Land Surveyors | Project Managers

REGISTERED PROFESSIONAL ENGINEER
82679PE
OREGON
NOV. 3, 1999
KEITH W. WHISENHUNT
EXPIRES: JUNE 30, 2020
DATE SIGNED:

PRELIMINARY; NOT FOR CONSTRUCTION

BELLE PLAINE ESTATES SUBDIVISION

JENSEN CONSULTING & DEVELOPMENT, LLC

SALEM, OREGON

REVISIONS

NO.	DESCRIPTION	DATE	BY

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VERT SCALE:	AS SHOWN
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DRAWN:	JSL
CHECKED:	KW
APPROVED:	

SHEET TITLE

POST DEVELOPMENT DRAINAGE BASINS AND FLOW PATHS

EXHIBIT B

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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

June 11, 2018

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

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

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: 1:1,020 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 45 90 180 270

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 14, Sep 19, 2017

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

Date(s) aerial images were photographed: Jun 15, 2015—Jun 23, 2015

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
Co	Concord silt loam	1.1	24.3%
WuA	Woodburn silt loam, 0 to 3 percent slopes	3.6	75.7%
Totals for Area of Interest		**4.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Marion County Area, Oregon

Co—Concord silt loam

Map Unit Setting

National map unit symbol: 24p2
Elevation: 120 to 350 feet
Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 190 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Concord and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Concord

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Mixed mineralogy alluvium

Typical profile

H1 - 0 to 15 inches: silt loam
H2 - 15 to 29 inches: silty clay
H3 - 29 to 60 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Available water storage in profile: High (about 11.4 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Forage suitability group: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Minor Components

Dayton

Percent of map unit: 10 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave

Across-slope shape: Concave
Hydric soil rating: Yes

WuA—Woodburn silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 24s3
Elevation: 150 to 350 feet
Mean annual precipitation: 40 to 45 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 200 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodburn and similar soils: 85 percent
Minor components: 1 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Woodburn

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty alluvium and mixed mineralogy loess

Typical profile

H1 - 0 to 17 inches: silt loam
H2 - 17 to 32 inches: silty clay loam
H3 - 32 to 68 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 25 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Forage suitability group: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Aquolls, somewhat poorly drained
Percent of map unit: 1 percent
Landform: Terraces
Hydric soil rating: Yes

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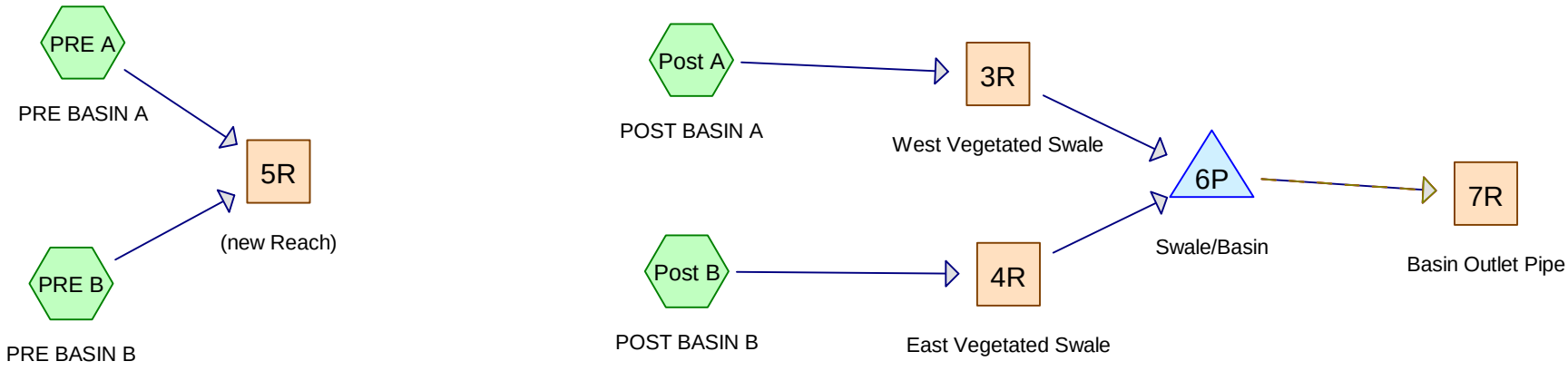
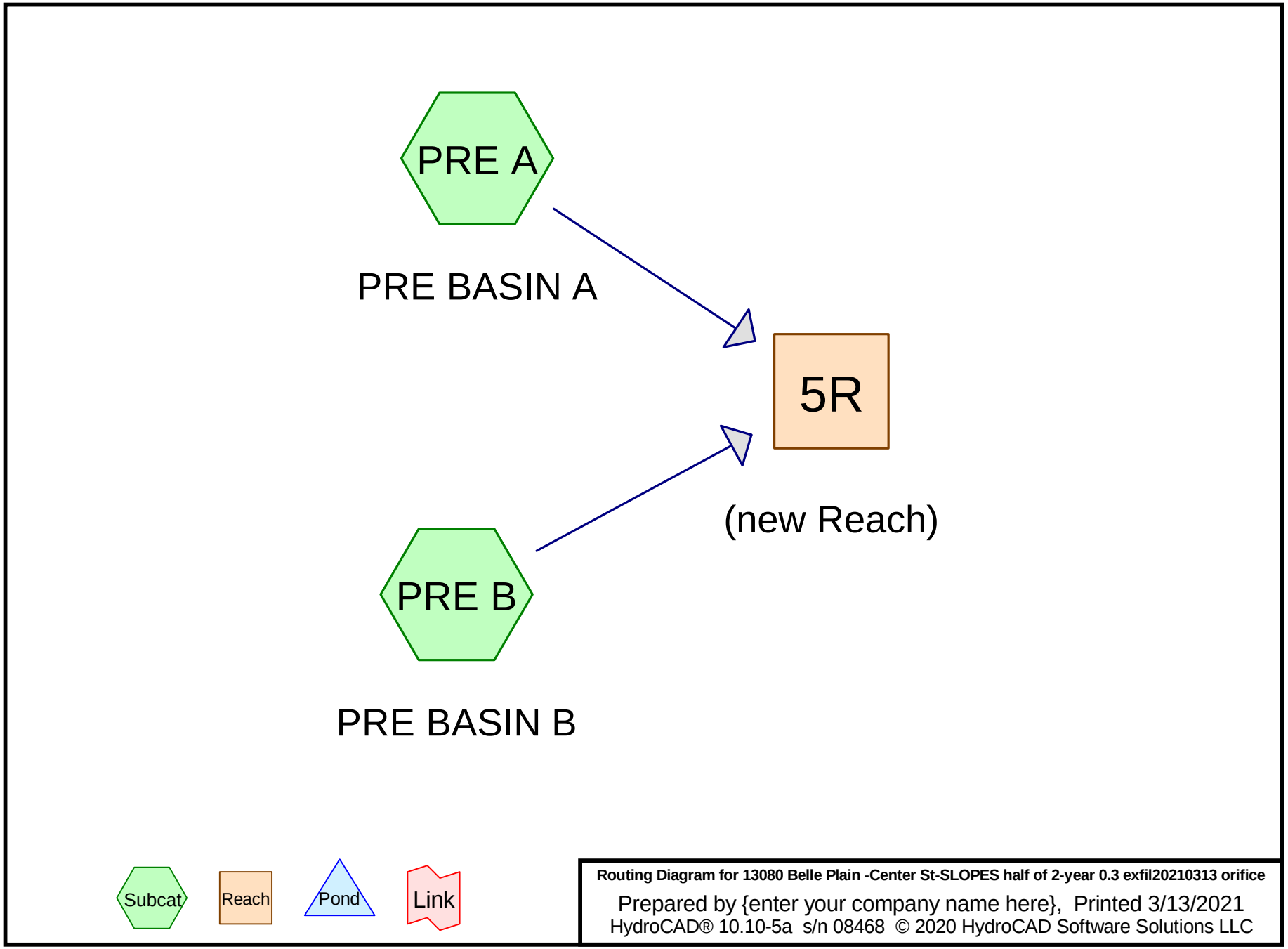
APPENDIX C— DRAINAGE BASIN, DETENTION POND, AND OUTLET PIPE HYDRO CAD MODEL ANALYSIS RESULTS



Subcat Reach Pond Link

Routing Diagram for 13080 Belle Plain -Center St-SLOPES half of 2-year 0.3 exfil20210228 orifice

Prepared by {enter your company name here}, Printed 3/8/2021



Routing Diagram for 13080 Belle Plain -Center St-SLOPES half of 2-year 0.3 exfil20210313 orifice

Prepared by {enter your company name here}, Printed 3/13/2021

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1/2 of 2 year	Type IA 24-hr		Default	24.00	1	1.80	2
2	2	Type IA 24-hr		Default	24.00	1	2.20	2
3	10	Type IA 24-hr		Default	24.00	1	3.20	2
4	25	Type IA 24-hr		Default	24.00	1	3.60	2
5	100	Type IA 24-hr		Default	24.00	1	4.40	2
6	WQ	Type IA 24-hr		Default	24.00	1	1.38	2

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	5R	207.40	207.26	142.0	0.0010	0.013	0.0	15.0	0.0

Summary for Subcatchment PRE A: PRE BASIN A

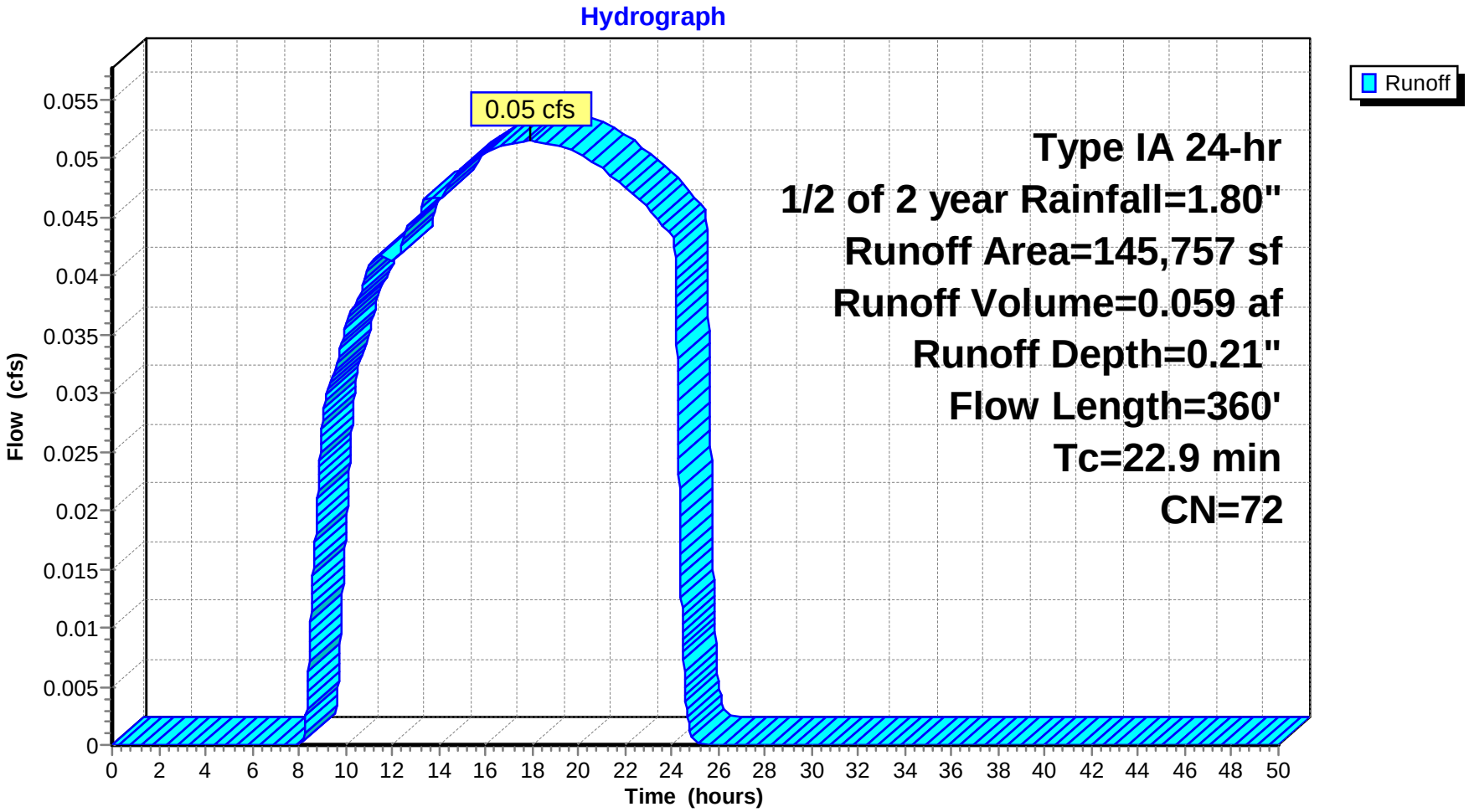
Runoff = 0.05 cfs @ 17.89 hrs, Volume= 0.059 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 of 2 year Rainfall=1.80"

	Area (sf)	CN	Description
*	145,757	72	COS - Required Pre-Dev.
	145,757		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	300	0.0071	0.24		**Sheet Flow, Sheet flow across field** Cultivated: Residue<=20% n= 0.060 P2= 2.20"
2.2	60	0.0020	0.45		**Shallow Concentrated Flow, Flow in Drainage Ditch** Nearly Bare & Untilled Kv= 10.0 fps
22.9	360	Total			

Subcatchment PRE A: PRE BASIN A



Summary for Subcatchment PRE B: PRE BASIN B

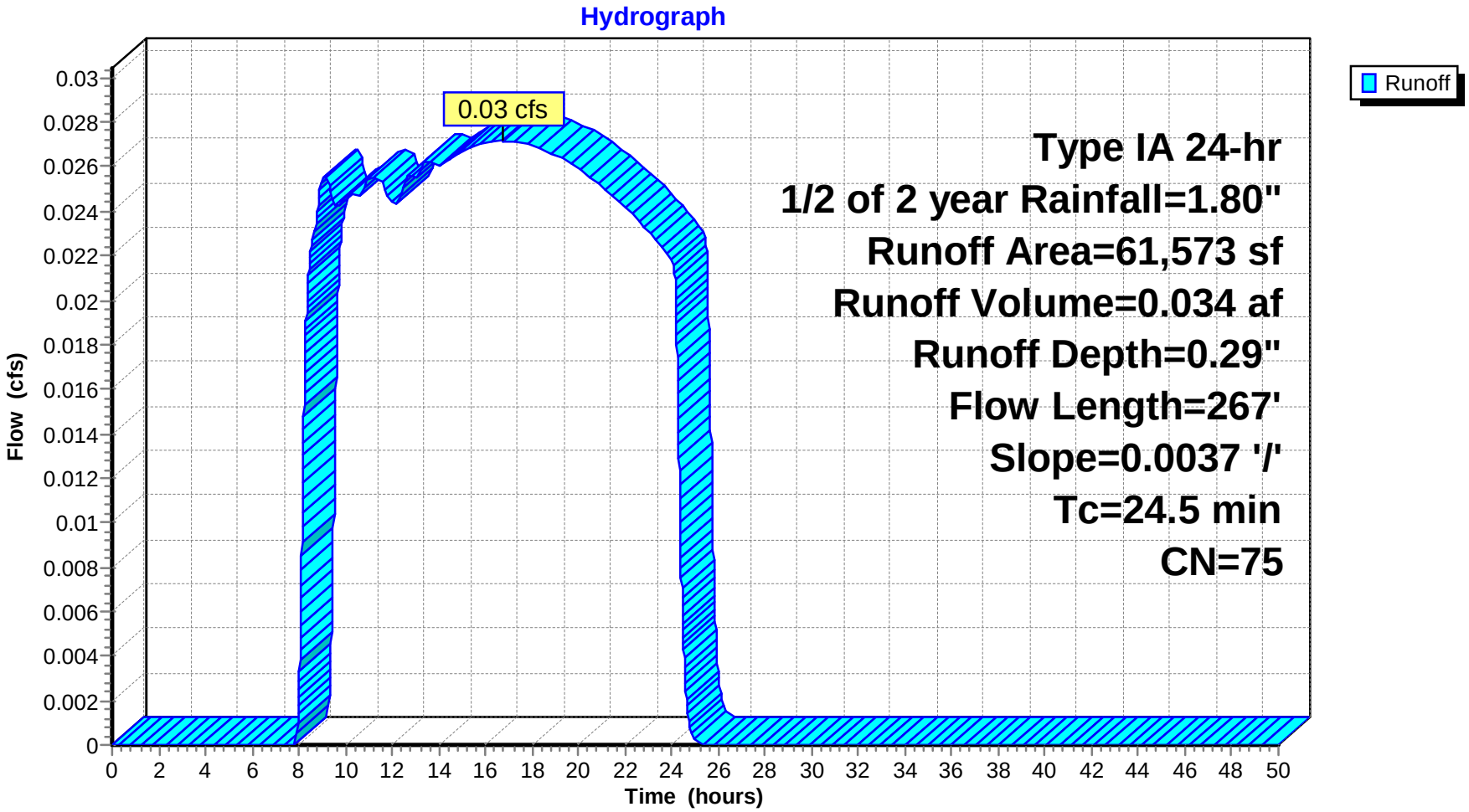
Runoff = 0.03 cfs @ 16.74 hrs, Volume= 0.034 af, Depth= 0.29"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 of 2 year Rainfall=1.80"

	Area (sf)	CN	Description
*	53,913	72	COS Required Pre-Dev
	7,660	98	Paved roads w/curbs & sewers, HSG C
	61,573	75	Weighted Average
	53,913		87.56% Pervious Area
	7,660		12.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	267	0.0037	0.18		**Sheet Flow, Sheet Flow Across Field** Cultivated: Residue<=20% n= 0.060 P2= 2.20"

Subcatchment PRE B: PRE BASIN B



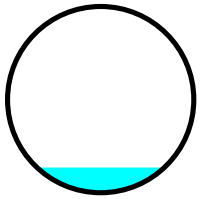
Summary for Reach 5R: (new Reach)

Inflow Area = 4.760 ac, 3.69% Impervious, Inflow Depth = 0.23" for 1/2 of 2 year event
Inflow = 0.08 cfs @ 17.33 hrs, Volume= 0.093 af
Outflow = 0.08 cfs @ 17.54 hrs, Volume= 0.093 af, Atten= 0%, Lag= 12.6 min

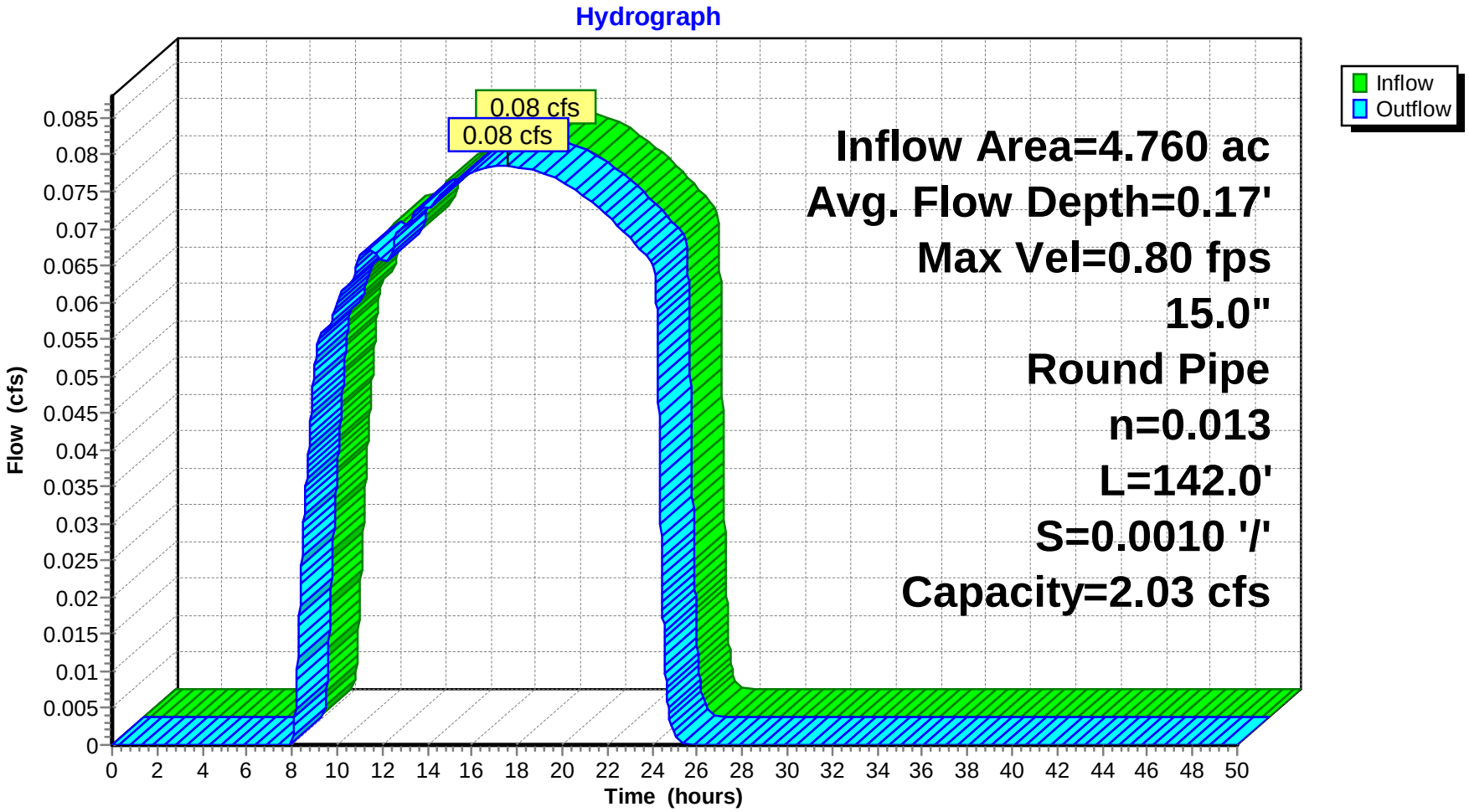
Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.80 fps, Min. Travel Time= 3.0 min
Avg. Velocity = 0.71 fps, Avg. Travel Time= 3.3 min

Peak Storage= 14 cf @ 17.54 hrs
Average Depth at Peak Storage= 0.17' , Surface Width= 0.85'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 2.03 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 142.0' Slope= 0.0010 '/'
Inlet Invert= 207.40', Outlet Invert= 207.26'



Reach 5R: (new Reach)



Summary for Subcatchment PRE A: PRE BASIN A

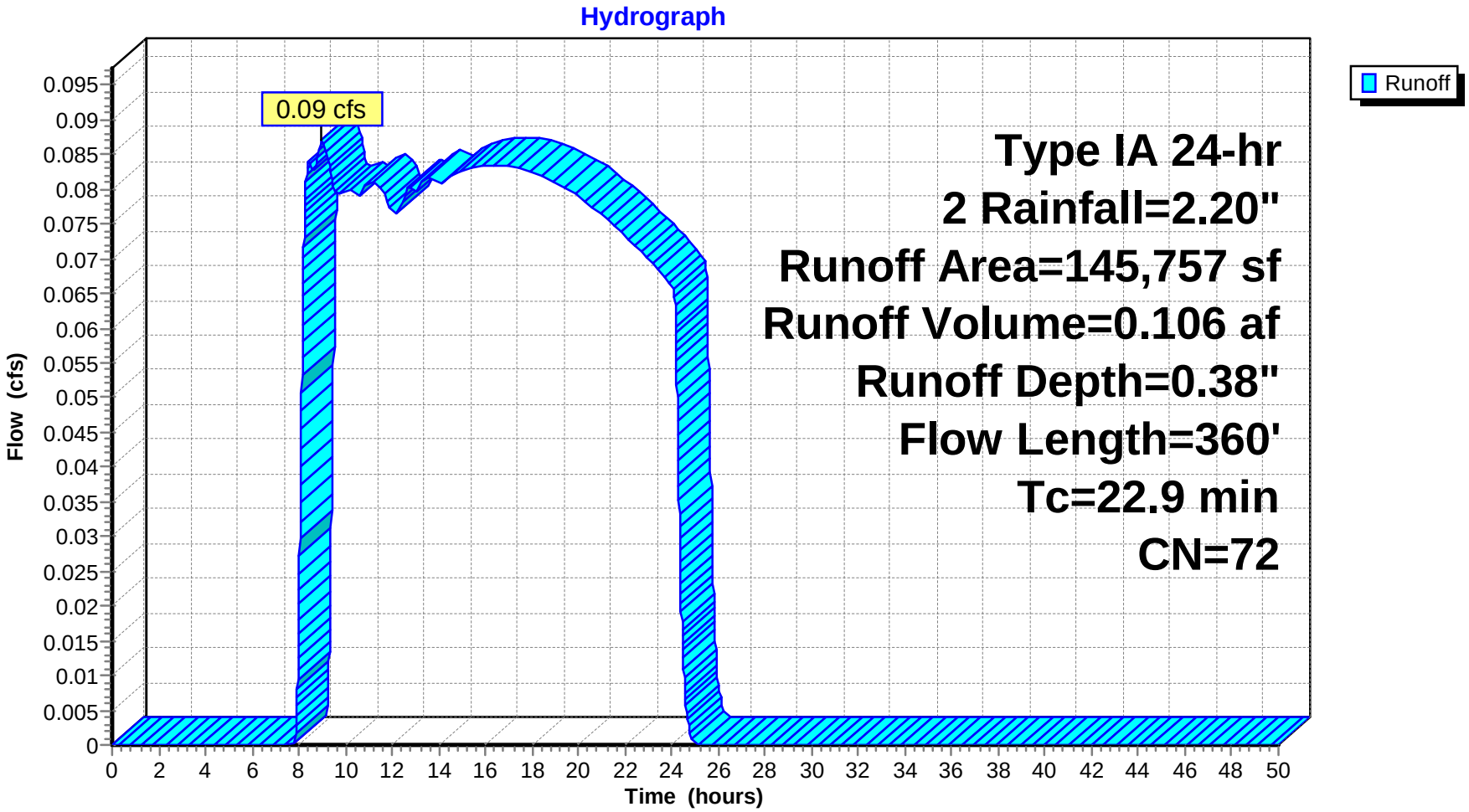
Runoff = 0.09 cfs @ 8.98 hrs, Volume= 0.106 af, Depth= 0.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Rainfall=2.20"

	Area (sf)	CN	Description
*	145,757	72	COS - Required Pre-Dev.
	145,757		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	300	0.0071	0.24		**Sheet Flow, Sheet flow across field** Cultivated: Residue<=20% n= 0.060 P2= 2.20"
2.2	60	0.0020	0.45		**Shallow Concentrated Flow, Flow in Drainage Ditch** Nearly Bare & Untilled Kv= 10.0 fps
22.9	360	Total			

Subcatchment PRE A: PRE BASIN A



Summary for Subcatchment PRE B: PRE BASIN B

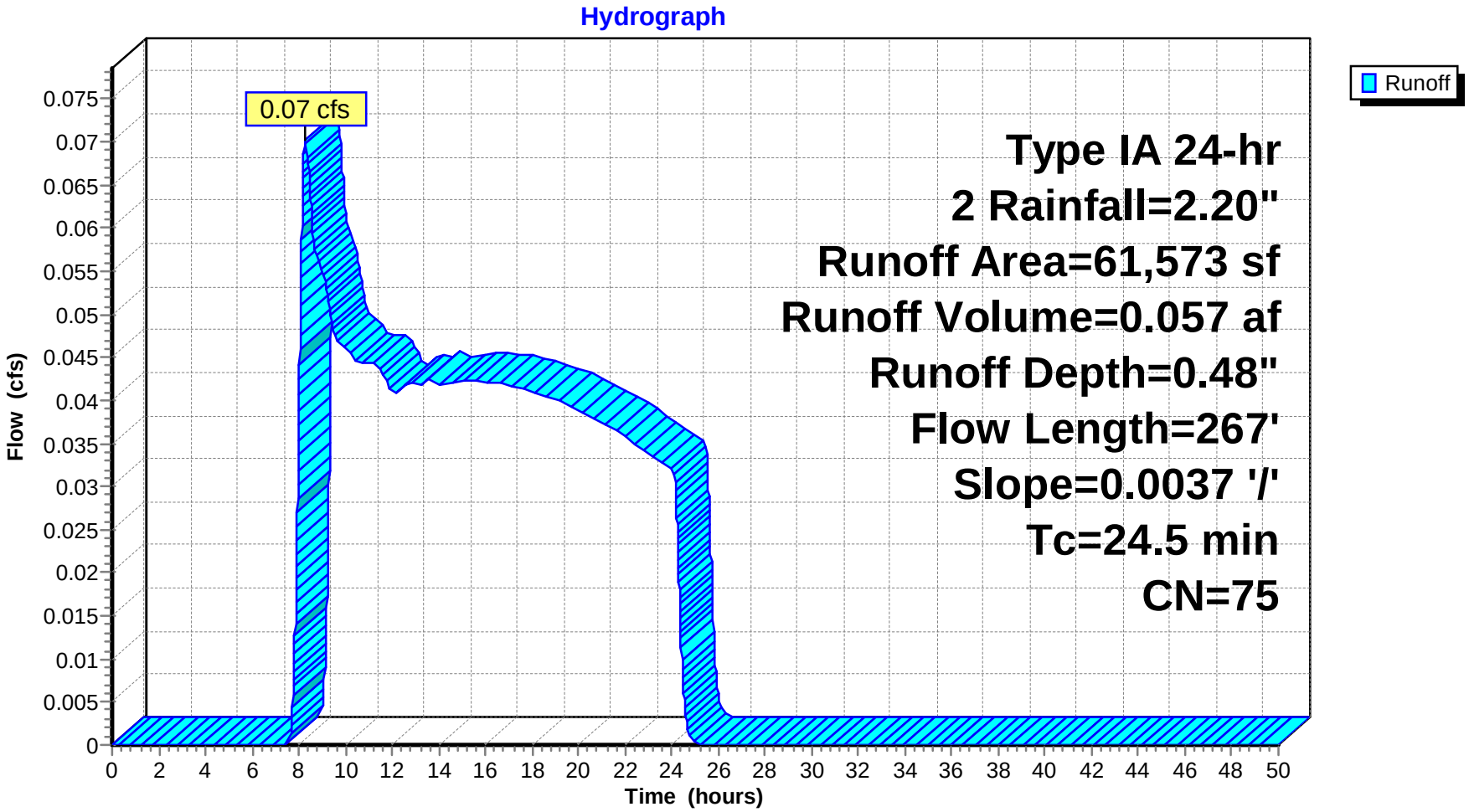
Runoff = 0.07 cfs @ 8.30 hrs, Volume= 0.057 af, Depth= 0.48"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Rainfall=2.20"

	Area (sf)	CN	Description
*	53,913	72	COS Required Pre-Dev
	7,660	98	Paved roads w/curbs & sewers, HSG C
	61,573	75	Weighted Average
	53,913		87.56% Pervious Area
	7,660		12.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	267	0.0037	0.18		**Sheet Flow, Sheet Flow Across Field**
					Cultivated: Residue<=20% n= 0.060 P2= 2.20"

Subcatchment PRE B: PRE BASIN B



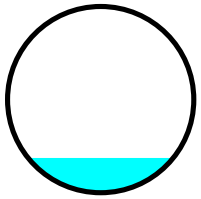
Summary for Reach 5R: (new Reach)

Inflow Area = 4.760 ac, 3.69% Impervious, Inflow Depth = 0.41" for 2 event
Inflow = 0.15 cfs @ 8.37 hrs, Volume= 0.163 af
Outflow = 0.15 cfs @ 8.40 hrs, Volume= 0.163 af, Atten= 0%, Lag= 2.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.97 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 0.83 fps, Avg. Travel Time= 2.8 min

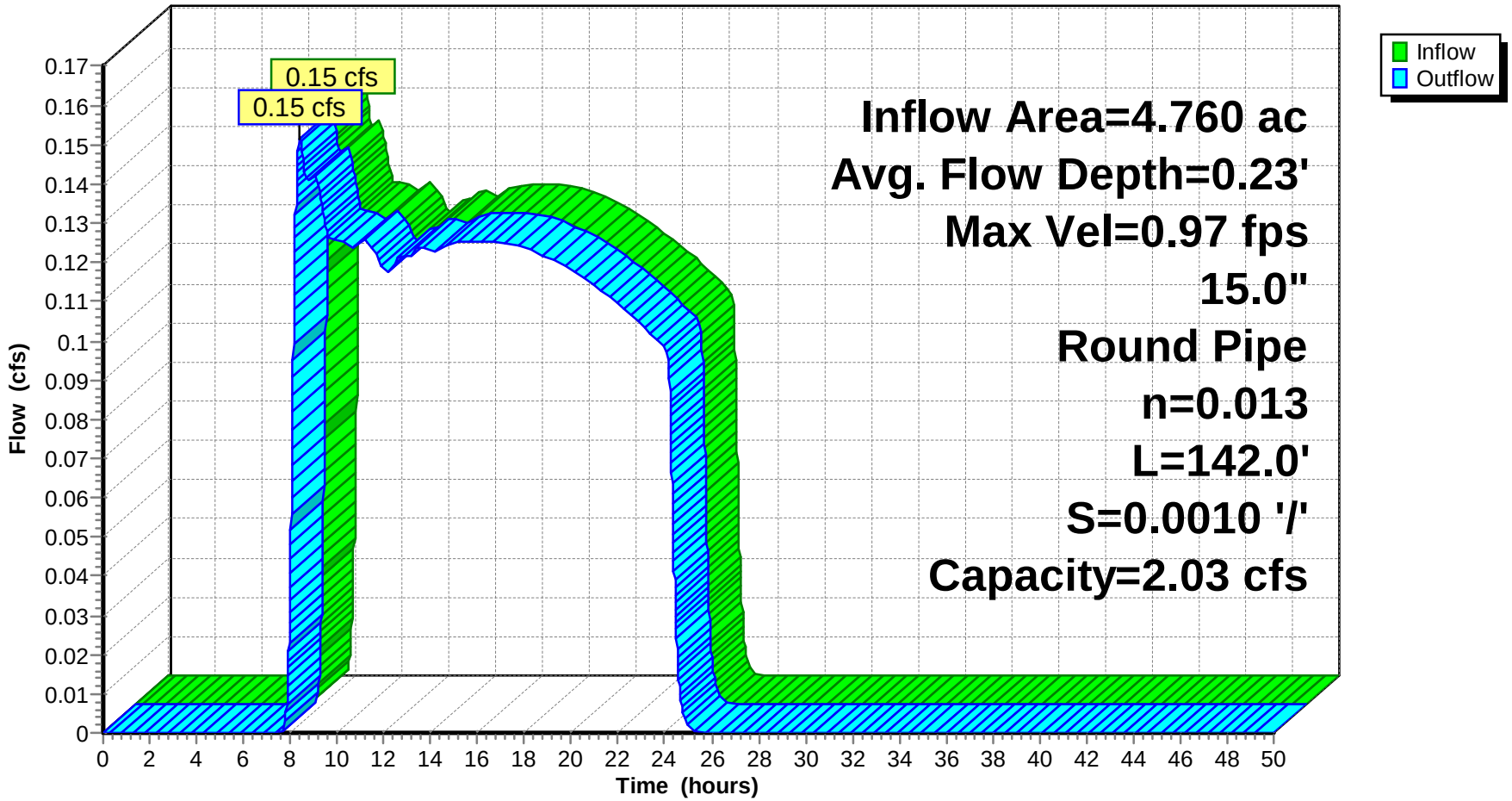
Peak Storage= 22 cf @ 8.40 hrs
Average Depth at Peak Storage= 0.23' , Surface Width= 0.97'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 2.03 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 142.0' Slope= 0.0010 '/'
Inlet Invert= 207.40', Outlet Invert= 207.26'



Reach 5R: (new Reach)

Hydrograph



Summary for Subcatchment PRE A: PRE BASIN A

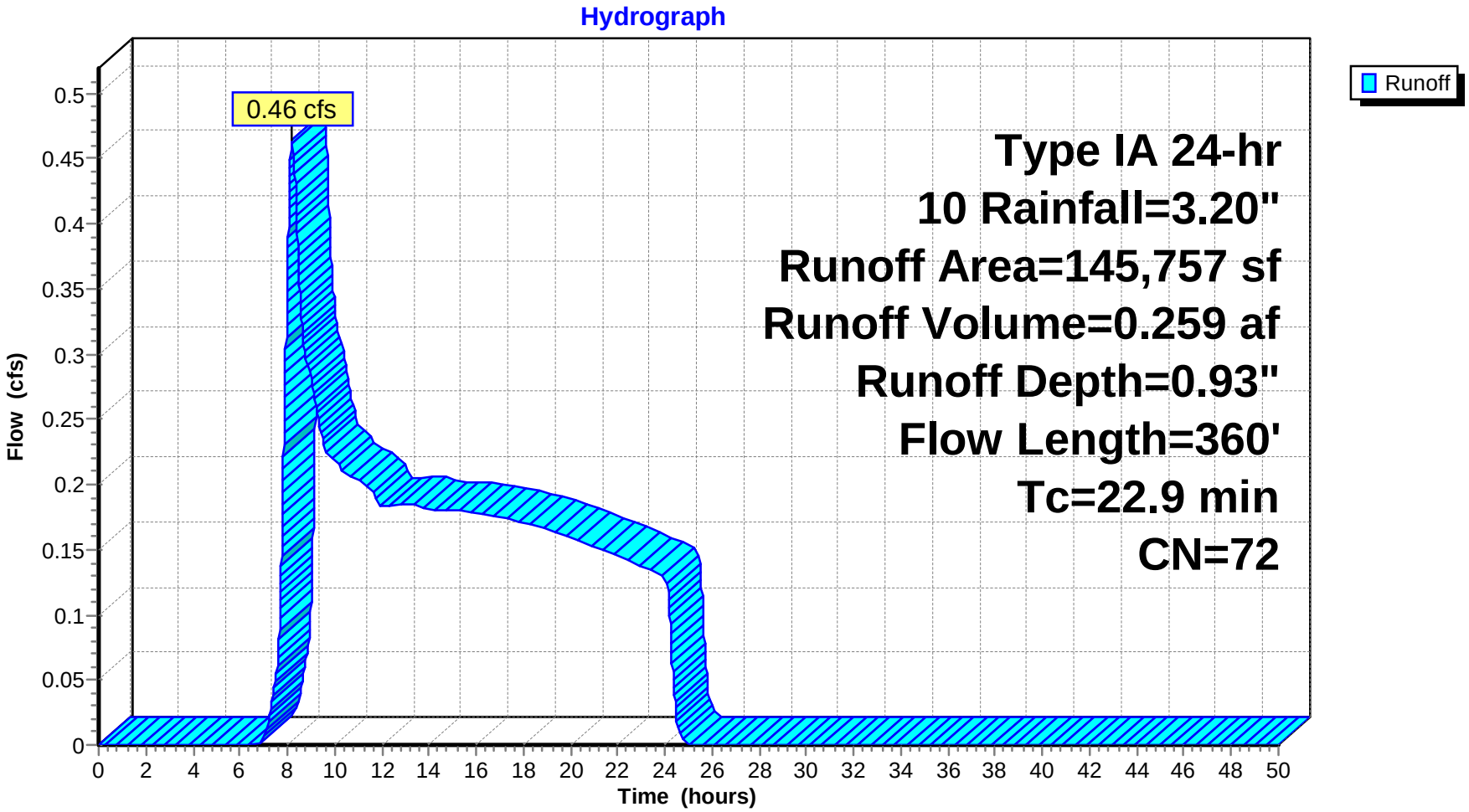
Runoff = 0.46 cfs @ 8.21 hrs, Volume= 0.259 af, Depth= 0.93"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Rainfall=3.20"

	Area (sf)	CN	Description
*	145,757	72	COS - Required Pre-Dev.
	145,757		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	300	0.0071	0.24		**Sheet Flow, Sheet flow across field** Cultivated: Residue<=20% n= 0.060 P2= 2.20"
2.2	60	0.0020	0.45		**Shallow Concentrated Flow, Flow in Drainage Ditch** Nearly Bare & Untilled Kv= 10.0 fps
22.9	360	Total			

Subcatchment PRE A: PRE BASIN A



Summary for Subcatchment PRE B: PRE BASIN B

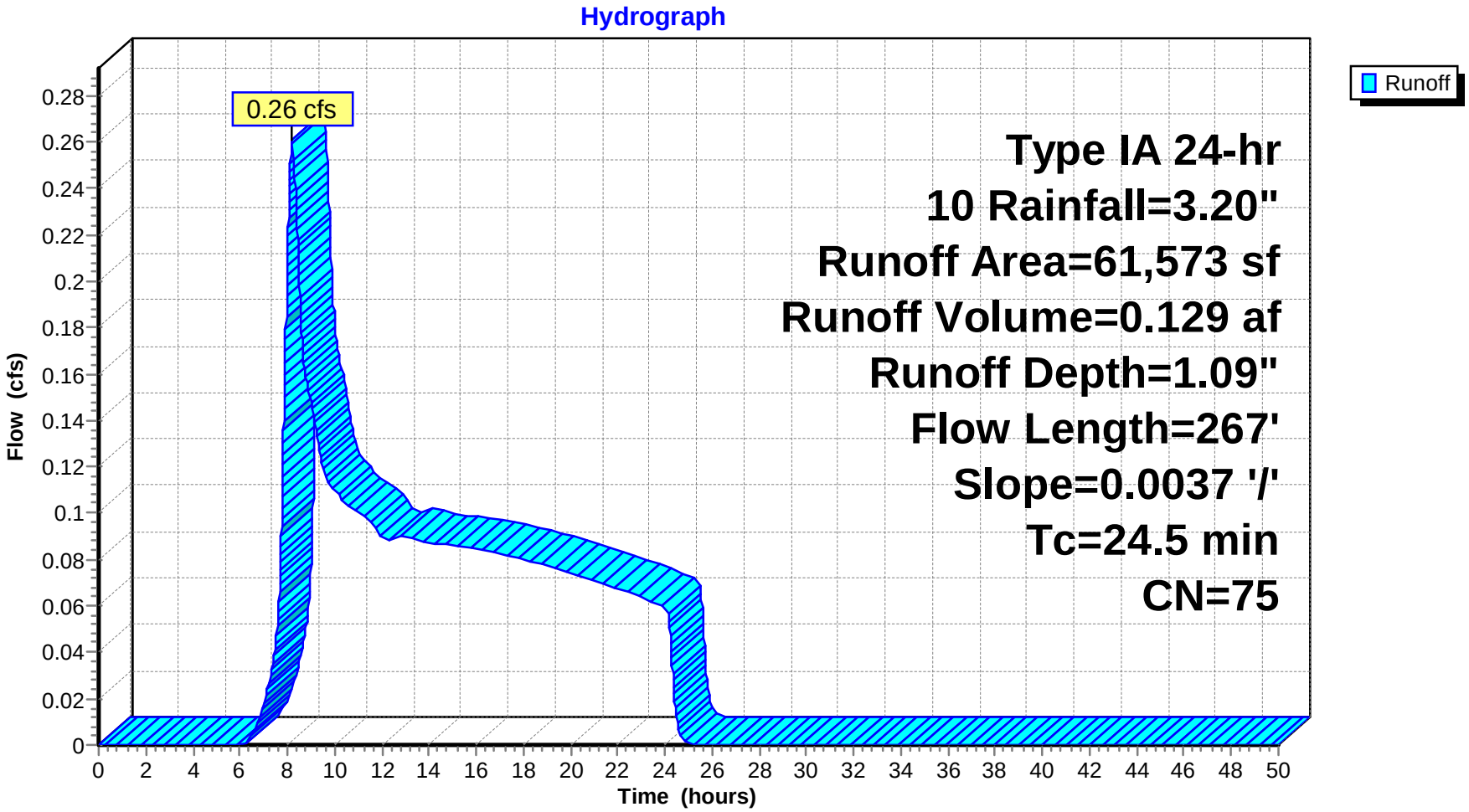
Runoff = 0.26 cfs @ 8.20 hrs, Volume= 0.129 af, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Rainfall=3.20"

	Area (sf)	CN	Description
*	53,913	72	COS Required Pre-Dev
	7,660	98	Paved roads w/curbs & sewers, HSG C
	61,573	75	Weighted Average
	53,913		87.56% Pervious Area
	7,660		12.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	267	0.0037	0.18		**Sheet Flow, Sheet Flow Across Field**
					Cultivated: Residue<=20% n= 0.060 P2= 2.20"

Subcatchment PRE B: PRE BASIN B



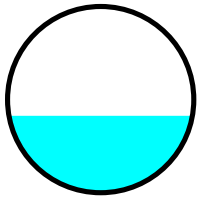
Summary for Reach 5R: (new Reach)

Inflow Area = 4.760 ac, 3.69% Impervious, Inflow Depth = 0.98" for 10 event
Inflow = 0.72 cfs @ 8.21 hrs, Volume= 0.388 af
Outflow = 0.72 cfs @ 8.23 hrs, Volume= 0.388 af, Atten= 0%, Lag= 1.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.51 fps, Min. Travel Time= 1.6 min
Avg. Velocity = 1.02 fps, Avg. Travel Time= 2.3 min

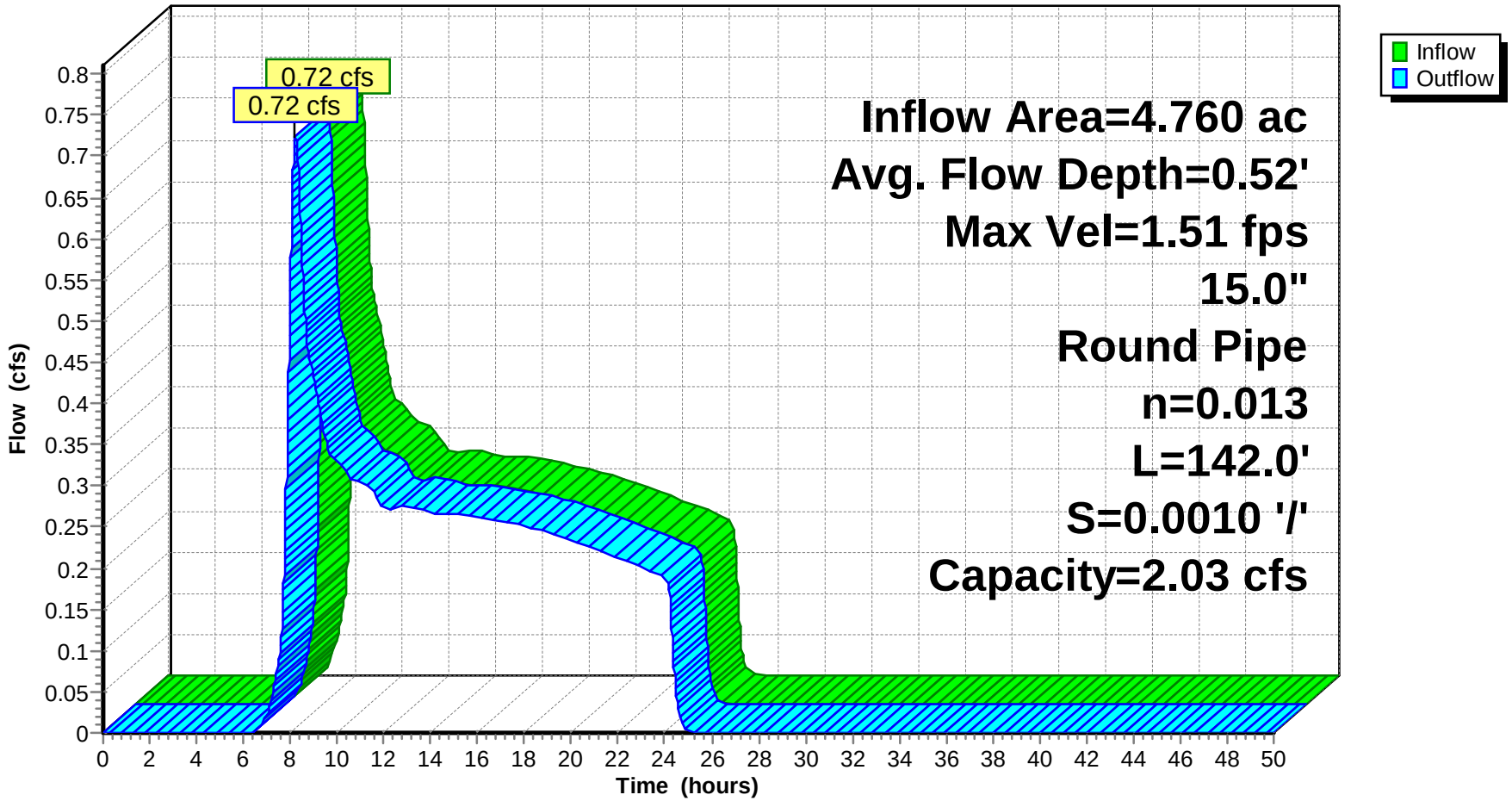
Peak Storage= 68 cf @ 8.23 hrs
Average Depth at Peak Storage= 0.52' , Surface Width= 1.23'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 2.03 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 142.0' Slope= 0.0010 '/'
Inlet Invert= 207.40', Outlet Invert= 207.26'



Reach 5R: (new Reach)

Hydrograph



Summary for Subcatchment PRE A: PRE BASIN A

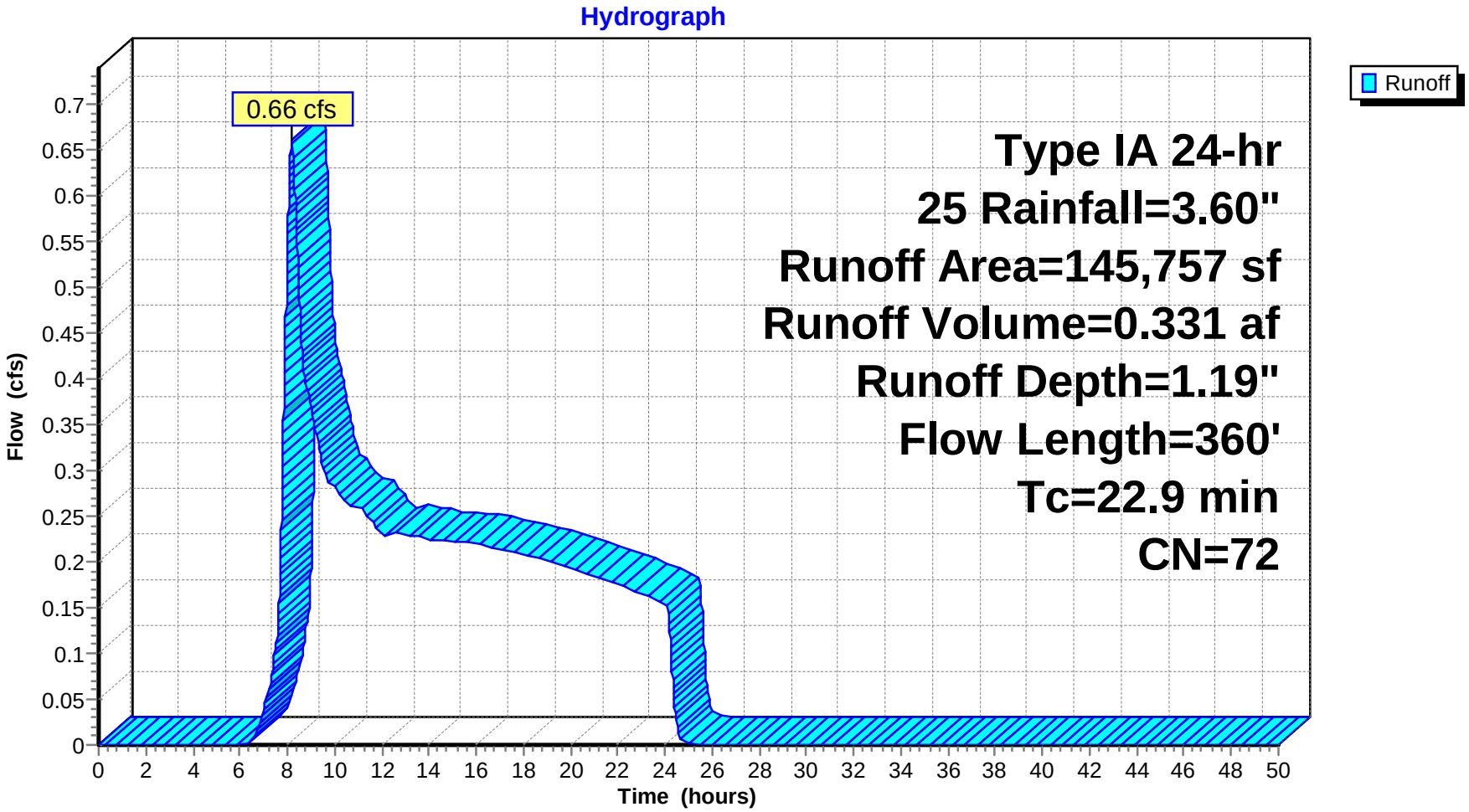
Runoff = 0.66 cfs @ 8.19 hrs, Volume= 0.331 af, Depth= 1.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 Rainfall=3.60"

	Area (sf)	CN	Description
*	145,757	72	COS - Required Pre-Dev.
	145,757		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	300	0.0071	0.24		**Sheet Flow, Sheet flow across field** Cultivated: Residue<=20% n= 0.060 P2= 2.20"
2.2	60	0.0020	0.45		**Shallow Concentrated Flow, Flow in Drainage Ditch** Nearly Bare & Untilled Kv= 10.0 fps
22.9	360	Total			

Subcatchment PRE A: PRE BASIN A



Summary for Subcatchment PRE B: PRE BASIN B

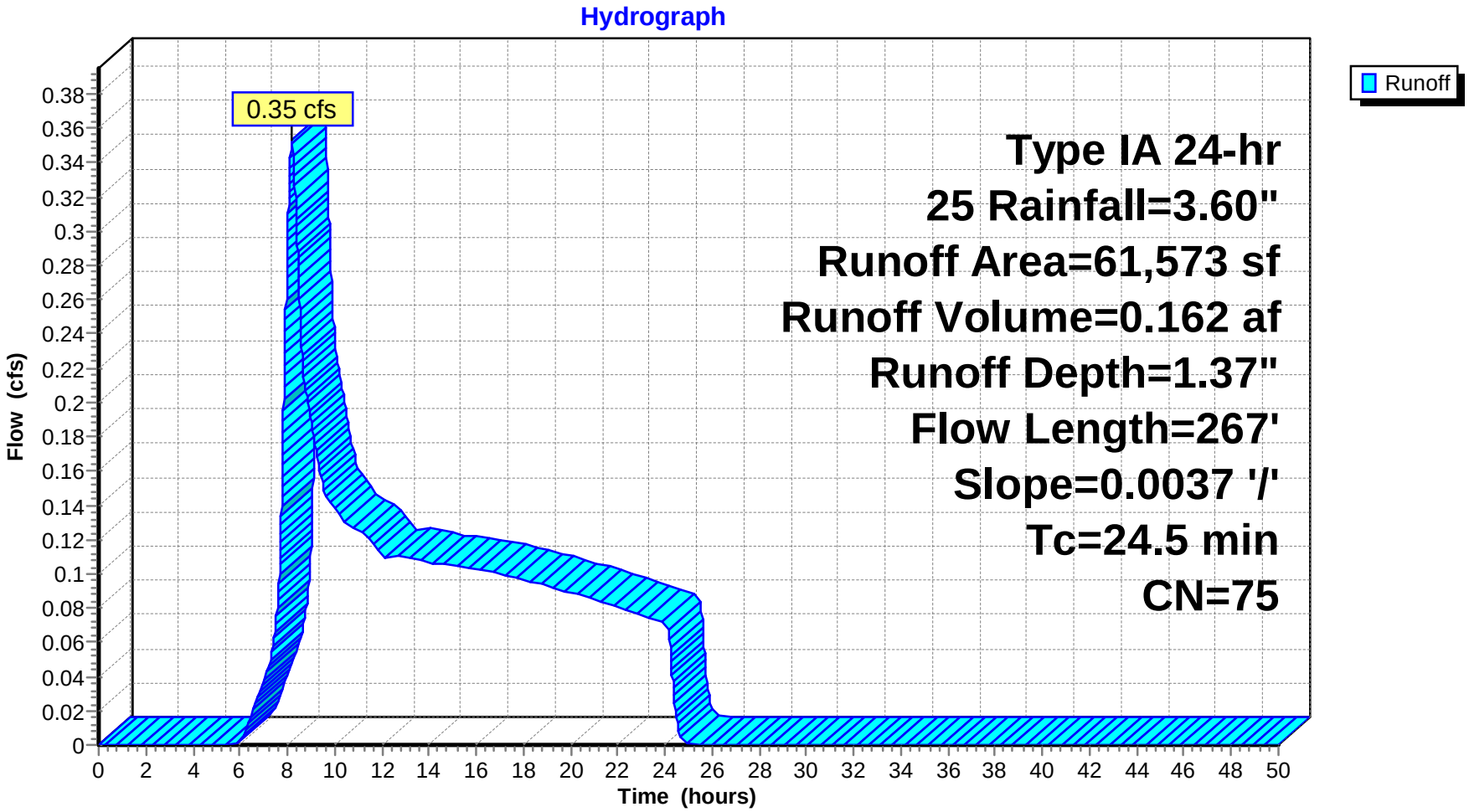
Runoff = 0.35 cfs @ 8.19 hrs, Volume= 0.162 af, Depth= 1.37"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 Rainfall=3.60"

	Area (sf)	CN	Description
*	53,913	72	COS Required Pre-Dev
	7,660	98	Paved roads w/curbs & sewers, HSG C
	61,573	75	Weighted Average
	53,913		87.56% Pervious Area
	7,660		12.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	267	0.0037	0.18		**Sheet Flow, Sheet Flow Across Field**
					Cultivated: Residue<=20% n= 0.060 P2= 2.20"

Subcatchment PRE B: PRE BASIN B



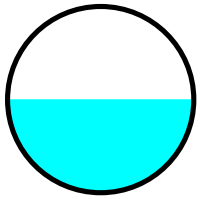
Summary for Reach 5R: (new Reach)

Inflow Area = 4.760 ac, 3.69% Impervious, Inflow Depth = 1.24" for 25 event
Inflow = 1.01 cfs @ 8.19 hrs, Volume= 0.493 af
Outflow = 1.01 cfs @ 8.21 hrs, Volume= 0.493 af, Atten= 0%, Lag= 1.1 min

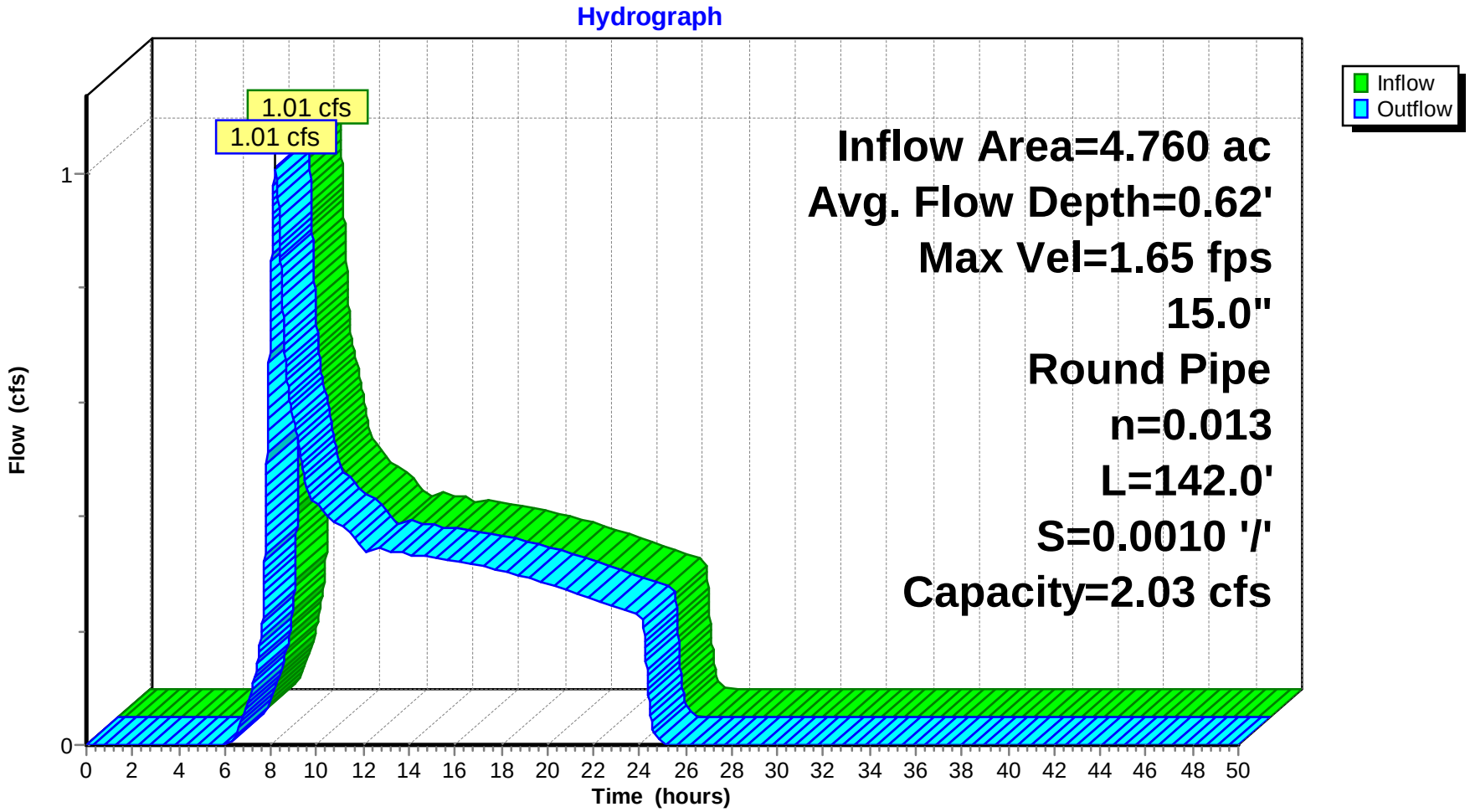
Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.65 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 1.08 fps, Avg. Travel Time= 2.2 min

Peak Storage= 87 cf @ 8.21 hrs
Average Depth at Peak Storage= 0.62' , Surface Width= 1.25'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 2.03 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 142.0' Slope= 0.0010 '/'
Inlet Invert= 207.40', Outlet Invert= 207.26'



Reach 5R: (new Reach)



Summary for Subcatchment PRE A: PRE BASIN A

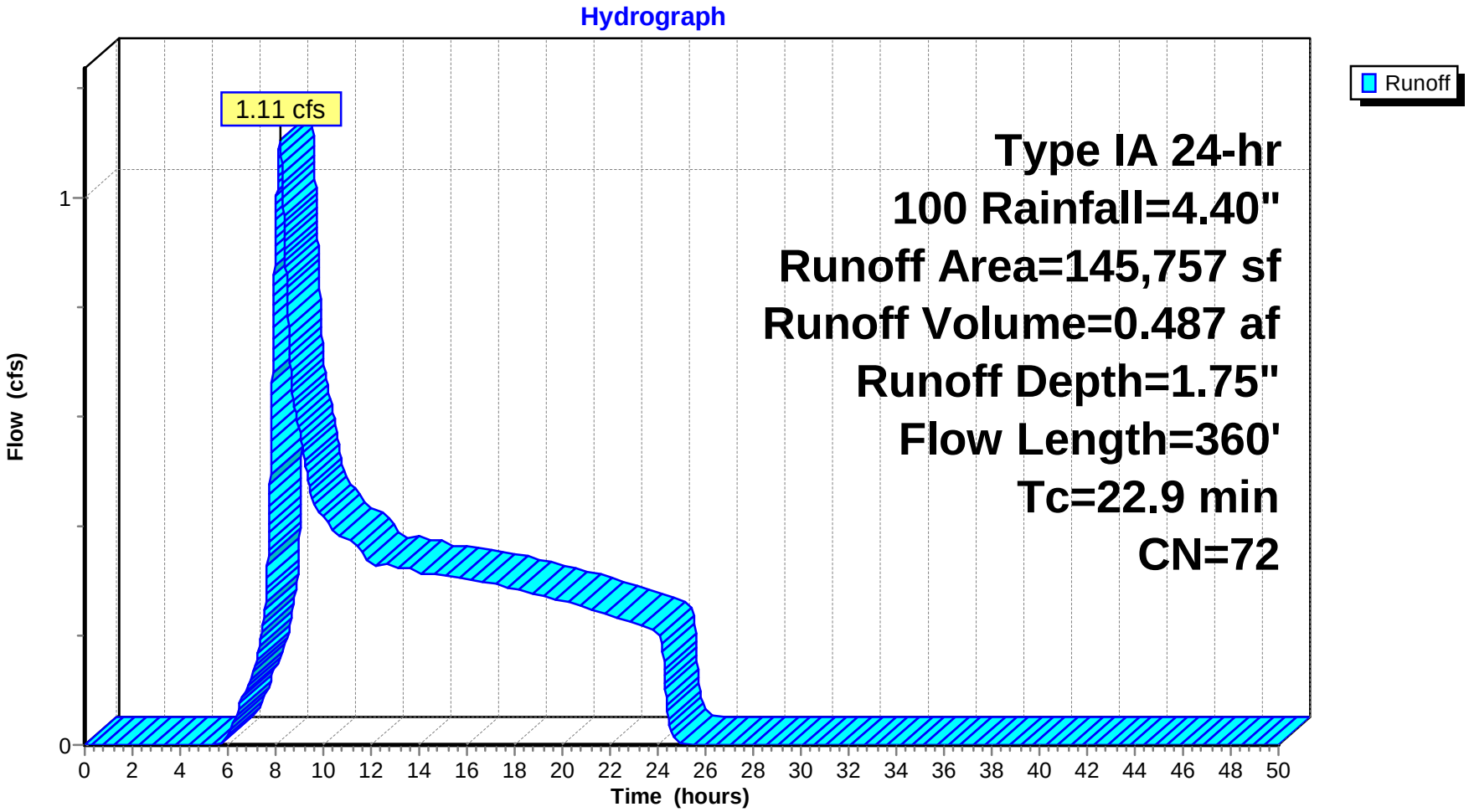
Runoff = 1.11 cfs @ 8.17 hrs, Volume= 0.487 af, Depth= 1.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Rainfall=4.40"

	Area (sf)	CN	Description
*	145,757	72	COS - Required Pre-Dev.
	145,757		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	300	0.0071	0.24		**Sheet Flow, Sheet flow across field** Cultivated: Residue<=20% n= 0.060 P2= 2.20"
2.2	60	0.0020	0.45		**Shallow Concentrated Flow, Flow in Drainage Ditch** Nearly Bare & Untilled Kv= 10.0 fps
22.9	360	Total			

Subcatchment PRE A: PRE BASIN A



Summary for Subcatchment PRE B: PRE BASIN B

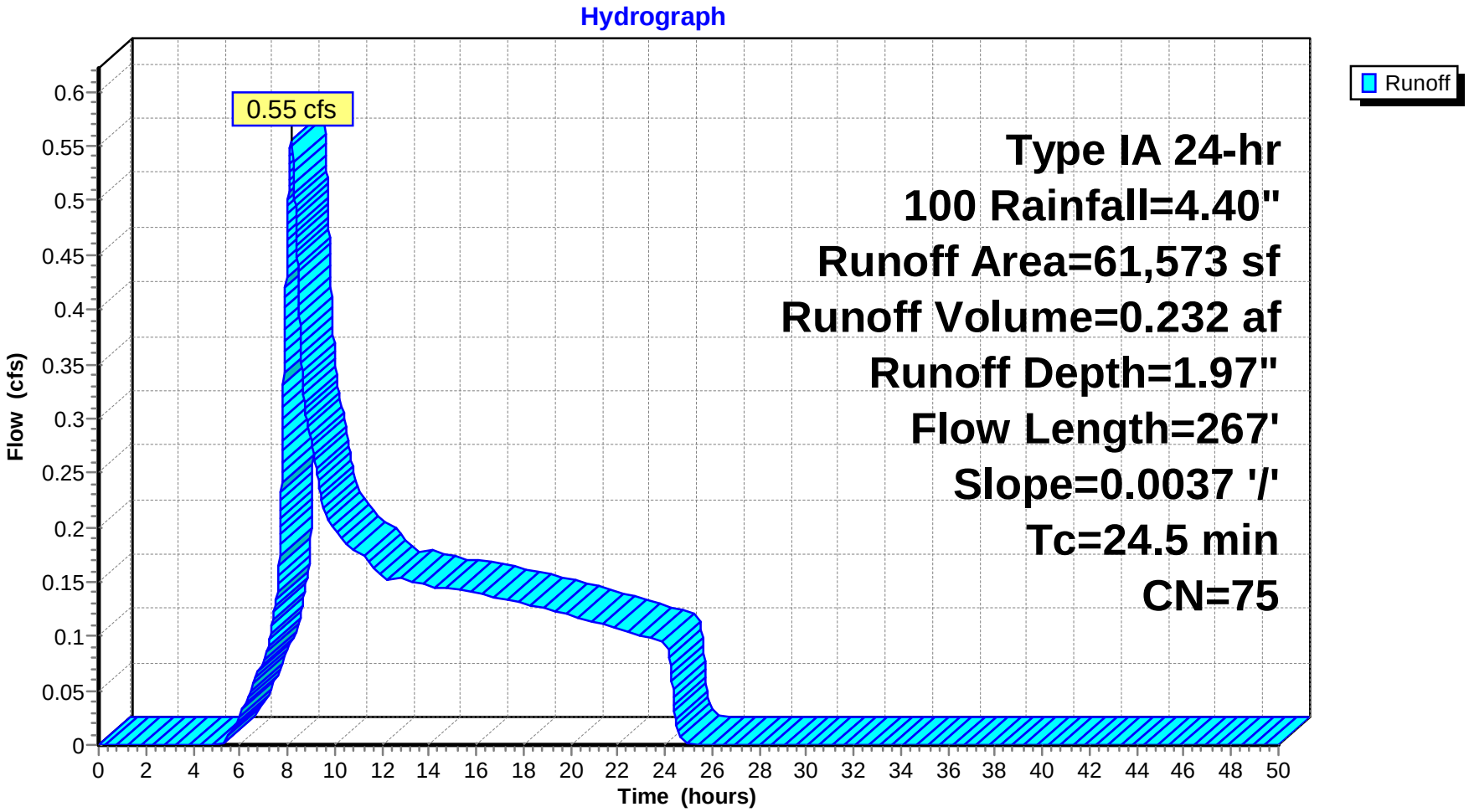
Runoff = 0.55 cfs @ 8.19 hrs, Volume= 0.232 af, Depth= 1.97"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Rainfall=4.40"

	Area (sf)	CN	Description
*	53,913	72	COS Required Pre-Dev
	7,660	98	Paved roads w/curbs & sewers, HSG C
	61,573	75	Weighted Average
	53,913		87.56% Pervious Area
	7,660		12.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	267	0.0037	0.18		**Sheet Flow, Sheet Flow Across Field** Cultivated: Residue<=20% n= 0.060 P2= 2.20"

Subcatchment PRE B: PRE BASIN B



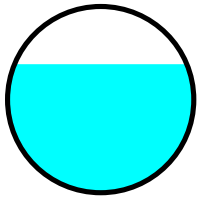
Summary for Reach 5R: (new Reach)

Inflow Area = 4.760 ac, 3.69% Impervious, Inflow Depth = 1.81" for 100 event
Inflow = 1.66 cfs @ 8.17 hrs, Volume= 0.719 af
Outflow = 1.66 cfs @ 8.19 hrs, Volume= 0.719 af, Atten= 0%, Lag= 1.2 min

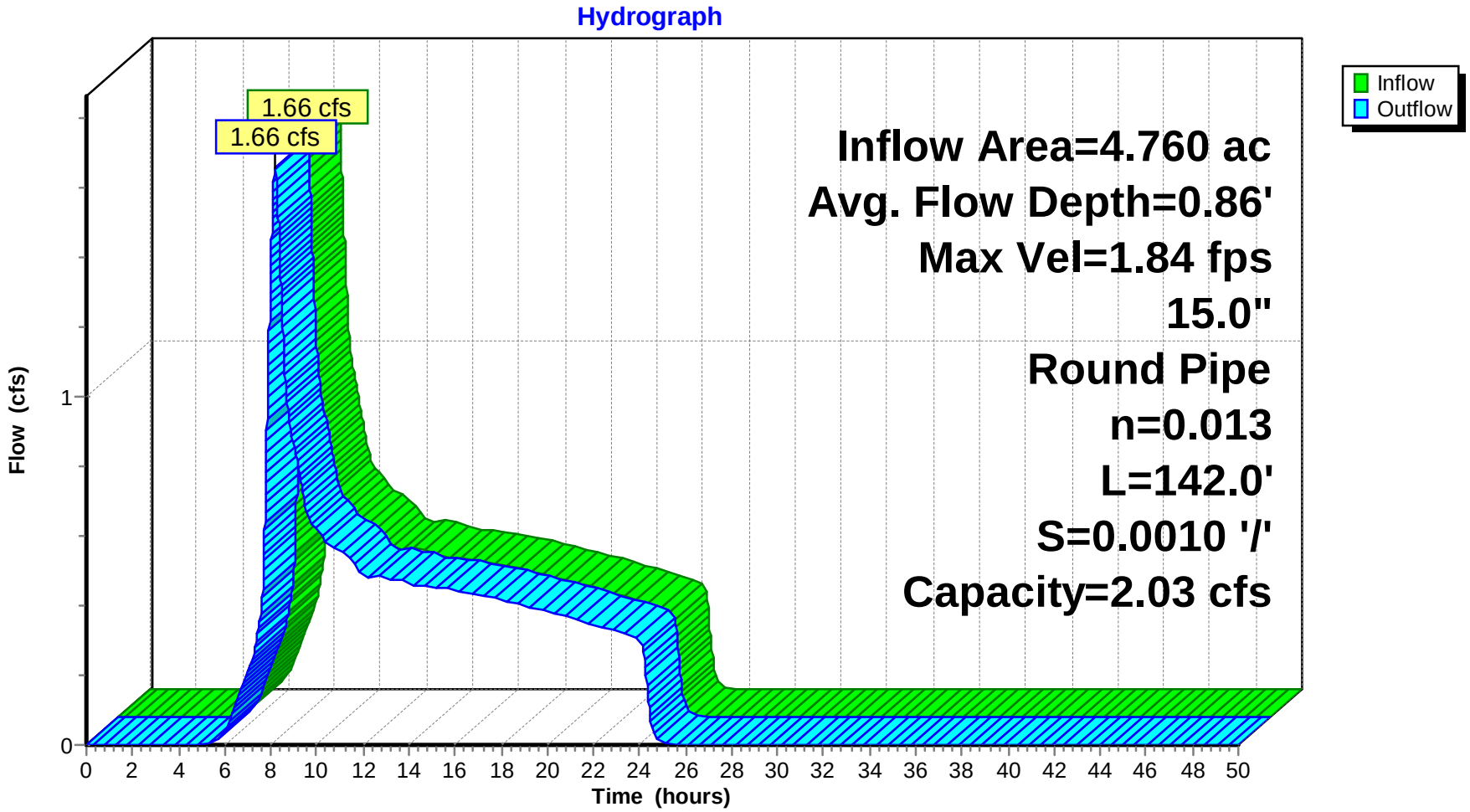
Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.84 fps, Min. Travel Time= 1.3 min
Avg. Velocity = 1.19 fps, Avg. Travel Time= 2.0 min

Peak Storage= 128 cf @ 8.19 hrs
Average Depth at Peak Storage= 0.86' , Surface Width= 1.16'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 2.03 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 142.0' Slope= 0.0010 '/'
Inlet Invert= 207.40', Outlet Invert= 207.26'



Reach 5R: (new Reach)



Summary for Subcatchment PRE A: PRE BASIN A

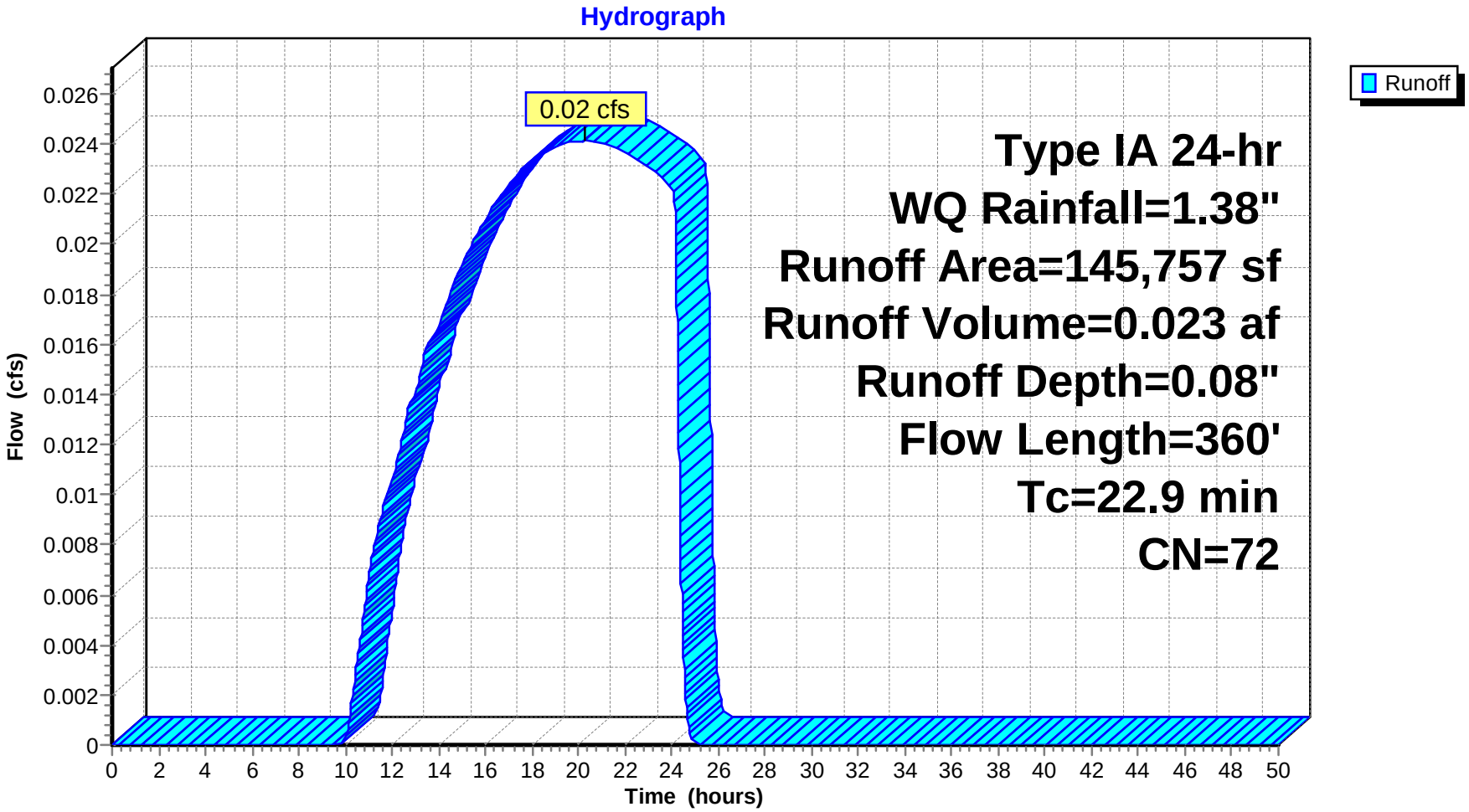
Runoff = 0.02 cfs @ 20.28 hrs, Volume= 0.023 af, Depth= 0.08"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.38"

	Area (sf)	CN	Description
*	145,757	72	COS - Required Pre-Dev.
	145,757		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
20.7	300	0.0071	0.24		**Sheet Flow, Sheet flow across field** Cultivated: Residue<=20% n= 0.060 P2= 2.20"
2.2	60	0.0020	0.45		**Shallow Concentrated Flow, Flow in Drainage Ditch** Nearly Bare & Untilled Kv= 10.0 fps
22.9	360	Total			

Subcatchment PRE A: PRE BASIN A



Summary for Subcatchment PRE B: PRE BASIN B

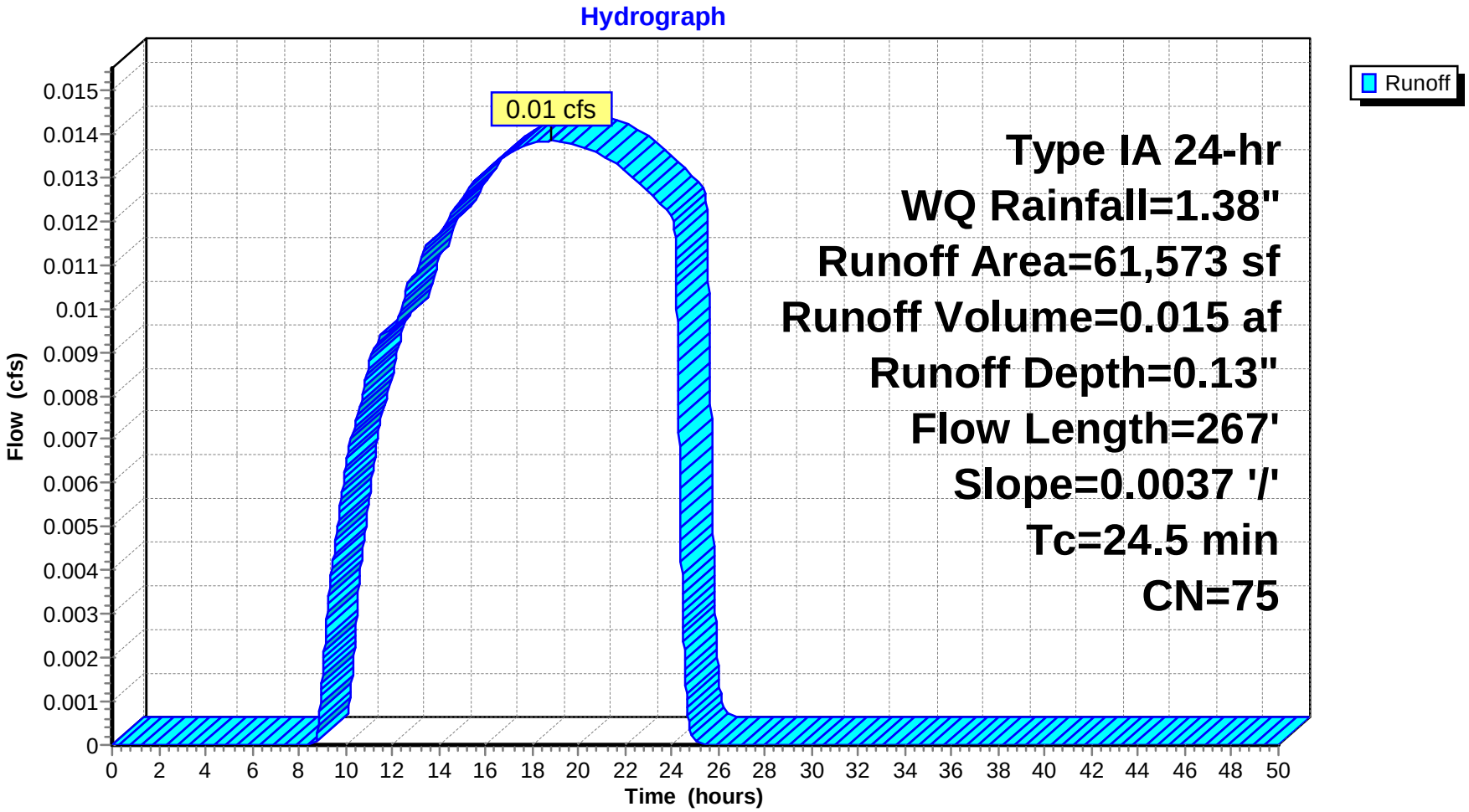
Runoff = 0.01 cfs @ 18.81 hrs, Volume= 0.015 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.38"

	Area (sf)	CN	Description
*	53,913	72	COS Required Pre-Dev
	7,660	98	Paved roads w/curbs & sewers, HSG C
	61,573	75	Weighted Average
	53,913		87.56% Pervious Area
	7,660		12.44% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.5	267	0.0037	0.18		**Sheet Flow, Sheet Flow Across Field** Cultivated: Residue<=20% n= 0.060 P2= 2.20"

Subcatchment PRE B: PRE BASIN B



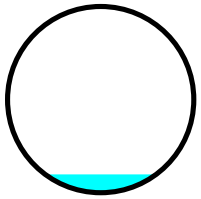
Summary for Reach 5R: (new Reach)

Inflow Area = 4.760 ac, 3.69% Impervious, Inflow Depth = 0.09" for WQ event
Inflow = 0.04 cfs @ 19.67 hrs, Volume= 0.037 af
Outflow = 0.04 cfs @ 19.79 hrs, Volume= 0.037 af, Atten= 0%, Lag= 6.9 min

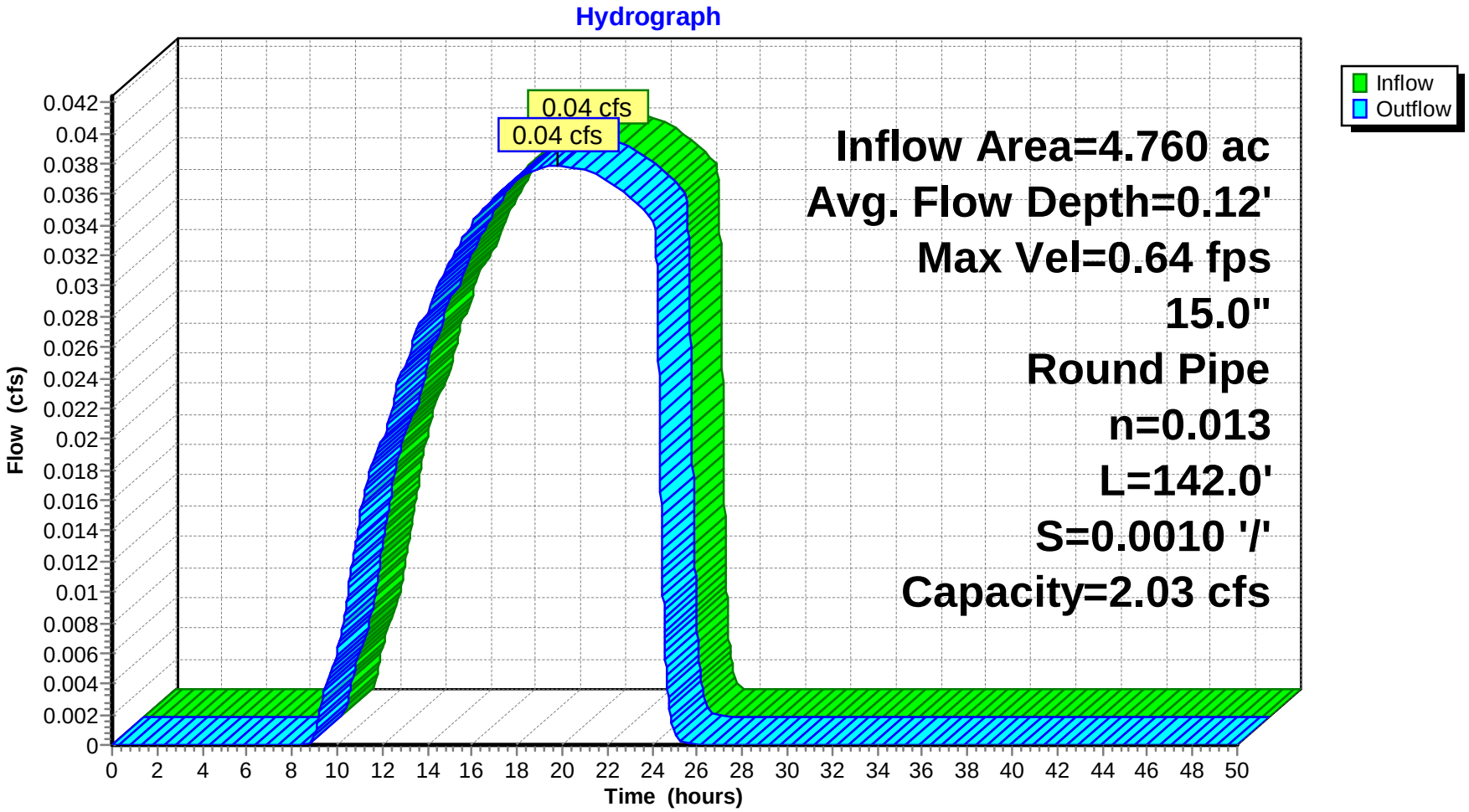
Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.64 fps, Min. Travel Time= 3.7 min
Avg. Velocity = 0.54 fps, Avg. Travel Time= 4.4 min

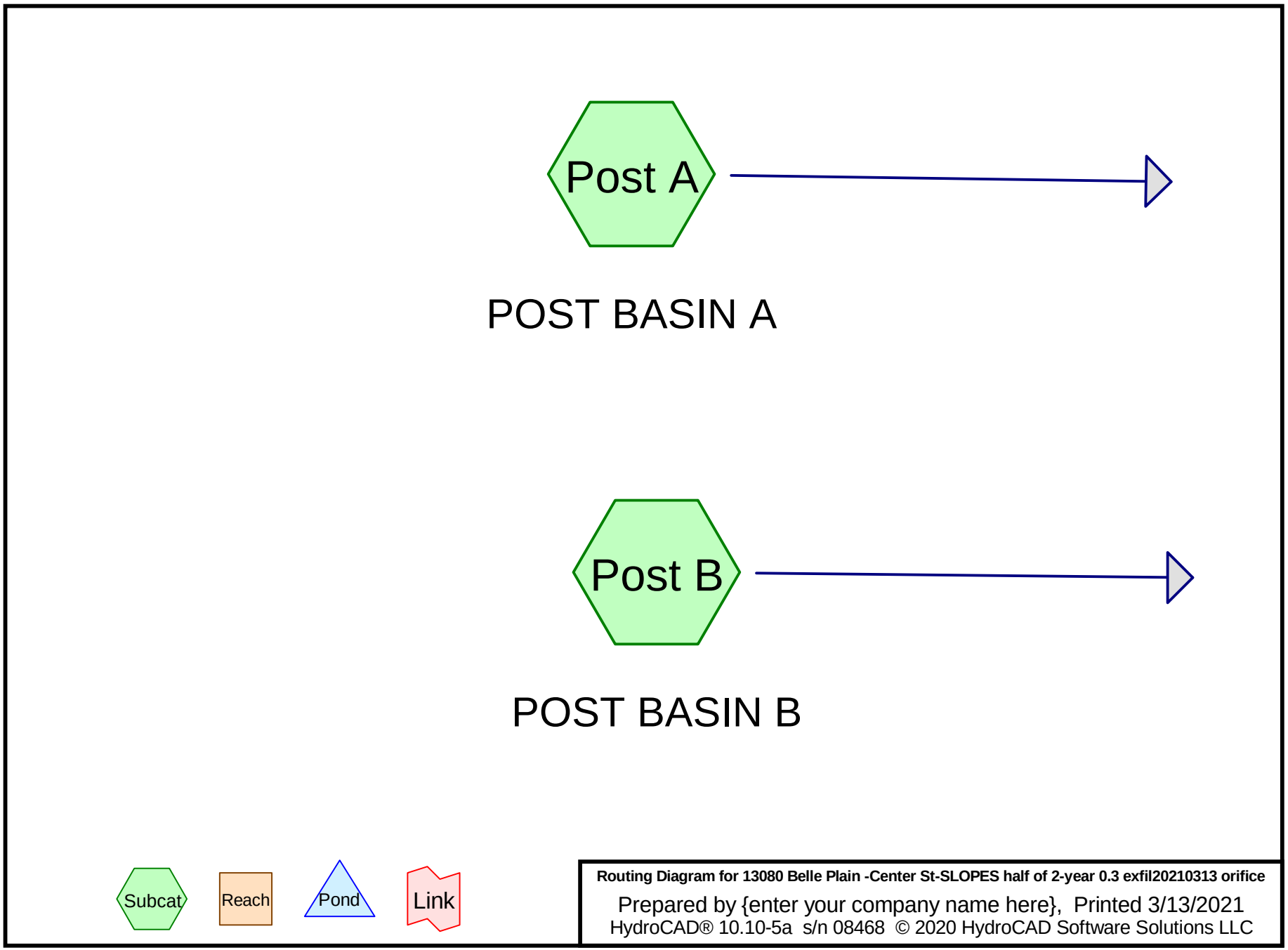
Peak Storage= 8 cf @ 19.79 hrs
Average Depth at Peak Storage= 0.12' , Surface Width= 0.73'
Bank-Full Depth= 1.25' Flow Area= 1.2 sf, Capacity= 2.03 cfs

15.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 142.0' Slope= 0.0010 '/'
Inlet Invert= 207.40', Outlet Invert= 207.26'



Reach 5R: (new Reach)




Post A
POST BASIN A
Post B
POST BASIN B
Subcat
Reach
Pond
Link

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1/2 of 2 year	Type IA 24-hr		Default	24.00	1	1.80	2
2	2	Type IA 24-hr		Default	24.00	1	2.20	2
3	10	Type IA 24-hr		Default	24.00	1	3.20	2
4	25	Type IA 24-hr		Default	24.00	1	3.60	2
5	100	Type IA 24-hr		Default	24.00	1	4.40	2
6	WQ	Type IA 24-hr		Default	24.00	1	1.38	2

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	Post A	0.00	0.00	136.0	0.0100	0.010	0.0	6.0	0.0
2	Post A	0.00	0.00	763.0	0.0022	0.013	0.0	12.0	0.0
3	Post B	0.00	0.00	62.0	0.0050	0.013	0.0	12.0	0.0

Summary for Subcatchment Post A: POST BASIN A

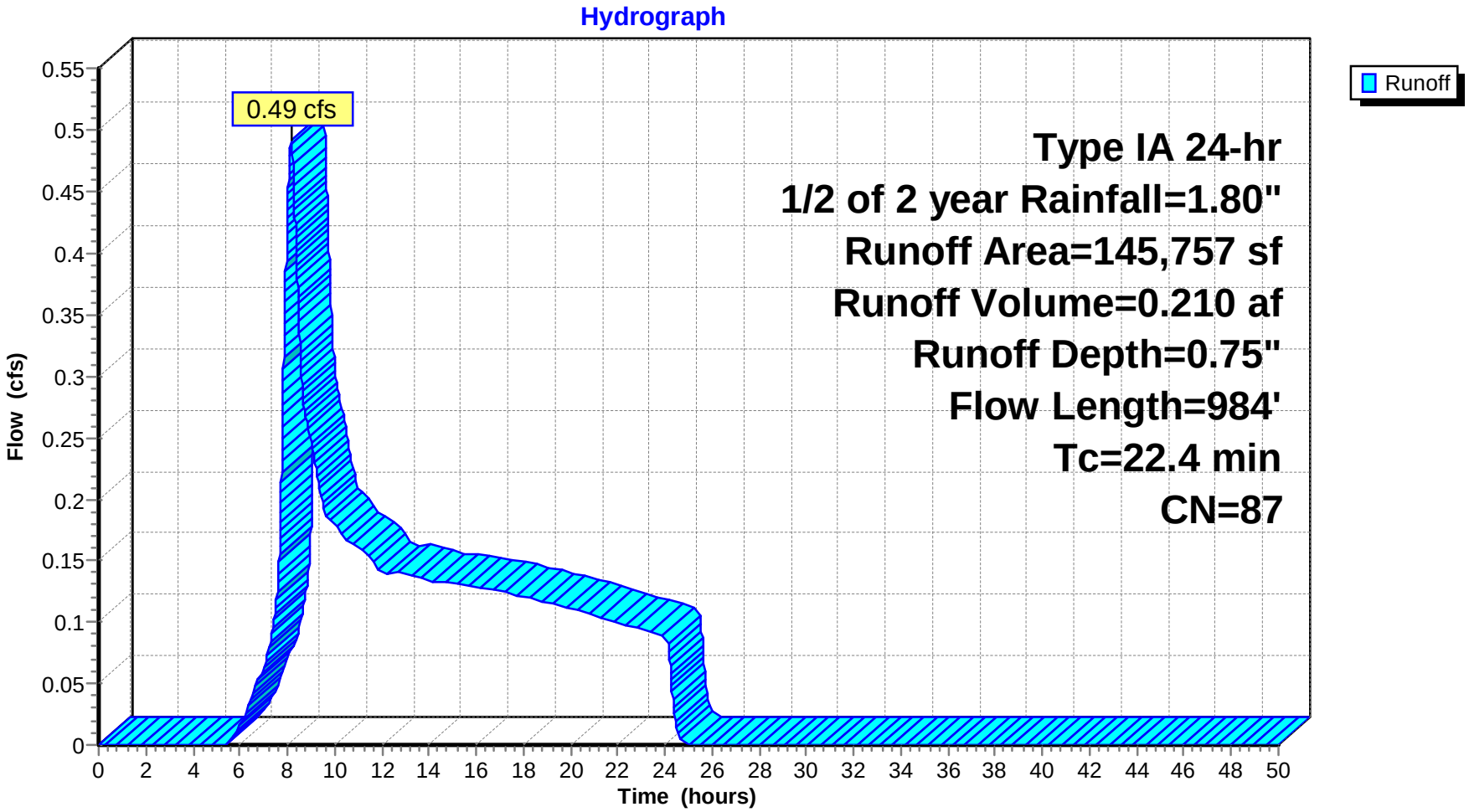
Runoff = 0.49 cfs @ 8.16 hrs, Volume= 0.210 af, Depth= 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 of 2 year Rainfall=1.80"

	Area (sf)	CN	Description
*	23,522	98	Paving, C&G
*	5,401	98	Sidewalk
*	39,988	98	Roofs: 2,000 sf/lot, 20 lots
*	8,015	98	Driveways: 400 sf/lot, 20 lots
	68,831	74	>75% Grass cover, Good, HSG C
	145,757	87	Weighted Average
	68,831		47.22% Pervious Area
	76,926		52.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	85	0.0070	0.09		**Sheet Flow, Sheet flow over Grass** Grass: Short n= 0.150 P2= 2.20"
0.6	136	0.0100	3.71	0.73	**Pipe Channel, 6" Area Drain to Curb inlet** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.010 PVC, smooth interior
6.0	763	0.0022	2.13	1.67	**Pipe Channel, Curb Inlet to Basin** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
22.4	984	Total			

Subcatchment Post A: POST BASIN A



Summary for Subcatchment Post B: POST BASIN B

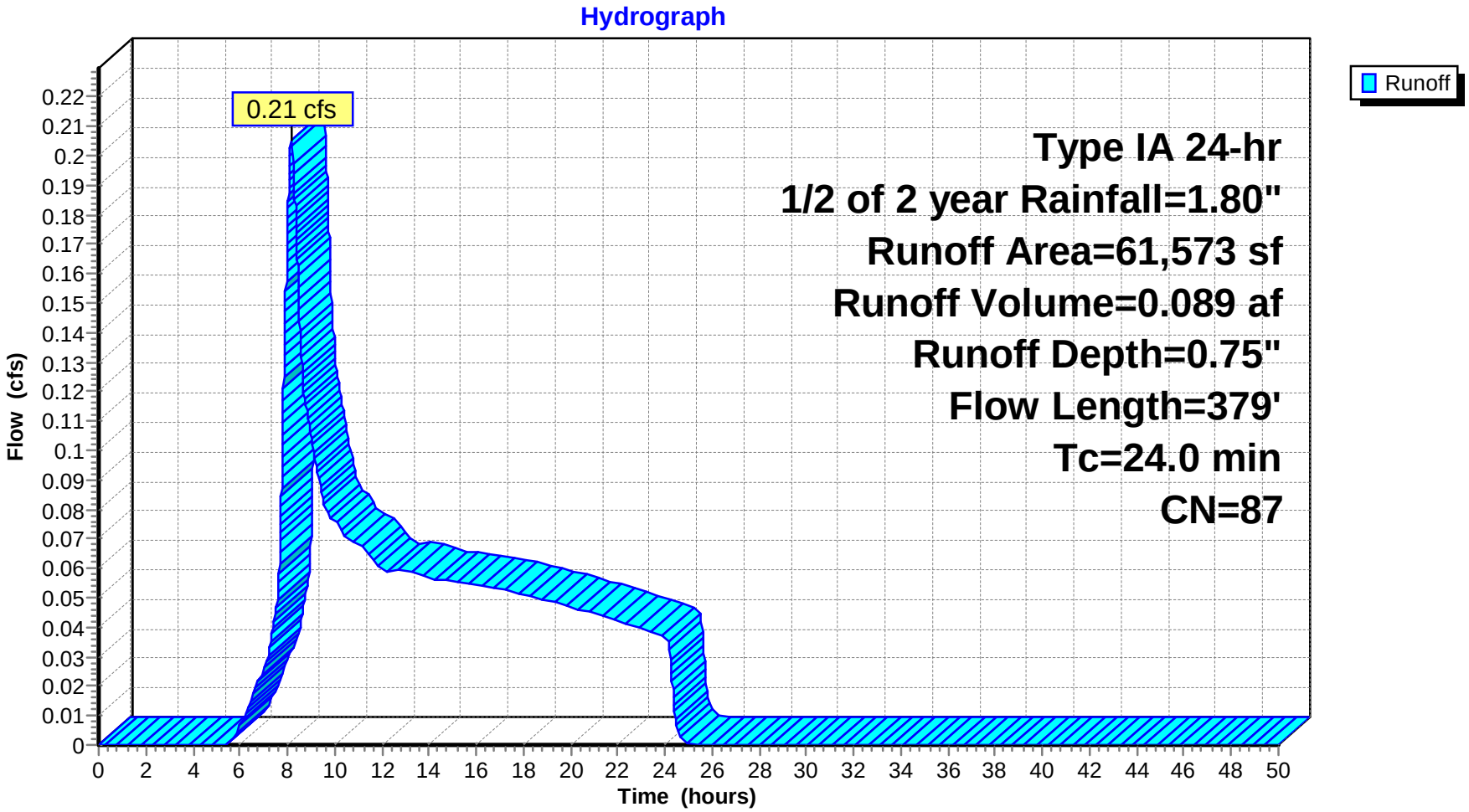
Runoff = 0.21 cfs @ 8.18 hrs, Volume= 0.089 af, Depth= 0.75"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 1/2 of 2 year Rainfall=1.80"

	Area (sf)	CN	Description
*	19,215	98	Paving, C&G
*	4,515	98	Sidewalk
*	8,000	98	Roofs: 2,000 sf/lot, 20 lots
*	1,600	98	Driveways: 400 sf/lot, 20 lots
	28,243	74	>75% Grass cover, Good, HSG C
	61,573	87	Weighted Average
	28,243		45.87% Pervious Area
	33,330		54.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	88	0.0055	0.08		**Sheet Flow, Sheet flow over Grass to Sidewalk**
					Grass: Short n= 0.150 P2= 2.20"
1.4	6	0.0150	0.07		**Sheet Flow, Sheet Flow Across Sidewalk and Curb**
					Grass: Short n= 0.150 P2= 2.20"
1.9	9	0.0150	0.08		**Sheet Flow, Sheet Flow Acress Landscape Strip**
					Grass: Short n= 0.150 P2= 2.20"
2.5	214	0.0050	1.44		**Shallow Concentrated Flow, zshallow Concentrated (gutter flow)**
					Paved Kv= 20.3 fps
0.3	62	0.0050	3.21	2.52	**Pipe Channel, Curb Inlet to Basin**
					12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
					n= 0.013 Corrugated PE, smooth interior
24.0	379	Total			

Subcatchment Post B: POST BASIN B



Summary for Subcatchment Post A: POST BASIN A

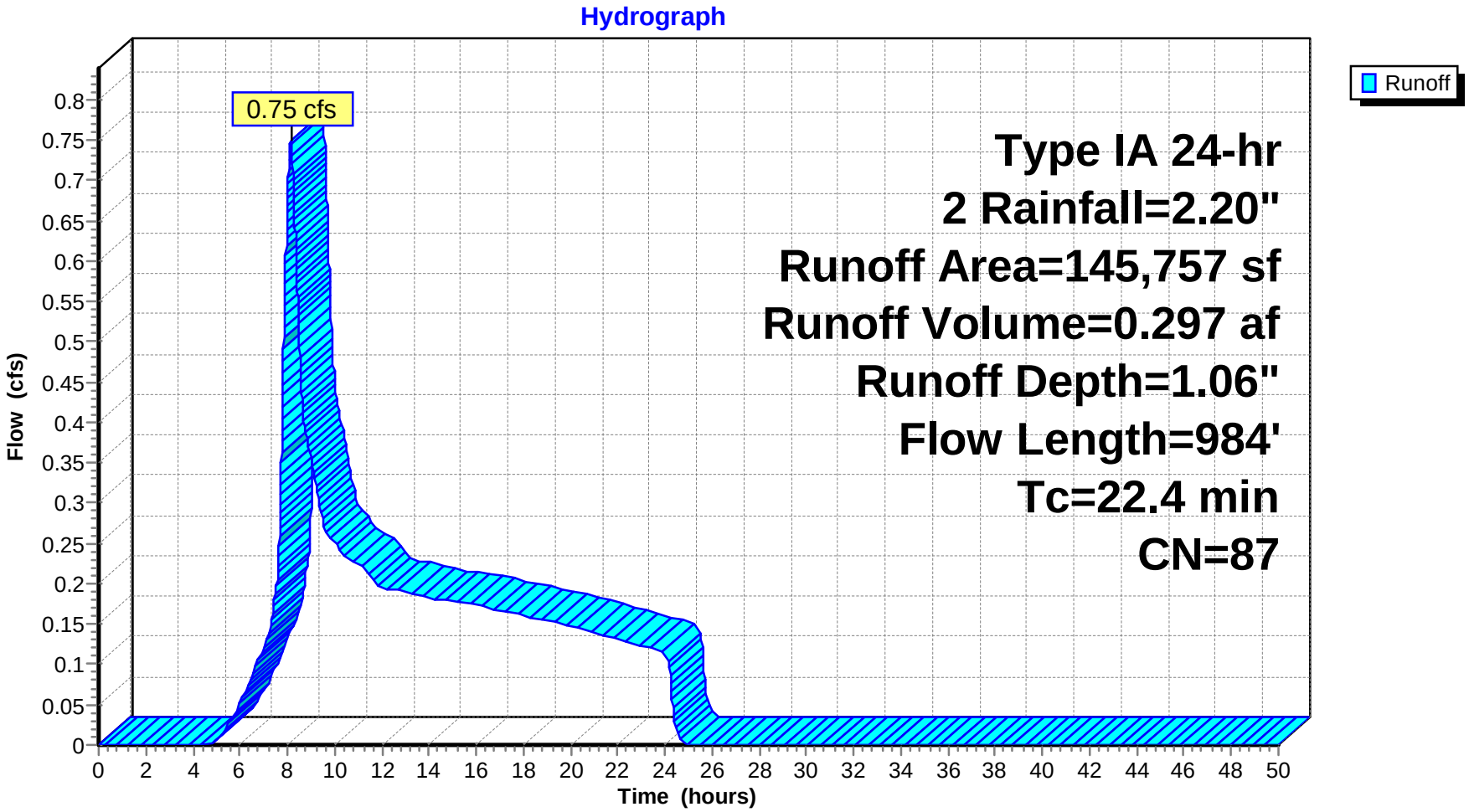
Runoff = 0.75 cfs @ 8.14 hrs, Volume= 0.297 af, Depth= 1.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Rainfall=2.20"

	Area (sf)	CN	Description
*	23,522	98	Paving, C&G
*	5,401	98	Sidewalk
*	39,988	98	Roofs: 2,000 sf/lot, 20 lots
*	8,015	98	Driveways: 400 sf/lot, 20 lots
	68,831	74	>75% Grass cover, Good, HSG C
	145,757	87	Weighted Average
	68,831		47.22% Pervious Area
	76,926		52.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	85	0.0070	0.09		**Sheet Flow, Sheet flow over Grass** Grass: Short n= 0.150 P2= 2.20"
0.6	136	0.0100	3.71	0.73	**Pipe Channel, 6" Area Drain to Curb inlet** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.010 PVC, smooth interior
6.0	763	0.0022	2.13	1.67	**Pipe Channel, Curb Inlet to Basin** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
22.4	984	Total			

Subcatchment Post A: POST BASIN A



Summary for Subcatchment Post B: POST BASIN B

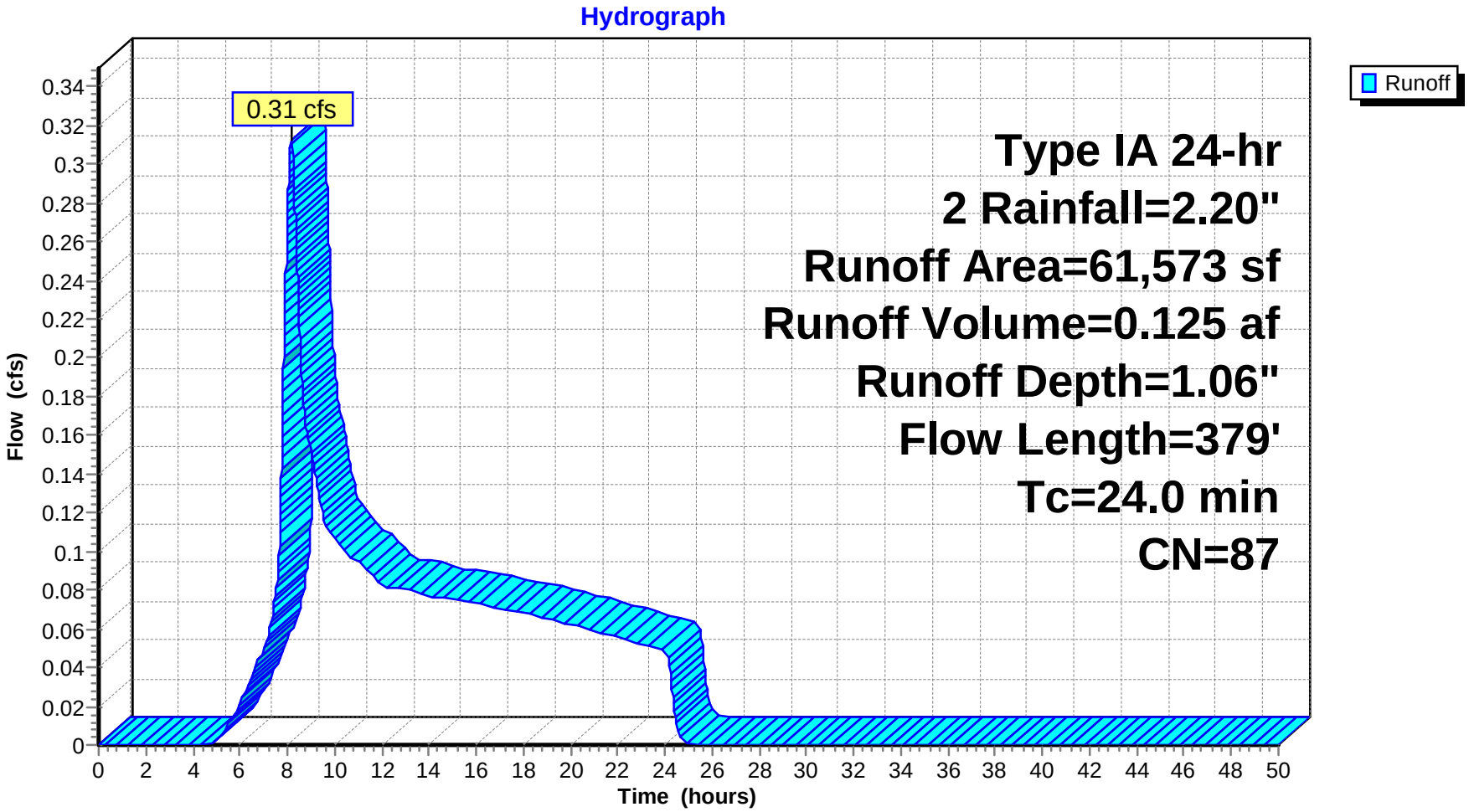
Runoff = 0.31 cfs @ 8.18 hrs, Volume= 0.125 af, Depth= 1.06"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 2 Rainfall=2.20"

	Area (sf)	CN	Description
*	19,215	98	Paving, C&G
*	4,515	98	Sidewalk
*	8,000	98	Roofs: 2,000 sf/lot, 20 lots
*	1,600	98	Driveways: 400 sf/lot, 20 lots
	28,243	74	>75% Grass cover, Good, HSG C
	61,573	87	Weighted Average
	28,243		45.87% Pervious Area
	33,330		54.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	88	0.0055	0.08		**Sheet Flow, Sheet flow over Grass to Sidewalk**
					Grass: Short n= 0.150 P2= 2.20"
1.4	6	0.0150	0.07		**Sheet Flow, Sheet Flow Across Sidewalk and Curb**
					Grass: Short n= 0.150 P2= 2.20"
1.9	9	0.0150	0.08		**Sheet Flow, Sheet Flow Acress Landscape Strip**
					Grass: Short n= 0.150 P2= 2.20"
2.5	214	0.0050	1.44		**Shallow Concentrated Flow, zshallow Concentrated (gutter flow)**
					Paved Kv= 20.3 fps
0.3	62	0.0050	3.21	2.52	**Pipe Channel, Curb Inlet to Basin**
					12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
					n= 0.013 Corrugated PE, smooth interior
24.0	379	Total			

Subcatchment Post B: POST BASIN B



Summary for Subcatchment Post A: POST BASIN A

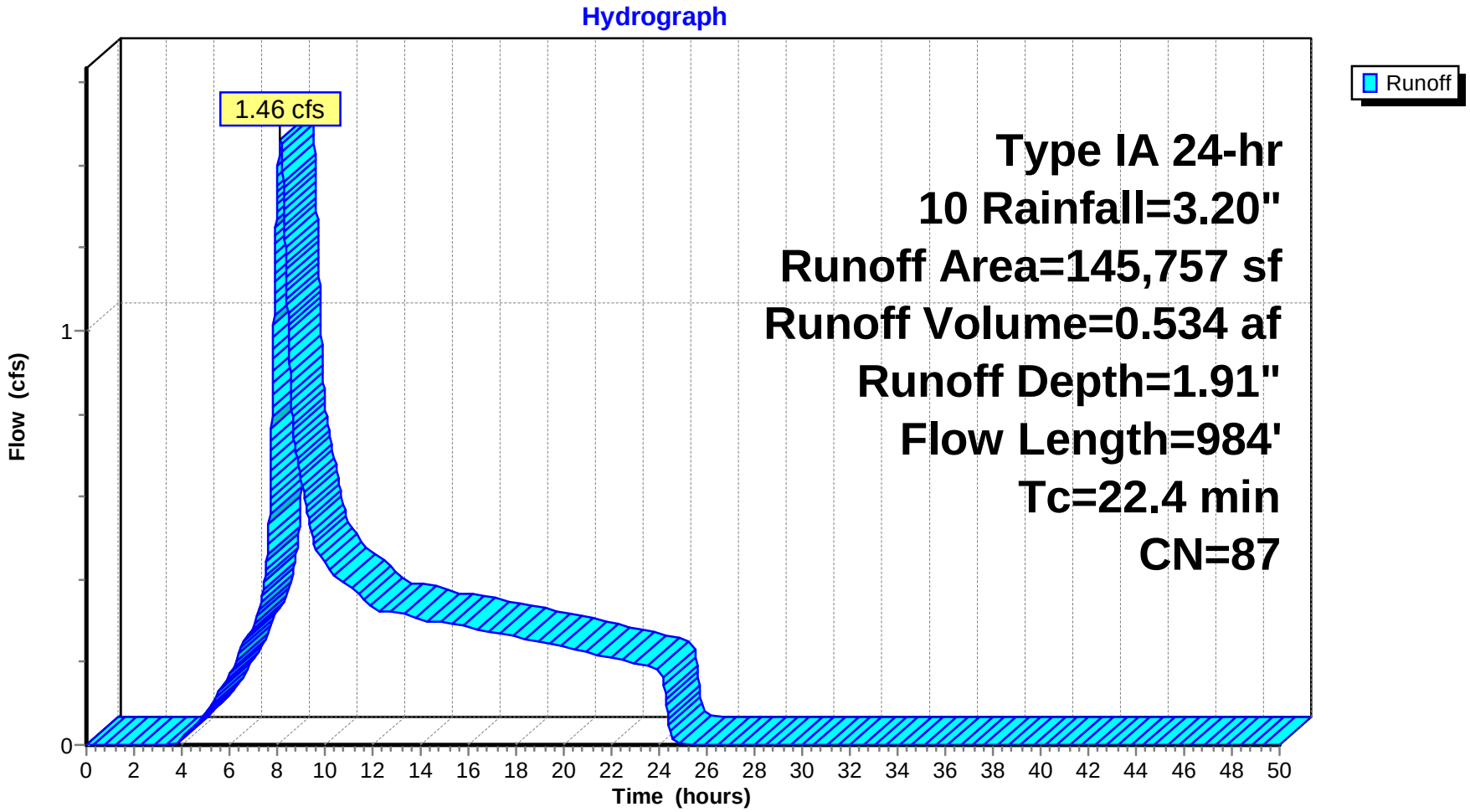
Runoff = 1.46 cfs @ 8.14 hrs, Volume= 0.534 af, Depth= 1.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Rainfall=3.20"

	Area (sf)	CN	Description
*	23,522	98	Paving, C&G
*	5,401	98	Sidewalk
*	39,988	98	Roofs: 2,000 sf/lot, 20 lots
*	8,015	98	Driveways: 400 sf/lot, 20 lots
	68,831	74	>75% Grass cover, Good, HSG C
	145,757	87	Weighted Average
	68,831		47.22% Pervious Area
	76,926		52.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	85	0.0070	0.09		**Sheet Flow, Sheet flow over Grass** Grass: Short n= 0.150 P2= 2.20"
0.6	136	0.0100	3.71	0.73	**Pipe Channel, 6" Area Drain to Curb inlet** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.010 PVC, smooth interior
6.0	763	0.0022	2.13	1.67	**Pipe Channel, Curb Inlet to Basin** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
22.4	984	Total			

Subcatchment Post A: POST BASIN A



Summary for Subcatchment Post B: POST BASIN B

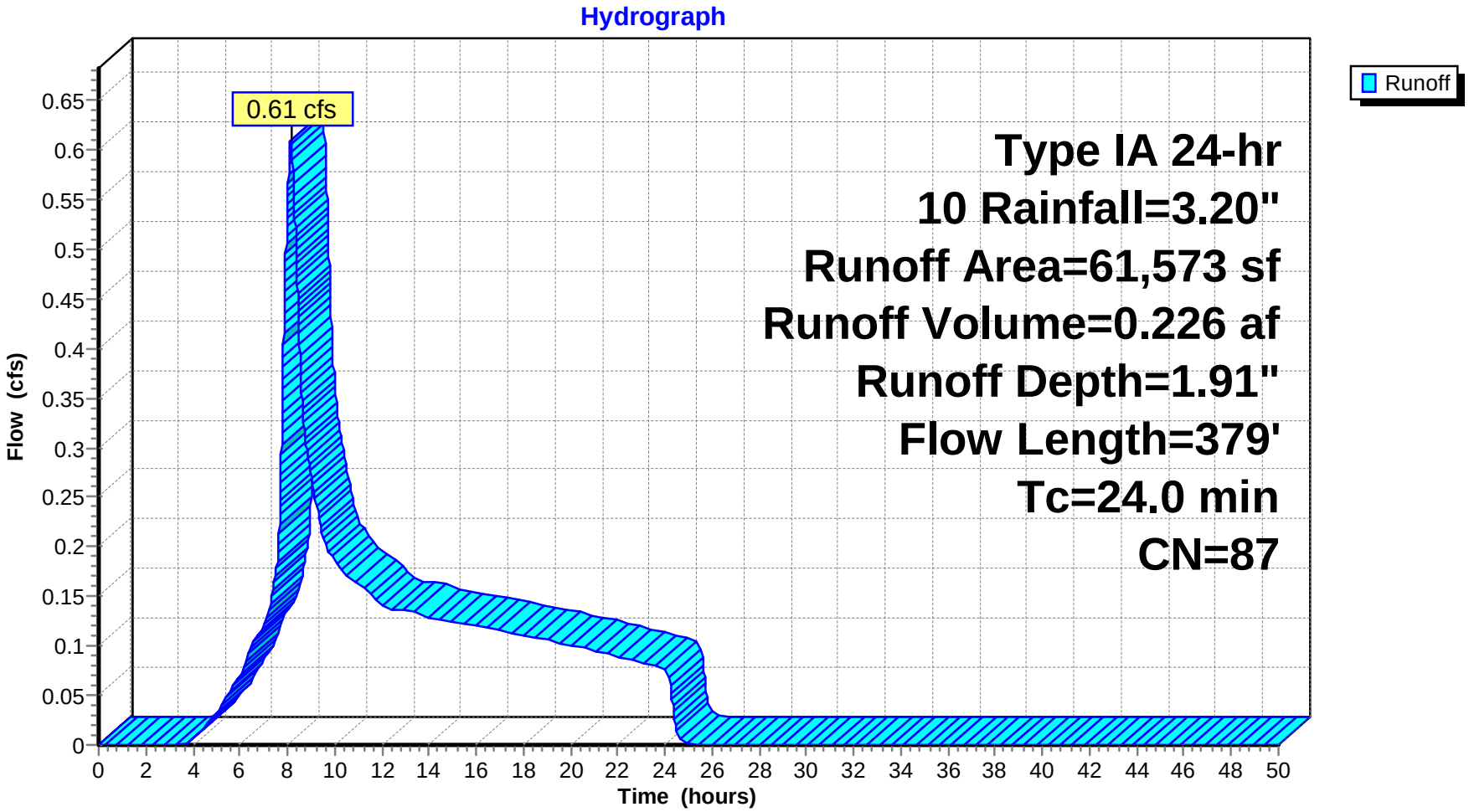
Runoff = 0.61 cfs @ 8.16 hrs, Volume= 0.226 af, Depth= 1.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 10 Rainfall=3.20"

	Area (sf)	CN	Description
*	19,215	98	Paving, C&G
*	4,515	98	Sidewalk
*	8,000	98	Roofs: 2,000 sf/lot, 20 lots
*	1,600	98	Driveways: 400 sf/lot, 20 lots
	28,243	74	>75% Grass cover, Good, HSG C
	61,573	87	Weighted Average
	28,243		45.87% Pervious Area
	33,330		54.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	88	0.0055	0.08		**Sheet Flow, Sheet flow over Grass to Sidewalk**
					Grass: Short n= 0.150 P2= 2.20"
1.4	6	0.0150	0.07		**Sheet Flow, Sheet Flow Across Sidewalk and Curb**
					Grass: Short n= 0.150 P2= 2.20"
1.9	9	0.0150	0.08		**Sheet Flow, Sheet Flow Acress Landscape Strip**
					Grass: Short n= 0.150 P2= 2.20"
2.5	214	0.0050	1.44		**Shallow Concentrated Flow, zshallow Concentrated (gutter flow)**
					Paved Kv= 20.3 fps
0.3	62	0.0050	3.21	2.52	**Pipe Channel, Curb Inlet to Basin**
					12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
					n= 0.013 Corrugated PE, smooth interior
24.0	379	Total			

Subcatchment Post B: POST BASIN B



Summary for Subcatchment Post A: POST BASIN A

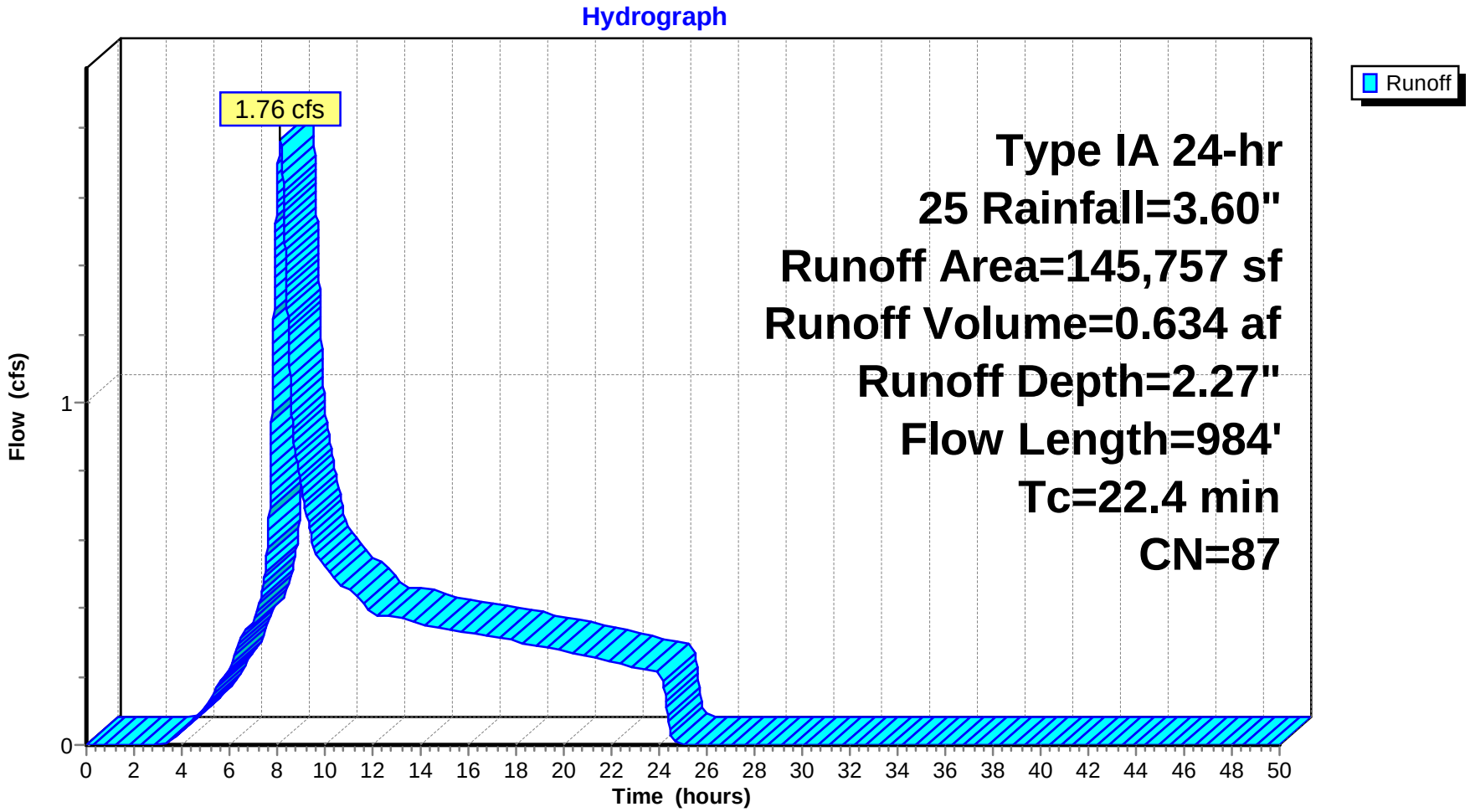
Runoff = 1.76 cfs @ 8.14 hrs, Volume= 0.634 af, Depth= 2.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 Rainfall=3.60"

	Area (sf)	CN	Description
*	23,522	98	Paving, C&G
*	5,401	98	Sidewalk
*	39,988	98	Roofs: 2,000 sf/lot, 20 lots
*	8,015	98	Driveways: 400 sf/lot, 20 lots
	68,831	74	>75% Grass cover, Good, HSG C
	145,757	87	Weighted Average
	68,831		47.22% Pervious Area
	76,926		52.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	85	0.0070	0.09		**Sheet Flow, Sheet flow over Grass** Grass: Short n= 0.150 P2= 2.20"
0.6	136	0.0100	3.71	0.73	**Pipe Channel, 6" Area Drain to Curb inlet** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.010 PVC, smooth interior
6.0	763	0.0022	2.13	1.67	**Pipe Channel, Curb Inlet to Basin** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
22.4	984	Total			

Subcatchment Post A: POST BASIN A



Summary for Subcatchment Post B: POST BASIN B

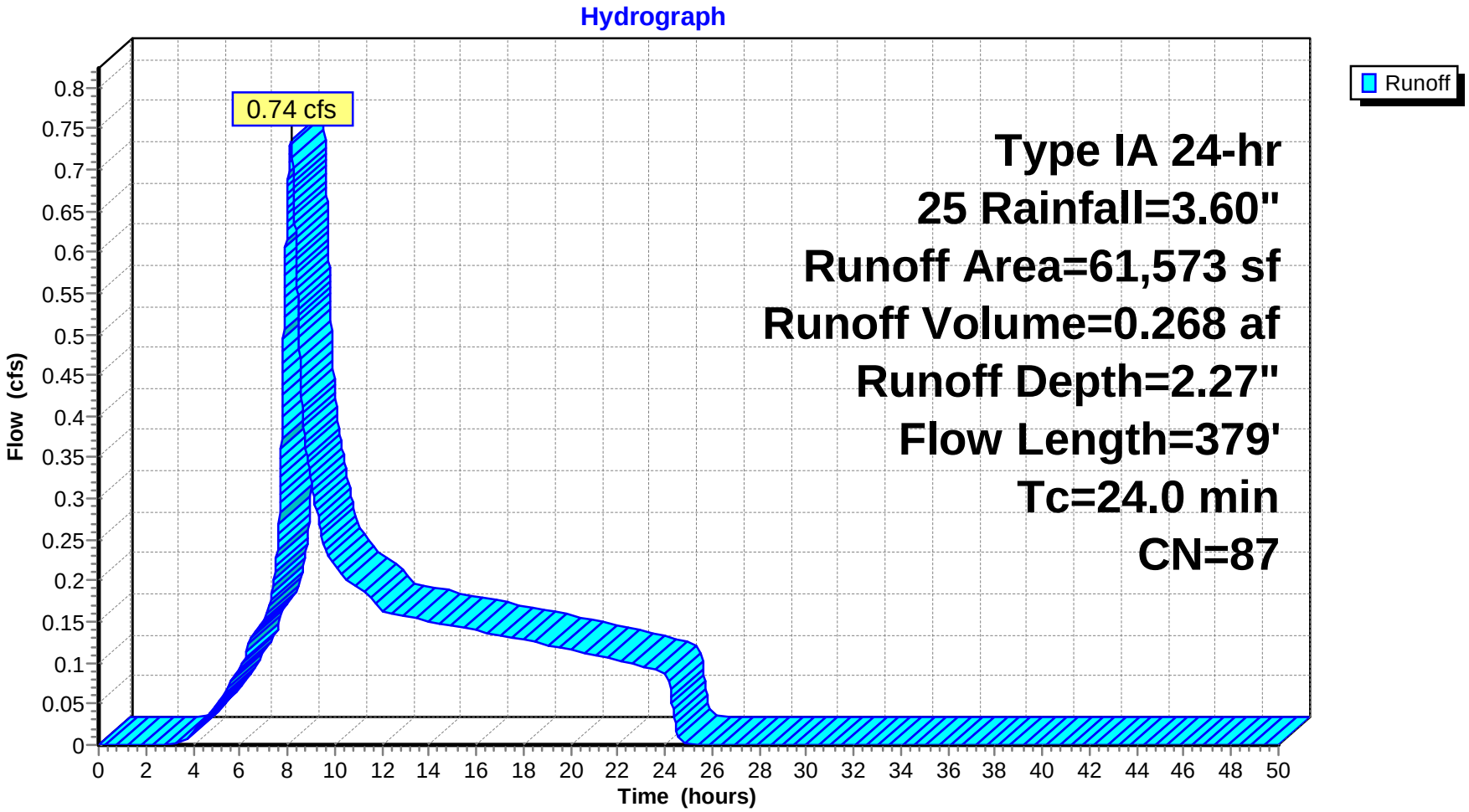
Runoff = 0.74 cfs @ 8.15 hrs, Volume= 0.268 af, Depth= 2.27"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 25 Rainfall=3.60"

	Area (sf)	CN	Description
*	19,215	98	Paving, C&G
*	4,515	98	Sidewalk
*	8,000	98	Roofs: 2,000 sf/lot, 20 lots
*	1,600	98	Driveways: 400 sf/lot, 20 lots
	28,243	74	>75% Grass cover, Good, HSG C
	61,573	87	Weighted Average
	28,243		45.87% Pervious Area
	33,330		54.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	88	0.0055	0.08		**Sheet Flow, Sheet flow over Grass to Sidewalk**
					Grass: Short n= 0.150 P2= 2.20"
1.4	6	0.0150	0.07		**Sheet Flow, Sheet Flow Across Sidewalk and Curb**
					Grass: Short n= 0.150 P2= 2.20"
1.9	9	0.0150	0.08		**Sheet Flow, Sheet Flow Acress Landscape Strip**
					Grass: Short n= 0.150 P2= 2.20"
2.5	214	0.0050	1.44		**Shallow Concentrated Flow, zshallow Concentrated (gutter flow)**
					Paved Kv= 20.3 fps
0.3	62	0.0050	3.21	2.52	**Pipe Channel, Curb Inlet to Basin**
					12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
					n= 0.013 Corrugated PE, smooth interior
24.0	379	Total			

Subcatchment Post B: POST BASIN B



Summary for Subcatchment Post A: POST BASIN A

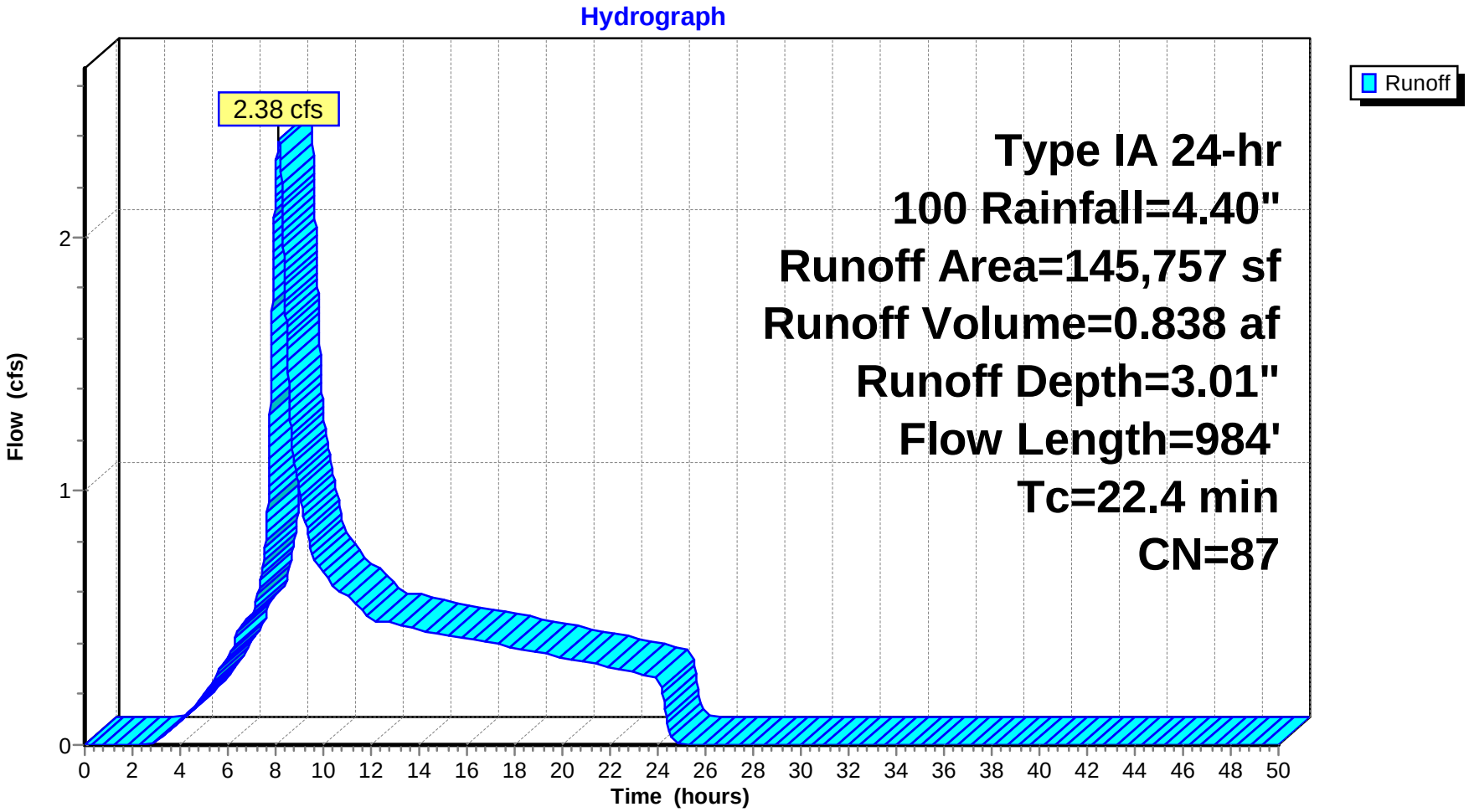
Runoff = 2.38 cfs @ 8.13 hrs, Volume= 0.838 af, Depth= 3.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Rainfall=4.40"

	Area (sf)	CN	Description
*	23,522	98	Paving, C&G
*	5,401	98	Sidewalk
*	39,988	98	Roofs: 2,000 sf/lot, 20 lots
*	8,015	98	Driveways: 400 sf/lot, 20 lots
	68,831	74	>75% Grass cover, Good, HSG C
	145,757	87	Weighted Average
	68,831		47.22% Pervious Area
	76,926		52.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	85	0.0070	0.09		**Sheet Flow, Sheet flow over Grass** Grass: Short n= 0.150 P2= 2.20"
0.6	136	0.0100	3.71	0.73	**Pipe Channel, 6" Area Drain to Curb inlet** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.010 PVC, smooth interior
6.0	763	0.0022	2.13	1.67	**Pipe Channel, Curb Inlet to Basin** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
22.4	984	Total			

Subcatchment Post A: POST BASIN A



Summary for Subcatchment Post B: POST BASIN B

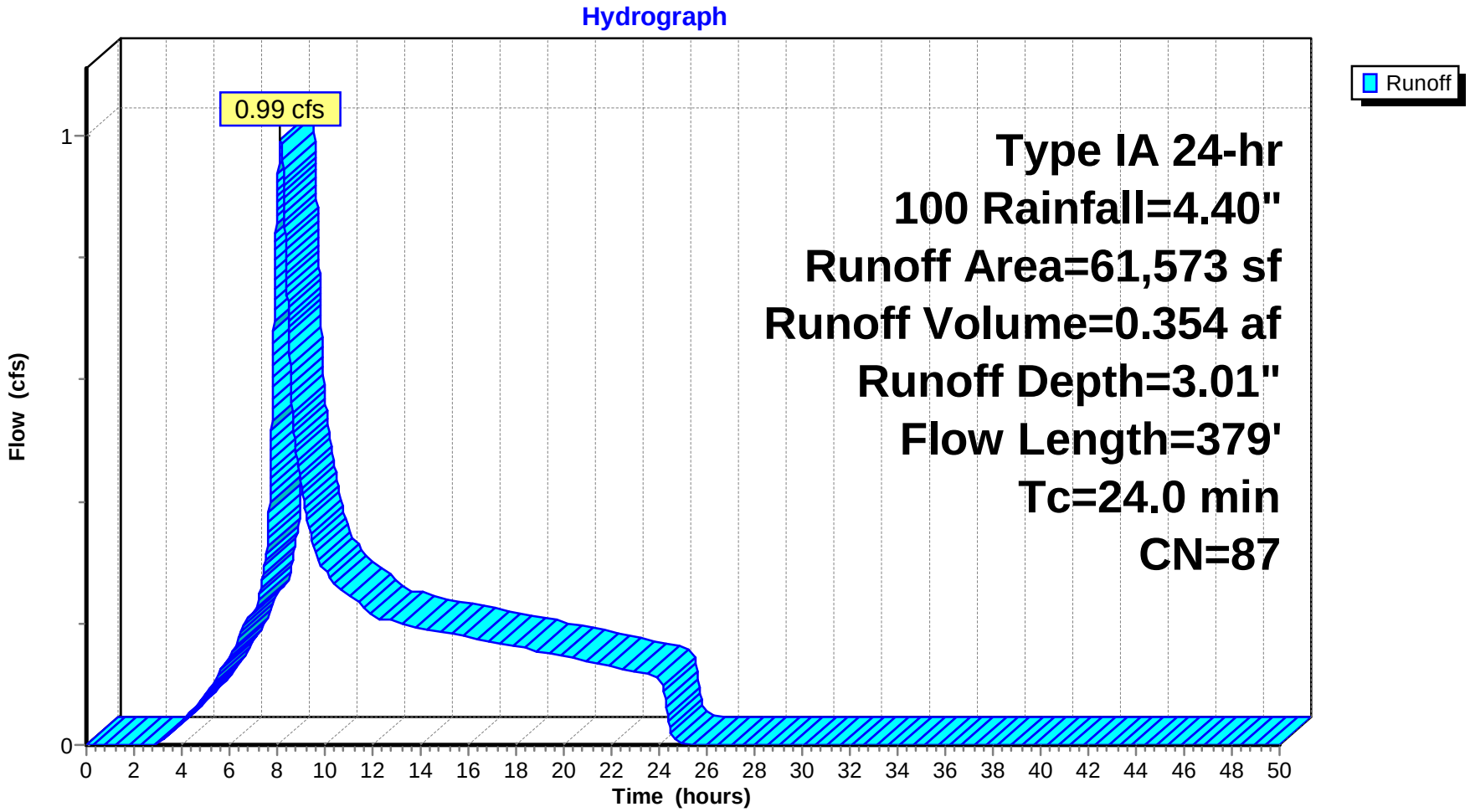
Runoff = 0.99 cfs @ 8.14 hrs, Volume= 0.354 af, Depth= 3.01"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr 100 Rainfall=4.40"

	Area (sf)	CN	Description
*	19,215	98	Paving, C&G
*	4,515	98	Sidewalk
*	8,000	98	Roofs: 2,000 sf/lot, 20 lots
*	1,600	98	Driveways: 400 sf/lot, 20 lots
	28,243	74	>75% Grass cover, Good, HSG C
	61,573	87	Weighted Average
	28,243		45.87% Pervious Area
	33,330		54.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	88	0.0055	0.08		**Sheet Flow, Sheet flow over Grass to Sidewalk**
					Grass: Short n= 0.150 P2= 2.20"
1.4	6	0.0150	0.07		**Sheet Flow, Sheet Flow Across Sidewalk and Curb**
					Grass: Short n= 0.150 P2= 2.20"
1.9	9	0.0150	0.08		**Sheet Flow, Sheet Flow Acress Landscape Strip**
					Grass: Short n= 0.150 P2= 2.20"
2.5	214	0.0050	1.44		**Shallow Concentrated Flow, zshallow Concentrated (gutter flow)**
					Paved Kv= 20.3 fps
0.3	62	0.0050	3.21	2.52	**Pipe Channel, Curb Inlet to Basin**
					12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25'
					n= 0.013 Corrugated PE, smooth interior
24.0	379	Total			

Subcatchment Post B: POST BASIN B



Summary for Subcatchment Post A: POST BASIN A

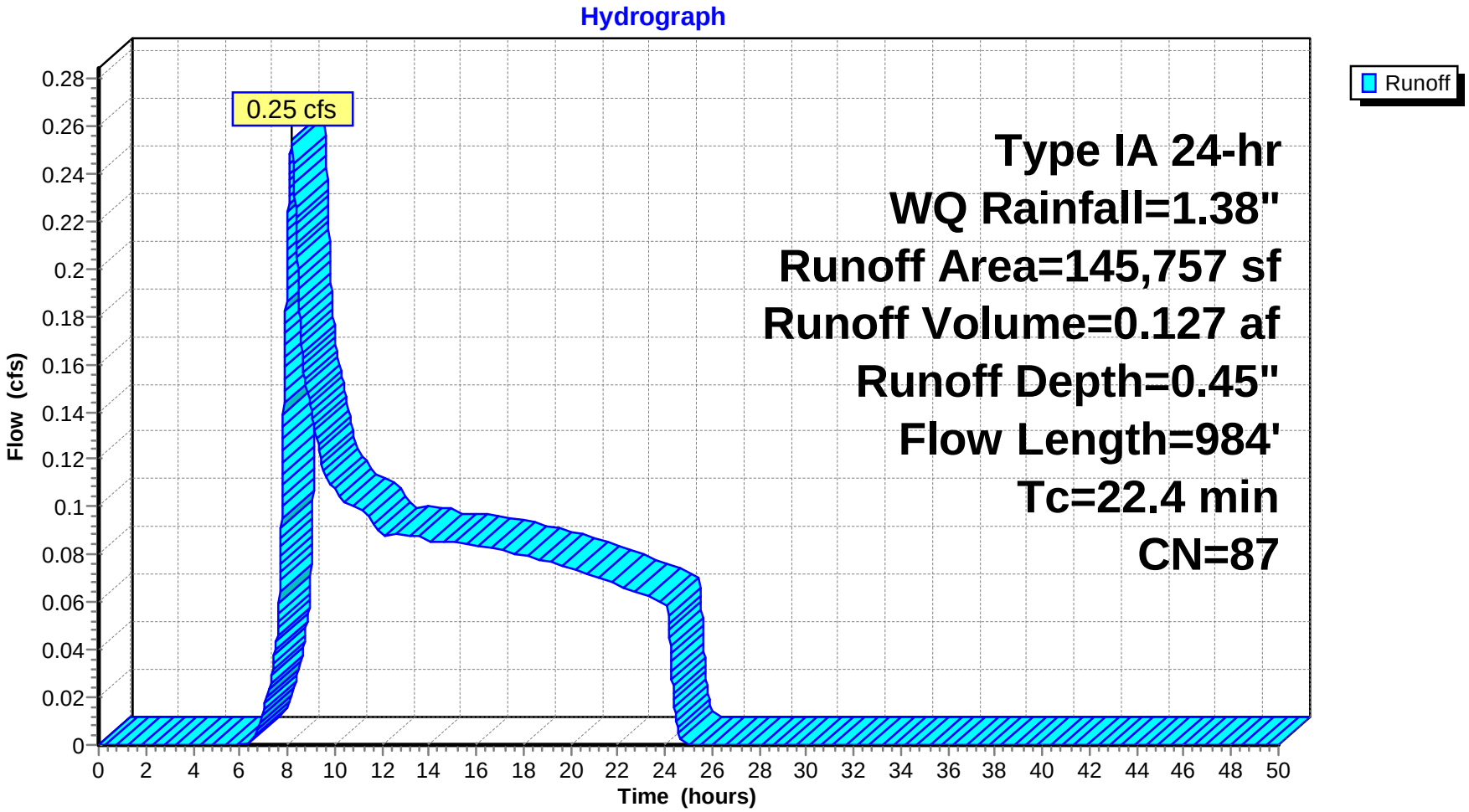
Runoff = 0.25 cfs @ 8.19 hrs, Volume= 0.127 af, Depth= 0.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.38"

	Area (sf)	CN	Description
*	23,522	98	Paving, C&G
*	5,401	98	Sidewalk
*	39,988	98	Roofs: 2,000 sf/lot, 20 lots
*	8,015	98	Driveways: 400 sf/lot, 20 lots
	68,831	74	>75% Grass cover, Good, HSG C
	145,757	87	Weighted Average
	68,831		47.22% Pervious Area
	76,926		52.78% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	85	0.0070	0.09		**Sheet Flow, Sheet flow over Grass** Grass: Short n= 0.150 P2= 2.20"
0.6	136	0.0100	3.71	0.73	**Pipe Channel, 6" Area Drain to Curb inlet** 6.0" Round Area= 0.2 sf Perim= 1.6' r= 0.13' n= 0.010 PVC, smooth interior
6.0	763	0.0022	2.13	1.67	**Pipe Channel, Curb Inlet to Basin** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
22.4	984	Total			

Subcatchment Post A: POST BASIN A



Summary for Subcatchment Post B: POST BASIN B

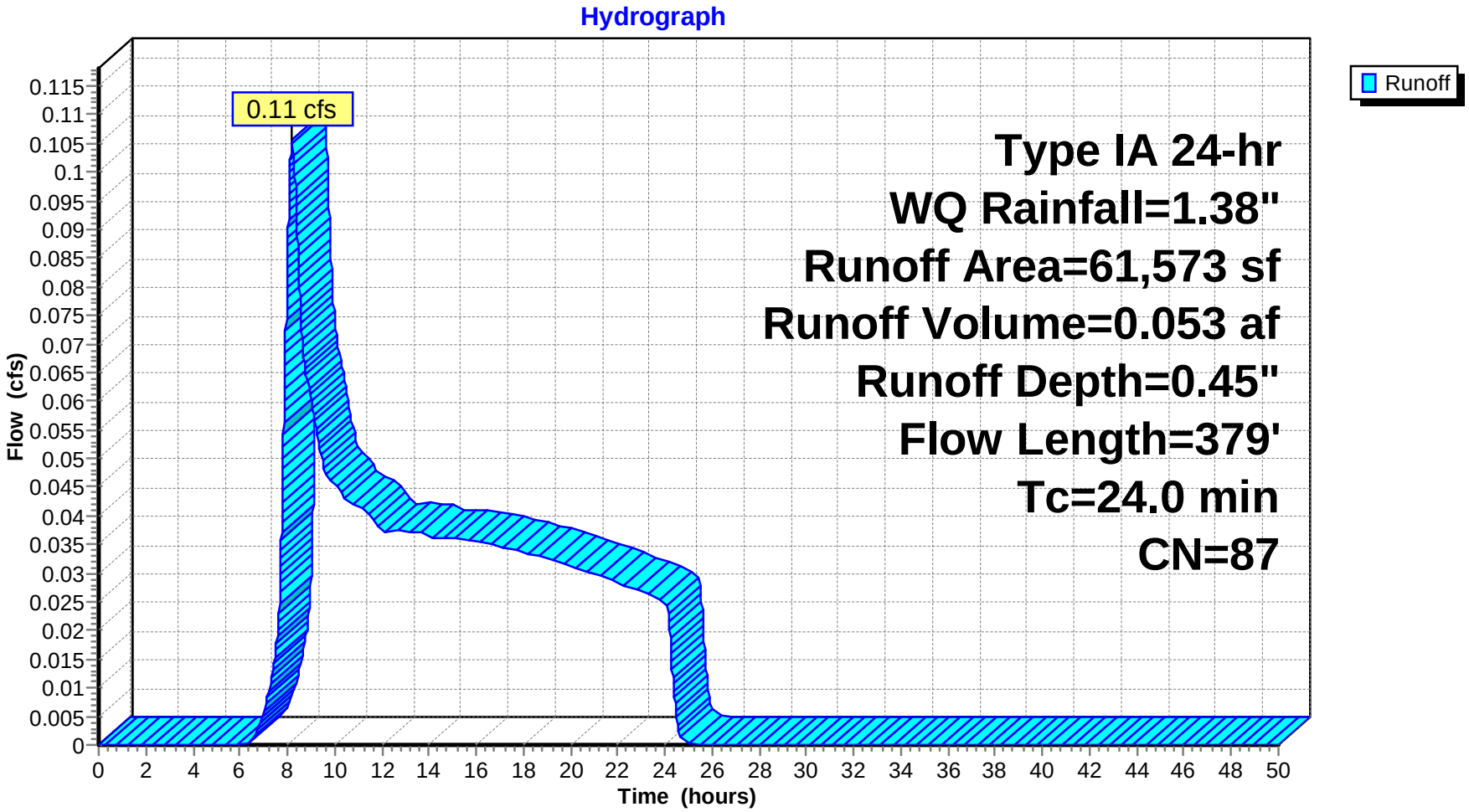
Runoff = 0.11 cfs @ 8.19 hrs, Volume= 0.053 af, Depth= 0.45"

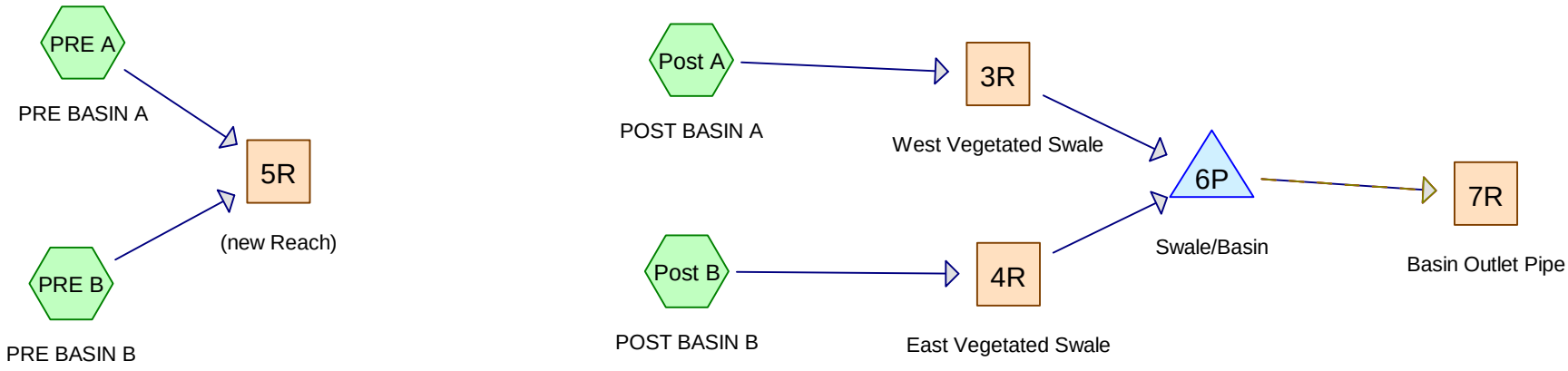
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Type IA 24-hr WQ Rainfall=1.38"

	Area (sf)	CN	Description
*	19,215	98	Paving, C&G
*	4,515	98	Sidewalk
*	8,000	98	Roofs: 2,000 sf/lot, 20 lots
*	1,600	98	Driveways: 400 sf/lot, 20 lots
	28,243	74	>75% Grass cover, Good, HSG C
	61,573	87	Weighted Average
	28,243		45.87% Pervious Area
	33,330		54.13% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
17.9	88	0.0055	0.08		**Sheet Flow, Sheet flow over Grass to Sidewalk** Grass: Short n= 0.150 P2= 2.20"
1.4	6	0.0150	0.07		**Sheet Flow, Sheet Flow Across Sidewalk and Curb** Grass: Short n= 0.150 P2= 2.20"
1.9	9	0.0150	0.08		**Sheet Flow, Sheet Flow Acress Landscape Strip** Grass: Short n= 0.150 P2= 2.20"
2.5	214	0.0050	1.44		**Shallow Concentrated Flow, zshallow Concentrated (gutter flow)** Paved Kv= 20.3 fps
0.3	62	0.0050	3.21	2.52	**Pipe Channel, Curb Inlet to Basin** 12.0" Round Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Corrugated PE, smooth interior
24.0	379	Total			

Subcatchment Post B: POST BASIN B

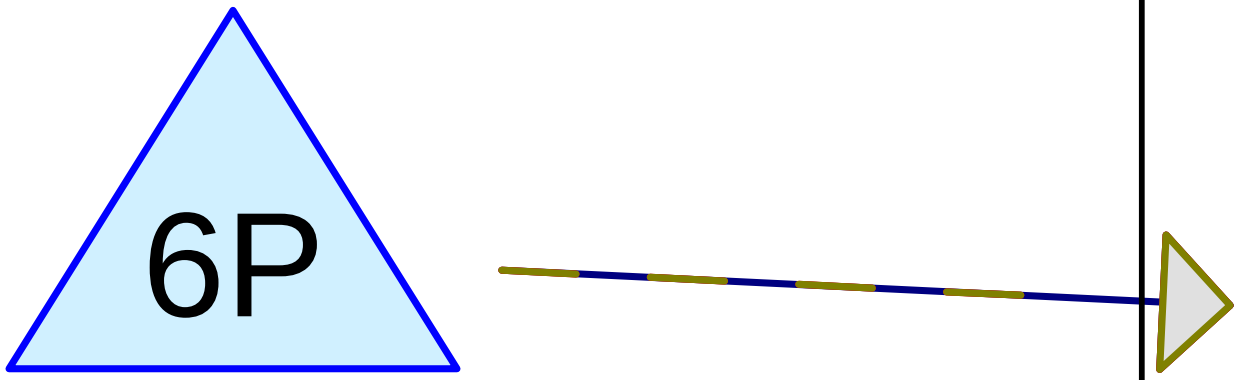




Subcat Reach Pond Link

Routing Diagram for 13080 Belle Plain -Center St-SLOPES half of 2-year 0.3 exfil20210228 orifice

Prepared by {enter your company name here}, Printed 3/8/2021



Swale/Basin

Subcat Reach Pond Link

Routing Diagram for 13080 Belle Plain -Center St-SLOPES half of 2-year 0.3 exfil20210313 orifice

Prepared by {enter your company name here}, Printed 3/13/2021

Rainfall Events Listing

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	1/2 of 2 year	Type IA 24-hr		Default	24.00	1	1.80	2
2	2	Type IA 24-hr		Default	24.00	1	2.20	2
3	10	Type IA 24-hr		Default	24.00	1	3.20	2
4	25	Type IA 24-hr		Default	24.00	1	3.60	2
5	100	Type IA 24-hr		Default	24.00	1	4.40	2
6	WQ	Type IA 24-hr		Default	24.00	1	1.38	2

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	6P	207.62	207.59	34.0	0.0009	0.013	0.0	10.0	0.0

Summary for Pond 6P: Swale/Basin

Inflow Area = 4.760 ac, 53.18% Impervious, Inflow Depth = 0.75" for 1/2 of 2 year event
Inflow = 0.66 cfs @ 8.26 hrs, Volume= 0.298 af
Outflow = 0.13 cfs @ 24.04 hrs, Volume= 0.298 af, Atten= 81%, Lag= 946.6 min
Discarded = 0.05 cfs @ 24.04 hrs, Volume= 0.138 af
Primary = 0.08 cfs @ 24.04 hrs, Volume= 0.160 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Peak Elev= 208.59' @ 24.04 hrs Surf.Area= 6,969 sf Storage= 5,992 cf

Plug-Flow detention time= 573.0 min calculated for 0.298 af (100% of inflow)
Center-of-Mass det. time= 573.1 min (1,430.2 - 857.1)

Volume	Invert	Avail.Storage	Storage Description
#1	207.63'	22,974 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
207.63	0	0	0
207.70	2,515	88	88
207.80	6,100	431	519
207.90	6,916	651	1,170
208.00	6,924	692	1,862
208.10	6,932	693	2,554
208.50	6,962	2,779	5,333
209.00	7,000	3,491	8,824
209.50	7,037	3,509	12,333
210.00	7,076	3,528	15,861
210.50	7,113	3,547	19,408
211.00	7,151	3,566	22,974

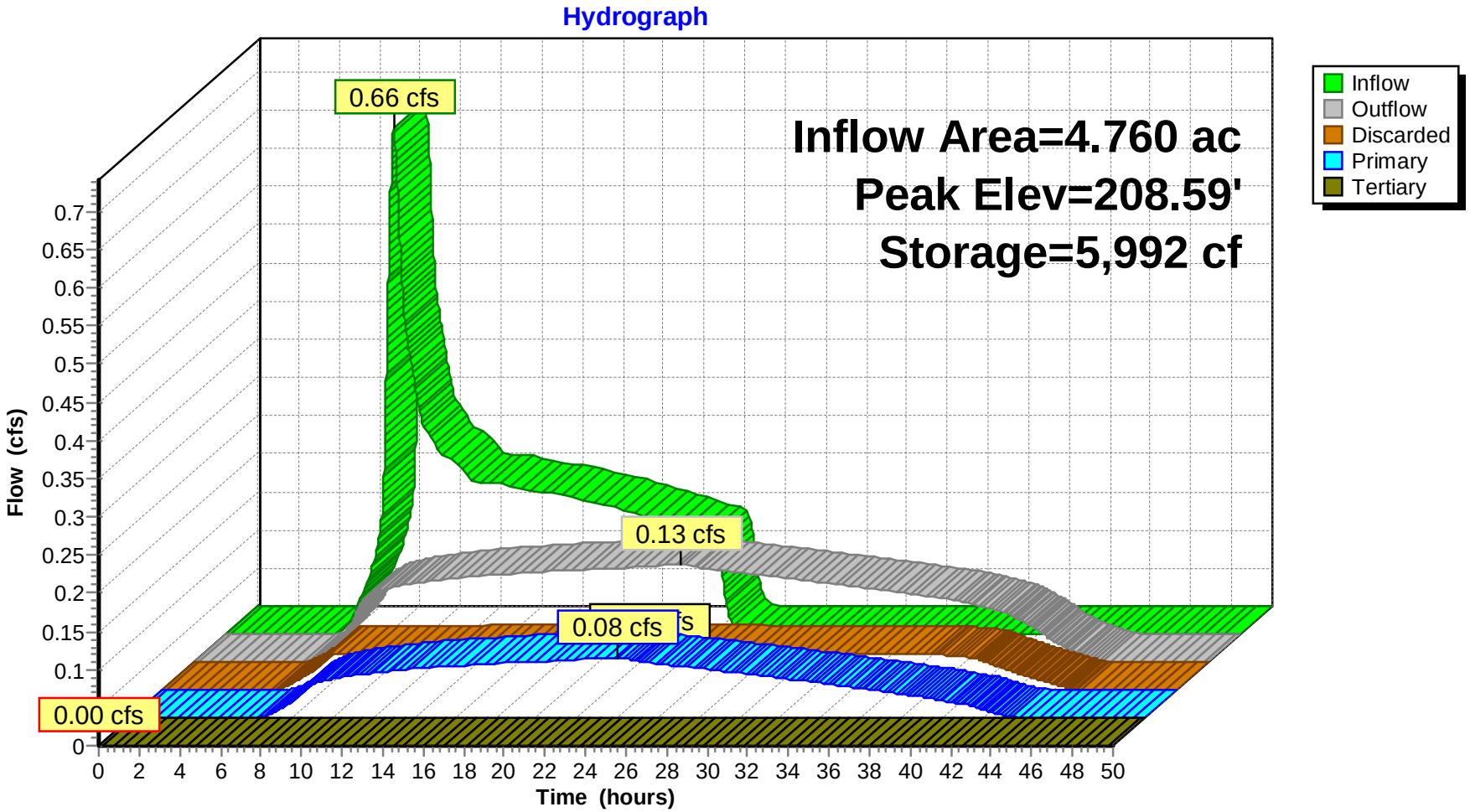
Device	Routing	Invert	Outlet Devices
#1	Discarded	207.63'	**0.300 in/hr Exfiltration over Surface area**
#2	Primary	207.62'	**10.0" Round 10" outlet pipe** L= 34.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 207.62' / 207.59' S= 0.0009 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	207.62'	**1.8" Horiz. Orifice -1/2 of 2-year** C= 0.600 Limited to weir flow at low heads
#4	Device 2	208.55'	**2.0" Vert. Orifice -2 year** C= 0.600 Limited to weir flow at low heads
#5	Device 2	208.90'	**8.0" Vert. Orifice -10 year -1** C= 0.600 Limited to weir flow at low heads
#6	Device 2	208.90'	**8.0" Vert. Orifice -10 year -2** C= 0.600 Limited to weir flow at low heads
#7	Tertiary	210.00'	**10.0" Horiz. Orifice/Grate -1 10 " Overflow Riser** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.05 cfs @ 24.04 hrs HW=208.59' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.08 cfs @ 24.04 hrs HW=208.59' TW=207.82' (Dynamic Tailwater)
└─**2=10" outlet pipe** (Passes 0.08 cfs of 1.33 cfs potential flow)
  ├─**3=Orifice -1/2 of 2-year** (Orifice Controls 0.08 cfs @ 4.25 fps)
  ├─**4=Orifice -2 year** (Orifice Controls 0.00 cfs @ 0.72 fps)
  ├─**5=Orifice -10 year -1** (Controls 0.00 cfs)
  └─**6=Orifice -10 year -2** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=207.63' TW=207.62' (Dynamic Tailwater)
└─**7=Orifice/Grate -1 10 " Overflow Riser** (Controls 0.00 cfs)

Pond 6P: Swale/Basin



Summary for Pond 6P: Swale/Basin

Inflow Area = 4.760 ac, 53.18% Impervious, Inflow Depth = 1.06" for 2 event
Inflow = 1.02 cfs @ 8.24 hrs, Volume= 0.422 af
Outflow = 0.20 cfs @ 21.27 hrs, Volume= 0.422 af, Atten= 81%, Lag= 781.8 min
Discarded = 0.05 cfs @ 21.27 hrs, Volume= 0.156 af
Primary = 0.15 cfs @ 21.27 hrs, Volume= 0.266 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Peak Elev= 208.93' @ 21.27 hrs Surf.Area= 6,994 sf Storage= 8,309 cf

Plug-Flow detention time= 619.7 min calculated for 0.422 af (100% of inflow)
Center-of-Mass det. time= 619.8 min (1,453.9 - 834.1)

Volume	Invert	Avail.Storage	Storage Description
#1	207.63'	22,974 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
207.63	0	0	0
207.70	2,515	88	88
207.80	6,100	431	519
207.90	6,916	651	1,170
208.00	6,924	692	1,862
208.10	6,932	693	2,554
208.50	6,962	2,779	5,333
209.00	7,000	3,491	8,824
209.50	7,037	3,509	12,333
210.00	7,076	3,528	15,861
210.50	7,113	3,547	19,408
211.00	7,151	3,566	22,974

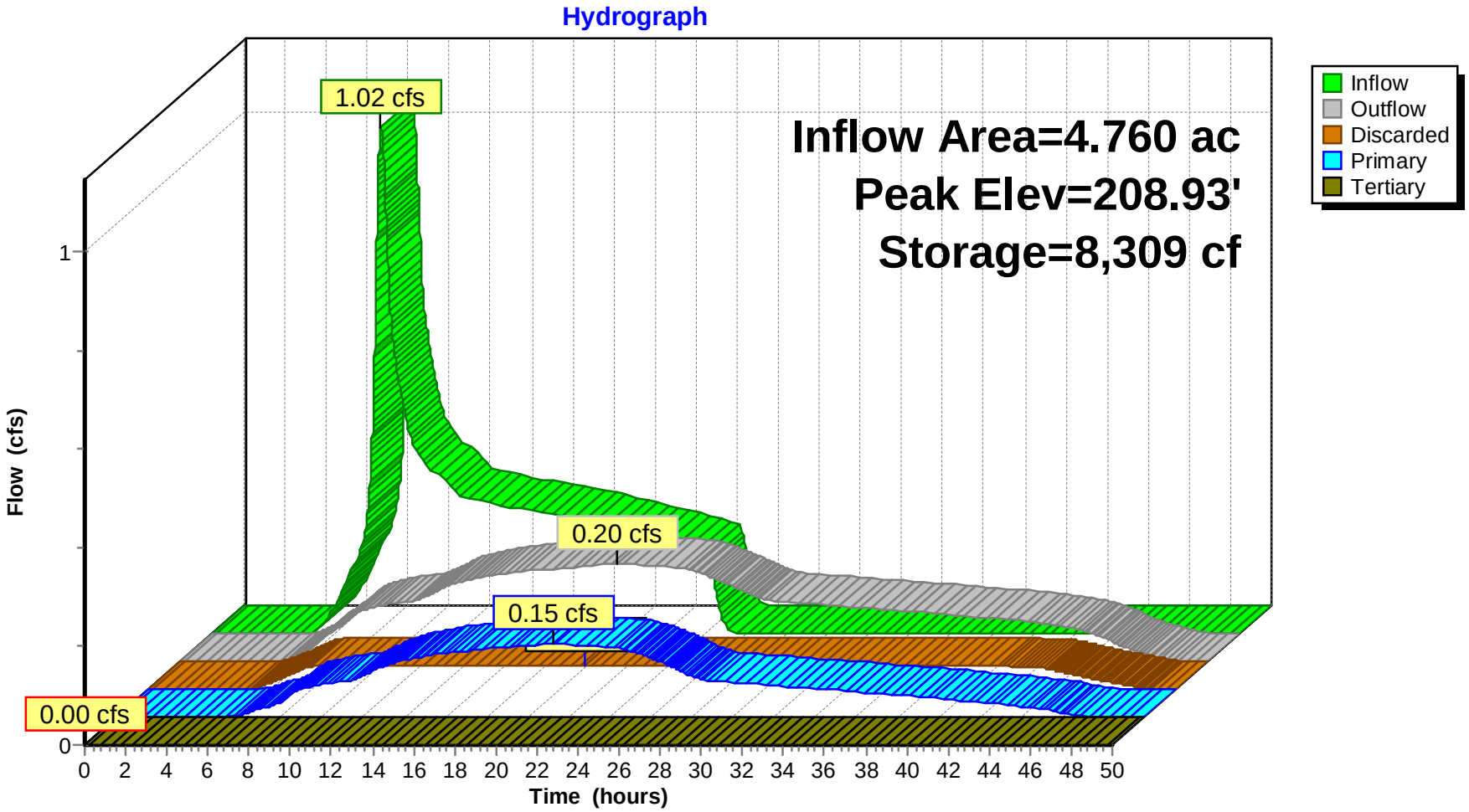
Device	Routing	Invert	Outlet Devices
#1	Discarded	207.63'	**0.300 in/hr Exfiltration over Surface area**
#2	Primary	207.62'	**10.0" Round 10" outlet pipe** L= 34.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 207.62' / 207.59' S= 0.0009 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	207.62'	**1.8" Horiz. Orifice -1/2 of 2-year** C= 0.600 Limited to weir flow at low heads
#4	Device 2	208.55'	**2.0" Vert. Orifice -2 year** C= 0.600 Limited to weir flow at low heads
#5	Device 2	208.90'	**8.0" Vert. Orifice -10 year -1** C= 0.600 Limited to weir flow at low heads
#6	Device 2	208.90'	**8.0" Vert. Orifice -10 year -2** C= 0.600 Limited to weir flow at low heads
#7	Tertiary	210.00'	**10.0" Horiz. Orifice/Grate -1 10 " Overflow Riser** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.05 cfs @ 21.27 hrs HW=208.93' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.15 cfs @ 21.27 hrs HW=208.93' TW=207.89' (Dynamic Tailwater)
└**2=10" outlet pipe** (Passes 0.15 cfs of 1.84 cfs potential flow)
  ├**3=Orifice -1/2 of 2-year** (Orifice Controls 0.09 cfs @ 4.90 fps)
  ├**4=Orifice -2 year** (Orifice Controls 0.06 cfs @ 2.61 fps)
  ├**5=Orifice -10 year -1** (Orifice Controls 0.00 cfs @ 0.55 fps)
  └**6=Orifice -10 year -2** (Orifice Controls 0.00 cfs @ 0.55 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=207.63' TW=207.62' (Dynamic Tailwater)
└**7=Orifice/Grate -1 10 " Overflow Riser** (Controls 0.00 cfs)

Pond 6P: Swale/Basin



Summary for Pond 6P: Swale/Basin

Inflow Area = 4.760 ac, 53.18% Impervious, Inflow Depth = 1.91" for 10 event
Inflow = 2.03 cfs @ 8.20 hrs, Volume= 0.760 af
Outflow = 0.58 cfs @ 10.60 hrs, Volume= 0.760 af, Atten= 72%, Lag= 143.8 min
Discarded = 0.05 cfs @ 10.60 hrs, Volume= 0.166 af
Primary = 0.53 cfs @ 10.60 hrs, Volume= 0.594 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Peak Elev= 209.14' @ 10.60 hrs Surf.Area= 7,010 sf Storage= 9,786 cf

Plug-Flow detention time= 427.3 min calculated for 0.759 af (100% of inflow)
Center-of-Mass det. time= 427.5 min (1,224.4 - 796.9)

Volume	Invert	Avail.Storage	Storage Description
#1	207.63'	22,974 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
207.63	0	0	0
207.70	2,515	88	88
207.80	6,100	431	519
207.90	6,916	651	1,170
208.00	6,924	692	1,862
208.10	6,932	693	2,554
208.50	6,962	2,779	5,333
209.00	7,000	3,491	8,824
209.50	7,037	3,509	12,333
210.00	7,076	3,528	15,861
210.50	7,113	3,547	19,408
211.00	7,151	3,566	22,974

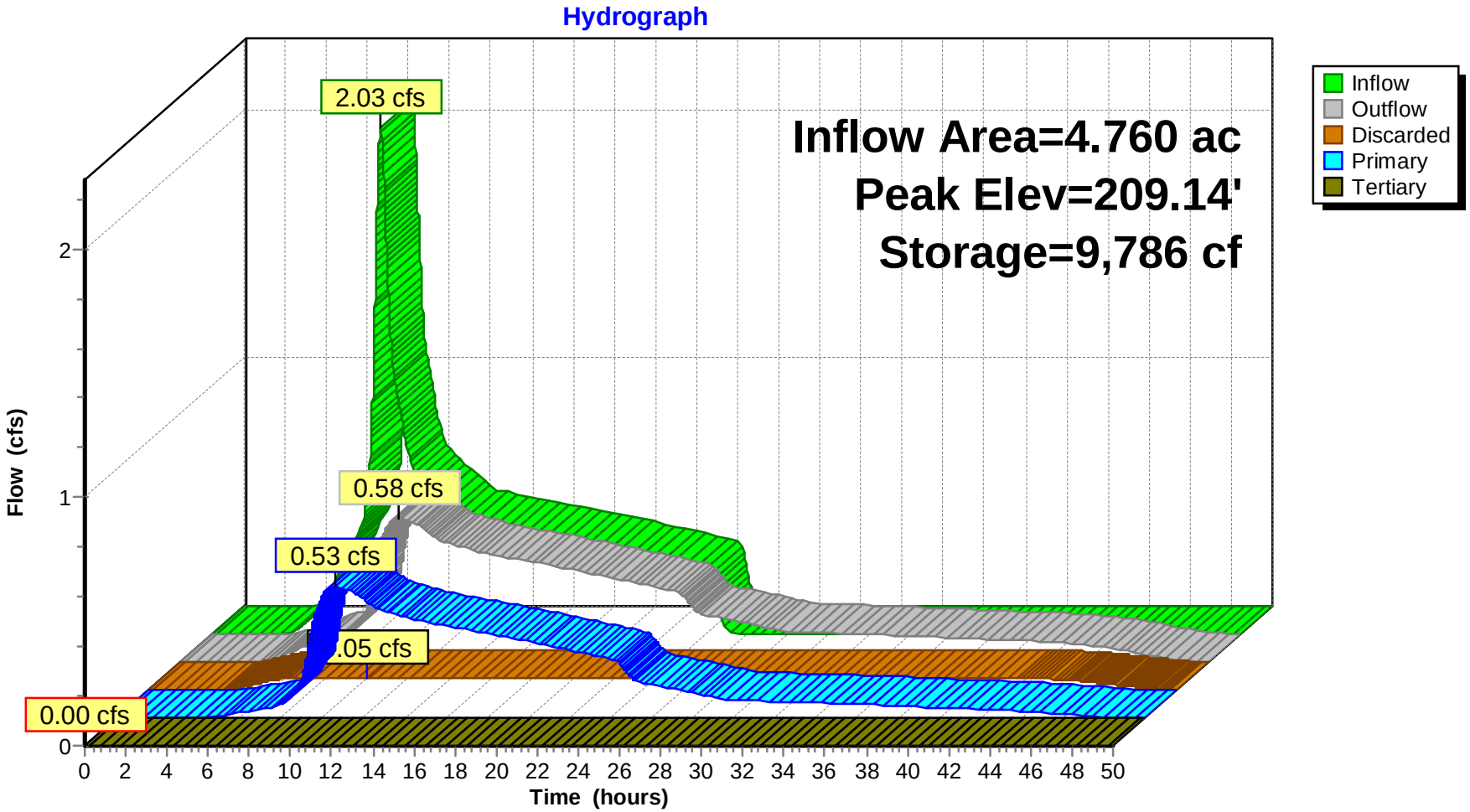
Device	Routing	Invert	Outlet Devices
#1	Discarded	207.63'	**0.300 in/hr Exfiltration over Surface area**
#2	Primary	207.62'	**10.0" Round 10" outlet pipe** L= 34.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 207.62' / 207.59' S= 0.0009 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	207.62'	**1.8" Horiz. Orifice -1/2 of 2-year** C= 0.600 Limited to weir flow at low heads
#4	Device 2	208.55'	**2.0" Vert. Orifice -2 year** C= 0.600 Limited to weir flow at low heads
#5	Device 2	208.90'	**8.0" Vert. Orifice -10 year -1** C= 0.600 Limited to weir flow at low heads
#6	Device 2	208.90'	**8.0" Vert. Orifice -10 year -2** C= 0.600 Limited to weir flow at low heads
#7	Tertiary	210.00'	**10.0" Horiz. Orifice/Grate -1 10 " Overflow Riser** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.05 cfs @ 10.60 hrs HW=209.14' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.53 cfs @ 10.60 hrs HW=209.14' TW=208.19' (Dynamic Tailwater)
└─**2=10" outlet pipe** (Passes 0.53 cfs of 2.19 cfs potential flow)
  ├─**3=Orifice -1/2 of 2-year** (Orifice Controls 0.08 cfs @ 4.69 fps)
  ├─**4=Orifice -2 year** (Orifice Controls 0.07 cfs @ 3.42 fps)
  ├─**5=Orifice -10 year -1** (Orifice Controls 0.18 cfs @ 1.66 fps)
  └─**6=Orifice -10 year -2** (Orifice Controls 0.18 cfs @ 1.66 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=207.63' TW=207.62' (Dynamic Tailwater)
└─**7=Orifice/Grate -1 10 " Overflow Riser** (Controls 0.00 cfs)

Pond 6P: Swale/Basin



Summary for Pond 6P: Swale/Basin

Inflow Area = 4.760 ac, 53.18% Impervious, Inflow Depth = 2.27" for 25 event
Inflow = 2.46 cfs @ 8.19 hrs, Volume= 0.901 af
Outflow = 0.86 cfs @ 9.53 hrs, Volume= 0.901 af, Atten= 65%, Lag= 80.0 min
Discarded = 0.05 cfs @ 9.53 hrs, Volume= 0.168 af
Primary = 0.81 cfs @ 9.53 hrs, Volume= 0.734 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Peak Elev= 209.23' @ 9.53 hrs Surf.Area= 7,017 sf Storage= 10,407 cf

Plug-Flow detention time= 373.2 min calculated for 0.901 af (100% of inflow)
Center-of-Mass det. time= 373.4 min (1,160.0 - 786.6)

Volume	Invert	Avail.Storage	Storage Description
#1	207.63'	22,974 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
207.63	0	0	0
207.70	2,515	88	88
207.80	6,100	431	519
207.90	6,916	651	1,170
208.00	6,924	692	1,862
208.10	6,932	693	2,554
208.50	6,962	2,779	5,333
209.00	7,000	3,491	8,824
209.50	7,037	3,509	12,333
210.00	7,076	3,528	15,861
210.50	7,113	3,547	19,408
211.00	7,151	3,566	22,974

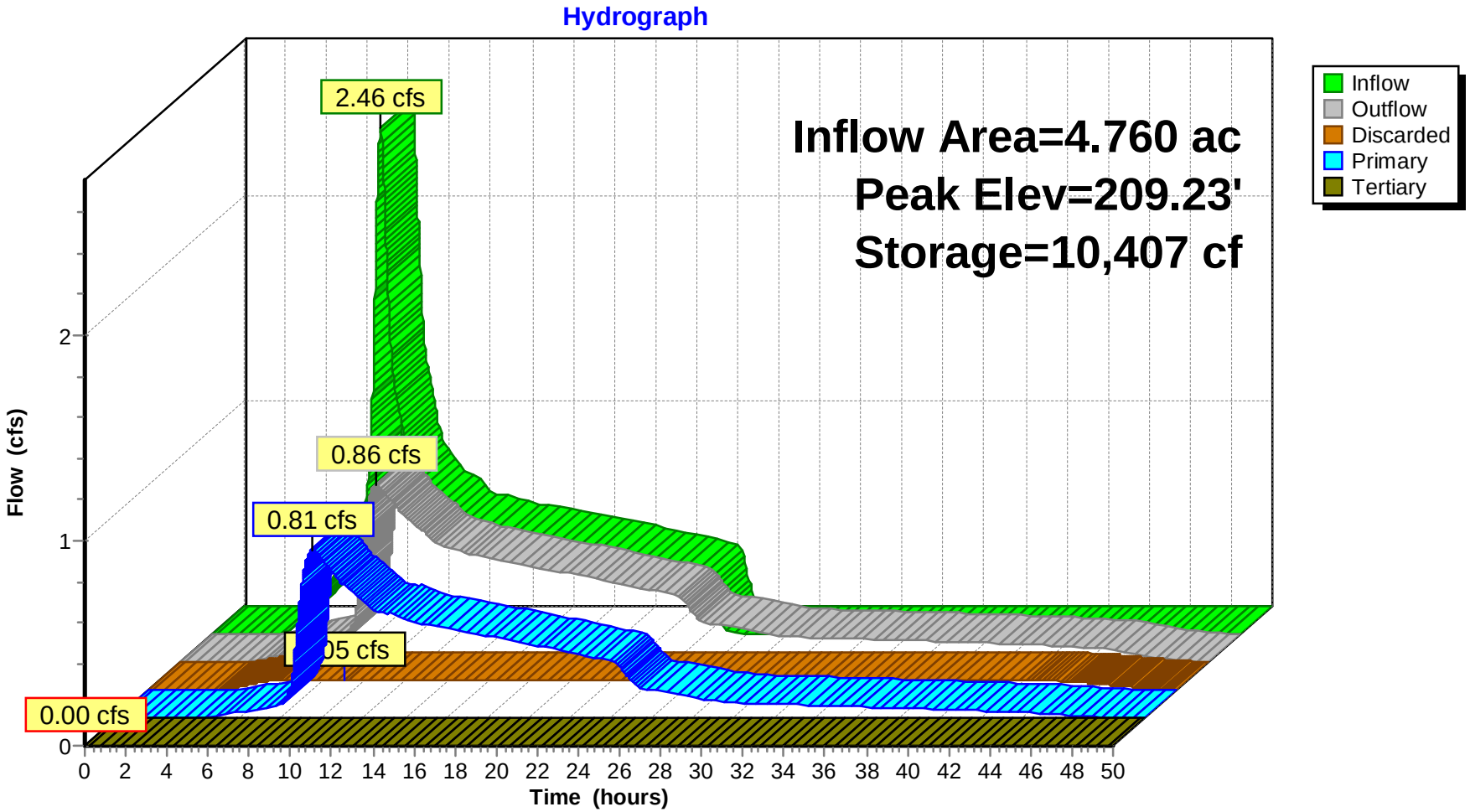
Device	Routing	Invert	Outlet Devices
#1	Discarded	207.63'	**0.300 in/hr Exfiltration over Surface area**
#2	Primary	207.62'	**10.0" Round 10" outlet pipe** L= 34.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 207.62' / 207.59' S= 0.0009 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	207.62'	**1.8" Horiz. Orifice -1/2 of 2-year** C= 0.600 Limited to weir flow at low heads
#4	Device 2	208.55'	**2.0" Vert. Orifice -2 year** C= 0.600 Limited to weir flow at low heads
#5	Device 2	208.90'	**8.0" Vert. Orifice -10 year -1** C= 0.600 Limited to weir flow at low heads
#6	Device 2	208.90'	**8.0" Vert. Orifice -10 year -2** C= 0.600 Limited to weir flow at low heads
#7	Tertiary	210.00'	**10.0" Horiz. Orifice/Grate -1 10 " Overflow Riser** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.05 cfs @ 9.53 hrs HW=209.23' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.81 cfs @ 9.53 hrs HW=209.23' TW=208.45' (Dynamic Tailwater)
└─**2=10" outlet pipe** (Passes 0.81 cfs of 2.27 cfs potential flow)
  ├─**3=Orifice -1/2 of 2-year** (Orifice Controls 0.07 cfs @ 4.23 fps)
  ├─**4=Orifice -2 year** (Orifice Controls 0.08 cfs @ 3.71 fps)
  ├─**5=Orifice -10 year -1** (Orifice Controls 0.33 cfs @ 1.94 fps)
  └─**6=Orifice -10 year -2** (Orifice Controls 0.33 cfs @ 1.94 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=207.63' TW=207.62' (Dynamic Tailwater)
└─**7=Orifice/Grate -1 10 " Overflow Riser** (Controls 0.00 cfs)

Pond 6P: Swale/Basin



Summary for Pond 6P: Swale/Basin

Inflow Area = 4.760 ac, 53.18% Impervious, Inflow Depth = 3.01" for 100 event
Inflow = 3.33 cfs @ 8.18 hrs, Volume= 1.192 af
Outflow = 1.70 cfs @ 8.77 hrs, Volume= 1.192 af, Atten= 49%, Lag= 35.5 min
Discarded = 0.05 cfs @ 8.77 hrs, Volume= 0.171 af
Primary = 1.65 cfs @ 8.77 hrs, Volume= 1.021 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Peak Elev= 209.43' @ 8.77 hrs Surf.Area= 7,032 sf Storage= 11,833 cf

Plug-Flow detention time= 299.5 min calculated for 1.192 af (100% of inflow)
Center-of-Mass det. time= 299.5 min (1,069.9 - 770.3)

Volume	Invert	Avail.Storage	Storage Description
#1	207.63'	22,974 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
207.63	0	0	0
207.70	2,515	88	88
207.80	6,100	431	519
207.90	6,916	651	1,170
208.00	6,924	692	1,862
208.10	6,932	693	2,554
208.50	6,962	2,779	5,333
209.00	7,000	3,491	8,824
209.50	7,037	3,509	12,333
210.00	7,076	3,528	15,861
210.50	7,113	3,547	19,408
211.00	7,151	3,566	22,974

Device	Routing	Invert	Outlet Devices
#1	Discarded	207.63'	**0.300 in/hr Exfiltration over Surface area**
#2	Primary	207.62'	**10.0" Round 10" outlet pipe** L= 34.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 207.62' / 207.59' S= 0.0009 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	207.62'	**1.8" Horiz. Orifice -1/2 of 2-year** C= 0.600 Limited to weir flow at low heads
#4	Device 2	208.55'	**2.0" Vert. Orifice -2 year** C= 0.600 Limited to weir flow at low heads
#5	Device 2	208.90'	**8.0" Vert. Orifice -10 year -1** C= 0.600 Limited to weir flow at low heads
#6	Device 2	208.90'	**8.0" Vert. Orifice -10 year -2** C= 0.600 Limited to weir flow at low heads
#7	Tertiary	210.00'	**10.0" Horiz. Orifice/Grate -1 10 " Overflow Riser** C= 0.600 Limited to weir flow at low heads

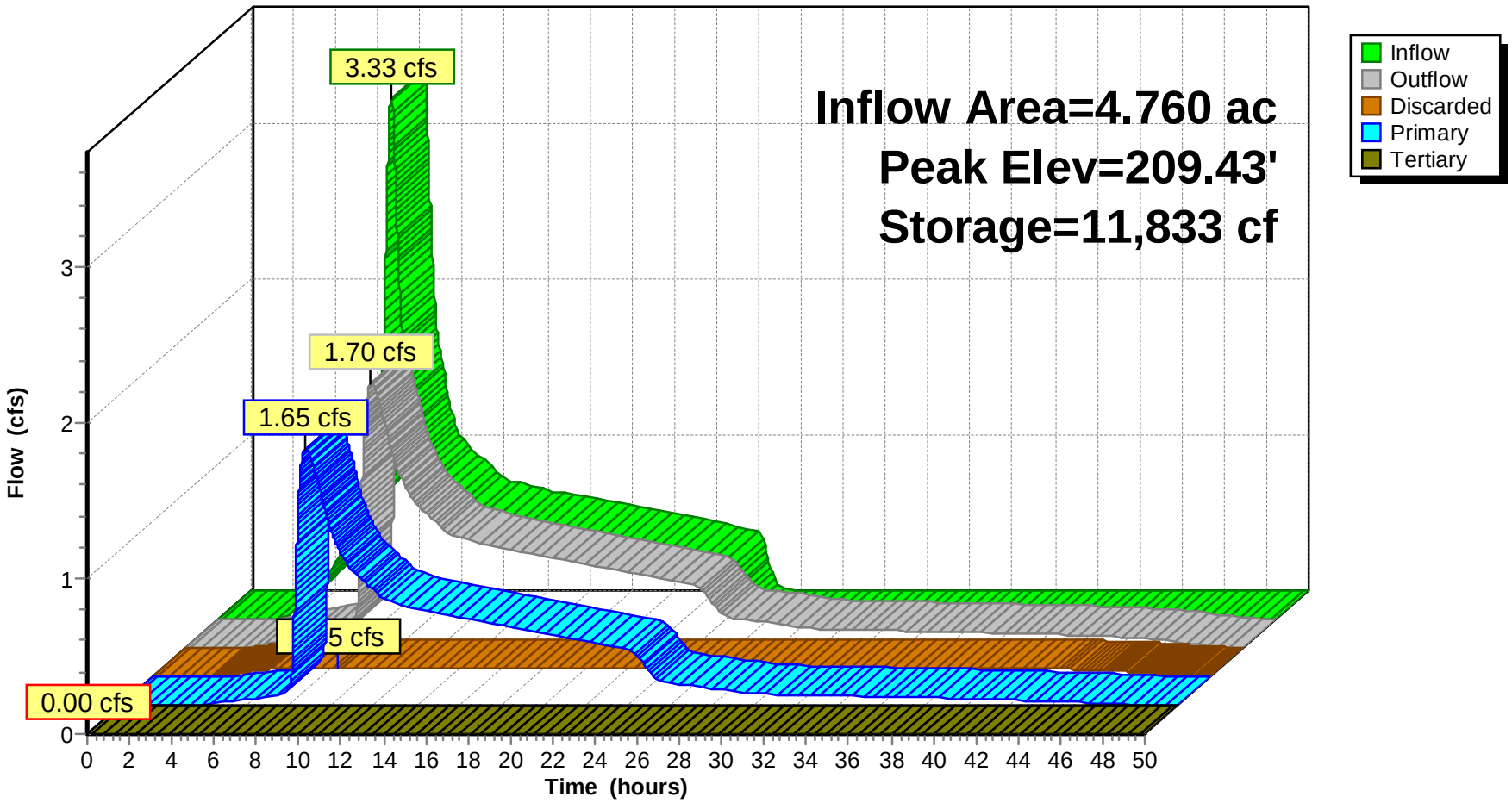
Discarded OutFlow Max=0.05 cfs @ 8.77 hrs HW=209.43' (Free Discharge)
└**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=1.65 cfs @ 8.77 hrs HW=209.43' TW=208.45' (Dynamic Tailwater)
└**2=10" outlet pipe** (Passes 1.65 cfs of 2.56 cfs potential flow)
  ├**3=Orifice -1/2 of 2-year** (Orifice Controls 0.08 cfs @ 4.76 fps)
  ├**4=Orifice -2 year** (Orifice Controls 0.09 cfs @ 4.29 fps)
  ├**5=Orifice -10 year -1** (Orifice Controls 0.74 cfs @ 2.48 fps)
  └**6=Orifice -10 year -2** (Orifice Controls 0.74 cfs @ 2.48 fps)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=207.63' TW=207.62' (Dynamic Tailwater)
└**7=Orifice/Grate -1 10 " Overflow Riser** (Controls 0.00 cfs)

Pond 6P: Swale/Basin

Hydrograph



Summary for Pond 6P: Swale/Basin

Inflow Area = 4.760 ac, 53.18% Impervious, Inflow Depth = 0.45" for WQ event
Inflow = 0.33 cfs @ 8.33 hrs, Volume= 0.180 af
Outflow = 0.10 cfs @ 22.17 hrs, Volume= 0.180 af, Atten= 70%, Lag= 830.1 min
Discarded = 0.05 cfs @ 22.17 hrs, Volume= 0.099 af
Primary = 0.05 cfs @ 22.17 hrs, Volume= 0.081 af
Tertiary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Peak Elev= 208.09' @ 22.17 hrs Surf.Area= 6,931 sf Storage= 2,478 cf

Plug-Flow detention time= 326.9 min calculated for 0.180 af (100% of inflow)
Center-of-Mass det. time= 327.0 min (1,218.4 - 891.4)

Volume	Invert	Avail.Storage	Storage Description
#1	207.63'	22,974 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
207.63	0	0	0
207.70	2,515	88	88
207.80	6,100	431	519
207.90	6,916	651	1,170
208.00	6,924	692	1,862
208.10	6,932	693	2,554
208.50	6,962	2,779	5,333
209.00	7,000	3,491	8,824
209.50	7,037	3,509	12,333
210.00	7,076	3,528	15,861
210.50	7,113	3,547	19,408
211.00	7,151	3,566	22,974

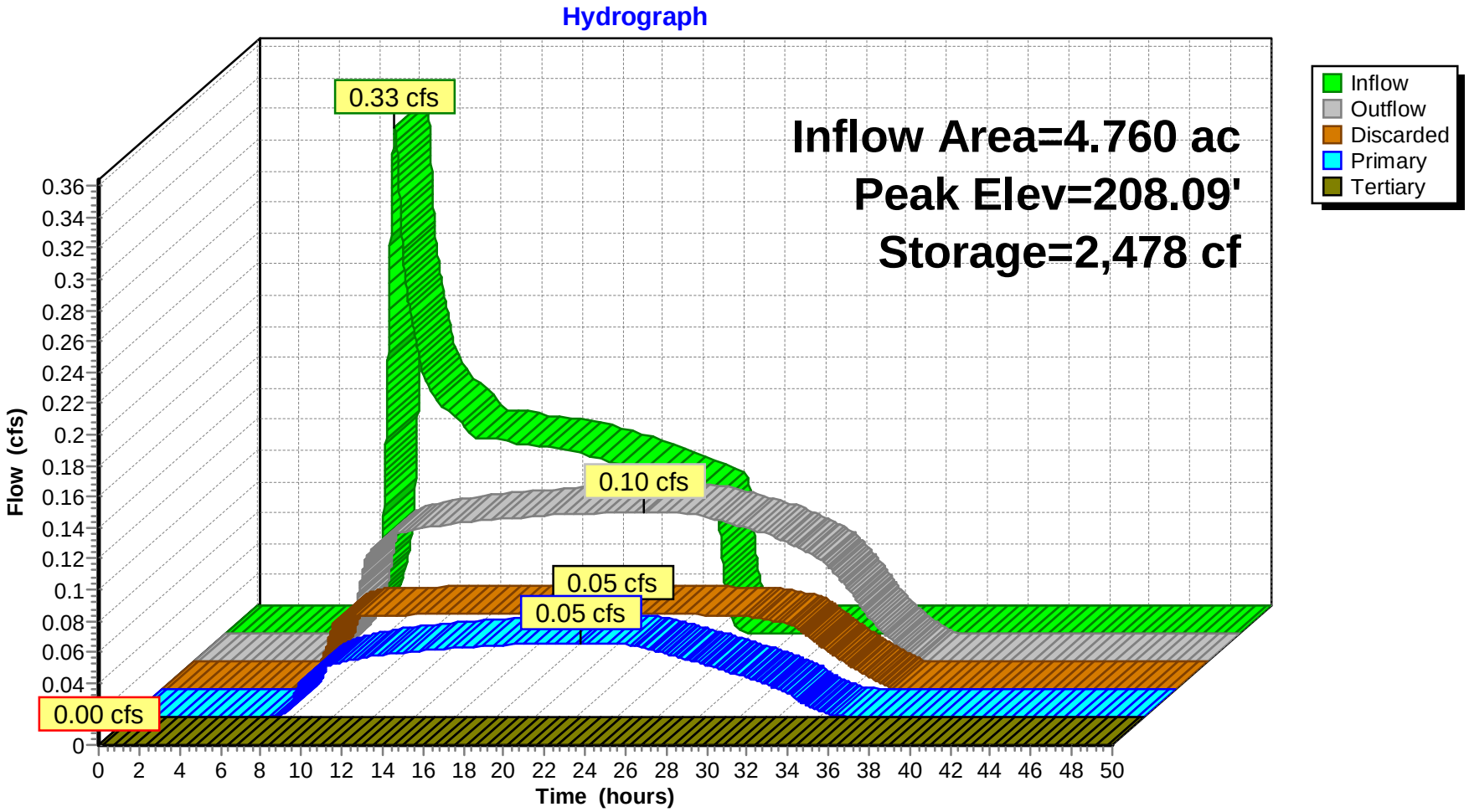
Device	Routing	Invert	Outlet Devices
#1	Discarded	207.63'	**0.300 in/hr Exfiltration over Surface area**
#2	Primary	207.62'	**10.0" Round 10" outlet pipe** L= 34.0' CPP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 207.62' / 207.59' S= 0.0009 '/' Cc= 0.900 n= 0.013 Corrugated PE, smooth interior, Flow Area= 0.55 sf
#3	Device 2	207.62'	**1.8" Horiz. Orifice -1/2 of 2-year** C= 0.600 Limited to weir flow at low heads
#4	Device 2	208.55'	**2.0" Vert. Orifice -2 year** C= 0.600 Limited to weir flow at low heads
#5	Device 2	208.90'	**8.0" Vert. Orifice -10 year -1** C= 0.600 Limited to weir flow at low heads
#6	Device 2	208.90'	**8.0" Vert. Orifice -10 year -2** C= 0.600 Limited to weir flow at low heads
#7	Tertiary	210.00'	**10.0" Horiz. Orifice/Grate -1 10 " Overflow Riser** C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.05 cfs @ 22.17 hrs HW=208.09' (Free Discharge)
└─**1=Exfiltration** (Exfiltration Controls 0.05 cfs)

Primary OutFlow Max=0.05 cfs @ 22.17 hrs HW=208.09' TW=207.77' (Dynamic Tailwater)
└─**2=10" outlet pipe** (Passes 0.05 cfs of 0.38 cfs potential flow)
  ├─**3=Orifice -1/2 of 2-year** (Orifice Controls 0.05 cfs @ 2.71 fps)
  ├─**4=Orifice -2 year** (Controls 0.00 cfs)
  ├─**5=Orifice -10 year -1** (Controls 0.00 cfs)
  └─**6=Orifice -10 year -2** (Controls 0.00 cfs)

Tertiary OutFlow Max=0.00 cfs @ 0.00 hrs HW=207.63' TW=207.62' (Dynamic Tailwater)
└─**7=Orifice/Grate -1 10 " Overflow Riser** (Controls 0.00 cfs)

Pond 6P: Swale/Basin



Basin Outlet Pipe

Subcat Reach Pond Link

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10	Type IA 24-hr		Default	24.00	1	3.20	2
2	25	Type IA 24-hr		Default	24.00	1	3.60	2
3	100	Type IA 24-hr		Default	24.00	1	4.40	2

Pipe Listing (selected nodes)

Line#	Node Number	In-Invert (feet)	Out-Invert (feet)	Length (feet)	Slope (ft/ft)	n	Width (inches)	Diam/Height (inches)	Inside-Fill (inches)
1	7R	207.62	207.59	34.0	0.0009	0.013	0.0	10.0	0.0

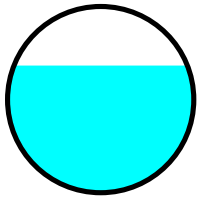
Summary for Reach 7R: Basin Outlet Pipe

Inflow Area = 4.760 ac, 53.18% Impervious, Inflow Depth = 1.50" for 10 event
Inflow = 0.53 cfs @ 10.60 hrs, Volume= 0.594 af
Outflow = 0.53 cfs @ 10.60 hrs, Volume= 0.594 af, Atten= 0%, Lag= 0.4 min

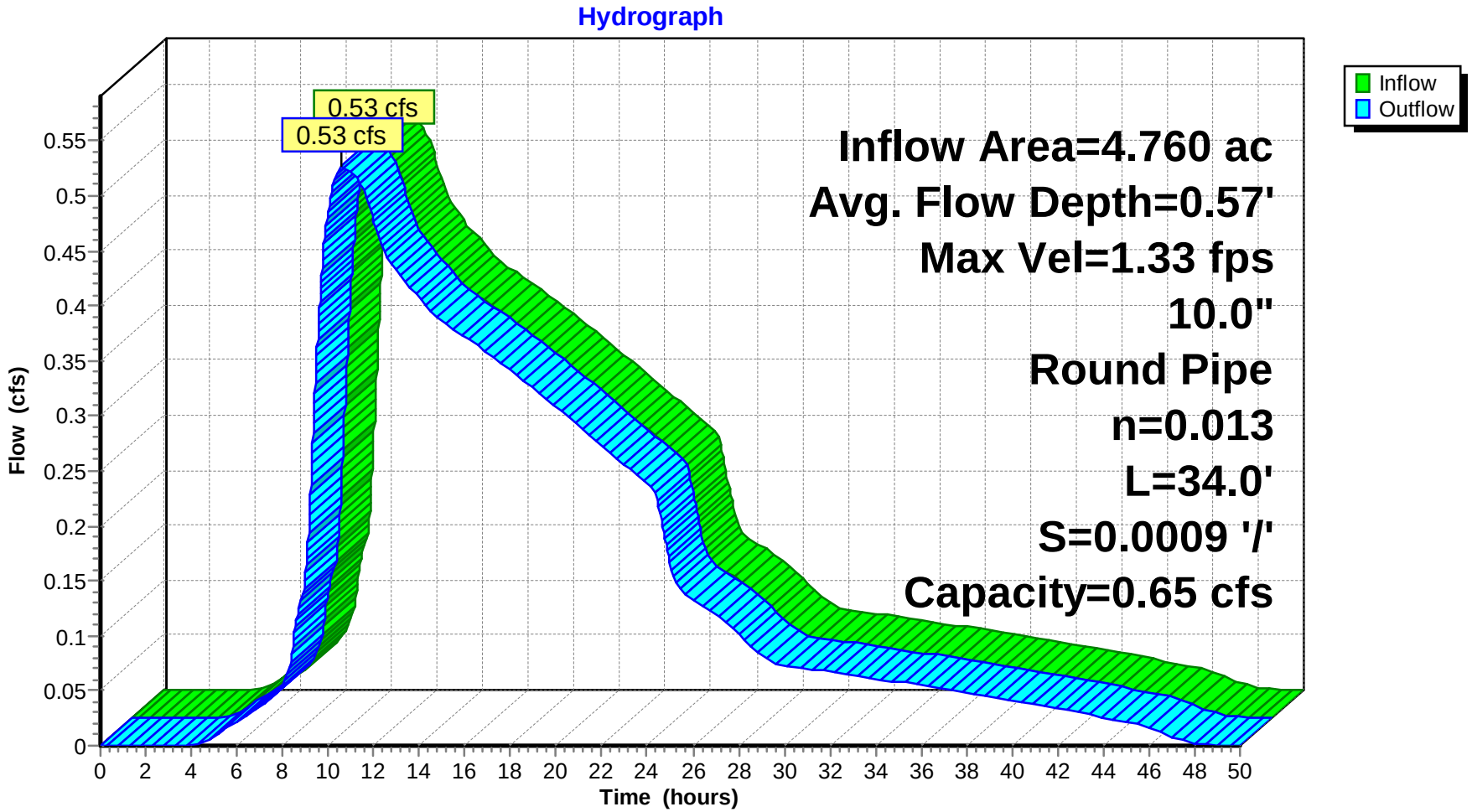
Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.33 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.84 fps, Avg. Travel Time= 0.7 min

Peak Storage= 13 cf @ 10.60 hrs
Average Depth at Peak Storage= 0.57' , Surface Width= 0.78'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 0.65 cfs

10.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 34.0' Slope= 0.0009 '/'
Inlet Invert= 207.62', Outlet Invert= 207.59'



Reach 7R: Basin Outlet Pipe



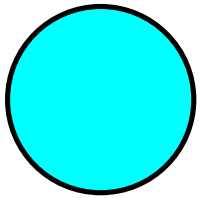
Summary for Reach 7R: Basin Outlet Pipe

Inflow Area = 4.760 ac, 53.18% Impervious, Inflow Depth = 1.85" for 25 event
Inflow = 0.81 cfs @ 9.53 hrs, Volume= 0.734 af
Outflow = 0.70 cfs @ 9.10 hrs, Volume= 0.734 af, Atten= 13%, Lag= 0.0 min

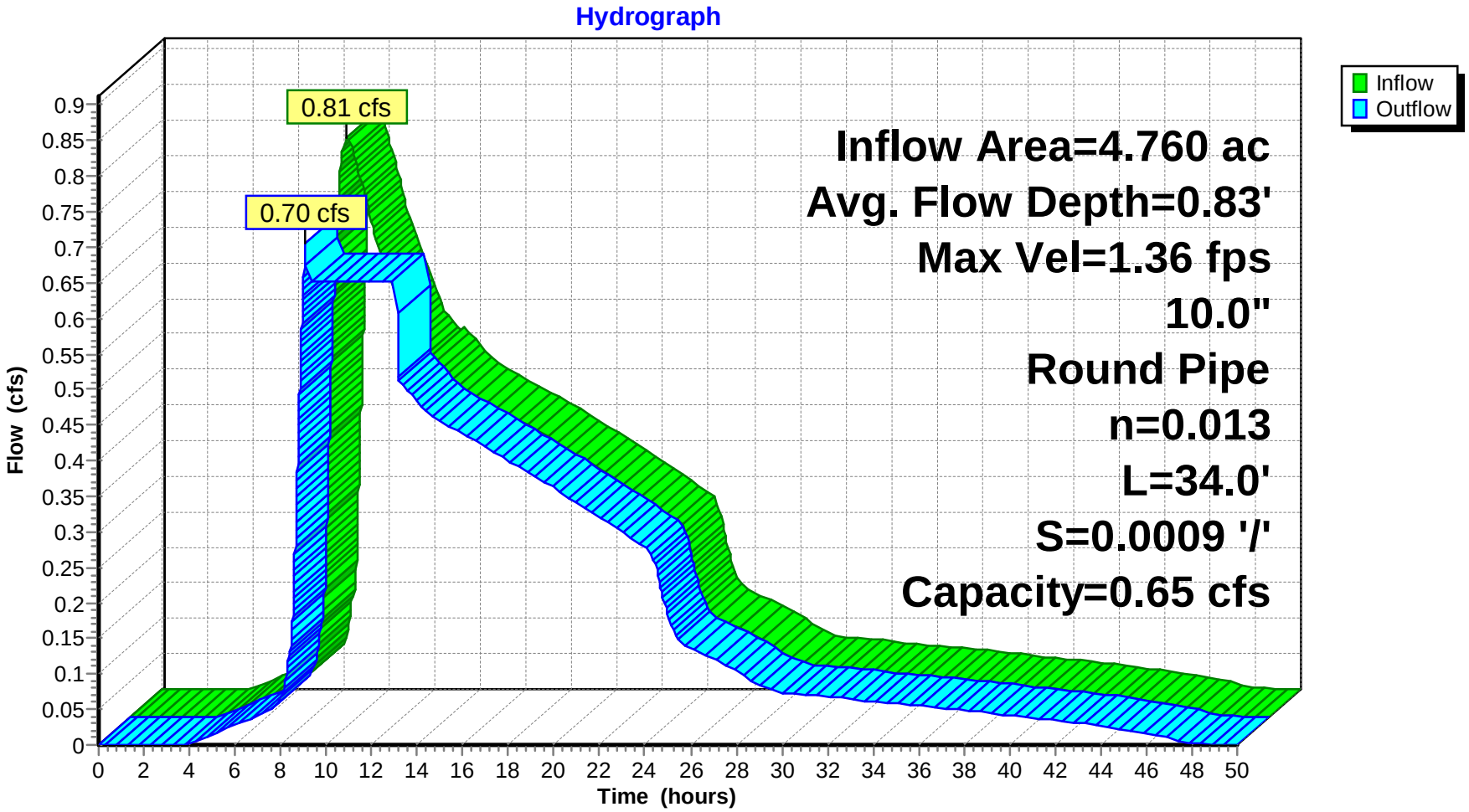
Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.36 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.85 fps, Avg. Travel Time= 0.7 min

Peak Storage= 19 cf @ 9.11 hrs
Average Depth at Peak Storage= 0.83'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 0.65 cfs

10.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 34.0' Slope= 0.0009 '/'
Inlet Invert= 207.62', Outlet Invert= 207.59'



Reach 7R: Basin Outlet Pipe



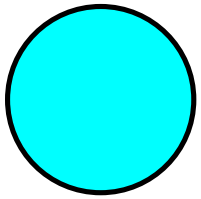
Summary for Reach 7R: Basin Outlet Pipe

Inflow Area = 4.760 ac, 53.18% Impervious, Inflow Depth = 2.57" for 100 event
Inflow = 1.65 cfs @ 8.77 hrs, Volume= 1.021 af
Outflow = 0.70 cfs @ 8.28 hrs, Volume= 1.021 af, Atten= 58%, Lag= 0.0 min

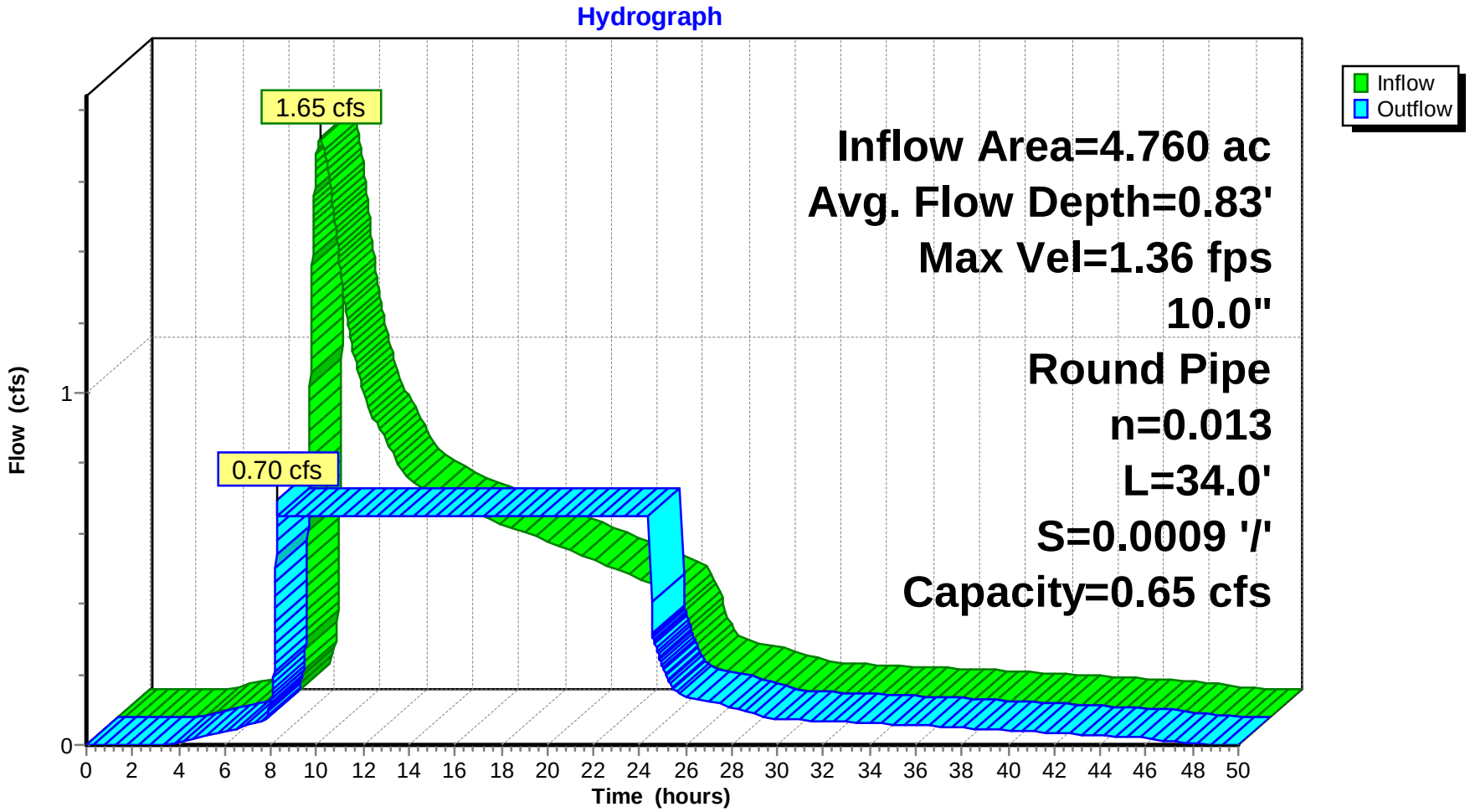
Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Max. Velocity= 1.36 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 0.85 fps, Avg. Travel Time= 0.7 min

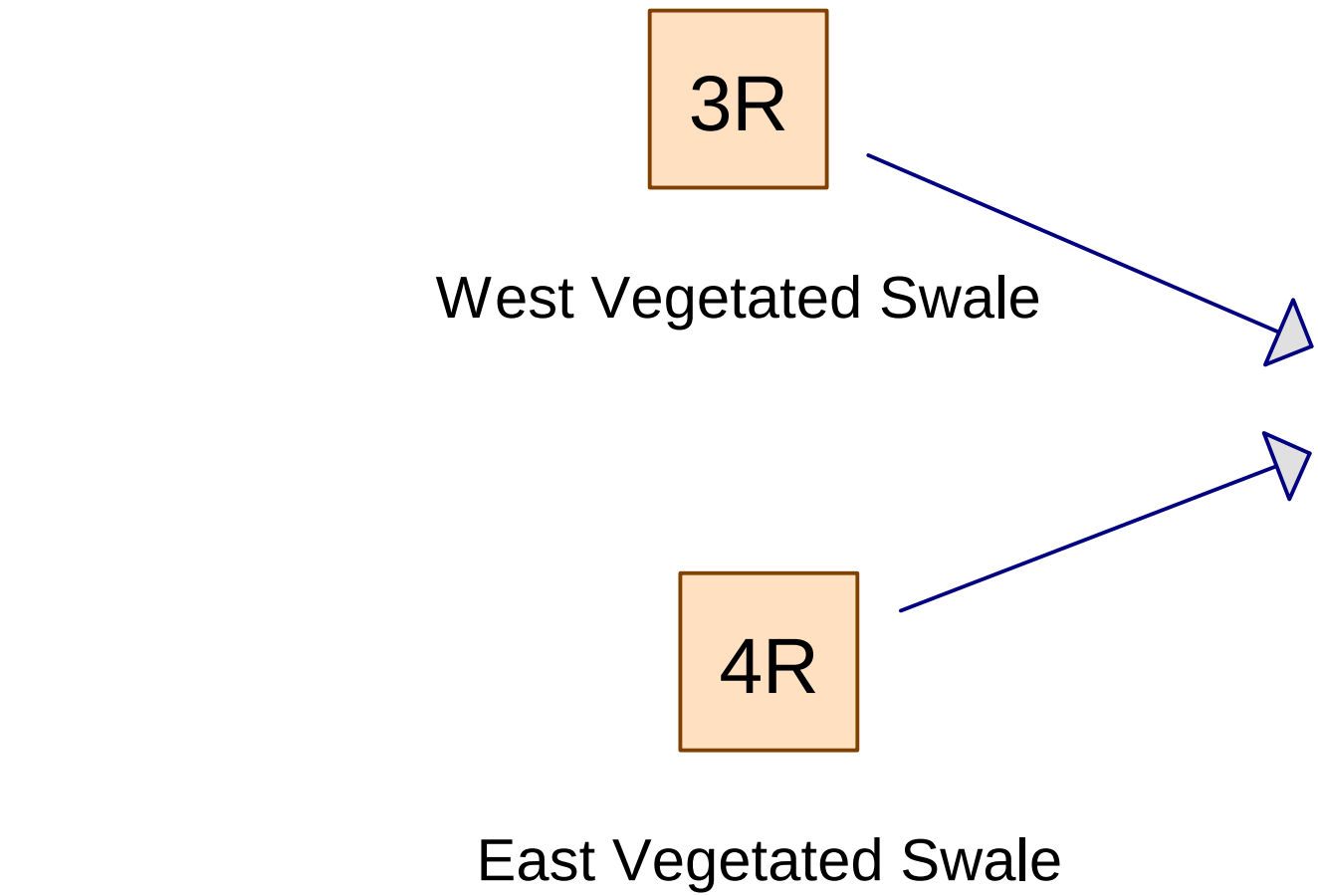
Peak Storage= 19 cf @ 8.29 hrs
Average Depth at Peak Storage= 0.83'
Bank-Full Depth= 0.83' Flow Area= 0.5 sf, Capacity= 0.65 cfs

10.0" Round Pipe
n= 0.013 Corrugated PE, smooth interior
Length= 34.0' Slope= 0.0009 '/'
Inlet Invert= 207.62', Outlet Invert= 207.59'



Reach 7R: Basin Outlet Pipe





Subcat Reach Pond Link

Routing Diagram for 13080 Belle Plain -Center St-SLOPES half of 2-year 0.3 exfil20210313 orifice

Prepared by {enter your company name here}, Printed 3/13/2021

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	WQ	Type IA 24-hr		Default	24.00	1	1.38	2

Summary for Reach 3R: West Vegetated Swale

Inflow Area = 3.346 ac, 52.78% Impervious, Inflow Depth = 0.45" for WQ event
Inflow = 0.25 cfs @ 8.19 hrs, Volume= 0.127 af
Outflow = 0.15 cfs @ 8.93 hrs, Volume= 0.127 af, Atten= 43%, Lag= 44.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.05 fps, Min. Travel Time= 56.0 min
Avg. Velocity = 0.03 fps, Avg. Travel Time= 95.3 min

Peak Storage= 490 cf @ 8.93 hrs
Average Depth at Peak Storage= 0.12' , Surface Width= 24.81'
Bank-Full Depth= 3.29' Flow Area= 81.9 sf, Capacity= 30.68 cfs

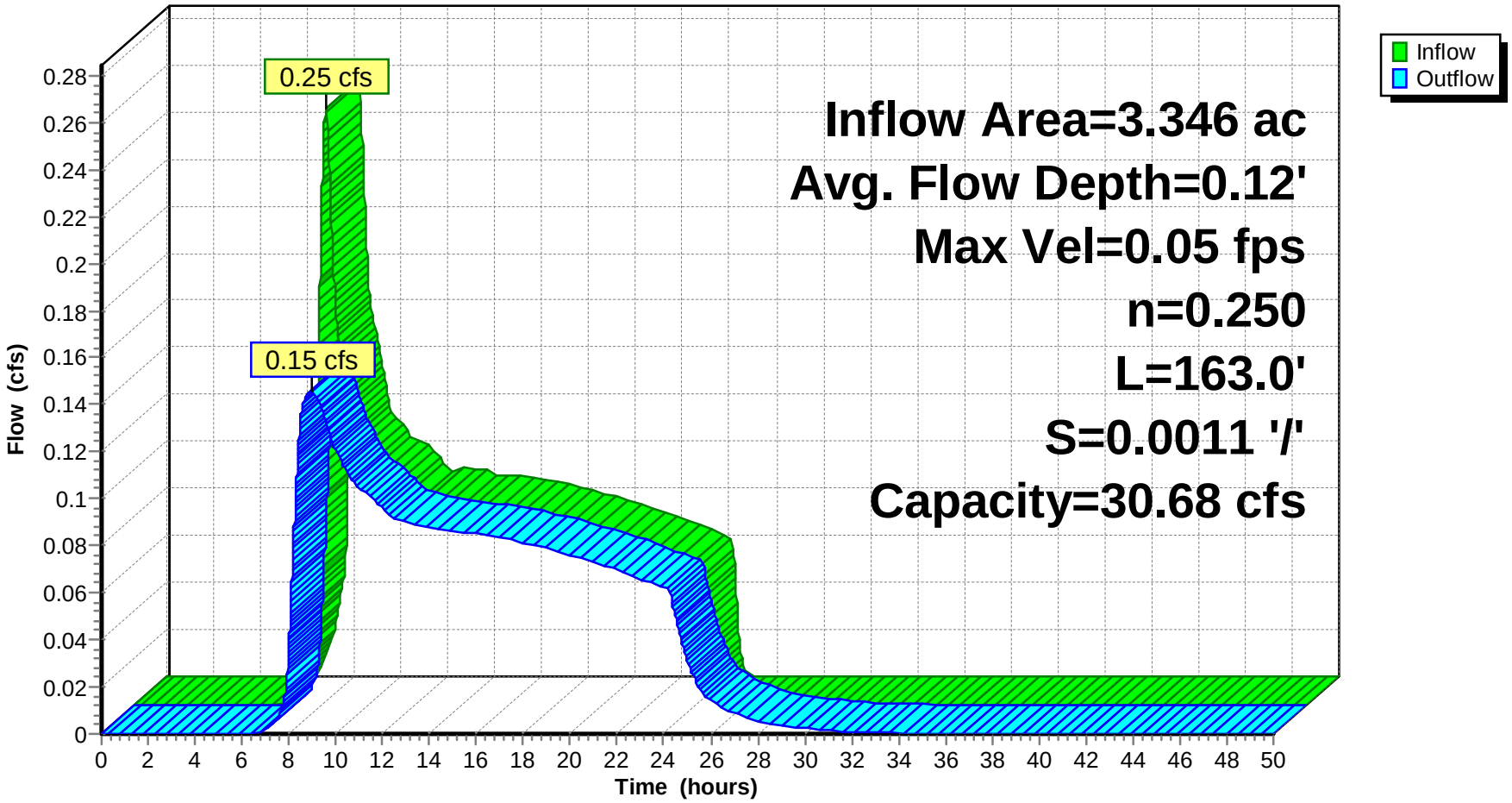
Custom cross-section, Length= 163.0' Slope= 0.0011 '/'
Constant n= 0.250
Inlet Invert= 207.81', Outlet Invert= 207.63'

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	211.00	0.00
0.10	207.71	3.29
24.90	207.71	3.29
25.00	211.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	24.8	0.0	0	0.00
3.29	81.9	31.4	25.0	13,353	30.68

Reach 3R: West Vegetated Swale

Hydrograph



Summary for Reach 4R: East Vegetated Swale

Inflow Area = 1.414 ac, 54.13% Impervious, Inflow Depth = 0.45" for WQ event
Inflow = 0.11 cfs @ 8.19 hrs, Volume= 0.053 af
Outflow = 0.06 cfs @ 8.89 hrs, Volume= 0.053 af, Atten= 40%, Lag= 41.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.04 fps, Min. Travel Time= 52.1 min
Avg. Velocity = 0.03 fps, Avg. Travel Time= 73.4 min

Peak Storage= 197 cf @ 8.89 hrs
Average Depth at Peak Storage= 0.07' , Surface Width= 24.80'
Bank-Full Depth= 3.29' Flow Area= 81.9 sf, Capacity= 31.59 cfs

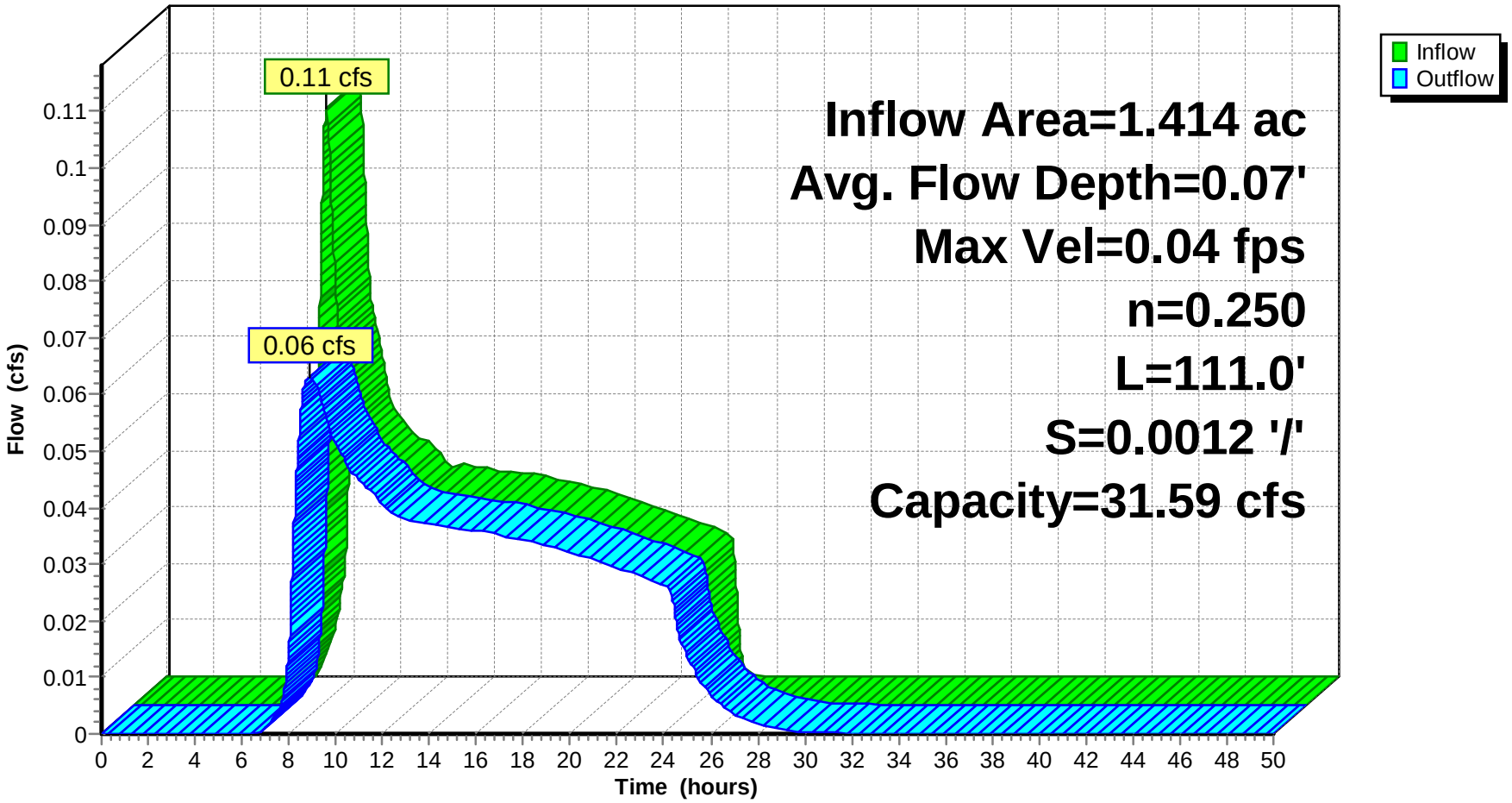
Custom cross-section, Length= 111.0' Slope= 0.0012 '/'
Constant n= 0.250
Inlet Invert= 207.76', Outlet Invert= 207.63'

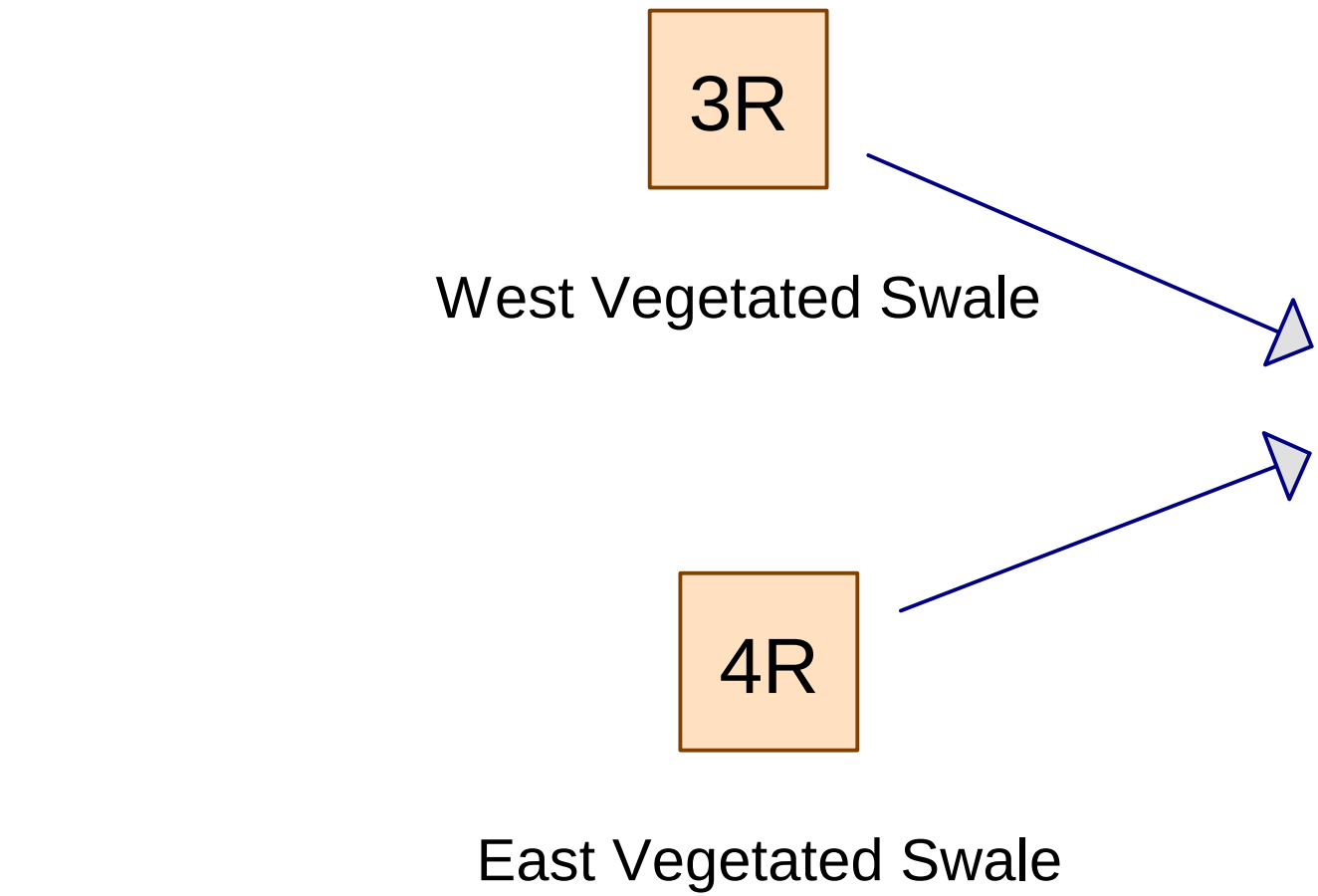
Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	211.00	0.00
0.10	207.71	3.29
24.90	207.71	3.29
25.00	211.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	24.8	0.0	0	0.00
3.29	81.9	31.4	25.0	9,093	31.59

Reach 4R: East Vegetated Swale

Hydrograph





Subcat Reach Pond Link

Routing Diagram for 13080 Belle Plain -Center St-SLOPES half of 2-year 0.3 exfil20210313 orifice

Prepared by {enter your company name here}, Printed 3/13/2021

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	25	Type IA 24-hr		Default	24.00	1	3.60	2

Summary for Reach 3R: West Vegetated Swale

Inflow Area = 3.346 ac, 52.78% Impervious, Inflow Depth = 2.27" for 25 event
Inflow = 1.76 cfs @ 8.14 hrs, Volume= 0.634 af
Outflow = 1.73 cfs @ 8.19 hrs, Volume= 0.634 af, Atten= 2%, Lag= 3.1 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.46 fps, Min. Travel Time= 5.8 min
Avg. Velocity = 0.24 fps, Avg. Travel Time= 11.4 min

Peak Storage= 608 cf @ 8.19 hrs
Average Depth at Peak Storage= 0.15' , Surface Width= 24.81'
Bank-Full Depth= 3.29' Flow Area= 81.9 sf, Capacity= 255.64 cfs

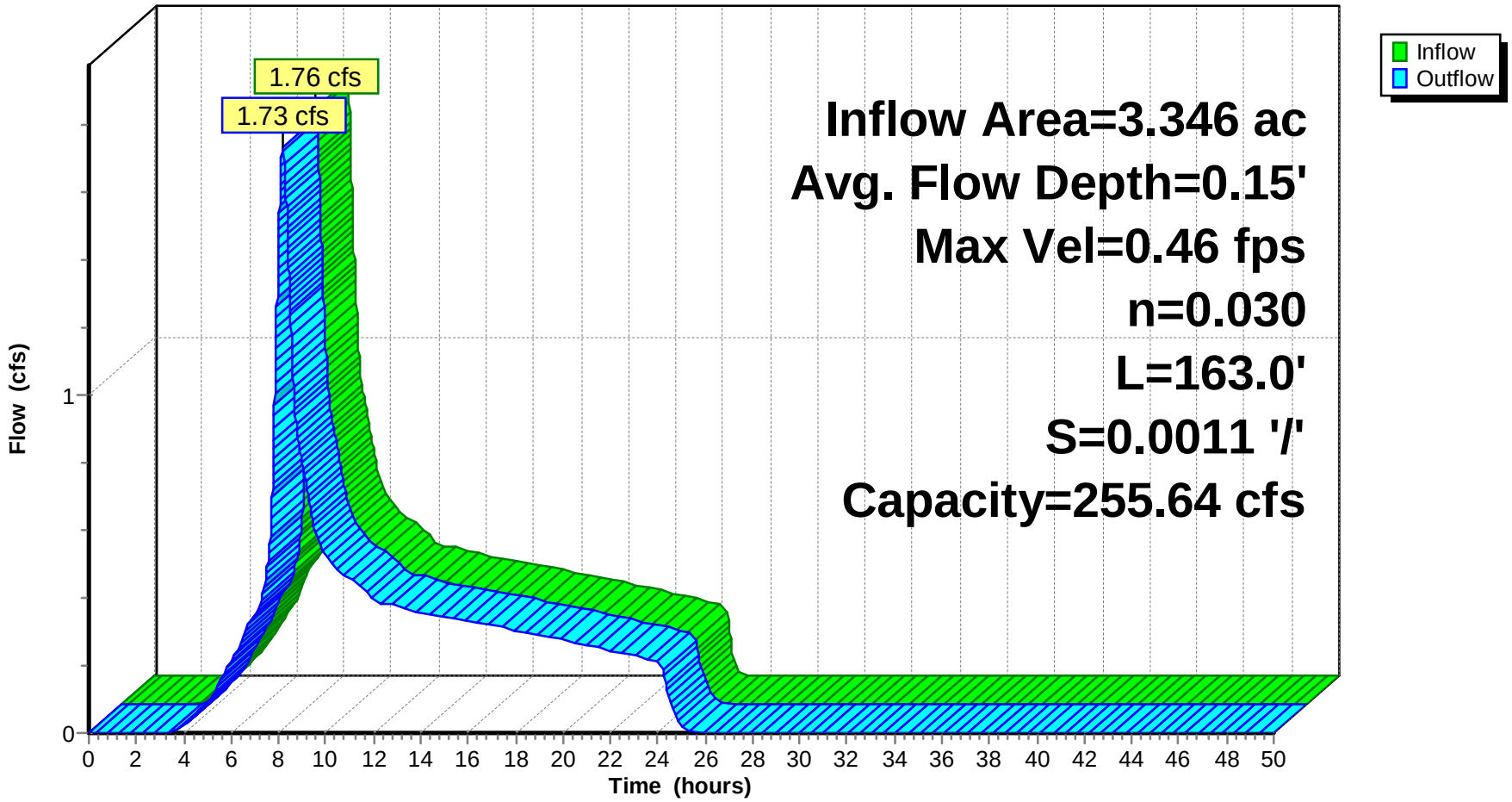
Custom cross-section, Length= 163.0' Slope= 0.0011 '/'
Constant n= 0.030
Inlet Invert= 207.81', Outlet Invert= 207.63'

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	211.00	0.00
0.10	207.71	3.29
24.90	207.71	3.29
25.00	211.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	24.8	0.0	0	0.00
3.29	81.9	31.4	25.0	13,353	255.64

Reach 3R: West Vegetated Swale

Hydrograph



Summary for Reach 4R: East Vegetated Swale

Inflow Area = 1.414 ac, 54.13% Impervious, Inflow Depth = 2.27" for 25 event
Inflow = 0.74 cfs @ 8.15 hrs, Volume= 0.268 af
Outflow = 0.72 cfs @ 8.20 hrs, Volume= 0.268 af, Atten= 1%, Lag= 3.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-50.00 hrs, dt= 0.01 hrs
Max. Velocity= 0.34 fps, Min. Travel Time= 5.5 min
Avg. Velocity = 0.19 fps, Avg. Travel Time= 9.9 min

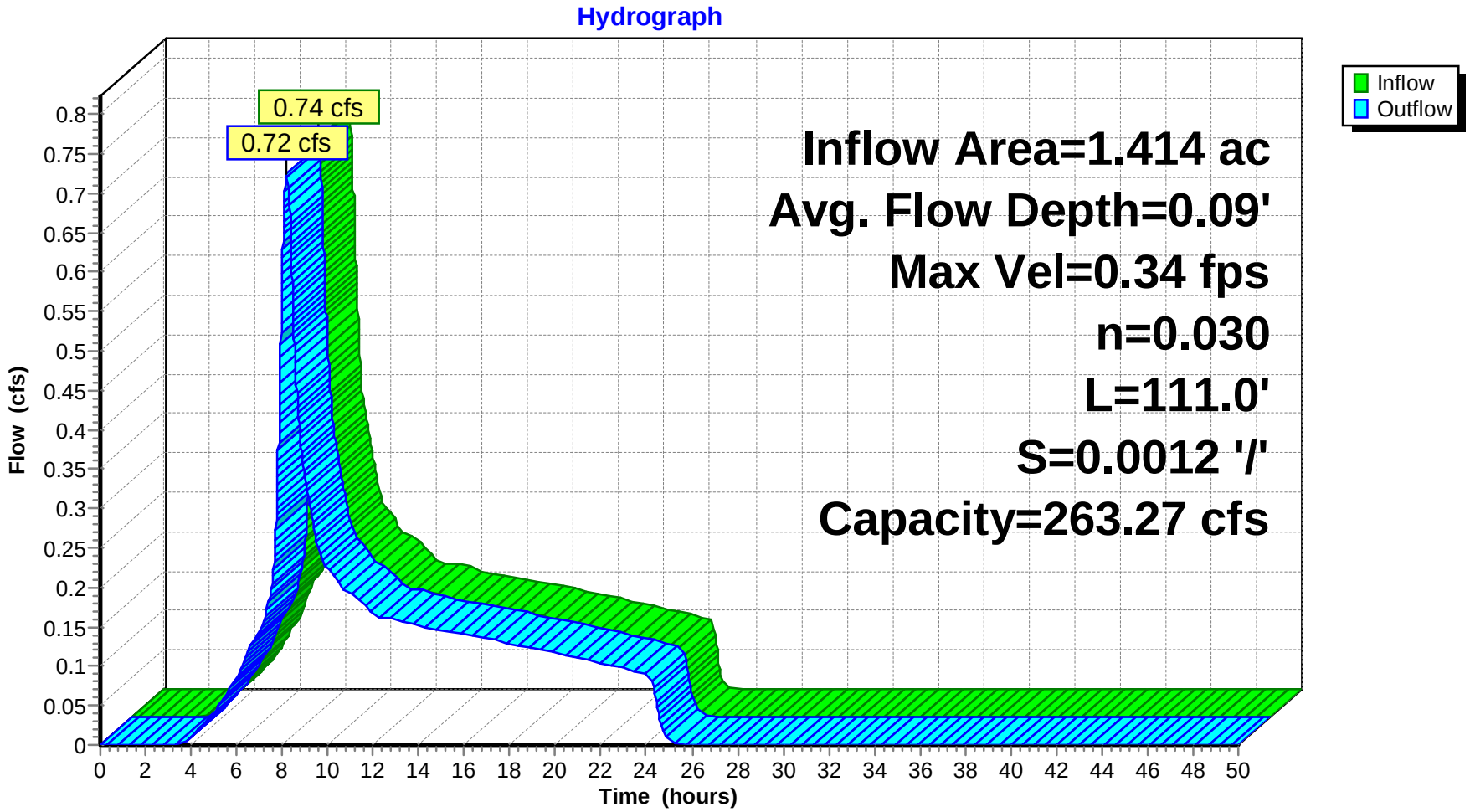
Peak Storage= 239 cf @ 8.20 hrs
Average Depth at Peak Storage= 0.09' , Surface Width= 24.81'
Bank-Full Depth= 3.29' Flow Area= 81.9 sf, Capacity= 263.27 cfs

Custom cross-section, Length= 111.0' Slope= 0.0012 '/'
Constant n= 0.030
Inlet Invert= 207.76', Outlet Invert= 207.63'

Offset (feet)	Elevation (feet)	Chan.Depth (feet)
0.00	211.00	0.00
0.10	207.71	3.29
24.90	207.71	3.29
25.00	211.00	0.00

Depth (feet)	End Area (sq-ft)	Perim. (feet)	Width (feet)	Storage (cubic-feet)	Discharge (cfs)
0.00	0.0	24.8	0.0	0	0.00
3.29	81.9	31.4	25.0	9,093	263.27

Reach 4R: East Vegetated Swale



APPENDIX E— STORMWATER MANAGEMENT SYSTEM INSPECTION AND MAINTENANCE PLAN FOR SLOPES

Inspection and Maintenance Plan for GSI BMPs of the Stormwater Management System of the Belle Plaine Estates Residential Subdivision

Date:
January 2020

Site Location:

4560 Center Street NE
072W30AA/8000 – 4.9 Acres

Prepared for:

Jensen Consulting and Development, LLC
5190 Kale Street NE
Salem, Oregon 97301

Prepared by:

Project Delivery Group, LLC
3772 Portland Road NE
Salem, Oregon 97301

Table of Contents

1. Overview:

This Plan is a summary of the expected routine maintenance and operation activities to be performed for the management of the low-impact development best management practices (BMPs) utilizing green stormwater infrastructure (GSI) implemented as part of the development of the Project Site: Belle Plaine Estates residential subdivision. The successful use of the Plan hinges on the inspection and maintenance of the GSI BMP facilities which primarily consists of pretreatment manholes, a combined vegetated swale/detention basin, an outflow control structure (OCS) and the upgradient stormwater collection and conveyance facilities. The inspection work performed triggers the maintenance work required of the GSI facilities to facilitate their successful operation. This plan needs to be a "living" document that will need to be revised periodically to reflect situations and conditions that occur with the Project Site's various GSI BMP and stormwater management facilities over the life of the Project Site.

2. Background

Rather than let stormwater runoff flow directly from the streets or lots directly into the existing underground stormwater piped conveyance system within Center Street NE that eventually discharges into the West Fork Little Pudding River, the runoff from low flow storm events from the Project Site will be filtered through pretreatment manholes before flowing through the vegetated swales of the combined vegetated swale/detention basin. The treated water will then flow by underground conveyance pipe to the existing underground conveyance system in Center Street NE.

By treating the water at the source, the toxicity, contaminant load, and flow rates of the water flowing into the West Fork Little Pudding River will be reduced. Additionally, construction BMPs from the Project's erosion and sediment control plan will continue to be implemented during infrastructure and residence development of Belle Plaine Estates, implementing these BMP items as a minimum:

Erosion Control

- Preserve Natural Vegetation
- Dust Control
- Temporary/Permanent Seeding
- Straw placement

Sediment Control

- Sediment Fence (Perimeter)
- Inlet Protection
- Construction Entrance
- Straw Wattles, and Wood Chip/Rock Bag Check Dams

Pollution Control

- Proper Signage
- Hazardous Waste Management
- Spill Kit on site
- Designated Fueling Area
- Concrete Washout Area
- Recycle Materials

As illustrated in the post-construction drainage map provided in Appendix A, collected stormwater run-off will flow through a pre-treatment manhole (Downstream Defender®) before being conveyed through a vegetated swale (with rock check dams for flow attenuation/spreading purposes) that is part of the vegetated swale/detention basin located parallel with and along the frontage of Center Street NE,

where it will be treated before being discharged out of the swale/detention basin and into the existing stormwater management system in Center Street, NE. The westerly vegetated swale portion of the swale/detention basin is approximately 176 feet in length; the easterly vegetated swale portion of the swale/detention basin is approximately 105 feet in length.

The flow out of the vegetated swale/detention basin is regulated by an outlet control manhole located out in the Center Street NE right-of-way. The manhole is equipped with two orifices for flow control, and an overflow riser pipe to address very large storm event flows without overtopping of the swale/detention basin.

3. Inspection Schedule and Process

Provided below is a brief description of the inspection process description and schedule for each GSI BMP.

3.1 General

During and immediately following active construction work, the site will be monitored daily, and during and immediately following significant (equal to or greater than 0.5 inches of rainfall in a 24-hour period) storm events to mitigate erosion and control sediment migration. Following the completion of infrastructure development and all planting work, the site will be periodically monitored (initially daily, progressing to weekly, and then to monthly) to ensure plant development and sustained growth, and address any erosion control and sediment migration/deposition problems. Best management erosion control and sediment migration practices will be continued to be employed to mitigate erosion and sediment migration/deposition and any resulting damage to the GSI BMPs.

3.2 Vegetated Swales/Detention Basin – General

It is assumed that the bottom and side-slopes of the vegetated swales will be planted as part of its initial development. The integrity, viability, and sustained propagation of the planted vegetation of the bottom and the side-slopes of the vegetated swales, and the accumulation of any sediment, debris, or other deleterious material (refuse, feces, weeds and other noxious vegetation, etc.) within the vegetated swales will be monitored and addressed on a routine basis as part of the erosion and sediment control plan of the Project and post construction monitoring and routine maintenance.

During planting and vegetation development, a permanent irrigation system will be designed and employed to foster vegetation development. The irrigation system will be a metered service off of the City's domestic water conveyance system. Once planted/seeded, the vegetation will be reviewed on an initial daily basis, progressing to weekly, and then to monthly basis to ensure that adequate irrigation is being performed, and that there is successful and sustained propagation of the vegetation planted. Once the vegetation is established, the vegetated bottom and side slopes will be inspected on a minimum bi-monthly basis and after significant rain events (i.e. 5-year design type storm event) for the presence of deleterious materials (refuse, sediment loads, feces, weeds and other noxious/invasive vegetation, etc.) that affect the operation of the vegetated swale; the presence of standing water within the vegetated bottom 48-hours after cessation of a storm event; vegetation stress, damage, loss, or

overgrowth; pest/rodent presence; the integrity and function of the rock check dams across the bottom of the vegetated swale; any structural damage to either the curb and gutter, sidewalk, and other hardscape or landscape areas surrounding the vegetated swales; any structural damage to the sloped sides, block wall sides, ditch inlet outlet, and the outlet flow control manhole.

During major storm events, the water flowing into the upper ends of the vegetated swale/detention basin will be periodically observed and compared to the water flowing out of the outlet flow control manhole to determine presence (i.e. is the detention pond infiltrating surface water); and for overall turbidity/suspended and conveyed solids comparison.

A blank inspection log for the vegetated swale/detention basin, is provided at the end of this plan.

3.3 Detention Basin – OCS

Following construction completion of the OCS of the detention basin, the OCS and associated detention basin will be inspected on a minimum semi-annual basis with more frequent inspections performed during the wet weather portion of the year (October to May) after major storm events (5-year frequency events or larger) as needed by City Public Works staff for overall OCS operation (noting flow though orifices, any overflow indication (i.e. staining or sediment accumulation in the overflow riser pipe); debris or flow stopping vegetation accumulation on or in front of the ditch inlet grate in the detention basin; sediment accumulation; debris or other deleterious material presence; structural facility damage; or blockage/clogging of inlets or outlets (including grates and orifices) of the ditch inlet and OCS. The inlet grates/manhole covers will be removed and replaced as needed to facilitate inspection work

3.5 Catch Basins, Manholes, and Conveyance Pipes

Following construction completion of the catch basins, manholes, and conveyance piping of the stormwater management system, these facilities will be inspected on a minimum semi-annual basis with more frequent inspections performed during the wet weather portion of the year (October to May) after major storm events (5-year frequency events or larger) as needed by City Public Works staff for sediment accumulation; debris or other deleterious material presence; weed or other vegetation presence in pavement or other non-planted areas; structural facility damage; or blockage/clogging of inlets or outlets or conveyance pipes of these facilities. Catch basin grates and manhole covers will be removed and replaced as needed to facilitate a visual inspection of the insides of the structure.

4 Maintenance Activities

Provided below is a brief description of the maintenance activities for the GSI BMPs. In the event that the maintenance activities outlined below are not effective in providing the required storm water conveyance, quality preservation/enhancement, treatment, and detention required, then an action plan will be developed and implemented which will either reinforce or remediate the measures implemented to ensure the continued management of storm and surface water run-off from the development; the viability and function of the vegetated swale and associated rock check dams; adequate conveyance and detention of accumulated flows; the detention of storm water flows to minimize downgradient

flooding; and the containment and treatment of storm and surface water pollutants typically expected in storm water run-off within a residential development.

4.1 General

During and immediately following active construction work (including dwelling structure development), the routine maintenance work will be what is specified in the erosion and sediment control plan for the Project for the control of pollutants, and the mitigation of any erosion or sediment migration. Following construction completion, routine maintenance activities include immediate removal of deposited feces by applicable pet owners (a City requirement) from street, sidewalk, or landscaped areas within the City rights-of-way and adjoining front yards and driveways; routine street sweeping by City forces; twice annual leaf collection performed by subcontracted City forces (performed in the Fall); and routine landscape strip, driveway, and front yard maintenance (including grass cutting, clipping removal, and leaf removal) work performed by the various homeowners. There will be no logging of these general maintenance activities.

4.2 Vegetated Swale/Detention Basin

During the year after development (under the City's public infrastructure "warranty period"), the vegetated swale/Detention Basin maintenance shall be performed by qualified contracted contractor or landscape workers retained by the Developer. The contracted contractor or landscape workers will be qualified in the maintenance of the vegetated swales and their associated plantings. At the end of the "warranty period", the maintenance of the vegetated swales and detention basin, including the planted vegetation, and outlet pipes, inlets, and outflow control structure will be the responsibility of the City, similar to any other public infrastructure owned by the City.

Sediment accumulation shall be removed in the vegetated swales/detention basin if it is found to be more than 4-inches thick; so thick as to damage or kill vegetation; or to impair the permeable function of the vegetated swales. Sediment removal shall be performed to minimize damage to vegetation utilizing proper erosion and sediment migration control measures. The vegetated swales will have sediment removal either performed utilizing a vacuum truck (with a long piped "stinger") or removed utilizing hand tools and buckets/wheelbarrows. Debris, garbage, floatables, and other deleterious materials will be removed from the vegetated swales as necessary.

The vegetated swale/detention basin will be inspected monthly and after every major storm event for debris which could inhibit the proper flow into and through the pre-treatment manholes and the vegetated swale/detention basin. Any debris and sediment will be removed immediately and disposed of or placed in a location to prevent future maintenance and to not cause impact up- or downstream of the pipe. Sources of the debris and sediment shall be identified and corrected. Mowing of the bank slopes and area around the vegetated swales bi-monthly during the growing season and as needed during the cooler months is recommended. The swale's vegetation shall be trimmed as necessary to keep sedge, rush, tall grass and other herbaceous vegetation heights between 6 to 9 inches. Shrubs will be trimmed to manageable widths and heights to not present an overgrown appearance, and to keep the vegetation in a healthy and ever-growing state, except during dormant periods of the year. The trimmings/

prunings shall be properly bagged, removed, and disposed of/recycled off-site. Fallen leaves, thatch, and debris shall be raked, bagged, removed, and disposed/recycled off-site. Weeds and other nuisance, noxious, or invasive vegetation contributing up to 20 percent of vegetation of all species shall be removed and replaced with original specification vegetation, as needed. Dead herbaceous and shrub vegetation shall be removed and replaced as needed to maintain less than 10 percent of area cover loss or when the vegetated swale's function is impaired. Dead vegetation shall be replaced within 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed.

Rip-rap around the outlet piping and the rock check dams shall be replenished (i.e. removed, replaced, or reconstucted) as necessary to maintain their erosion control, energy dissipation, and flow spreading functions.

The detention basin's outlet catch basin (ditch inlet) will be cleaned with removal of any accumulated sediment in the inlet's sump removed by use of a vacuum truck with "stinger" hose or by hand methods. Any refuse/debris that fouls the grate will be removed. Any vegetation that interferes with free flow of water into and through the grate will be removed. Any dirt accumulation or debris/refuse found within the inlet shall be removed. The outlet pipe shall be checked for the accumulation of any sediment or other blockage, and the sediment or blockage items shall be removed.

The vegetated swale's underlying growing/filtering media shall allow storm water to percolate. If the swales do not drain within 12 hours of the cessation of inflows into the vegetated swales, then the growing/filtering media layers shall be tilled (and if necessary the enhanced soil growing media replaced) and replanted to original specifications. Slopes and bottoms of the vegetated swale shall be maintained to minimize erosion and keep their original configuration. Sediment from the site may accumulate in the swale bottom and reduce the swale to below design volume requirements. The vegetated swales bottom should be excavated or the accumulated soils removed (i.e. by vacuum truck "stinger pipe' methods) if the pond bottom elevation reached a level that allows excessive aquatic growth or reduces the vegetated swales efficiency such that the sediments are passing the discharge structure and release off site. Sources of sediment deposition and debris shall be identified and corrected.

The side slopes and bottoms of the vegetated swales will be reviewed for any soil/growing mediums displacement, with the side slopes and bottom being restored with replacement soils or growing medium to the original configuration as needed. Adjoining hardscape (i.e. block retaining wall, sidewalks, etc.) or landscape that becomes damaged shall be removed and replaced as needed to restore the hardscape/landscape to its original condition and function. Stabilization or re-grading of side slopes may be required periodically or after excessive rain events. Any disturbance of slopes should be reseeded or may require installation of erosion control materials until seeding can reestablish adequate grasses to prevent future erosion.

Shrub and tree pruning, fertilizing, and replacement (to be typically performed during the winter [dormant] and early part of the growing season, as applicable) shall be performed to ensure active and vigorous growth of the planted items.

Insects and rodents shall not be harbored in the vegetated swales/detention basin. All rodent holes shall be filled upon detection. Approved pest control measures shall be taken when insects/rodents are found to be present. All pesticide/herbicide spray application shall be performed by a licensed individual or contractor using environmentally sensitive pesticides and herbicides.

Supplemental irrigation will be provided as necessary by use of above-ground sprinklers facilitated by a pressurized irrigation system, which will utilize domestic water as supplied through a metered service from the City's domestic water distribution system.

Training and /or written guidance information for operating and maintaining the vegetated swales/detention basin will be provided to the Developer as needed.

4.3 Catch Basins, Manholes, and Conveyance Piping

Maintenance of the catch basins, manholes (including pre-treatment and flow control), and conveyance piping will be performed by City forces as part of the City's routine stormwater collection and conveyance system maintenance work. If catch basin grates are found to be plugged with leaves or other deleterious material, they will be cleaned by City staff as needed to allow the free flow of surface water through the grate. If sediment (at ½ the sump depth or higher), refuse, or other deleterious material accumulation is noted in the catch basins, manholes, or inlet structure, the structure will be cleaned by City staff and equipment, or City contracted forces with the use of a vacuum truck and stinger pipe, with recovered materials being properly disposed or recycled off-site.

Stormwater conveyance piping will be hydro-flushed periodically to ensure their continued operation and to facilitate the removal of any accumulated sediments which may interfere with the proper operation of these facilities. During flushing operations, downgradient check dams will be incorporated to trap the "flushed-out" materials. Any removed materials shall be properly dewatered, reutilized and/or disposed of off-site, as required.

4.4 OCS

Similar to the detention basin within the public rights-of-way, the OCMHs will be maintained by the developer and then City. If OCMHs are found to be overflowing through the riser pipe and not through the orifice(s), the orifice hole(s) will be cleared of any sediment or debris accumulation using the inspection port or manhole access points, and a wooded handle or other suitable probe will be utilized to clear the orifice hole(s) as needed. Any debris, sediment, floatables, or other deleterious material accumulations within the OCMHs shall be removed using a vacuum truck.

4. Legal and Fiscal Responsibility

The party responsible for the vegetated swales/detention basin inspection, operation, and maintenance will initially be the Developer of Belle Plaine Estates as part of the infrastructure warranty process within the City of Salem (1 year). During this warranty period, the Developer is legally and financially responsible for the stormwater management system within the Project, including the pre-treatment manholes, vegetated swales/detention basin, and outlet and flow control structures. The Developer will be responsible to provide inspection and timely correction of any deficiencies noted with the

stormwater management system. At the end of this period, the operation, maintenance, inspection, inspection logging, and legal and fiscal responsibility for the stormwater management system of the Project will be transferred to the City of Salem who will continue with the inspection (including inspection log documentation), operation, and maintenance of the stormwater management system of the Project.

The contacts for these parties, is as follows:

- Developer: Don Jensen, Jensen Consulting and Development, LLC, 503-932-2259, don.jensen@jensencollc.com
- City of Salem: 503-588-6211

Belle Plaine Estates
Vegetated Swales/Detetion Basin Inspection Checklist Log
Inspector: _____ Photos Attached: Y/N
Date:_____

Item No.	Inspection Item	Checked Y/N/NC	Maintenance Required Y/N/NA	Repair Work Required Y/N/NA	Comments (use back of sheet for more description)
1A	Veg. Swale Bottom- West				
1B	Veg. Swale Bottom- East				
2A	Veg. Swale Slopes-West				
2B	Veg. Swale Slopes-East				
3A	Inlet Pipe and Rip-Rap- West				
3B	Inlet Pipe and Rip-Rap- East				
4A	Rock Check Dams - West				
4B	Rock Check Dams - East				
5	Outlet Control Structure				

Inspection Legend: Y=Yes; N=No; NC=Not Constructed; NA=Not Applicable; FP=Feces Presence; LP=Leaves Presence; DRP=Debris/Refuse Presence; DV=Dead/Damaged Vegetation; OGV=Overgrown Vegetation; WP=Weed/Noxious Vegetation Presence; SDP=Sediment Deposition Presence; PP=Pest Presence; RP=Rodent Presence; I/O=Inlet/Outlet Plugged; BE=Bottom Erosion; SE=Slope Erosion; BNR=Bottom Needs Repair; SNR=Slopes Need Repair; IPW/OPW=Inlet Pipe Working/Outlet Pipe Working; LD=Landscape Damage; IPC=Inlet Pipe Clogged; OPC=Outlet Pipe Cloggged; IPS=Sediment in Inlet Pipe; OPS=Sediment in Outlet Pipe; BS=Bare Spots; HD=Hardscape Damage; RR=RipRap Replacement; GrateP=Grate Plugged; SD=Structure Damage; GD=Grate Damage; RCDR=Rock check dam damage;BWG=Blockwall graffitti; BWD= Blockwall damage; FenceD = Fence Damage

Maintenance Legend: TH=Trim Herbaceous; TS=Trim Shrubs; TT=Trim Trees; XC=Remove Clippings; XL=Remove Leaves; XSedV=Remove Sediment-Vac Truck; XSedH=Remove Sediment-Hands Method; XR=Remove Refuse/Debris; XF=Remove Feces; MB= Mow Bottom; MS=Mow Slopes; RHV=Replace Herbaceous Vegetation; RS=Replace Shrubs; RT=Replace Tree; RRB=Restore Bottom; RRS=Restore Slopes; RRR=Restore Riprap; RRH=Restore Hardscape; RRL=Restore Landscape; RRGM=Restore Growing Medium; ARR=Add Rock to Riprap; RRP=Remediate Pest Presence; RRR=Remediate Rodent Presence; RRPerc=Restore Percolation; FI=Flush Inlet Pipe; FO=Flush Outlet Pipe; RRAer=Aerate Growing Medium; RRStruc=Restore Structure; RRRiser=Restore Riser; CGrate=Clean Grate; RGrate=Replace Grate; UOrifice=Unplug/Unclog Orifice; RCDR=Rock Check Dam Rebuild; RCDRR=Rock Check Dam Remove & Replace; RBW=Repair Block Wall; RRBW=Removed and Replace Block Wall; BWRG= Block Wall-Remove Graffiti

Item No.	More Description

Belle Plaine Estates
Vegetated Swales/Detention Basin Maintenance Log
Inspector: _____ Photos Attached: Y/N
Date:_____

Item No.	Inspection Item	Maintenance Required	Repair Work Required	Date Completed	Work Performed (use back of sheet for more description)
		Y/N/NA	Y/N/NA		
1A	Veg. Swale Bottom- West				
1B	Veg. Swale Bottom- East				
2A	Veg. Swale Slopes-West				
2B	Veg. Swale Slopes-East				
3A	Inlet Pipe and Rip-Rap- West				
3B	Inlet Pipe and Rip-Rap- East				
4A	Rock Check Dams - West				
4B	Rock Check Dams - East				
5	Outlet Control Structure				

Maintenance Legend: TH=Trim Herbaceous; TS=Trim Shrubs; TT=Trim Trees; XC=Remove Clippings; XL=Remove Leaves; XSedV=Remove Sediment-Vac Truck; XSedH=Remove Sediment-Hands Method; XR=Remove Refuse/Debris; XF=Remove Feces; MB= Mow Bottom; MS=Mow Slopes; RHV=Replace Herbaceous Vegetation; RS=Replace Shrubs; RT=Replace Tree; RRB=Restore Bottom; RRS=Restore Slopes; RRR=Restore Riprap; RRH=Restore Hardscape; RRL=Restore Landscape; RRGM=Restore Growing Medium; ARR=Add Rock to Riprap; RRP=Remediate Pest Presence; RRR=Remediate Rodent Presence; RRPerc=Restore Percolation; FI=Flush Inlet Pipe; FO=Flush Outlet Pipe; RRAer=Aerate Growing Medium; RRStruc=Restore Structure; RRRiser=Restore Riser; CGrate=Clean Grate; RGrate=Replace Grate; UOrifice=Unplug/Unclog Orifice; RCDR=Rock Check Dam Rebuild; RCDRR=Rock Check Dam Remove & Replace; RBW=Repair Block Wall; RRBW=Removed and Replace Block Wall; BWRG= Block Wall-Remove Graffiti

Item No.	More Description

Belle Plaine Estates
Curb Inlet and Manhole Inspection Checklist Log
Inspector: _____
Date:_____

Photos Attached: Y/N

Item No.	Inspection Item	Checked Y/N/NC	Maintenance Required Y/N/NA	Repair Work Required Y/N/NA	Comments (use back of sheet for more description)
46th Ave. NE					
1	SDCI - Lot 15				
2	SDCI - Lot 14South				
3	SDMH Lot 14				
4	SDCI - Lot 14North				
5	SDCI - Lot 24				
6	SDCI - Lot 13				
7	SDMH - Lot 11				
8	SDCI - Lot 21				
9	SDCI Lot 2				
10	SDMH Lot 3				
11	PTSDMH (DD) Lot 4				
12	SDMH Lot 5				
Center St./46th Ave.					
13	SDCI Lot 1 E				
14	SDCI Lot 1 W				
15	SDCI Lot 1 N				
16	SDMH Lot 1 N				
17	PTSDMH (DD) Lot 1				
18	OCMH - Center St Landscape Strip				
19	SDMH - Center St. DWS of OCMH				
20	SDMH INTX 46 & Center				

Inspection Legend: Y=Yes; N=No; NC=Not Constructed; NA=Not Applicable; FP=Feces Presence; LP=Leaves Presence; RVI=Root/Vegetation Intrusion; DRP=Debris/Refuse Presence; WP=Weed/Noxious Vegetation Presence; SDP=Sediment Deposition Presence; PP=Pest Presence; RP=Rodent Presence; WI=Water Infiltration/Sidewall Inflow; IPC=Inlet Pipe Clogged; OPC=Outlet Pipe Clogged; GrateP=Grate Plugged; SD=Structure Damage; GD=Grate Damage; MHD=Manhole Frame and Cover Damaged; MHOP=Manhole Orifice Plugged

Maintenance Legend: FI=Flush Inlet Pipe; FO=Flush Outlet Pipe; XV=Remove Vegetation; XF=Remove Feces; XL=Remove Leaves; XR=Remove Refuse/Debris; XSedV=Remove Sediment-Vac Truck; XSedH=Remove Sediment-Hand Methods; RRP=Remediate Pest Presence; RRR=Remediate Rodent Presence; RRMH=Restore MH Frame and Cover; RRStruc=Restore Structure; RWater=Remediate Water Intrusion; Rroot=Remediate Root Intrusion; CGrate=Clean Grate; RGrate=Replace Grate; MHOU=Manhole Orifice Unplug

Item No.	More Description

Belle Plaine Estates
Curb Inlet and Manhole Maintenance Log
Inspector: _____
Date:_____

Photos Attached: Y/N

Item No.	Inspection Item	Maintenance Required	Repair Work Required	Date Completed	Work Performed (use back of sheet for more description)
		Y/N/NA	Y/N/NA		
46th Ave. NE					
1	SDCI - Lot 15				
2	SDCI - Lot 14South				
3	SDMH Lot 14				
4	SDCI - Lot 14North				
5	SDCI - Lot 24				
6	SDCI - Lot 13				
7	SDMH - Lot 11				
8	SDCI - Lot 21				
9	SDCI Lot 2				
10	SDMH Lot 3				
11	PTSDMH (DD) Lot 4				
12	SDMH Lot 5				
Center St./46th Ave.					
13	SDCI Lot 1 E				
14	SDCI Lot 1 W				
15	SDCI Lot 1 N				
16	SDMH Lot 1 N				
17	PTSDMH (DD) Lot 1				
18	OCMH -Center St Landscape Strip				
19	SDMH -Center St DWS of OCMH				
20	SDMH INTX 46 & Center				

Maintenance Legend: FI=Flush Inlet Pipe; FO=Flush Outlet Pipe; XV=Remove Vegetation; XF=Remove Feces; XL=Remove Leaves; XR=Remove Refuse/Debris; XSedV=Remove Sediment-Vac Truck; XSedH=Remove Sediment-Hand Methods; RRP=Remediate Pest Presence; RRR=Remediate Rodent Presence; RRMH=Restore MH Frame and Cover; RRStruc=Restore Structure; RWater=Remediate Water Intrusion; Rroot=Remediate Root Intrusion; CGrate=Clean Grate; RGrate=Replace Grate; MHOU=Manhole Orifice Unplug

Item No.	More Description

Attachment 3

Wetland Functional Assessment
ORWAP

Attachment 4

CM Eligibility & Accounting Sheet

COMPENSATORY MITIGATION - ROUTINE ELIGIBILITY ACCOUNTING WORKSHEET
Belle Plaine Estates / PHS #5769

Draft Compensatory Mitigation Eligibility and Accounting Determination Form
STEP 1. ELIGIBILITY

INSTRUCTIONS: This eligibility worksheet is used to determine whether a proposed compensatory mitigation site is ecologically appropriate to offset proposed impacts. Final eligibility is determined by the agency. The expectation is that compensatory mitigation sites provide an ecological match (i.e. class, function, and value) to the impact site. In some circumstances, an exception to ecological match may be allowed if the permittee demonstrates that the proposed compensatory mitigation site addresses local or watershed needs or priorities. Enter data in red boxes only. Yellow boxes will populate automatically.

Criteria		RESPONSE	RESULT	COMMENTS
Expectation for providing ecological match for wetlands impacts	Does the mitigation site replace all of the following:			Aquatic Resources of Special Concern must be replaced in-kind and may not otherwise meet all criteria.
	a) HGM class(es) and subclass(es)? ▪ *Select yes or no from drop-down list.*	Yes	MET	
	b) Cowardin system(s) and class(es)? ▪ *Select yes or no from drop-down list.*	Yes	MET	
	c) Group-level functions and values? ▪ *Compare ORWAP ratings between the impact site and the mitigation site (predicted scores) to determine this. Select yes or no from drop-down list.*	Not applicable - see Comments	FALSE	This criterion does not apply when purchasing Legacy Credits, ILF credits not associated with a DSL-approved project, or PIL. Does not apply to non-tidal wetland impacts ≤0.2 acres purchasing credits.
Expectation for providing ecological match for stream impacts	Does the mitigation site replace all of the following:			Aquatic Resources of Special Concern must be replaced in-kind and may not otherwise meet all criteria.
	a) Flow permanance (intermittent or perennial)? ▪ *Select yes or no from drop-down list.*			
	b) Stream size class (small, medium, or large)? ▪ *Select yes or no from drop-down list.*			Stream size class as set forth by Oregon Department of Forestry in OAR 629-635-0200 Sections (13) and (14). Mitigation Planning Map Viewer
	c) Essential Indigenous Anadromous Salmonid Habitat (ESH) designation, if the impact is to an ESH stream? ▪ *Select yes, no, or Impact site is not ESH from the drop-down list.*			
	d) Group-level functions and values? ▪ *Compare SFAM ratings between the impact site and the mitigation site (predicted scores) to determine this. Select yes or no from drop-down list.*			This criterion does not apply when purchasing Legacy Credits, ILF credits not associated with a DSL approved project, or PIL
If any criterion above are not met, determine whether the mitigation site might qualify for an exception (as a watershed priority) by answering the following two questions. If all criteria above were met, skip the next two questions and move to Step 2: Accounting.				Aquatic Resources of Special Concern are not eligible for an exception and must be replaced in-kind
Possible exception to ecological match	Does the mitigation site:			
	a) Address a watershed priority, as identified in a planning or assessment document, report, or other data? ▪ *Must be fully described in the permit application. Select yes or no from the drop-down list.*			
	b) Provide a high level of the functions and values that are relevant to the targeted priority (either currently or post-construction)? ▪ *Must be fully described in the permit application. Select yes or no from the drop-down list.*			

COMPENSATORY MITIGATION - ROUTINE ELIGIBILITY ACCOUNTING WORKSHEET
Belle Plaine Estates / PHS #5769

STEP 2. ACCOUNTING

INSTRUCTIONS: This accounting worksheet is used to estimate a permittee's wetland mitigation requirements, specific to a particular impact and proposed mitigation site. There are no minimum requirements defined for streams. Final requirements will be determined by the agency. Requirements are based on (1) the mitigation method, (2) the function/value replacement achieved, (3) function temporal loss factors, (4) level of function replacement, and (5) stewardship and site protection plans. Enter data in red boxes only. Yellow boxes will populate automatically. A separate column must be used for each mitigation method used (e.g. if a mitigation site includes both restoration and enhancement, the mitigation method for those distinct areas must be calculated in separate columns). A separate column may also be used to allow different function temporal loss factors to be applied to different acreages, even if the mitigation method being used on that acreage is the same.

Factor		Method 1	Method 2	Method 3	Notes
Mitigation method	What method(s) of mitigation is proposed? ▪ *Select an option from drop-down list.*	Credit purchase			If purchasing credits, ILF or PIL, select "credit purchase." Minimum requirements for preservation and non-wetland waters are case-by-case, as determined by the Department.
	MINIMUM MITIGATION REQUIREMENT (acres of mitigation required per acre of impact)	1.00			

Note: Adjustments do not apply to non-tidal wetland impacts ≤0.2 acres purchasing credits as mitigation; select "Not applicable" for each factor.

Specific function and value replacement *(increase factor)*	How many specific functions and values from the impact site are replaced at the mitigation site? ▪ *Compare ORWAP ratings between the impact site and the mitigation site (predicted scores) to determine this. Select an option from drop-down list.*	Not applicable			Select "Not applicable" if the mitigation site is approved/seeking approval as an exception to in-kind replacement under a watershed priority approach, if purchasing legacy credits, or best professional judgement was used to assess functions and values.
		+ 0%			
Function temporal loss *(increase factor)*	Which factor, if any, will cause the greatest temporal loss of function? ▪ *Select **first** applicable option from drop-down list.*	Not applicable			Soil adjustment factors are not applicable to credit purchases or removal of historic fill. Vegetation and soil adjustments may not apply when the mitigation method is preservation.
		+ 0%			
High level of function replacement *(decrease factor)*	Does the CM site exceed at least 80% of the specific functions being lost at the impact site? ▪ *Compare ORWAP function ratings between the impact site and the mitigation site (predicted scores) to determine this. Select an option from drop-down list.*	Not applicable			"Exceed" means replaced beyond an overlapping rating break proximity. Select "Not applicable" if the mitigation site is approved/seeking approval as an exception to in-kind replacement under a watershed priority approach, if purchasing legacy credits, or best professional judgement was used to assess functions and values.
		- 0%			
Mitigation site protection & stewardship *(decrease factor)*	What level of site protection and stewardship is proposed for the mitigation site? ▪ *Select an option from the drop-down list.*	Enhanced stewardship			Mitigation banks and ILFs typically have enhanced stewardship. Minimum mitigation requirement is 1 acre credit to 1 acre of impact.
		- 20%			
	Total adjustment (percent increase)	0%			
	ADJUSTED MITIGATION REQUIREMENT (acres of mitigation required per acre of impact)	1.00			

	Method 1	Method 2	Method 3	Notes
Acreage of impact* (*enter the acreage associated with each method)	0.36			Insert the area of unavoidable permanent impact
MITIGATION ACREAGE REQUIRED (adjusted mitigation requirement * impacted acreage)	0.36			

TOTAL MITIGATION REQUIRED WITHOUT BUFFERS	0.36	**This is the mitigation acreage required if a buffer is not required by DSL**

COMPENSATORY MITIGATION - ROUTINE ELIGIBILITY ACCOUNTING WORKSHEET
Belle Plaine Estates / PHS #5769

This section is only used if DSL requires a buffer at the compensatory mitigation project					
Factor		**Method 1**	**Method 2**	**Method 3**	**Notes**
Credit for DSL Required Buffers	Buffer acreage				Use multiple methods only if more than one ratio will be applied to the buffer.
	Buffer credit ratio				DSL will determine the credit ratio for required buffers. Enter the acres of buffer required per credit (e.g. for 10:1, enter 10).
	Buffer Credit				
	Total Buffer Credit	0			
	TOTAL MITIGATION REQUIRED WITH BUFFER CREDITS APPLIED		**This is the mitigation acreage required if buffers are required by DSL**		