Memorandum

Home of the Tualatin River National Wildlife Refuge

City of Sherwood
22560 SW Pine St.
Sherwood, OR 97140
Tel 503-625-5522
Fax 503-625-5524
www.sherwoodoregon.gov

Mayor
Bill Middleton

Council President
Linda Henderson

Councilors
Dave Grant
Robyn Folsom
Bill Butterfield
Matt Langer
Krisanna Clark

City Manager
Joe Gall, ICMA-CM

Assistant City Manager
Tom Pessemier, P.E.

2009 Top Ten Selection

2007 18th Best Place to Live

Sherwood 2006 All-America City Finalist

DATE: August 5, 2014

TO: City Council

FROM: Michelle Miller, AICP, Senior Planner

SUBJECT: PUD 14-01 SUB 14-01, Cedar Brook PUD
Follow Up from Public Hearing on July 15, 2014

The following memorandum is intended to address issues raised by Council as well as to discuss the applicant's comments concerning the planned unit development and subdivision process, the onsite storm water treatment, open space, and trail issues. Included, are recommended modifications to conditions of approval based on the new information received and clarification of the initial Planning Commission Recommendation. (Exhibit 1)

PUD and Subdivision Process

The Cedar Brook PUD involves the subdivision of land and includes a preliminary subdivision plat that must meet Sherwood Zoning and Development Code Chapter 16.120. The Planning Commission Recommendation (Exhibit 1 of Ordinance 2014-013) includes a discussion addressing the criteria, makes findings and proposes conditions of approval for the preliminary plat beginning on page 14 of Exhibit 1. The preliminary subdivision plat is processed concurrently with the PUD.

If Council approves the PUD conceptual plan and preliminary plat of the subdivision, the subdivision must next receive detailed final development plan approval from the Planning Commission. The detailed final development plan review and approval ensures compliance with any conditions of the conceptual approval as well as applicable community design standards, etc.

The final development plan approval process is a Type IV process and will comply with the notice and public hearing requirements. The applicant will submit a final plat that will be reviewed during the final development plan approval process. After receiving final development plan approval, the applicant will submit final public improvement plans where the infrastructure, including the right of way, roadway design, easements and utilities will be reviewed and approved by the Engineering Department, Clean Water Services (CWS) and any other relevant agencies. The Engineering and Public Works Department will also review the final plat to ensure that it meets all of the City's requirements. The

Exhibit R

final plat will not be recorded until the applicant receives approval of the public improvement plans and has either constructed the improvements or financially bonded for them.

Storm Water Treatment

During the previous hearing, the applicant asked the City Engineer about treating and detaining their stormwater treatment facility on Tract C located in the northeastern corner of the site on the preliminary plat near proposed Lot 1 as opposed to the regional pond located further north and east near Cedar Brook Way. The amended proposal locates the storm water treatment facility on Tract C (Exhibit T.) The City Engineer has reviewed the proposal to determine whether it can feasibly serve the site and has provided a summary that is included in the Council materials. (Exhibit U.) Based on this review, Conditions D. 2 and D.12 of Exhibit 1, (Planning Commission Recommendation to Council) adequately addresses compliance with the City's standards and the CWS Service Provider Letter. Because the site will now serve as the water quality facility, staff recommends that Tract C be dedicated either to the City or that it include an easement over its entirety for the benefit of the CWS and the City. This would be an added condition E. 9 of Exhibit 1.

RECOMMENDED CONDITION:

> ***E. 9. Prior to approval of the final plat, Tract C will either be dedicated to the City of Sherwood or have a public storm water facility easement be placed over the tract in its entirety for the benefit of CWS and the City. The subdivision plat shall note the dedication of Tract C to the City or include language establishing a Public Storm Water Facility Easement over Tract C for the benefit of CWS and the City.***

The applicant proposes that the open space area in Tract C be used exclusively to accommodate the water quality facility. The applicant intends that this tract will be dedicated to the City for the purpose of monitoring and maintaining the water quality facility. If used as the water quality facility, Tract C would no longer be included in the open space calculation. The applicant had intended that Tract C would be a landscaped area rather than useable open space like a park. Tract C is adjacent to the sidewalk on SW Cedar Brook Way, so it did not include any pedestrian pathways and the water quality facility will look similar to a landscaped area, except that the plantings will be serving the purpose of treating the storm water runoff.

The change results in a reduction of open space by 3,581 square feet or 2 percent of proposed overall open space on the site. The threshold for required open space is 15 % and if Tract C were used for water quality treatment, the applicant would have 19 % open space, therefore they would continue to be in compliance with the standard. The minimum residential density for the site is now 63 dwelling units and the applicant continues to meet this requirement by providing 65 dwelling units.

Feeder Trails

The applicant proposed onsite trails throughout the open space areas of the development along with the construction of a trail on City property that will connect with the City's existing trail network. The new trail from SW Meinecke through the development's Tract K, as identified in the City's Transportation System Plan (TSP) will serve to connect the new neighborhood with the schools and the Wyndam Ridge subdivision. The Cedar Creek Trail, when constructed, will include an at grade crossing at the intersection of SW Meinecke and Highway 99W so this feeder trail will provide a direct connection south to the Cedar Creek Trail. This trail will be built to the standards identified in the TSP and comply with the City's Engineering Design Manual for local trails and will also include a permitting and approval process through the different government environmental agencies. The recommended condition outlined in the Planning Commission Recommendation addresses this segment of the trail. (See Condition G.7. of Exhibit 1 below)

At the hearing on July 15, 2014, the applicant requested that the trail be a "soft" trail. The City's trail standard is for a hard surface trail. Staff recommends that clarification of Condition G.7. include identifying that the trail will be constructed with a hard surface as the standard mandates. Proposed additional language to the condition is underlined in blue.

RECOMMENDED AMENDED CONDITION

G.7. Phase 2 portion of the project consists of design and construction of the hard surface trail extension from SW Cedar Brook Way through Tract K, connecting to the existing trail at Wyndam Ridge. Final occupancy for either the last townhome building or last three single-family homes (applicant's choice) shall be granted once the trail extension has been constructed and accepted by the City Engineer. An approval letter from the Engineering Department accepting all the public improvements under Phase 2 shall be issued prior to granting final occupancy for the buildings delineated under Phase 2.

Open Space Areas

The applicant proposes open space areas including a private street and pathways throughout the subdivision. The applicant included a pedestrian easement over Tract K for the connection to the feeder trail on the plans. After further review of the open space areas, staff recommends that the various tracts include pedestrian and bicycle access easements over their entirety within the development so that the subdivision has good circulation and connectivity for all pedestrians and bicyclists, not only on Tract K.

ADDITIONAL RECOMMENDED CONDITION

E. 9. Prior to approval of the final plat, provide pedestrian and bicycle access easements over all of the tracts that includes a pathway or private street.

From: Sylvia Murphy
To: City Council
Cc: Joseph Gall; Julia Hajduk; Bradley Kilby; Michelle Miller
Subject: FW: Cedar Brook PUD
Date: Wednesday, July 23, 2014 10:15:51 AM

Council Members,

See message below.

Sylvia Murphy, MMC, City Recorder
City of Sherwood
murphys@sherwoodoregon.gov
Ph: 503-625-4246
Fax: 503-625-4254

From: Jbroadhrst@aol.com [mailto:Jbroadhrst@aol.com]
Sent: Friday, July 18, 2014 8:14 PM
To: Krisanna Clark
Cc: Linda Henderson
Subject: Fwd: Cedar Brook PUD

From: Jbroadhrst@aol.com
To: middletonb@sherwoodoregon.gov
CC: langerm@sherwoodoregon.gov, grantd@sherwoodoregon.gov, butterfieldb@sherwoodoregon.gov, henderson@sherwoodoregon.gov, clark@sherwoodoregon.gov, folsomr@sherwoodoregon.gov
Sent: 7/18/2014 8:12:31 P.M. Pacific Daylight Time
Subj: Fwd: Cedar Brook PUD

Mayor and Councilors,

I guess I sent this to the City to late. It did not make it to the last meeting. Council needs to request that Staff advise as to why we cannot have smaller lots in MDRL & MDRH so as to build better mixed use communities of single family homes. Some local communities have 3500 sf lots in MDRL and down to 2500 sf lots in MDRH. We need to meet density mandates without all PUD's and or attached housing.

Thanks for listening

Joe Broadhurst

From: Jbroadhrst@aol.com
To: millerm@sherwoodoregon.gov
Sent: 7/15/2014 8:45:34 A.M. Pacific Daylight Time
Subj: Cedar Brook PUD

Mayor and Councilors,

The thought to allow smaller single family detached homes on smaller than 5000sf

Exhibit S

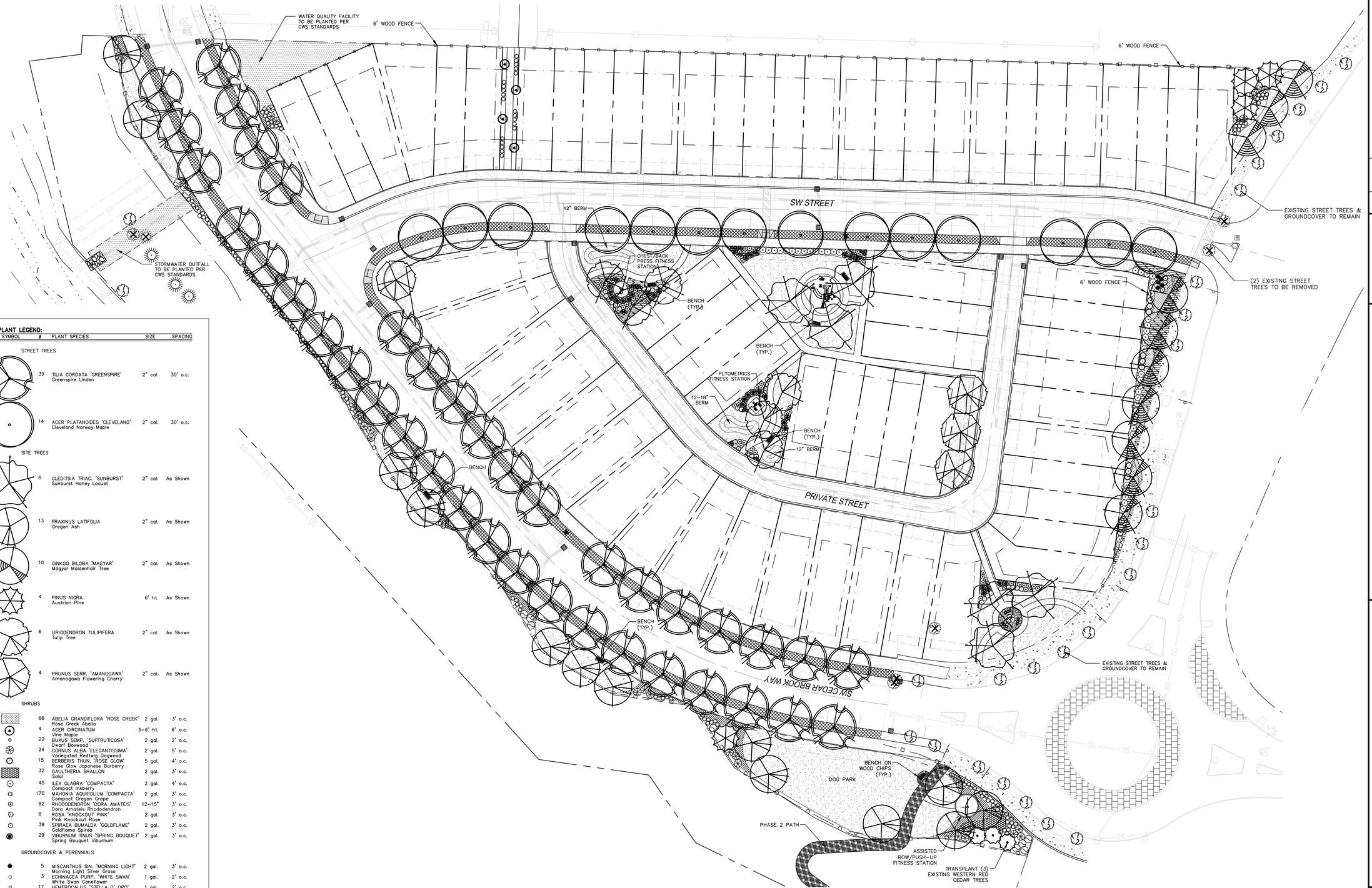
lots in our Code in Sherwood is being with held from local landowners and developers. In MDRL & MDRH our Code says 5000sf lots or attached housing on large lots. We should be able to have 3000sf lots in MDRL & MDRH without PUD! All new Residential Land coming into the City will be MDRL minimum with no up to date Code. Council is saying you must do a PUD to get smaller lots or build attached housing on large lots as per Code. Also PUD is 15% buildable land for Open Space and controlled by Planners.

This Property was re-zoned so as to make a bad situation better. If this Property tonight had been re-zoned to MDRL or MDRH and was allowed smaller single family home lots, we would have had a great little area with less density and plenty of parking because of Cedar Brook Way parking. But NO! HDR - PUD. Parking fights, maybe with Police Parking Enforcement. Oh boy, what a thing to do to a great town.

What warrants a PUD here? What are Variances? What is the Goal? Why have Code???

Take time to decide what is up. Rubber Stamping gets to be a habit.

Joe Broadhurst



PLANT LEGEND:

SYMBOL	#	PLANT SPECIES	SIZE	SPACING
STREET TREES				
	39	TILIA CORDATA 'GREENSPIRE' Greenspire Linden	2" cal.	30' o.c.
	14	ACER PLATANOIDES 'CLEVELAND' Cleveland Norway Maple	2" cal.	30' o.c.
SITE TREES				
	6	GLEDITSIA TRIAC. 'SUNBURST' Sunburst Honey Locust	2" cal.	As Shown
	13	FRAXINUS LATIFOLIA Oregon Ash	2" cal.	As Shown
	10	GINKGO BILOBA 'MAGYAR' Magyar Maidenhair Tree	2" cal.	As Shown
	4	PINUS NIGRA Austrian Pine	6' ht.	As Shown
	6	LIRIODENDRON TULIPIFERA Tulip Tree	2" cal.	As Shown
	4	PRUNUS SERR. 'AMANOGAWA' Amanogawa Flowering Cherry	2" cal.	As Shown
SHRUBS				
	66	ABELIA GRANDIFLORA 'ROSE CREEK' Rose Creek Abelia	2 gal.	3' o.c.
	4	ACER CIRCINATUM Vine Maple	5-6' ht.	6' o.c.
	22	BUXUS SEMP. 'SUFFRUTICOSA' Dwarf Boxwood	2 gal.	2' o.c.
	24	CORNUS ALBA 'ELEGANTISSIMA' Variegated Redtwig Dogwood	2 gal.	5' o.c.
	15	BERBERIS THUN. 'ROSE GLOW' Rose Glow Japanese Barberry	5 gal.	4' o.c.
	32	GAULTHERIA SHALLON Salal	2 gal.	3' o.c.
	45	ILEX GLABRA 'COMPACTA' Compact Inkberry	2 gal.	4' o.c.
	170	MAHONIA AQUIFOLIUM 'COMPACTA' Compact Oregon Grape	2 gal.	3' o.c.
	82	RHODODENDRON 'DORA AMATEIS' Dora Amateis Rhododendron	12-15"	3' o.c.
	8	ROSA 'KNOCKOUT PINK' Pink Knockout Rose	2 gal.	3' o.c.
	39	SPIRAEA BUMALDA 'GOLDFLAME' Goldflame Spirea	2 gal.	3' o.c.
	29	VIBURNUM TINUS 'SPRING BOUQUET' Spring Bouquet Viburnum	2 gal.	3' o.c.
GROUNDCOVER & PERENNIALS				
	5	MISCANTHUS SIN. 'MORNING LIGHT' Morning Light Silver Grass	2 gal.	3' o.c.
	3	ECHINACEA PURP. 'WHITE SWAN' White Swan Coneflower	1 gal.	2' o.c.
	17	HEMEROCALLIS 'STELLA D' ORO' Stella d' Oro Daylily	1 gal.	2' o.c.
	6	CROCOSMIA 'JENNY BLOOM' Jenny Bloom Montbretia	1 gal.	2' o.c.
	52	PENNISETUM ORIENTALE Oriental Fountain Grass	1 gal.	2' o.c.
	72	SPRING BULBS Tulips/Daffodils	Bulb	6" o.c.
	135	FRAGARIA CHILOENSIS Beach Strawberry	1 gal.	3' o.c.
	120	ARCTOSTAPHYLOS UVA-URSI 'MASS.' Spring Bouquet Viburnum	1 gal.	3' o.c.
	1,089	COTONEASTER DAMMERI 'EICHOLZ' Spring Bouquet Viburnum	1 gal.	3' o.c.
		FINE LAWN	Seed	

GENERAL NOTES:

1. Contractor is to verify all plant quantities.
2. Adjust plantings in the field as necessary.
3. Project is to be irrigated by an automatic, underground system, which will provide full coverage for all plant material. System is to be design/ build by Landscape Contractor. Guarantee system for a minimum one year. Show drip systems as alternate bid only.
4. All plants are to be fully foliaged, well branched and true to form.

CONCEPTUAL LANDSCAPE PLAN

SCALE 1" = 30'-0"

Exhibit T

NO.	DATE	REVISIONS

OTTEN LANDSCAPE ARCHITECTS Inc.
3933 SW Kelly Avenue • Suite B • Portland, Oregon 97239-4393
Phone (503) 972-0311 • Fax (503) 972-0314 • www.otteniln.com

CEDAR BROOK DEVELOPMENT

SHERWOOD, OREGON

LANDSCAPE PLAN

DATE	7-18-2014
SCALE	NOTED
DRAWN	EH
CHECKED	JLO
SHEET NO	L1.0
	1 OF 2

Storm Drainage Report

Cedar Brook PUD

Sherwood, Oregon

Renewal 12/31/15

Prepared For:
D.R. Horton
4380 SW Macadam Avenue
Suite 100
Portland, OR 97239

Prepared By:
Ryan Walker
Reviewed by Neil Fernando, P.E.
Emerio Design, LLC
8285 SW Nimbus Ave, Suite 180
Beaverton, OR 97008

Table of Contents:

Purpose

1.0 Purpose

1.1 Introduction/Project Overview

1.2 Existing Conditions

1.3 Proposed Conditions

2.0 Hydrologic Methodology

2.1 Conveyance System Design & Analysis

2.1 Upstream & Downstream Analysis

3.0 Conclusions

Appendices:

Appendix A - Vicinity Map, Existing Conditions Plan

Appendix B - Soil Maps & Classifications, Runoff Curve Numbers, Time of Concentration

Appendix C - Pre & Post Developed Basin Maps, Impervious Area Summary, Bio-Swale Calculation

Appendix D - Hydrocad Analysis for SBUH Hydrographs

1.0 Purpose:

The purpose of this analysis is to describe existing and proposed site conditions, provide data and analysis for the storm water impacts due to the proposed Cedar Brook PUD Developments, as well as address on-site storm water conveyance requirements. In addition, providing water quality calculations, and upstream and downstream analysis, for the site.

1.1 Introduction / Project Overview:

The proposed Cedar Brook PUD project will be comprised of 66 single family attached & detached residential lots to be located at approximately 21601 Cedar Brook Way, Sherwood, Oregon. Located on tax lot 13400 of Tax Map T2S R1W 30CD.

1.2 Existing Conditions:

The existing site is 5.77 acres in size and is zoned HDR, High Density Residential. The project site is currently cleared land covered in vegetation. The site is bounded by “Creekview Crossing” to the east, SW Meinecke Road and Cedar Brook Dental commercial development to the south and Cedar Brook creek to the north/northwest. The project site slopes gently from southeast to the northwest.

1.3 Proposed Conditions / Design Storm Intensity:

The proposed Cedar Brook PUD project will be comprised of 66 single family attached & detached residential lots, public and private streets and public open space areas. All neighboring parcels have been developed and are mitigating their own storm water runoff. A water quality swale will be provided to treat on-site impervious flows from the development it has been determined that detention will not be necessary on-site, reference the Downstream Analysis portion of this report. Due to this, only water quality and conveyance design will be provided for on-site storm water design.

2.0 On-Site Hydraulic Methodology:

The developed conditions were modeled using Hydrocad for Clean Water Services intensities and guidelines, the proposed run-off rates are shown in the table below:

SBUH Type 1A 24 Hour Storm – Table 1.0			
Storm Event	Depth	Pre-Developed Flow	Post Developed Flow
2-year	2.50”	0.53 cfs	2.69 cfs
10-year	3.45”	1.23 cfs	3.89 cfs
25-year	3.90”	1.61 cfs	4.46 cfs
50-year	4.20”	1.87 cfs	4.85 cfs
100-year	4.50”	2.15 cfs	5.24 cfs

Exhibit B is the Soils Survey Information for the project which includes the Hydrologic Soils Classification for the site as found in The USDA Soil Conservation Services "Soil Survey of Washington County". The majority of the soils on-site are classified as Quatama Silt Loam, Hydrologic Soils Group "C". Approximately 10.5% of the site is classified as Hillsboro Loam Hydrologic Soils Group "B". The composite curve number has been accounted for accordingly.

Exhibit B is the SCS Runoff Curve Numbers as found in the Soil Conservation Services Manual "Urban Hydrology for Small Watersheds" (TR-55 Method). A composite SGS Curve Number of 74 was assumed for all post developed on-site pervious surfaces based on the assumption of grass in good condition. An SCS Curve Number of 98 was assumed for all impervious surfaces.

Exhibit C is the pre-developed and post-developed basin maps, impervious area summary and bio-swale calculation.

Exhibit D is the Santa Barbara Urban Hydrograph SCS-Type 1A Method was used to compute the tributary basins peak flows for the 2, 10 and 25-Year, 24-Hour, design storm event. Precipitation for the storm events was taken from Clean Water Services standards.

2.1 Conveyance System Design & Analysis

Storm drainage runoff from proposed development will be collected in catch basin inlet structures and storm drain laterals where it will enter the storm pipe conveyance system.

Pipe conveyance for the project will be analyzed and designed to convey the peak 25- Year, 24-Hour storm event as part of the final construction drawing submittal.

Methodology: The site conveyance calculations will be performed using the SBUH - SCS Type 1-A unit hydrograph method.

Times of Concentration: Initial times of concentration for on-site basins will be assumed to be 9.1 minutes due to the large impervious area and small basin sizes. Incremental travel times were extended through the individual pipe system. See conveyance calculations for details.

2.2 Upstream Analysis & Downstream Basin Analysis

The Cedar Creek basin up-stream of the project release point has low-density, residential homes and forested areas. The total up-stream basin area is approximately 5,000 acres with an average slope of 10 percent.

The downstream system was analyzed per CWS code. See below for a determination of the limits of the downstream analysis. CWS code (R&O 07-20, section 2.04.2.m.3) describes the required limits of a downstream analysis.

CWS Code States:
Where the additional flow from the proposed development drops to less than 10 percent of the total tributary drainage flow, then the analysis will continue for the lesser of:
i. One-quarter (1/4) of a mile; or
ii. Until the additional flow constitutes less than 5 percent of the total tributary drainage flow.

Flood flows for Cedar Creek were reported in the FEMA Flood Insurance Study for the city of Sherwood, Washington County, July 1981 and in CWS watershed data catalog, Table 2 illustrates the existing flows versus the flows released from the Cedar Brook PUD site.

Project Flows Versus Cedar Creek Flows – Table 2.0				
Storm Event	Cedar Creek Flow (FEMA) @ HWY 99	Cedar Creek Flow (CWS) Sec. 7504584	Cedar Brook PUD Flow	Additional Run-off % VS CWS
10-year	1050 cfs	753 cfs	3.89	0.52%
100-year	1450 cfs	897 cfs	5.24	0.58%

This table illustrates that at our project boundary, the additional flow becomes less than 5% of the tributary drainage, and thus the downstream analysis is terminated at the point of discharge into the wetland prior to Cedar Creek.

A downstream inspection for one quarter mile was completed in July 2012. No barriers or limitations were found. In addition, a detailed search was performed through available maps and no further downstream barriers were noted within one quarter mile.

In conclusion, with the above mentioned references and calculations this development will not adversely affect downstream conditions, and has met the requirements of CWS code (R&O 07-20, section 2.04.2.m.3).

3.0 Conclusion:

1. The conveyance system for the proposed development has been sized to convey the peak 25-Year, 24-Hour storm as per Clean Water Services and City of Sherwood storm water standards.
2. Water Quality has been provided as per Clean Water Services and City of Sherwood standards.
3. Detention on-site is not required.
4. The increase in storm water runoff from the site will not impact the downstream adjacent neighboring properties.

4.0 References:

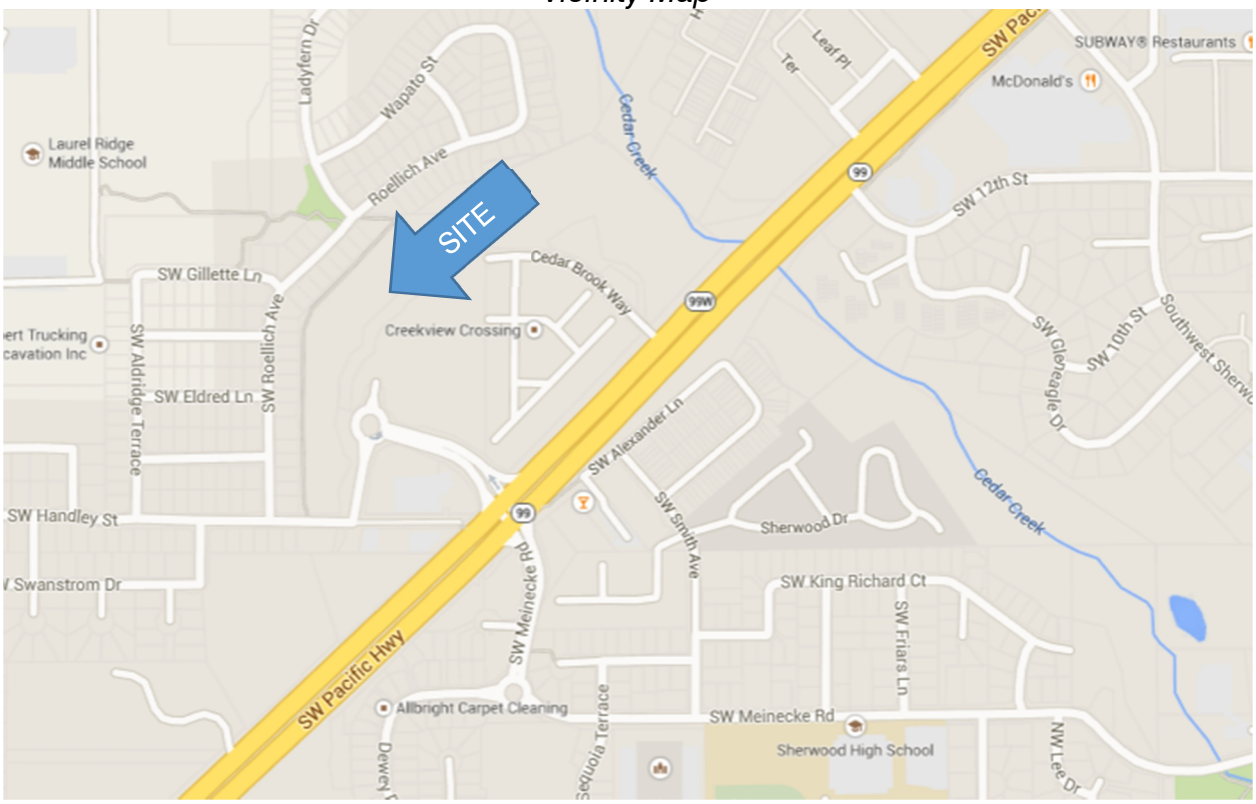
Clean Water Services (CWS), *Design and Construction Standards* (R&O 07-20)

OTAK, *Creekview Condominiums Final Drainage Report*, Sherwood Oregon, Dec. 2006

FEMA, *Flood Insurance Study for City of Sherwood*, July1981

Appendix A
Vicinity Map, Existing Conditions Plan

Vicinity Map



EXISTING CONDITIONS MAP

OF PARCEL 1 OF
PARTITION PLAT NO. 2007-029
SITUATED IN THE SOUTHWEST 1/4
OF SECTION 30, T.2S., R.1W., W.M.
CITY OF SHERWOOD, WASHINGTON
COUNTY, OREGON
P:\150-005\SURV\1150-005.dwg

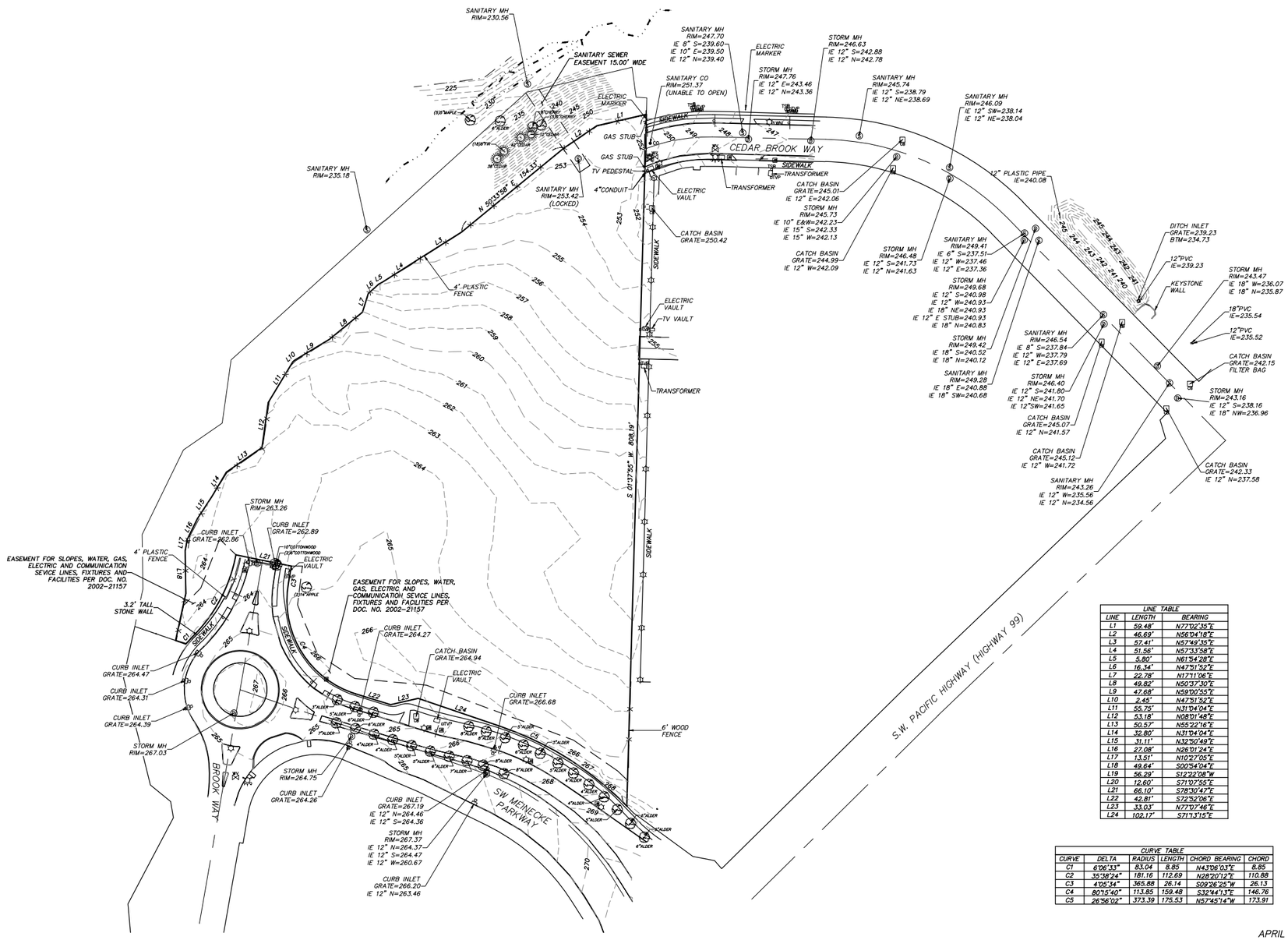
SURVEY NOTES:

THE DATUM FOR THIS SURVEY IS BASED UPON WASHINGTON COUNTY BENCHMARK NO. 100
A BRASS DISCK SET IN CONCRETE FILLED WITH IRON NORTH SIDE OF S.W. EDY ROAD, ON EXTENDED CENTERLINE OF S.W. EASTVIEW RD.
ELEVATION= 352.377', WASHINGTON COUNTY DATUM.

A TRIMBLE 5600 SERIES ROBOTIC INSTRUMENT WAS USED TO COMPLETE THIS SURVEY.

BOUNDARIES WERE DRAWN PER PLAT AND MONUMENTS FOUND. THIS IS NOT A BOUNDARY SURVEY. NO PROPERTY CORNERS WERE SET IN THIS SURVEY.

NO WARRANTIES ARE MADE AS TO MATTERS OF UNWRITTEN TITLE, SUCH AS ADVERSE POSSESSION, ESTOPPEL, ACQUIESCENCE, ETC.



LEGEND

- INDICATES STORM MANHOLE
- INDICATES CLEANOUT
- INDICATES CATCH BASIN
- INDICATES SANITARY SEWER MANHOLE
- INDICATES WATER VALVE
- INDICATES WATER METER
- INDICATES FIRE HYDRANT
- INDICATES SIGN
- INDICATES CURB INLET
- INDICATES JUNCTION BOX
- INDICATES TRAFFIC SIGNAL BOX
- INDICATES TELEVISION PEDESTAL
- INDICATES DECIDUOUS TREE
- INDICATES EVERGREEN TREE
- INDICATES 5 FOOT INTERVAL CONTOUR
- INDICATES 1 FOOT INTERVAL CONTOUR
- INDICATES FENCELINE
- INDICATES EDGE OF WATER
- INDICATES WETLANDS TIED AT FLAGS

LINE TABLE

LINE	LENGTH	BEARING
L1	59.48'	N77°02'35"E
L2	46.69'	N56°04'18"E
L3	57.41'	N57°49'35"E
L4	51.56'	N57°33'58"E
L5	5.80'	N61°54'28"E
L6	16.34'	N47°51'52"E
L7	22.78'	N17°11'06"E
L8	49.82'	N50°37'30"E
L9	47.68'	N59°00'55"E
L10	2.45'	N47°51'52"E
L11	55.75'	N31°04'04"E
L12	53.18'	N08°01'48"E
L13	50.57'	N55°22'16"E
L14	32.80'	N31°04'04"E
L15	31.11'	N32°50'49"E
L16	27.08'	N26°01'24"E
L17	13.51'	N10°27'05"E
L18	49.64'	S00°54'04"E
L19	56.29'	S12°22'08"W
L20	12.60'	S71°07'55"E
L21	66.10'	S78°30'47"E
L22	42.81'	S72°52'06"E
L23	33.03'	N77°07'46"E
L24	102.17'	S71°13'15"E

CURVE TABLE

CURVE	DELTA	RADIUS	LENGTH	CHORD BEARING	CHORD
C1	6°26'53"	83.04	8.65	N43°06'03"E	8.85
C2	35°38'24"	181.16	112.69	N28°20'12"E	110.88
C3	4°05'34"	365.88	26.14	S09°26'25"W	26.13
C4	80°15'40"	113.85	159.48	S32°44'13"E	146.76
C5	26°56'02"	373.39	175.53	N57°45'14"W	173.91

60' 0 30' 60' 120'
SCALE: 1" = 60'

EMERIO Design
8285 SW NIMBUS AVENUE, SUITE 180
BEAVERTON, OREGON 97008
PH: (503) 746-8812
FAX: (503) 639-9592

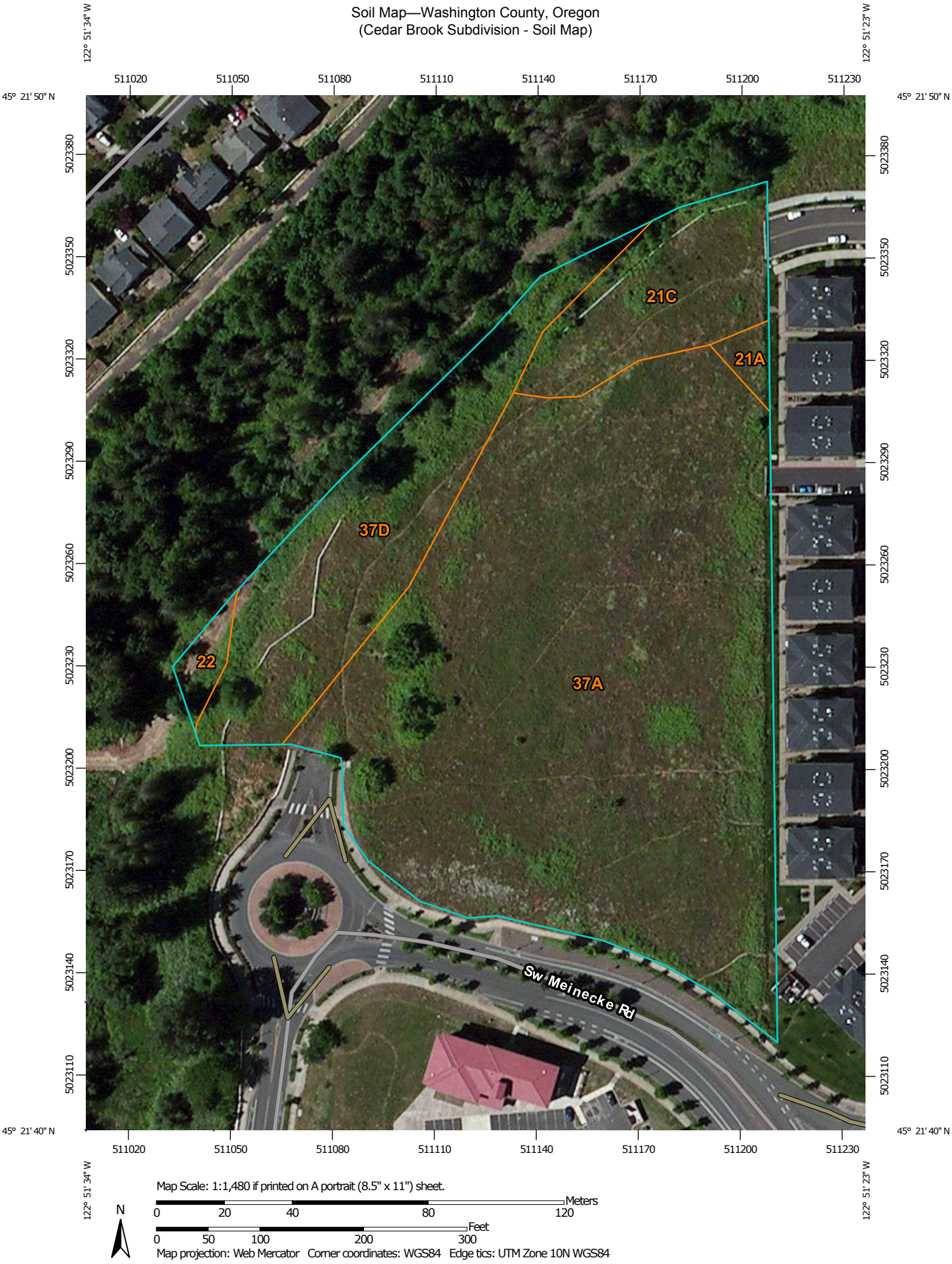
APRIL 14, 2014

JOB: 150-005

Appendix B

Soil Maps & Classifications, Runoff Curve Numbers, Time of Concentration Calculation

Soil Map—Washington County, Oregon
(Cedar Brook Subdivision - Soil Map)



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: http://websoilsurvey.nrcs.usda.gov
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: Washington County, Oregon
Survey Area Data: Version 11, Dec 4, 2013

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

Date(s) aerial images were photographed: Jul 8, 2010—Sep 4, 2011

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

Washington County, Oregon (OR067)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
21A	Hillsboro loam, 0 to 3 percent slopes	0.1	0.9%
21C	Hillsboro loam, 7 to 12 percent slopes	0.6	9.6%
22	Huberly silt loam	0.1	1.2%
37A	Quatama loam, 0 to 3 percent slopes	4.6	70.7%
37D	Quatama loam, 12 to 20 percent slopes	1.1	17.6%
Totals for Area of Interest		**6.5**	**100.0%**

SOIL FEATURES FOR WASHINGTON COUNTY

Soil name and map symbol	Group	Flooding		
		Frequency	Duration	Months
Aloha:				
1	C	None	None	None
Amity:				
2	C	None	None	None
Astoria:				
3E, 3F	B	None	None	None
Briedwell:				
4B, 5B, 5C, 5D	B	None	None	None
Carlton:				
6B, 6C	B	None	None	None
Cascade:				
7B, 7C, 7D, 7E, 7F	C	None	None	None
Chehalem:				
8C	C	None	None	None
Chehalis:				
9, 10	B	Common	Brief	Nov-Mar
Cornelius:				
11B, 11C, 11D, 11E, 11F:				
Cornelius part	C	None	None	None
Kinton part	C	None	None	None
Cornelius Varient:				
12A, 12B, 12C	C	None	None	None
Cove:				
13, 14	D	Common	Brief	Dec-Apr
Dayton:				
15	D	None	None	None
Delena:				
16C	D	None	None	None
Goble:				
17B, 17C, 17D, 17E, 18E, 18F	C	None	None	None
Helvetia:				
19B, 19C, 19D, 19E	C	None	None	None
Hembre:				
20E, 20F, 20G	B	None	None	None
Hillsboro:				
21A, 21B, 21C, 21D	B	None	None	None
Hubberly:				
22	D	None	None	None
Jory:				
23B, 23C, 23D, 23E, 23F	C	None	None	None
Kilchis:				
24G				
Kilchis part	C	None	None	None
Klickitat part	B	None	None	None

SOIL FEATURES FOR WASHINGTON COUNTY

Soil name and map symbol	Group	Flooding		
		Frequency	Duration	Months
Klickitat:				
25E, 25F, 25G	B	None	None	None
Knappa:				
26	B	None	None	None
Lablish:				
27	D	Frequent	Very Long	Dec-Apr
Laurelwood:				
28B, 28C, 28D, 28E, 29E, 29F	B	None	None	None
McBee:				
30	B	Frequent	Brief	Nov-May
Melborne:				
31B, 31C, 31D, 31E, 31F	B	None	None	None
Melby:				
32C, 32D, 32E, 33E, 33F, 33G	C	None	None	None
Olyic:				
34C, 34D, 34E, 35E, 35F, 35G	B	None	None	None
Pervina:				
36C, 36D, 36E, 36F	C	None	None	None
Quatama:				
37A, 37B, 37C, 37D	C	None	None	None
Saum:				
38B, 38C, 38D, 38E, 38F	C	None	None	None
Tolke:				
39E, 39F	B	None	None	None
Udifluvents:				
40	B	Frequent	Very Long	Nov-Apr
Verboot:				
42	D	Frequent	Brief	Dec-Apr
Wapato:				
43	D	Frequent	Brief	Dec-Apr
Willamette:				
44A, 44B, 44C, 44D	B	None	None	None
Woodburn:				
45A, 45B, 45C, 45D	C	None	None	None
Xerchrepts:				
46F				
Xerochrepts part	B	None	None	None
Haploxerolls part	C	None	None	None
47D				
Xerochrepts part	D	None	None	None
Rock outcrop part				

TR55 - CURVE NUMBERS

Table 2-2a: Runoff curve numbers for urban areas [1]

Cover description		CN for hydrologic soil				
Cover type and hydrologic condition	Average % impervious area[2]	A	B	C	D	
Fully developed urban areas (vegetation established)						
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:						
Poor condition (grass cover <50%)		68	79	86	89	
Fair condition (grass cover 50% to 75%)		49	69	79	84	Pre
Good condition (grass cover >75%)		39	61	74	80	Post
Impervious areas:						
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98	Imp.
Streets and roads:						
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98	
Paved; open ditches (including right-of-way)		83	89	92	93	
Gravel (including right-of-way)		76	85	89	91	
Dirt (including right-of-way)		72	82	87	89	
Western desert urban areas:						
Natural desert landscaping (pervious areas only) [4]		63	77	85	88	
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96	
Urban districts:						
Commercial and business	85	89	92	94	95	
Industrial	72	81	88	91	93	
Residential districts by average lot size:						
1/8 acre or less (town houses)	65	77	85	90	92	
1/4 acre	38	61	75	83	87	
1/3 acre	30	57	72	81	86	
1/2 acre	25	54	70	80	85	
1 acre	20	51	68	79	84	
2 acres	12	46	65	77	82	
Developing urban areas						
Newly graded areas (pervious areas only, no vegetation) [5]	77	86	91	94		
Idle lands (CNs are determined using cover types similar to those in table 2-2c)						

1: Average runoff condition, and $I_a = 0.2S$.
2: The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas hava a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of
3: CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open
4: Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to
5: Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

MANNING'S "n" VALUES

SHEET FLOW EQUATION MANNING'S VALUES	n_s
Smooth Surfaces (concrete, asphault, gravel, or bare hand packed soil)	0.011
Fallow Fields or loose soil surface (no residue)	0.05
Cultivated soil with residue cover ($\leq$ 20%)	0.06
Cultivated soil with residue cover (> 20%)	0.17
Short prairie grass and lawns	0.15
Dense grasses	0.24
Bermuda grasses	0.41
Range (natural)	0.13
Woods or forrest with light underbrush	0.40
Woods or forrest with dense underbrush	0.80

SHALLOW CONCENTRATED FLOW (after initial 300 ft of sheet flow, R = 0.1)	k_s
Forrest with heavy ground litter and meadows (n = 0.010)	3
Brushy ground with some trees (n = 0.060)	5
Fallow or minimum tillage cultivation (n = 0.040)	8
High grass (n = 0.035)	9
Short grass, pasture and lawns (n = 0.030)	11
Nearly bare ground (n = 0.25)	13
Paved and gravel areas (n = 0.012)	27

CHANNEL FLOW (Intermittent) (At the beginning of all visible channels, R = 0.2)	k_c
Forested swale with heavy ground cover (n = 0.10)	5
Forested drainage course/ravine with defined channel bed (n = 0.050)	10
Rock-lined waterway (n = 0.035)	15
Grassed waterway (n = 0.030)	17
Earth-lined waterway (n = 0.025)	20
CMP pipe (n = 0.024)	21
Concrete pipe (n = 0.012)	42
Other waterways and pipe 0.508/n	

CHANNEL FLOW (continuous stream, R = 0.4)	k_c
Meandering stream (n = 0.040)	20
Rock-lined stream (n = 0.035)	23
Grass-lined stream (n = 0.030)	27
Other streams, man-made channels and pipe (n = 0.807/n)	

TIME OF CONCENTRATION SUMMARY

Pre-Developed Time of Concentration

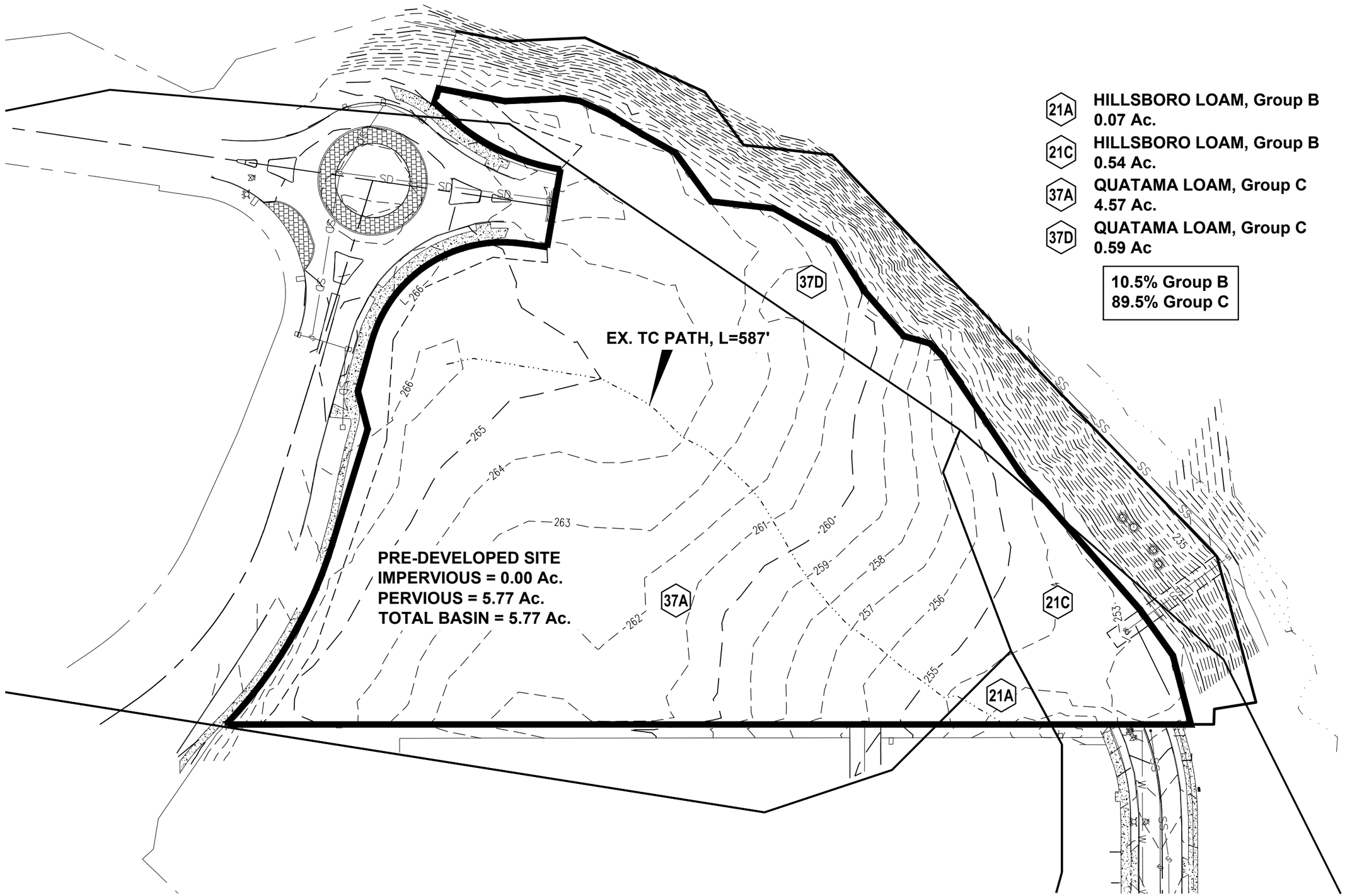
Lag One: Sheet Flow (First 300 ft)		Accum. Tc
Tt = Travel time		
Manning's "n " =	0.130	
Flow Length (300 ft. max.), L =	300 ft	
P = 2-year, 24hr storm =	2.5 in	
Slope, S_0 =	0.016 ft/ft	
$T_T = \frac{(0.42)(n * L)^{0.8}}{(P)^{0.5}(S_0)^{0.4}}$		26.2 min
Lag Two: Shhallow Concentrated Flow (Next ft)		
Tc Velocity factor, k=	8	
Slope, S0 =	0.034 ft/ft	
$V = k\sqrt{s_0}$	1.5 ft/s	
Flow Length, L =	287 ft	
$T = \frac{L}{(60)(V)}$	3.2 min	29.4 min
	Total Predeveloped Tc =	29.4 min

Developed Time of Concentration

Catchment Time	5.0 min
Longest Run of Pipe	736 ft
Velocity of Flow	3.0 ft/s
Time in Pipe = (736 ft)/(3.00 ft/s) =	245 s
Total Developed Tc =	9.1 min

Appendix C

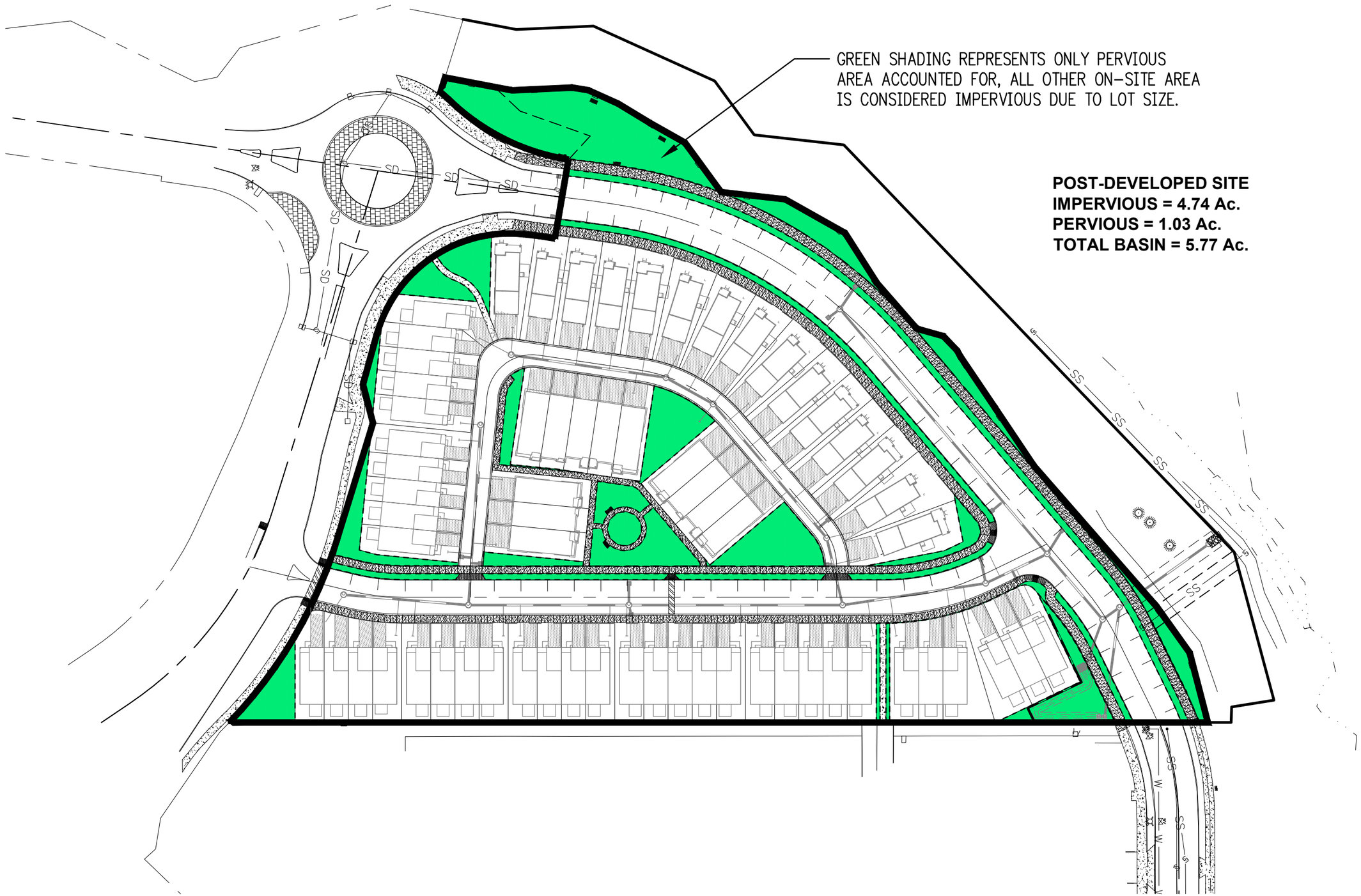
Pre & Post Developed Basin Maps, Impervious Area Summary, SBUH Hydrographs, Bio-Swale Calculation



PRE-DEVELOPED BASIN MAP

EMERIO Design
8285 SW NIMBUS AVE, SUITE 180
BEAVERTON, OREGON 97008
TEL: (503) 746-8812
FAX: (503) 639-9592
www.emeriodesign.com

PROJECT NO. 150-005
ORIG. DATE: 7/19/2014
DRAWN BY:
SHEET No.



EMERIO Design
8285 SW NIMBUS AVE, SUITE 180
BEAVERTON, OREGON 97008
TEL: (503) 746-8812
FAX: (503) 639-9592
www.emeriodesign.com

POST-DEVELOPED BASIN MAP

PROJECT NO. 150-005
ORIG. DATE: 7/19/2014
DRAWN BY:
SHEET No.

IMPERVIOUS AREA SUMMARY

Pre-Developed Areas

Imp-Areas	Gravel/Curbs/Pavement	0 sf	0.00 Ac.
Per-Areas	Bare Soil	251,331 sf	5.77 Ac.
	Total	251,331 sf	5.77 Ac.

Post-Developed Areas

Imp-Areas	Lot Area\Streets\Sidewalks	206,544 sf	4.74 Ac.
Per-Areas	Proposed Landscape	44,787 sf	1.03 Ac.
	Total	251,331 sf	5.76 Ac.

Existing Impervious Area	0 sf	0.00 Ac.
% Impervious		0.0%
Proposed Impervious Area	206,544 sf	4.74 Ac.
% Impervious		82.2%
Total Shed Area	251,331 sf	5.77 Ac.

WATER QUALITY SWALE CALCULATION

REFERENCES:
1. Clean Water Services R&O 07-20

REQUIRED WATER QUALITY TREATMENT: 65% Phosphorus Removal.

PROPOSED TREATMENT METHODS:

1. Sumped Catch Basins		15%
2. Bio-Filtration Swale		50%
	total	65%

DESIGN STORM:

Precipitation:	0.36	inches
Storm Duration:	4	hours
Storm Return Period:	96	hours
Storm Window:	2	weeks

IMPERVIOUS AREA:

Watershed Area:	5.77	acres
Percent imp:	82.18	%
Impervious Area:	4.74	acres

Design Inflow = (4.74 ac)*(43560 ft^2/ac)*(0.36 in / 4.0 hrs) = **0.43 cfs**

BIOFILTRATION SWALE DESIGN CRITERIA:

Max Velocity:	0.9	ft/s
Side Slopes:	4	:1 (treatment area)
Base:	2	feet (2' min)
n Factor:	0.24	(plantings)

SWALE CHARACTERISTICS:

Q=	0.43	Design Storm Discharge (determined abov
N=	0.24	Plantings
B=	3	ft Base width of channel
Z=	4	:1 Side slopes
SLOPE=	0.005	ft/ft Slope of channel (0.005 minimum)
ASS. Y=	0.5	ft Assumed depth to begin analysis (0.5 ft maximum)

ITERATIVE SOLUTION OF MANNING'S EQUATION FOR NORMAL DEPTH:

ITERATION	Y (FT)	P (FT)	A(FT^2)	R	Q (CFS)	% ERROR	V (FPS)
1	0.50	7.12	2.50	0.35	0.55	26.99	0.22
2	0.43	6.52	2.01	0.31	0.40	-6.61	0.20
3	0.45	6.68	2.14	0.32	0.44	1.91	0.21
4	0.44	6.63	2.10	0.32	0.43	-0.53	0.20
5	0.44	6.65	2.11	0.32	0.43	0.15	0.20
6	0.44	6.64	2.11	0.32	0.43	-0.04	0.20
7	0.44	6.64	2.11	0.32	0.43	0.01	0.20
8	0.44	6.64	2.11	0.32	0.43	0.00	0.20
9	0.44	6.64	2.11	0.32	0.43	0.00	0.20
10	0.44	6.64	2.11	0.32	0.43	0.00	0.20
11	0.44	6.64	2.11	0.32	0.43	0.00	0.20
12	0.44	6.64	2.11	0.32	0.43	0.00	0.20
13	0.44	6.64	2.11	0.32	0.43	0.00	0.20
14	0.44	6.64	2.11	0.32	0.43	0.00	0.20
15	0.44	6.64	2.11	0.32	0.43	0.00	0.20

NORMAL DEPTH =	0.44	ft	(Normal depth must be 0.5' or less)
FLOW WIDTH =	6.53	ft	
VELOCITY =	0.20	ft/s	
TREATMENT TIME =	9.00	min	
TREATMENT LENGTH =	**110.23**	**ft**	

STORMWATER CONVEYANCE CALCULATIONS
Onsite

Design Storm: 25 YR
Storm Duration: 24 HRS
Precipitation: 3.9 IN
Manning's "n" 0.013

LINE	INC. AREA (AC)	AREA TOTAL (AC)	% IMP.	AREA PERV. (AC)	CN PER.	AREA IMP. (AC)	CN IMP.	TIME (MIN)	Q (CFS)	PIPE SIZE (IN)	SLOPE (FT/FT)	Qf (CFS)	Q/Qf (%)	Vf (FPS)	V/Vf (%)	ACTUAL V (FPS)	LENGTH (FT)	INC. TIME (MIN)
Total Site																		
Min Slope for a 12" Pipe	0	5.77	82.18	1.03	74	4.74	98	9.09	4.72	12	0.0200	5.05	93.4%	6.4	1.134	7.30	20.00	0.05

Appendix D
Hydrocad Analysis for SBUH Hydrographs

Area Listing (all nodes)

Area (acres)	CN	Description (subcats)
0.108	61	>75% Grass cover, Good, HSG B (2S)
0.610	69	50-75% Grass cover, Fair, HSG B (1S,1S)
0.922	74	>75% Grass cover, Good, HSG C (2S)
5.160	79	50-75% Grass cover, Fair, HSG C (1S,1S)
4.740	98	Impervious Lot and Street Area (2S)
11.540		

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Site Runoff Area=5.770 ac Runoff Depth>0.63"
Flow Length=587' Tc=29.4 min CN=78/0 Runoff=0.53 cfs 0.303 af

Subcatchment 2S: Developed Site Runoff Area=5.770 ac Runoff Depth>1.59"
Flow Length=736' Slope=0.0044 '/' Tc=9.1 min CN=73/98 Runoff=2.69 cfs 0.766 af

Total Runoff Area = 11.540 ac Runoff Volume = 1.070 af Average Runoff Depth = 1.11"
58.93% Pervious Area = 6.800 ac 41.07% Impervious Area = 4.740 ac

Subcatchment 1S: Existing Site

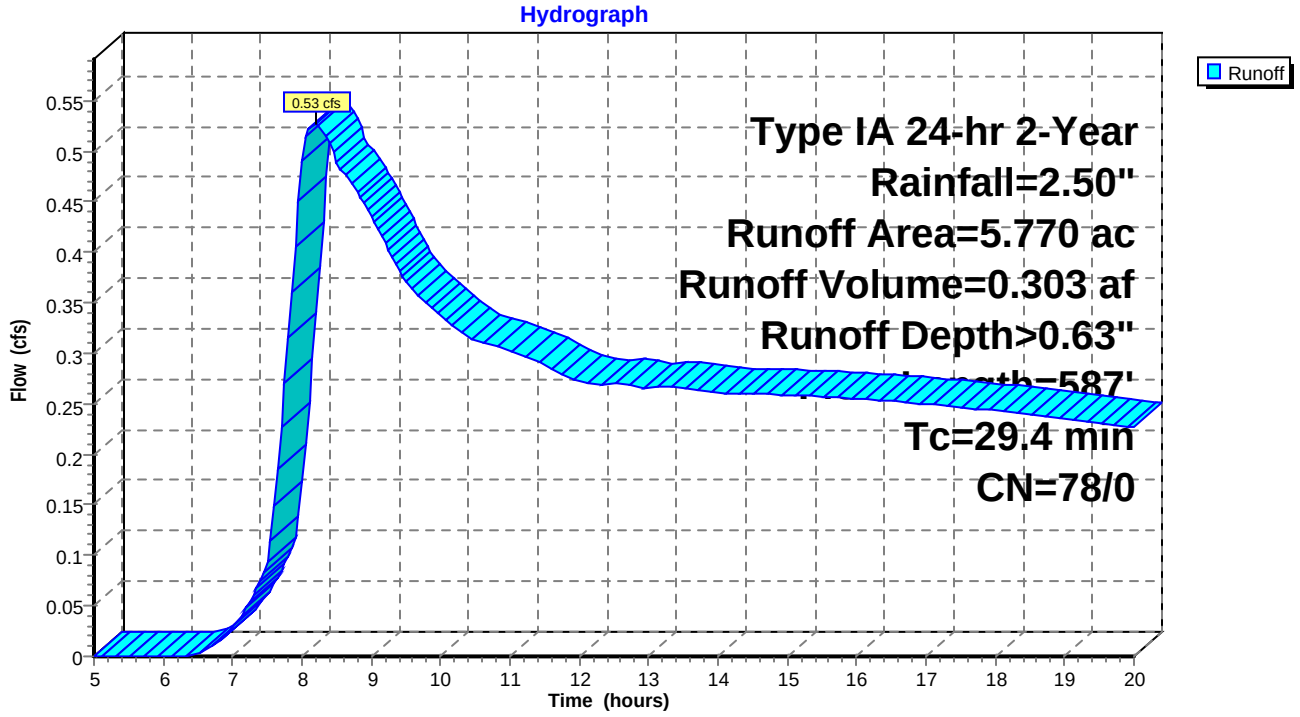
Runoff = 0.53 cfs @ 8.19 hrs, Volume= 0.303 af, Depth> 0.63"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-Year Rainfall=2.50"

Area (ac)	CN	Description
0.070	69	50-75% Grass cover, Fair, HSG B
0.540	69	50-75% Grass cover, Fair, HSG B
4.570	79	50-75% Grass cover, Fair, HSG C
0.590	79	50-75% Grass cover, Fair, HSG C
5.770	78	Weighted Average
5.770	78	Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.2	300	0.0157	0.19		**Sheet Flow, Sheet Flow (1st 300)** Range n= 0.130 P2= 2.50"
3.2	287	0.0339	1.47		**Shallow Concentrated Flow, Shallow Concentrated Flow** Kv= 8.0 fps
29.4	587	Total			

Subcatchment 1S: Existing Site



Subcatchment 2S: Developed Site

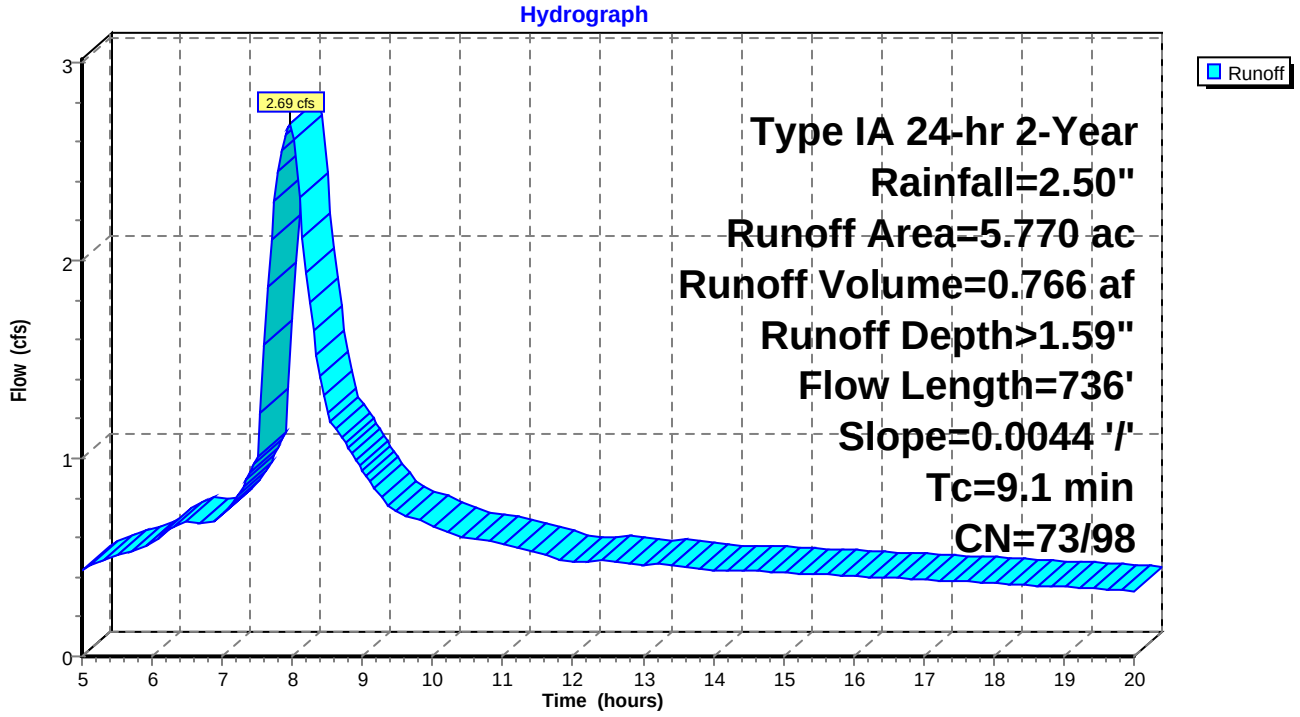
Runoff = 2.69 cfs @ 7.98 hrs, Volume= 0.766 af, Depth> 1.59"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 2-Year Rainfall=2.50"

Area (ac)	CN	Description
4.740	98	Impervious Lot and Street Area
0.108	61	>75% Grass cover, Good, HSG B
0.922	74	>75% Grass cover, Good, HSG C
5.770	93	Weighted Average
1.030	73	Pervious Area
4.740	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Catchment Time**
4.1	736	0.0044	3.01	2.36	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete sewer w/manholes & inlets
9.1	736	Total			

Subcatchment 2S: Developed Site



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Site Runoff Area=5.770 ac Runoff Depth>1.20"
Flow Length=587' Tc=29.4 min CN=78/0 Runoff=1.23 cfs 0.579 af

Subcatchment 2S: Developed Site Runoff Area=5.770 ac Runoff Depth>2.29"
Flow Length=736' Slope=0.0044 '/' Tc=9.1 min CN=73/98 Runoff=3.89 cfs 1.099 af

Total Runoff Area = 11.540 ac Runoff Volume = 1.678 af Average Runoff Depth = 1.75"
58.93% Pervious Area = 6.800 ac 41.07% Impervious Area = 4.740 ac

Subcatchment 1S: Existing Site

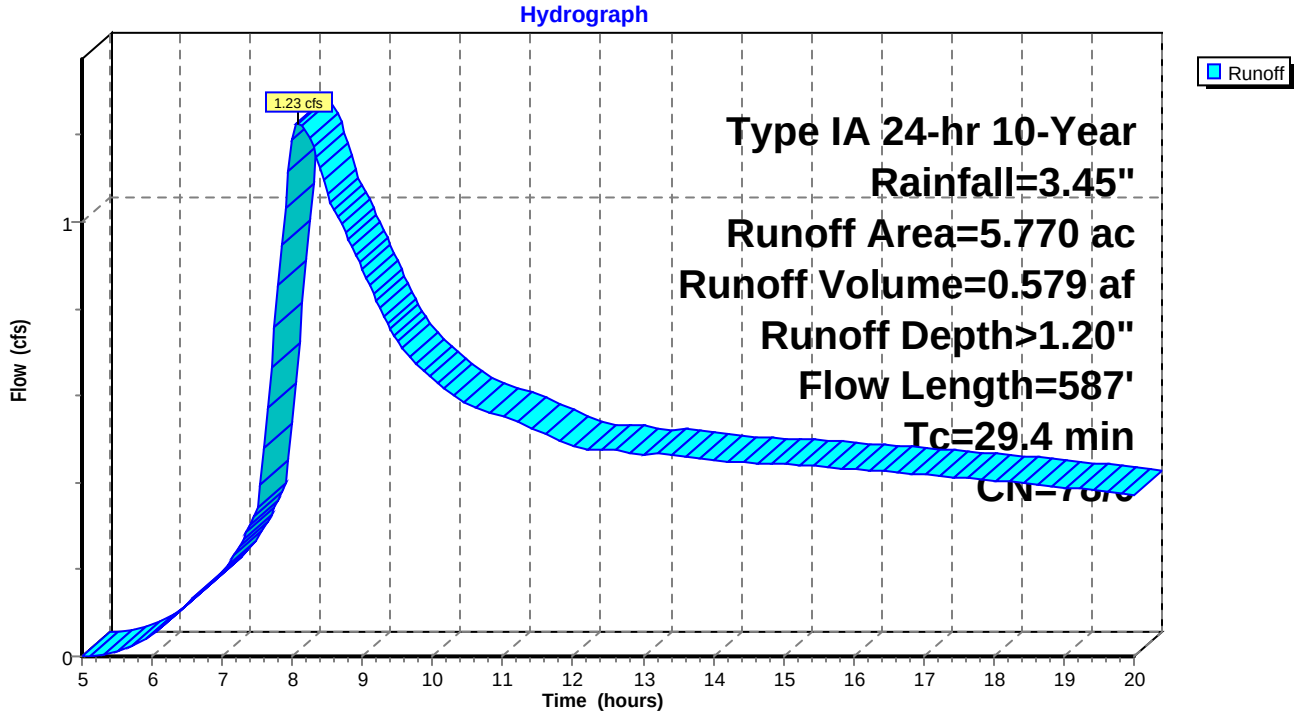
Runoff = 1.23 cfs @ 8.09 hrs, Volume= 0.579 af, Depth> 1.20"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-Year Rainfall=3.45"

Area (ac)	CN	Description
0.070	69	50-75% Grass cover, Fair, HSG B
0.540	69	50-75% Grass cover, Fair, HSG B
4.570	79	50-75% Grass cover, Fair, HSG C
0.590	79	50-75% Grass cover, Fair, HSG C
5.770	78	Weighted Average
5.770	78	Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.2	300	0.0157	0.19		**Sheet Flow, Sheet Flow (1st 300)** Range n= 0.130 P2= 2.50"
3.2	287	0.0339	1.47		**Shallow Concentrated Flow, Shallow Concentrated Flow** Kv= 8.0 fps
29.4	587	Total			

Subcatchment 1S: Existing Site



Subcatchment 2S: Developed Site

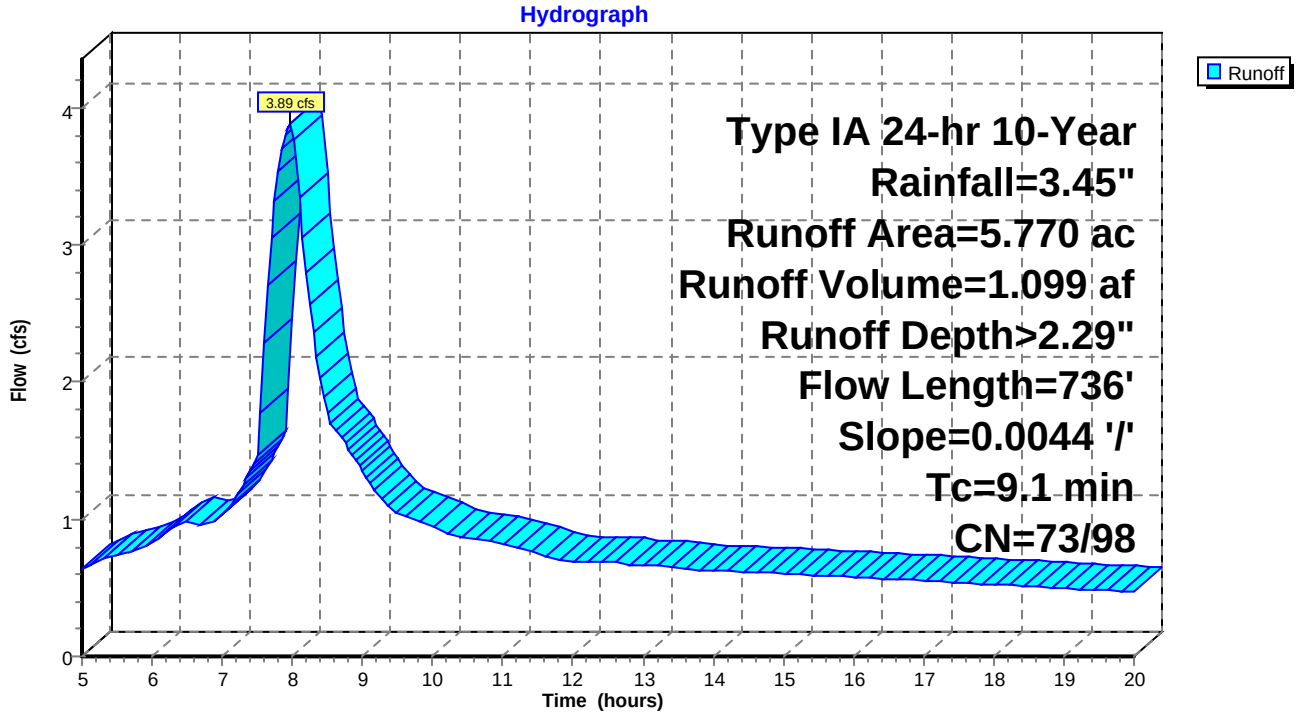
Runoff = 3.89 cfs @ 7.98 hrs, Volume= 1.099 af, Depth> 2.29"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-Year Rainfall=3.45"

Area (ac)	CN	Description
4.740	98	Impervious Lot and Street Area
0.108	61	>75% Grass cover, Good, HSG B
0.922	74	>75% Grass cover, Good, HSG C
5.770	93	Weighted Average
1.030	73	Pervious Area
4.740	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Catchment Time**
4.1	736	0.0044	3.01	2.36	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete sewer w/manholes & inlets
9.1	736	Total			

Subcatchment 2S: Developed Site



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Site Runoff Area=5.770 ac Runoff Depth>1.51"
Flow Length=587' Tc=29.4 min CN=78/0 Runoff=1.61 cfs 0.724 af

Subcatchment 2S: Developed Site Runoff Area=5.770 ac Runoff Depth>2.62"
Flow Length=736' Slope=0.0044 '/' Tc=9.1 min CN=73/98 Runoff=4.46 cfs 1.259 af

Total Runoff Area = 11.540 ac Runoff Volume = 1.983 af Average Runoff Depth = 2.06"
58.93% Pervious Area = 6.800 ac 41.07% Impervious Area = 4.740 ac

Subcatchment 1S: Existing Site

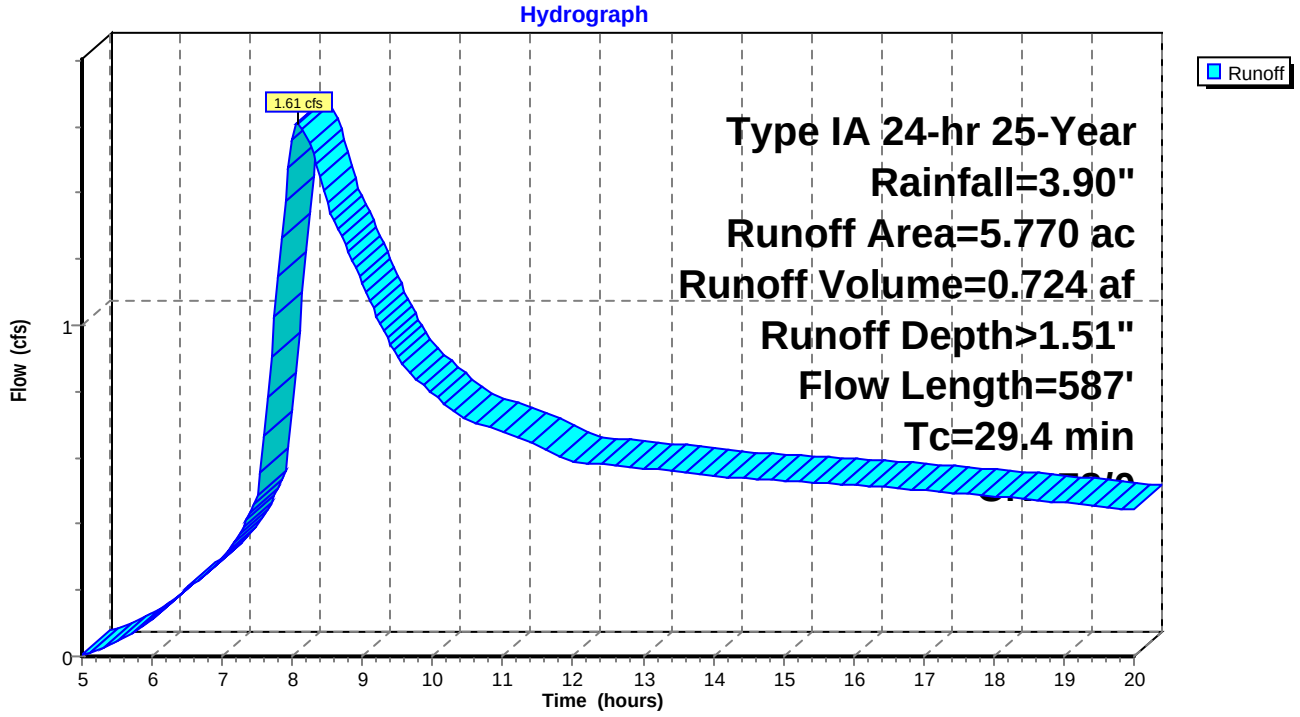
Runoff = 1.61 cfs @ 8.07 hrs, Volume= 0.724 af, Depth> 1.51"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-Year Rainfall=3.90"

Area (ac)	CN	Description
0.070	69	50-75% Grass cover, Fair, HSG B
0.540	69	50-75% Grass cover, Fair, HSG B
4.570	79	50-75% Grass cover, Fair, HSG C
0.590	79	50-75% Grass cover, Fair, HSG C
5.770	78	Weighted Average
5.770	78	Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.2	300	0.0157	0.19		**Sheet Flow, Sheet Flow (1st 300)** Range n= 0.130 P2= 2.50"
3.2	287	0.0339	1.47		**Shallow Concentrated Flow, Shallow Concentrated Flow** Kv= 8.0 fps
29.4	587	Total			

Subcatchment 1S: Existing Site



Subcatchment 2S: Developed Site

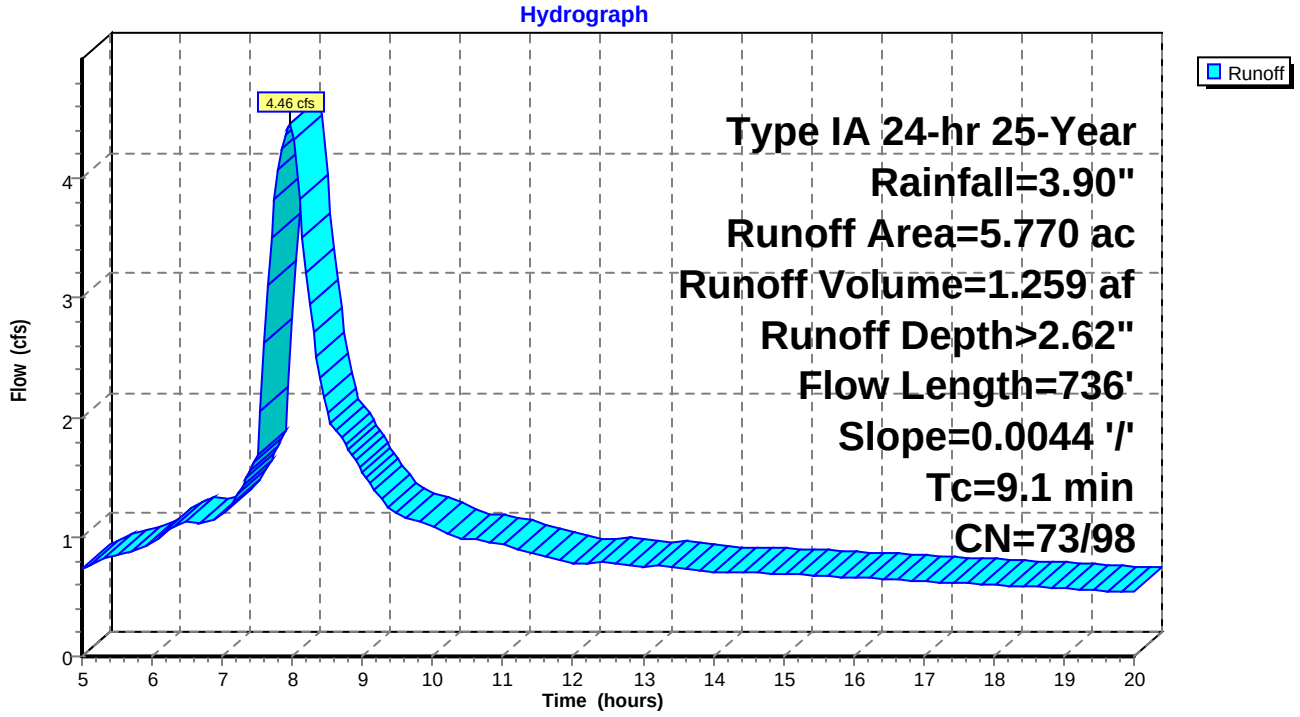
Runoff = 4.46 cfs @ 7.98 hrs, Volume= 1.259 af, Depth> 2.62"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-Year Rainfall=3.90"

Area (ac)	CN	Description
4.740	98	Impervious Lot and Street Area
0.108	61	>75% Grass cover, Good, HSG B
0.922	74	>75% Grass cover, Good, HSG C
5.770	93	Weighted Average
1.030	73	Pervious Area
4.740	98	Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Catchment Time**
4.1	736	0.0044	3.01	2.36	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete sewer w/manholes & inlets
9.1	736	Total			

Subcatchment 2S: Developed Site



Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SBUH method, Split Pervious/Imperv.
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Existing Site Runoff Area=5.770 ac Runoff Depth>1.93"
Flow Length=587' Tc=29.4 min CN=78/0 Runoff=2.15 cfs 0.926 af

Subcatchment 2S: Developed Site Runoff Area=5.770 ac Runoff Depth>3.07"
Flow Length=736' Slope=0.0044 '/' Tc=9.1 min CN=73/98 Runoff=5.24 cfs 1.474 af

Total Runoff Area = 11.540 ac Runoff Volume = 2.400 af Average Runoff Depth = 2.50"
58.93% Pervious Area = 6.800 ac 41.07% Impervious Area = 4.740 ac

Subcatchment 1S: Existing Site

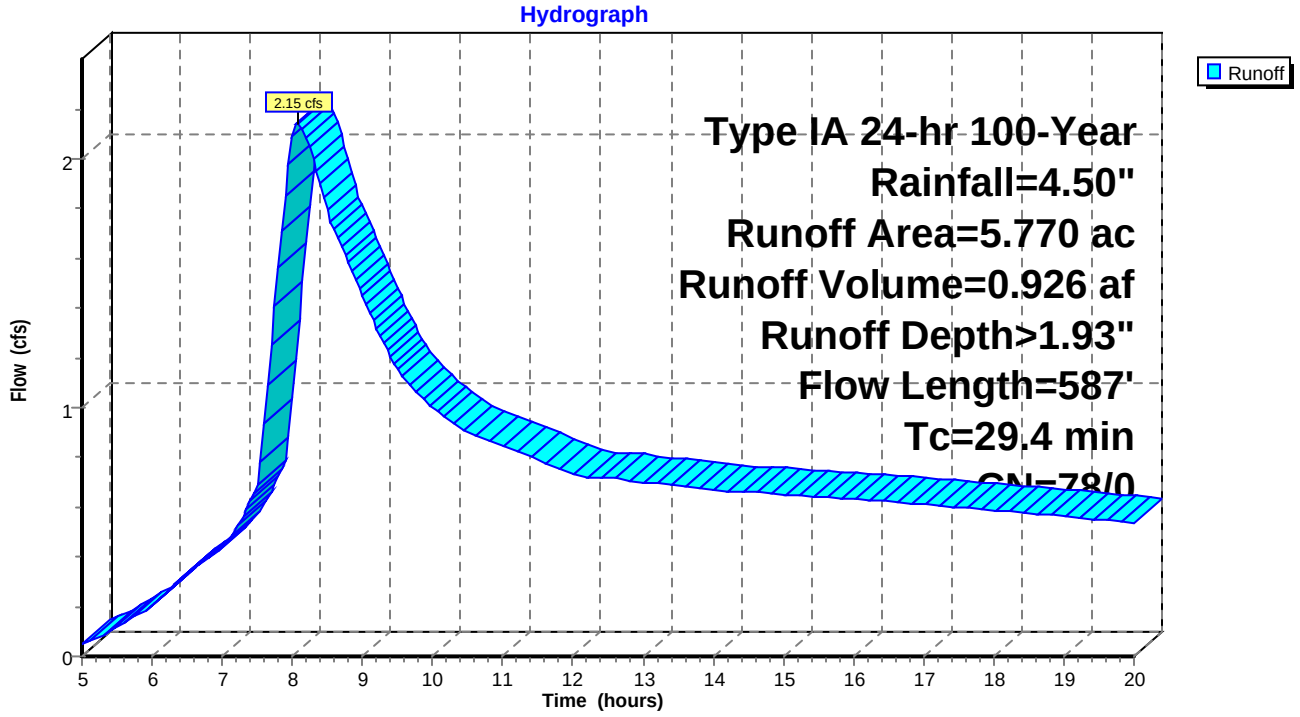
Runoff = 2.15 cfs @ 8.07 hrs, Volume= 0.926 af, Depth> 1.93"

Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-Year Rainfall=4.50"

Area (ac)	CN	Description
0.070	69	50-75% Grass cover, Fair, HSG B
0.540	69	50-75% Grass cover, Fair, HSG B
4.570	79	50-75% Grass cover, Fair, HSG C
0.590	79	50-75% Grass cover, Fair, HSG C
5.770	78	Weighted Average
5.770	78	Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
26.2	300	0.0157	0.19		**Sheet Flow, Sheet Flow (1st 300)** Range n= 0.130 P2= 2.50"
3.2	287	0.0339	1.47		**Shallow Concentrated Flow, Shallow Concentrated Flow** Kv= 8.0 fps
29.4	587	Total			

Subcatchment 1S: Existing Site



Subcatchment 2S: Developed Site

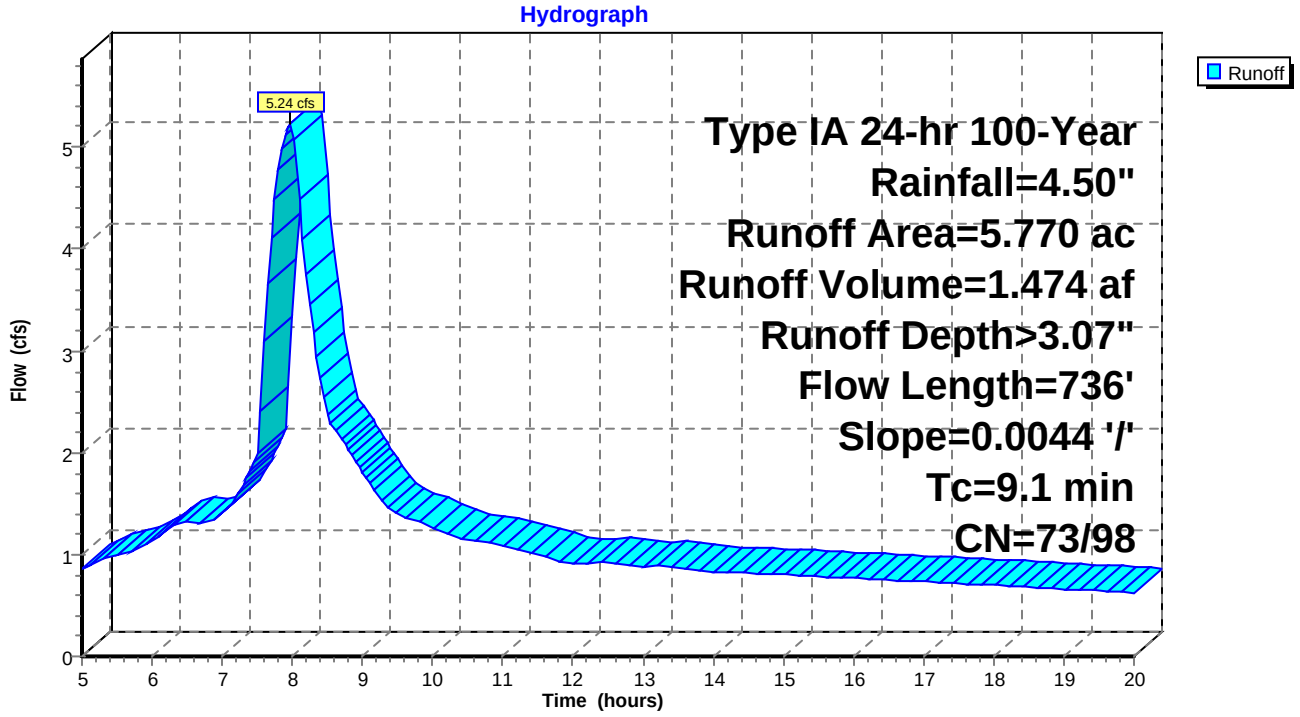
Runoff = 5.24 cfs @ 7.98 hrs, Volume= 1.474 af, Depth> 3.07"

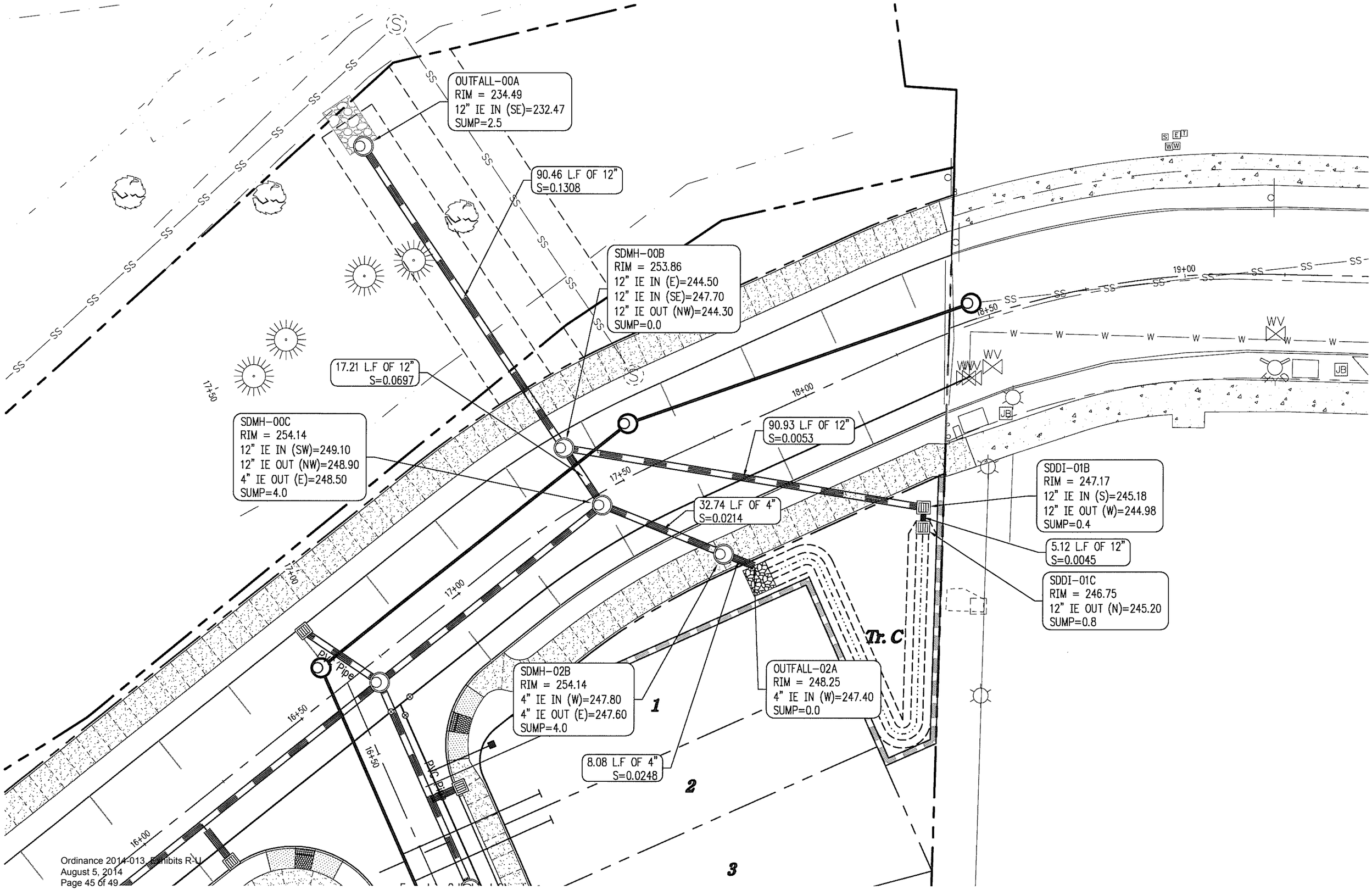
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-Year Rainfall=4.50"

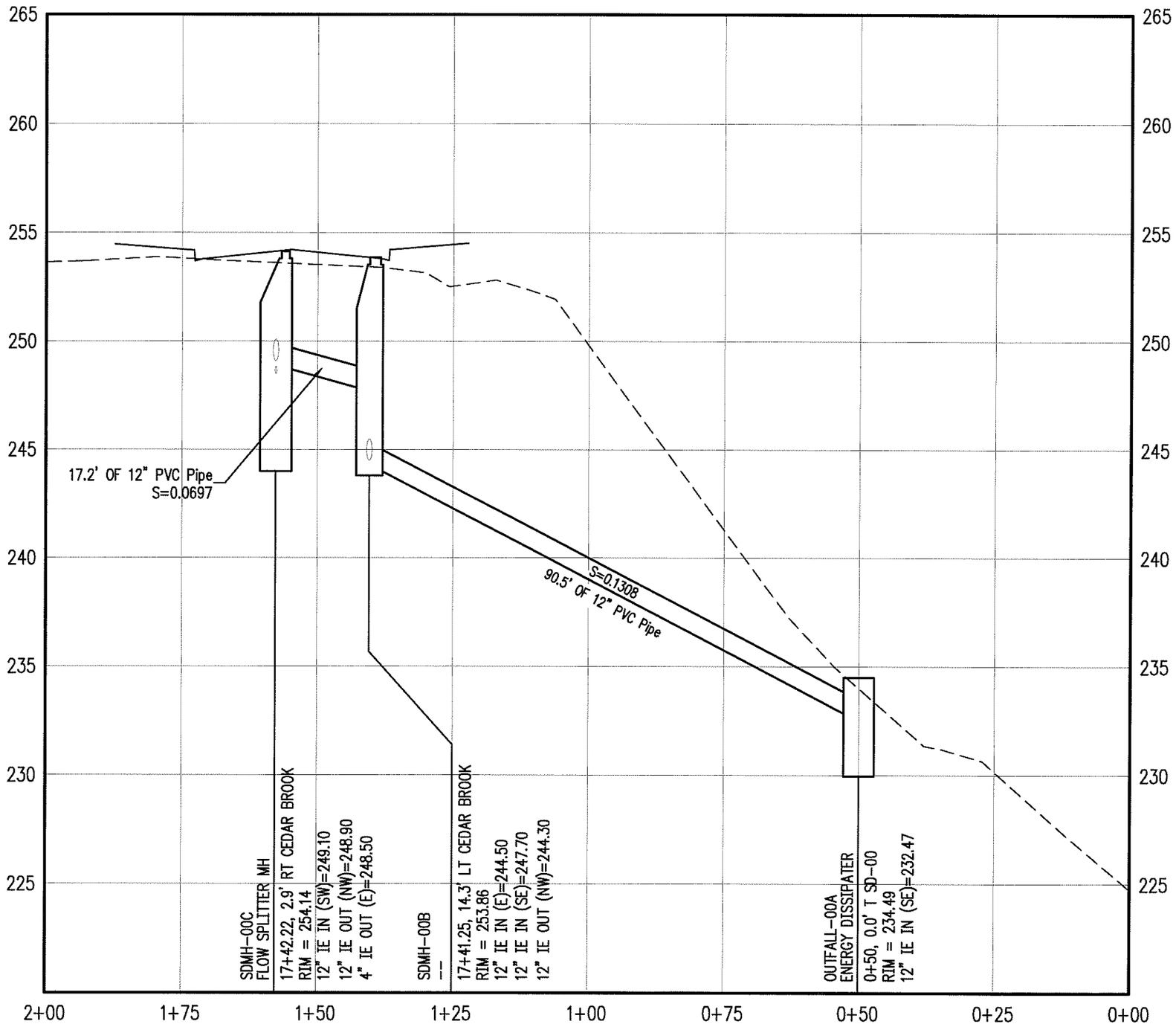
Area (ac)	CN	Description
4.740	98	Impervious Lot and Street Area
0.108	61	>75% Grass cover, Good, HSG B
0.922	74	>75% Grass cover, Good, HSG C
5.770	93	Weighted Average
1.030	73	Pervious Area
4.740	98	Impervious Area

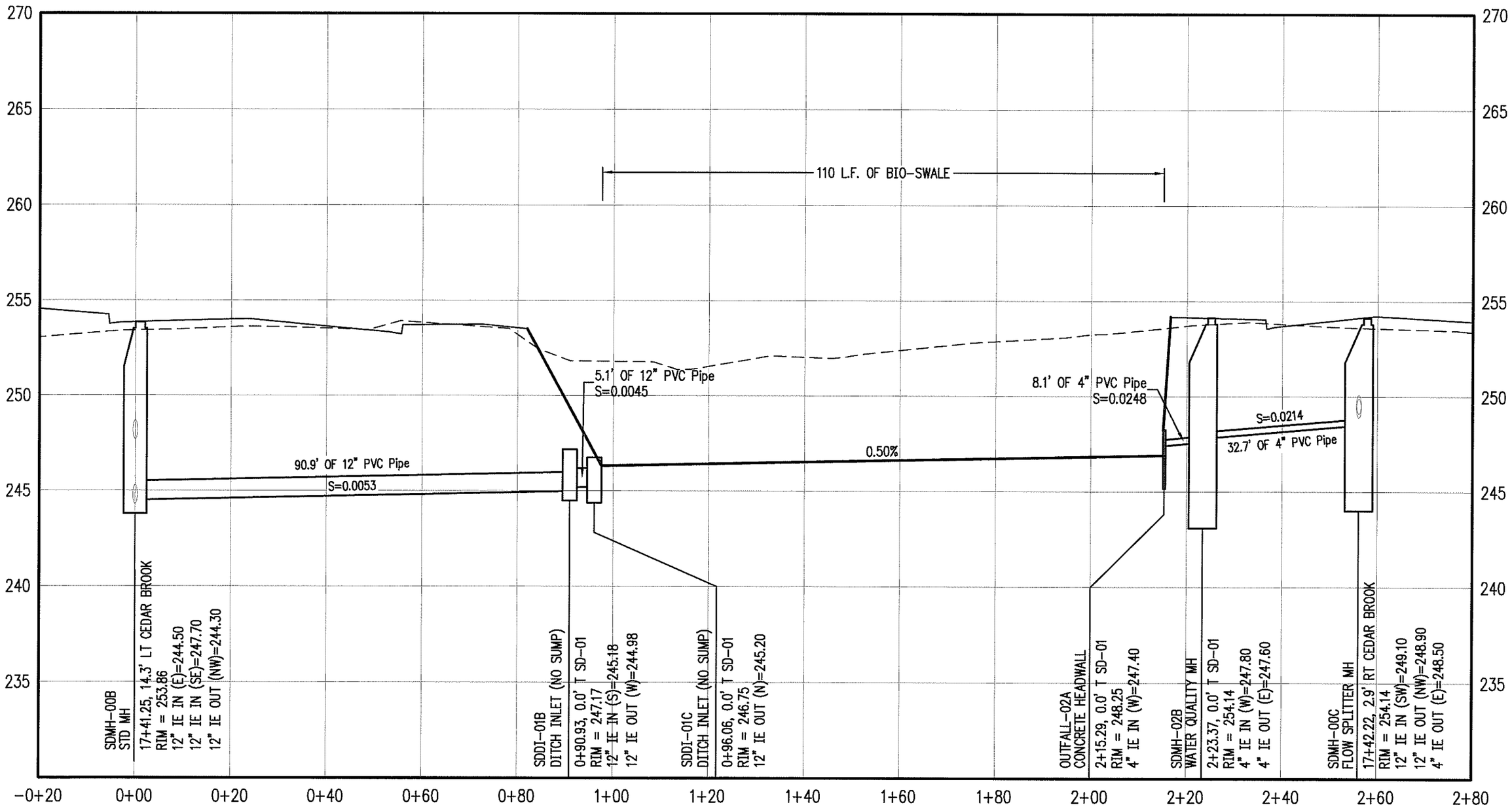
Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry, Catchment Time**
4.1	736	0.0044	3.01	2.36	**Circular Channel (pipe),** Diam= 12.0" Area= 0.8 sf Perim= 3.1' r= 0.25' n= 0.013 Concrete sewer w/manholes & inlets
9.1	736	Total			

Subcatchment 2S: Developed Site




OUTFALL-00A
RIM = 234.49
12" IE IN (SE)=232.47
SUMP=2.5
90.46 L.F OF 12"
S=0.1308
SDMH-00B
RIM = 253.86
12" IE IN (E)=244.50
12" IE IN (SE)=247.70
12" IE OUT (NW)=244.30
SUMP=0.0
17.21 L.F OF 12"
S=0.0697
SDMH-00C
RIM = 254.14
12" IE IN (SW)=249.10
12" IE OUT (NW)=248.90
4" IE OUT (E)=248.50
SUMP=4.0
90.93 L.F OF 12"
S=0.0053
32.74 L.F OF 4"
S=0.0214
SDDI-01B
RIM = 247.17
12" IE IN (S)=245.18
12" IE OUT (W)=244.98
SUMP=0.4
5.12 L.F OF 12"
S=0.0045
SDDI-01C
RIM = 246.75
12" IE OUT (N)=245.20
SUMP=0.8
Tr. C
SDMH-02B
RIM = 254.14
4" IE IN (W)=247.80
4" IE OUT (E)=247.60
SUMP=4.0
OUTFALL-02A
RIM = 248.25
4" IE IN (W)=247.40
SUMP=0.0
8.08 L.F OF 4"
S=0.0248
1
2
3
PVC Pipe
17+50
17+00
16+50
16+00
18+00
18+50
19+00
SS
W
WV
JB


265
260
255
250
245
240
235
230
225
17.2' OF 12" PVC Pipe
S=0.0697
S=0.1308
90.5' OF 12" PVC Pipe
SDMH-00C
FLOW SPLITTER MH
17+42.22, 2.9' RT CEDAR BROOK
RIM = 254.14
12" IE IN (SW)=249.10
12" IE OUT (NW)=248.90
4" IE OUT (E)=248.50
SDMH-00B
--
17+41.25, 14.3' LT CEDAR BROOK
RIM = 253.86
12" IE IN (E)=244.50
12" IE IN (SE)=247.70
12" IE OUT (NW)=244.30
OUTFALL-00A
ENERGY DISSIPATER
0+50, 0.0' T SD-00
RIM = 234.49
12" IE IN (SE)=232.47
2+00
1+75
1+50
1+25
1+00
0+75
0+50
0+25
0+00


270
265
260
255
250
245
240
235
110 L.F. OF BIO-SWALE
5.1' OF 12" PVC Pipe
S=0.0045
8.1' OF 4" PVC Pipe
S=0.0248
S=0.0214
32.7' OF 4" PVC Pipe
0.50%
90.9' OF 12" PVC Pipe
S=0.0053
SDMH-00B
STD MH
17+41.25, 14.3' LT CEDAR BROOK
RIM = 253.86
12" IE IN (E)=244.50
12" IE IN (SE)=247.70
12" IE OUT (NW)=244.30
SDDI-01B
DITCH INLET (NO SUMP)
0+90.93, 0.0' T SD-01
RIM = 247.17
12" IE IN (S)=245.18
12" IE OUT (W)=244.98
SDDI-01C
DITCH INLET (NO SUMP)
0+96.06, 0.0' T SD-01
RIM = 246.75
12" IE OUT (N)=245.20
OUTFALL-02A
CONCRETE HEADWALL
2+15.29, 0.0' T SD-01
RIM = 248.25
4" IE IN (W)=247.40
SDMH-02B
WATER QUALITY MH
2+23.37, 0.0' T SD-01
RIM = 254.14
4" IE IN (W)=247.80
4" IE OUT (E)=247.60
SDMH-00C
FLOW SPLITTER MH
17+42.22, 2.9' RT CEDAR BROOK
RIM = 254.14
12" IE IN (SW)=249.10
12" IE OUT (NW)=248.90
4" IE OUT (E)=248.50
-0+20
0+00
0+20
0+40
0+60
0+80
1+00
1+20
1+40
1+60
1+80
2+00
2+20
2+40
2+60
2+80

Engineering Department Land Use Application Review Comments

To: Brady Kilby, Planning Department Manager

From: Bob Galati PE, City Engineer

Project: Cedar Brook Planned Unit Development (PUD 14-01, SUB 14-01)

Date: July 25, 2014

Item: Revision of Proposed Storm Water Treatment Facility

BACKGROUND

The application for the Cedar Brook Planned Unit Development (PUD) included the proposal to utilize the existing storm water treatment facility constructed as part of Cedar Brook Condo project. The proposal information included hydrologic calculations and schematic plans for increasing the size of the existing facility and resizing of conveyance pipe systems as needed.

Just prior to the City Council meeting of July 15th, the applicant approached the City Engineer with preliminary information regarding a change of plan for providing storm water treatment. The information was provided verbally and with no supporting documentation. The information proposed utilizing Tract C, the small triangular portion of open space land, located at the north corner of the site adjacent to Cedar Brook Way.

The proposed change has merit in that the impact to the existing storm water system and public road infrastructure is eliminated. The issue is whether this change is acceptable to the City Council given the PC has not reviewed the proposal and has not been afforded the opportunity to provide comments or a recommendation.

PUD PROCESS IMPACTS

The impacts to the PUD process are viewed as follows:

1. The open space allocation as reviewed and recommended by the PC was 21 percent, with a 6 percent excess over minimum requirements. Reallocating Tract C into a storm water treatment facility will reduce the open space allocation to 19 percent, a reduction of 2 percent.
    a. This reallocation was not reviewed by the PC nor is it a part of the PC's recommendation.
    b. Reallocation of the open space may impact the density calculations for the PUD. This also was not a part of the PC's recommendation.

ENGINEERING REVIEW OF PROPOSED CHANGE

The applicant provided engineering calculations and schematic design drawings of the proposed changes to the storm water treatment system.

1. The engineering calculations are predicated on meeting CWS design standards for the water quality storm event (2-yr/24-hour). Detention is not a CWS requirement so calculations for detention are not included.
2. The calculations provide the physical dimensions for the water treatment system. These physical dimensions also meet CWS requirements for a storm water treatment swale.
3. The schematic drawing(s) provide assurance that the storm water treatment swale is constructible and will be able to fit within the property line limits of Tract C. Certain design elements of the stormwater system will need some minor revisions, but these elements do not affect the initial opinion of constructability and fit.

Exhibit U

CONDITIONS OF APPROVAL

Prior to Approval of the Public Improvement Plans

1. That full storm water treatment facility design calculations meeting CWS and City standards, complying with the requirements of the Service Provider Letter issued by CWS dated March 14, 2014, and stamped by an Oregon registered Civil Engineer, are provided and have received review and approval by the City Engineer.

Prior to Approval of the Final Plat

1. That Tract C be either dedicated to the City of Sherwood, or have a Public Storm Water Facility Easement be placed over the Tract in its entirety for the benefit of CWS and the City. That the plat of the subdivision shall indicate the dedication of Tract C to the City, or shall include language establishing a Public Storm Water Facility Easement over Tract C for the benefit of CWS and the City.

End of Engineering Land Use Review Comments