

MEMORANDUM

To: Chom Construction	From: Greg J. Zartman, P.E.
Date: February 11, 2025	Pages: 40
Job Number: 14-116 – Chom Construction – Martket Street	
Subject: Preliminary Stormwater Analysis	

Chom,

This memorandum presents a preliminary analysis for land use planning of the stormwater treatment requirements for the proposed subdivision at 4208 Market Street NE, Salem, Oregon.

The City of Salem Stormwater Standards (Stormwater Standards) were used to perform this preliminary analysis. The Stormwater Standards state that stormwater run-off shall be treated for flood control to limit post development stormwater runoff to the pre-development stormwater runoff condition for the ½ 2-year, 10-year, 25-year, and 100-year design storms. The Stormwater Standards go on to state that the proposed stormwater facility will provide water quality treatment with an approved City of Salem water quality facility. HydroCAD version 10.2 was used to perform this preliminary stormwater analysis using the Santa Barbra Urban Hydrograph method and rainfall depths listed in Appendix D of the Stormwater Standards.

The existing site consists of three residential lots that includes two existing single family residential homes. See Exhibit A-1 for details. For the purposes of modeling the pre-development condition, the entire site was assumed to consist of the ground cover Wood/grass combination (orchard or tree farm) from Table 4D-6 of the Stormwater Standards. A NRCS Soils Report was generated for the development which shows the soil type for all three lots is WuA – Woodburn Silt loam, 0 to 3 percent slopes, which is a Hydrologic Soil Group C soil. Current stormwater runoff from lots sheet flows as shown in Exhibit A-1. Time of concentration for pre-development modeling was based on a Manning's n value of 0.30 (Pre-developed: Mixed from Table 4D-4 of the Stormwater Standards). Based on these criteria the following pre-development flows were computed (See attached HydroCAD output):

- ½ 2-year pre-development: 0.00 cfs
- 10-year pre-development: 0.13 cfs
- 25-year pre-development: 0.17 cfs
- 100-year pre-development: 0.27 cfs

The proposed development is a 5-lot residential subdivision (See Exhibit A-2). The proposed stormwater treatment facility is a City of Salem standard shared infiltration planter placed in a utility easement. In December of 2024, an infiltration test was performed at the site (See attached Soil Infiltration Testing Report). From this testing, a design infiltration rate of 2.9 in/hr was determined. For the purposes of stormwater treatment modeling an infiltration rate of 2 in/hr was used for the planter due to limitations of flow through

growing medium. A near by well log was pulled from State of Oregon well database showing the static ground water level at 9' below the surface.

To treat stormwater runoff for water quality and flood control, a standard planter with 792 square feet of surface are required. A City of Salem standard 251D control structure will be used to limit flows out of the planter to meet water quality and pre-development flood control flows.

During the water quality design storm, 0.09 cfs of stormwater runoff enters the planter, resulting in 0.10' of ponding, 0.04 cfs of runoff being infiltrated, and 0.01 cfs leaving the control structure. During the required flood control design storms, the following flows leave the control structure, which are limited to the pre-development flows:

- ½ 2-year post-development: 0.01 cfs
- 10-year post-development: 0.13 cfs
- 25-year post-development: 0.15 cfs
- 100-year post-development: 0.25 cfs

Please call or email me with any questions. Thank you.

Respectfully submitted,
LEI ENGINEERING & SURVEYING OF OREGON, LLC



Gregory J. Zartman, P.E.
Principal Engineer



EXPIRES: 6/30/26

EXHIBIT A-1
PRE-DEVELOPMENT

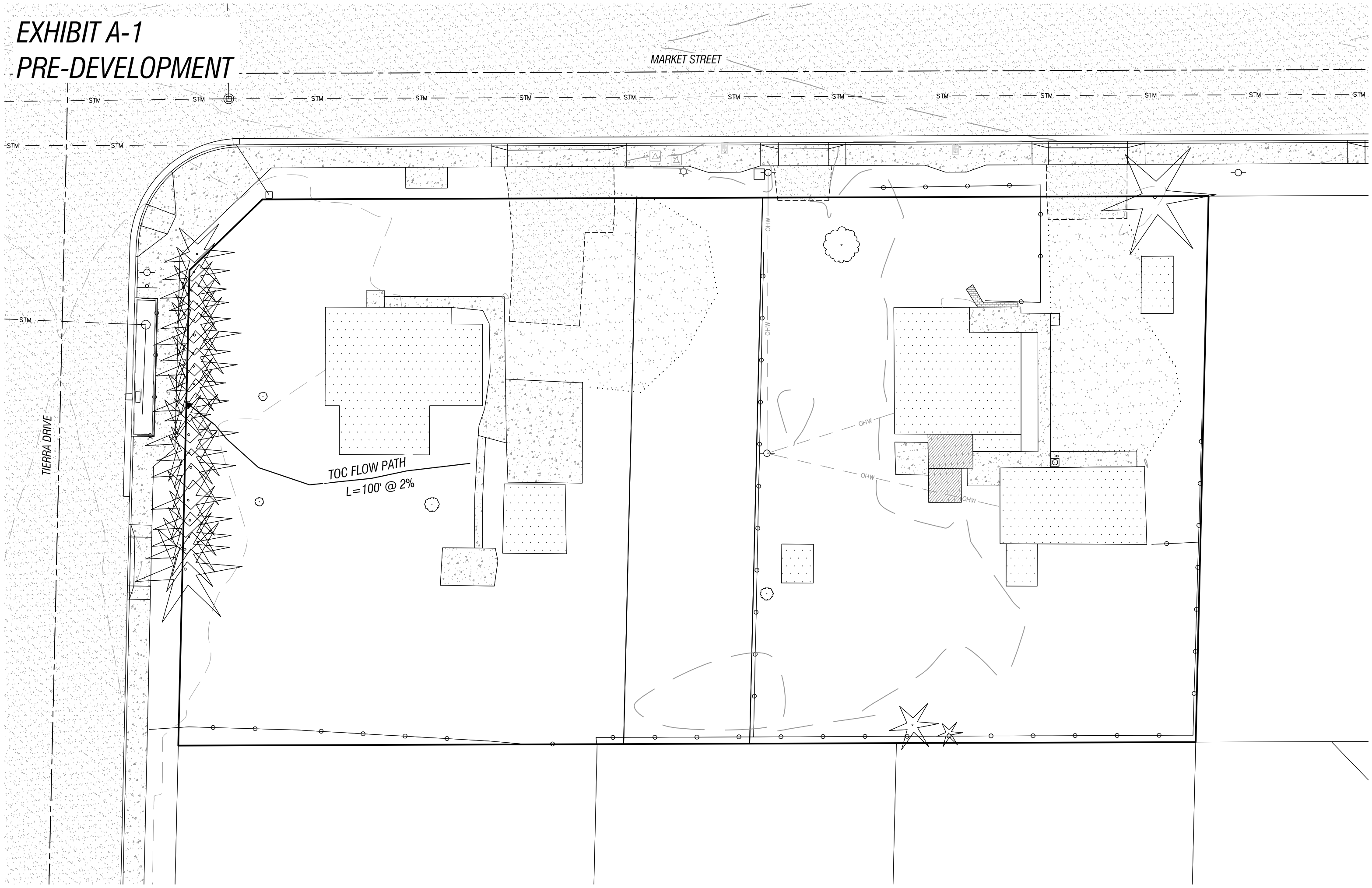
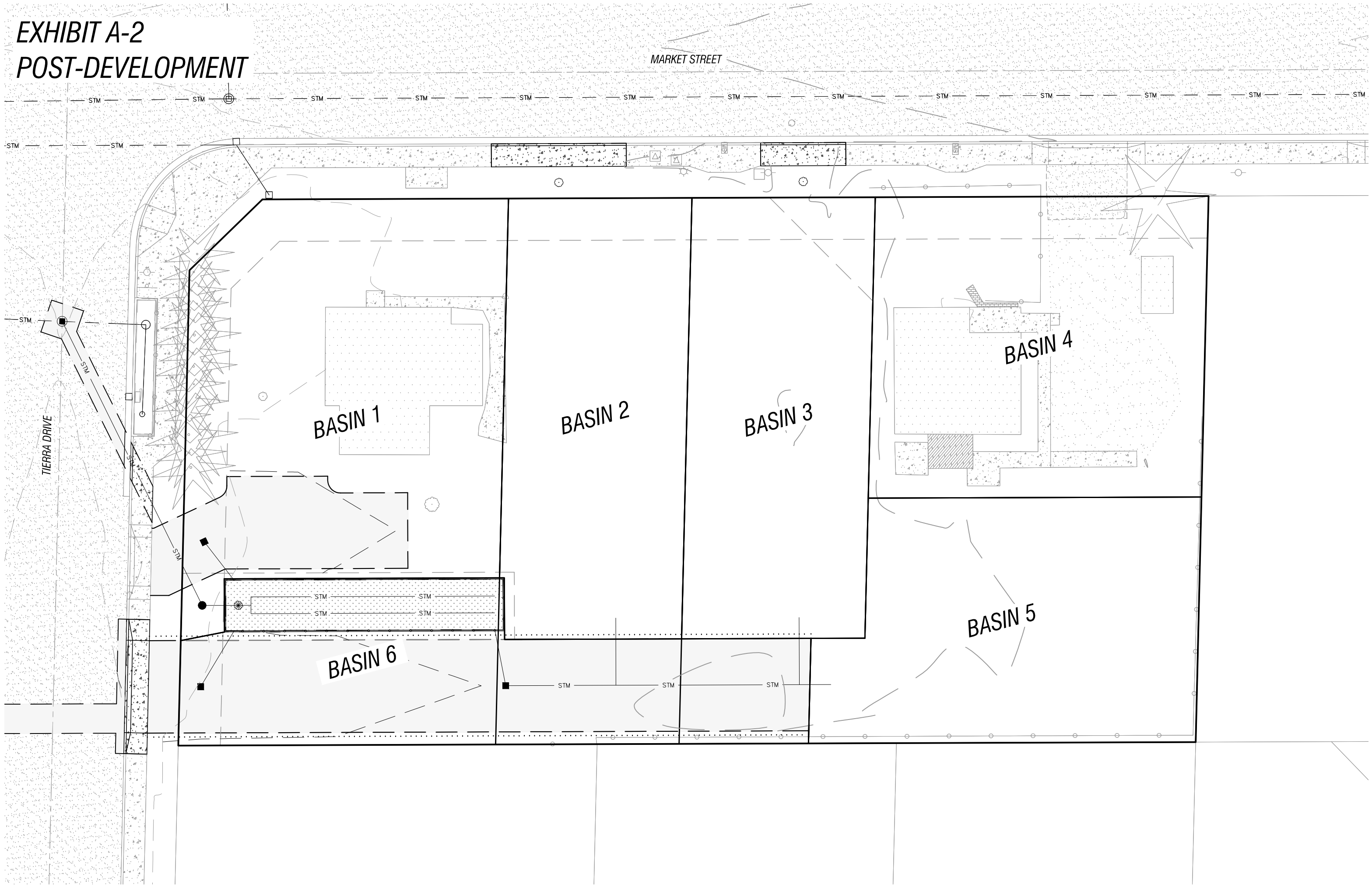


EXHIBIT A-2
POST-DEVELOPMENT





United States
Department of
Agriculture

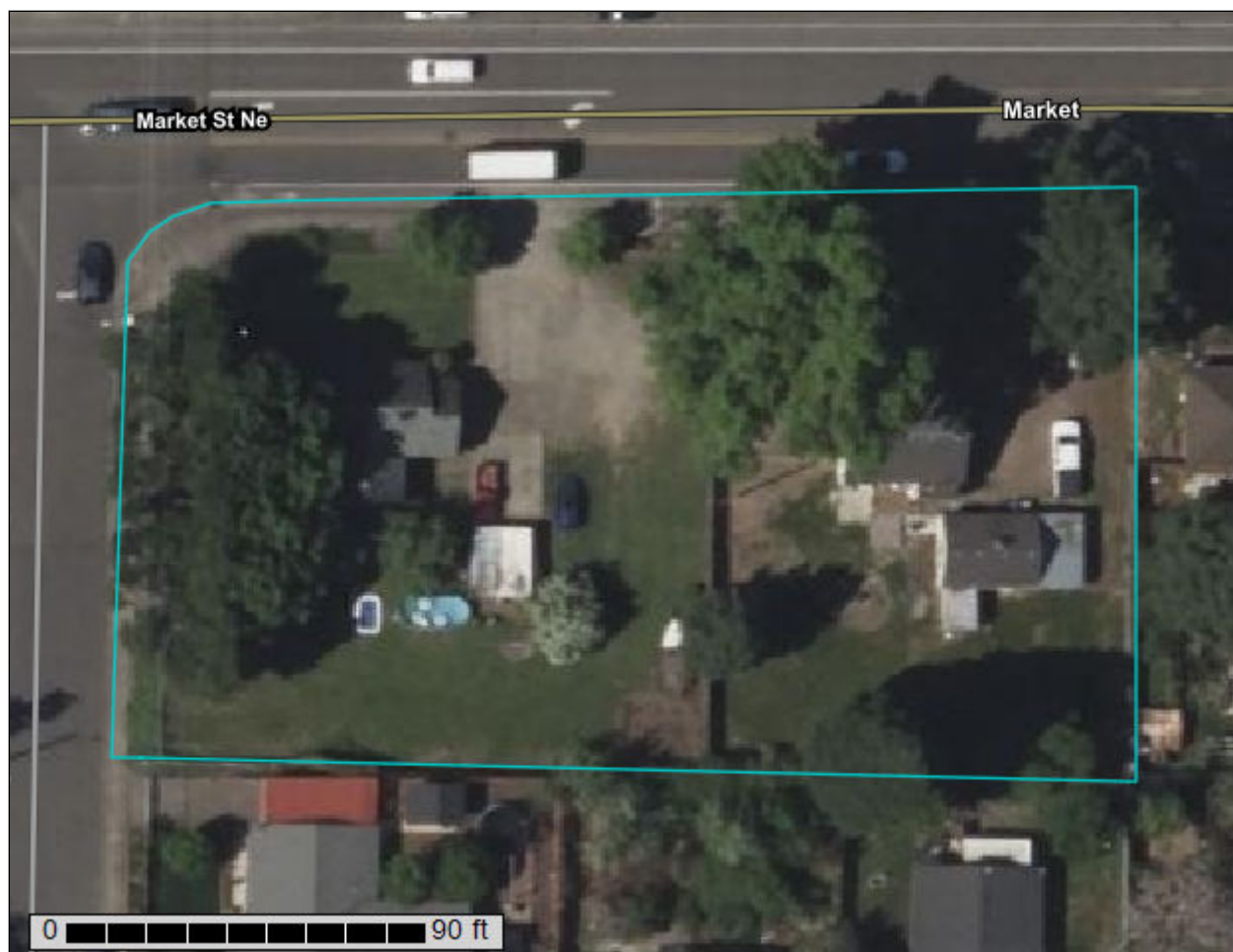
NRCS

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

4208 & 4258 Subdivision



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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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

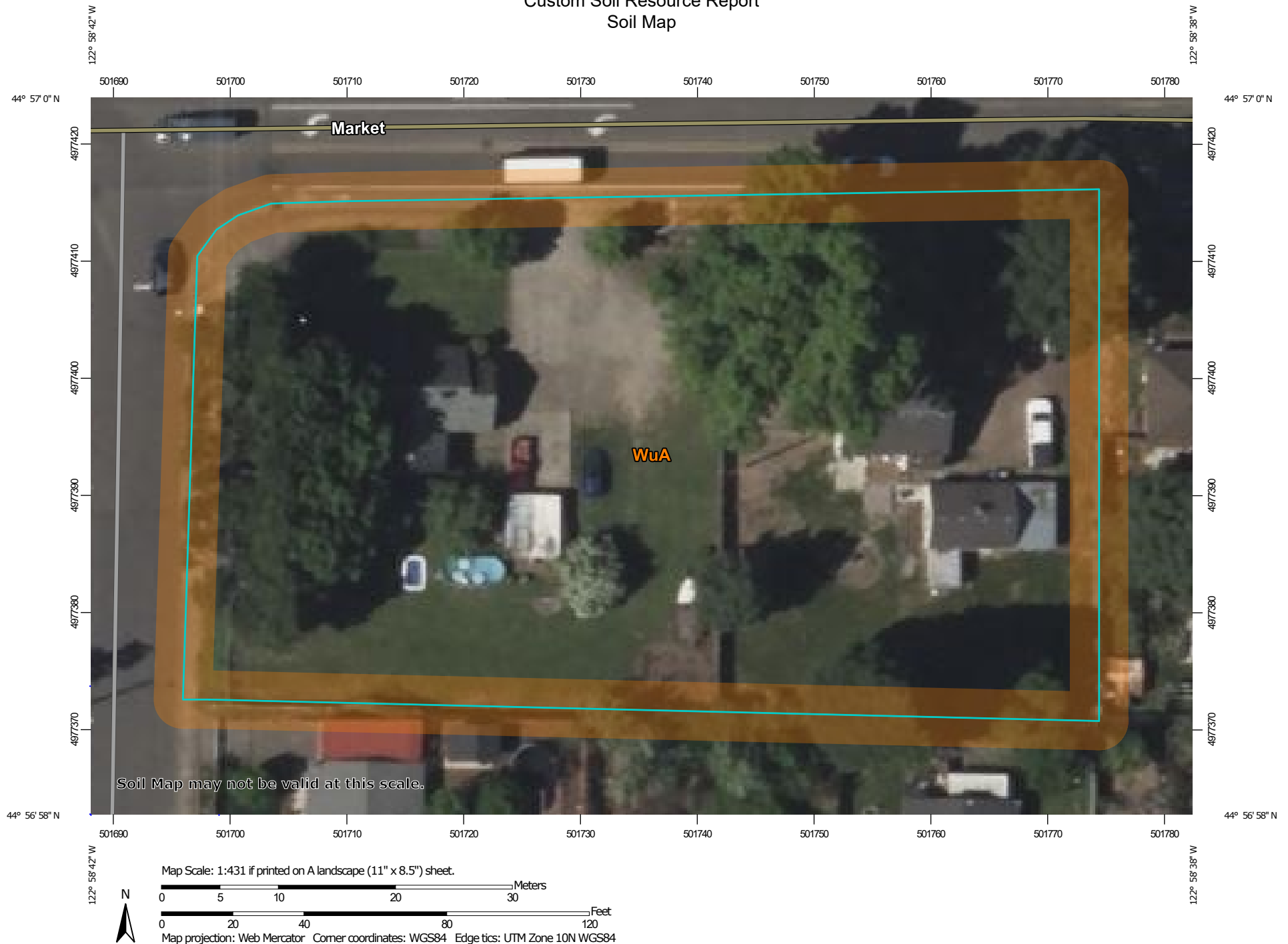
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identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

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.

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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 22, Aug 30, 2024

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

Date(s) aerial images were photographed: May 17, 2023—Jun 3, 2023

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
WuA	Woodburn silt loam, 0 to 3 percent slopes	0.8	100.0%
Totals for Area of Interest		0.8	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.

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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

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
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 supply, 0 to 60 inches: High (about 12.0 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Ecological site: R002XC008OR - Valley Terrace Group
Forage suitability group: Moderately Well Drained < 15% Slopes (G002XY004OR)
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Aquolls, somewhat poorly drained

Percent of map unit: 1 percent

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Landform: Terraces
Hydric soil rating: Yes

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission

rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group

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index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

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Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties—Marion County Area, Oregon														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>
WuA—Woodburn silt loam, 0 to 3 percent slopes														
Woodburn	85	C	0-17	Silt loam	ML	A-4	0- 0- 0	0- 0- 0	100-100 -100	95-98-1 00	85-90- 95	70-78- 85	25-28 -30	NP-3 -5
			17-32	Silty clay loam, silt loam	CL	A-6	0- 0- 0	0- 0- 0	100-100 -100	100-100 -100	95-98-1 00	85-90- 95	30-35 -40	10-15-2 0
			32-68	Silt loam, silty clay loam	CL-ML, CL, ML	A-4	0- 0- 0	0- 0- 0	100-100 -100	100-100 -100	95-98-1 00	80-85- 90	25-30 -35	5-8 -10

References

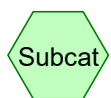
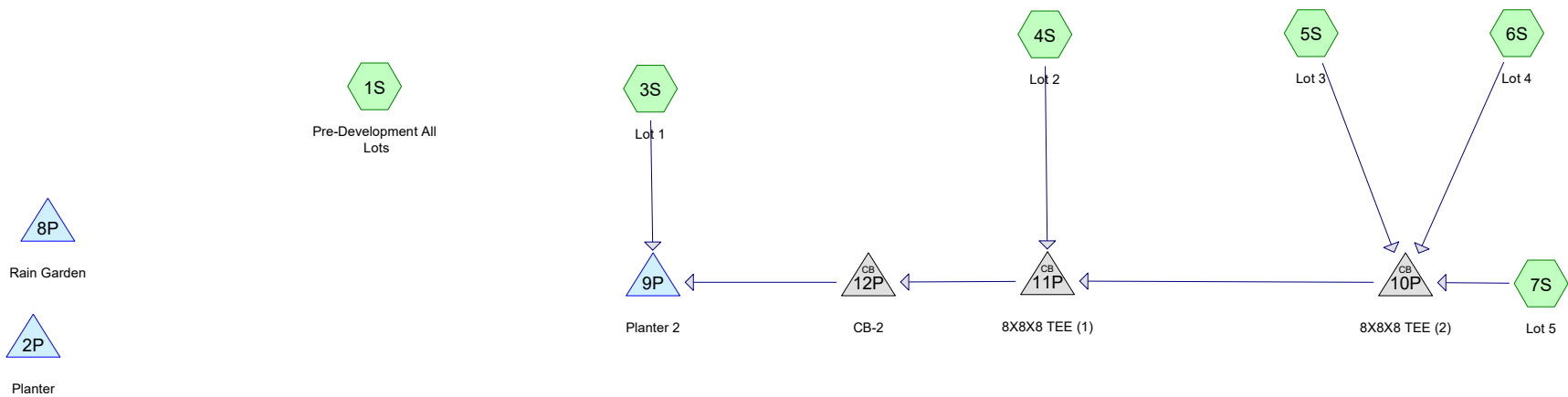
- American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.
- American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.
- Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.
- Federal Register. July 13, 1994. Changes in hydric soils of the United States.
- Federal Register. September 18, 2002. Hydric soils of the United States.
- Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.
- National Research Council. 1995. Wetlands: Characteristics and boundaries.
- Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262
- Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577
- Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580
- Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.
- United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.
- United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374
- United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. <http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelpdb1043084>

Custom Soil Resource Report

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

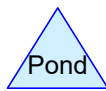
United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf



Subcat



Reach



Pond



Link

Routing Diagram for Market Street Stormwater Analysis - 011225

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Market Street Stormwater Analysis - 011225

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Page 1

Rainfall Events Listing (selected events)

Event#	Event Name	Storm Type	Curve	Mode	Duration (hours)	B/B	Depth (inches)	AMC
1	10-Year	Type IA 24-hr		Default	24.00	1	3.20	2
2	25-Year	Type IA 24-hr		Default	24.00	1	3.60	2
3	100-Year	Type IA 24-hr		Default	24.00	1	4.40	2
4	Half 2-Year	Type IA 24-hr		Default	24.00	1	1.10	2

Market Street Stormwater Analysis - 011225

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Type IA 24-hr 10-Year Rainfall=3.20"

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Page 2

Summary for Subcatchment 1S: Pre-Development All Lots

Runoff = 0.13 cfs @ 8.06 hrs, Volume= 3,007 cf, Depth= 1.15"

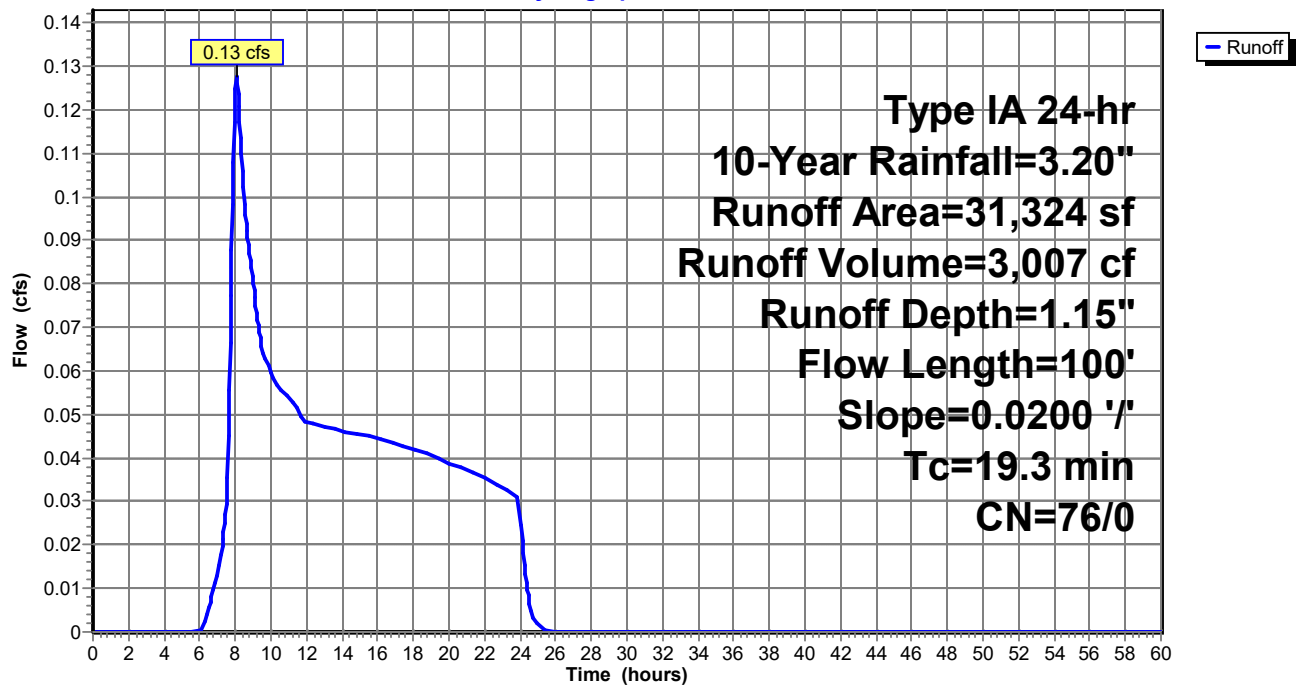
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type IA 24-hr 10-Year Rainfall=3.20"

	Area (sf)	CN	Description
*	31,324	76	Wood/Grass Combination, Type C Soil, Fair Veg
	31,324	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.3	100	0.0200	0.09		Sheet Flow, Pre-Developed Mixed Sheet Flow n= 0.300 P2= 2.50"

Subcatchment 1S: Pre-Development All Lots

Hydrograph



Summary for Pond 9P: Planter 2

[44] Hint: Outlet device #3 is below defined storage

[81] Warning: Exceeded Pond 12P by 0.51' @ 8.50 hrs

Inflow Area = 31,324 sf, 0.00% Impervious, Inflow Depth = 2.17" for 10-Year event
 Inflow = 0.40 cfs @ 7.94 hrs, Volume= 5,661 cf
 Outflow = 0.18 cfs @ 8.44 hrs, Volume= 5,661 cf, Atten= 56%, Lag= 29.5 min
 Discarded = 0.05 cfs @ 8.44 hrs, Volume= 2,927 cf
 Primary = 0.13 cfs @ 8.44 hrs, Volume= 2,734 cf

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs

Peak Elev= 207.39' @ 8.44 hrs Surf.Area= 792 sf Storage= 706 cf

Flood Elev= 208.00' Surf.Area= 792 sf Storage= 1,188 cf

Plug-Flow detention time= 46.1 min calculated for 5,661 cf (100% of inflow)

Center-of-Mass det. time= 46.1 min (794.4 - 748.3)

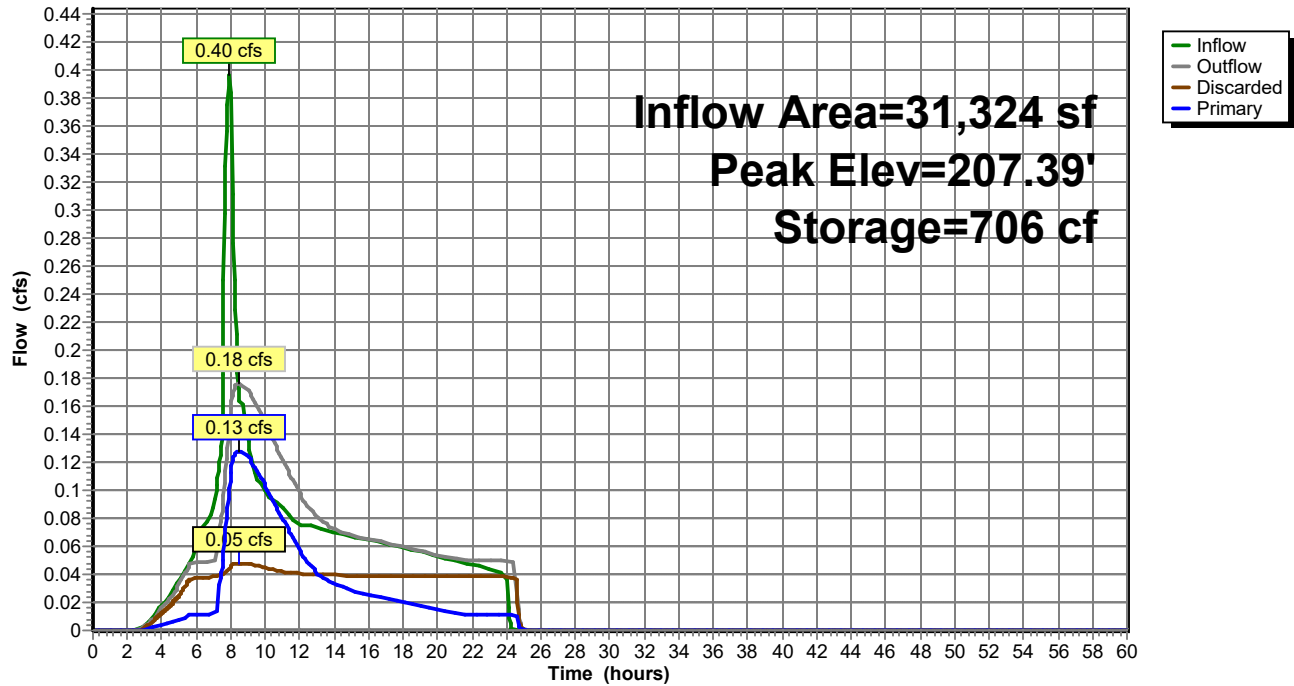
Volume	Invert	Avail.Storage	Storage Description
#1	206.50'	1,584 cf	12.00'W x 66.00'L x 2.00'H Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	206.50'	2.000 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 199.50'
#2	Primary	203.60'	8.0" Round Pipe L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 203.60' / 203.56' S= 0.0040 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#3	Device 2	203.50'	0.5" Vert. Low Flow Orifice C= 0.600 Limited to weir flow at low heads
#4	Device 2	206.70'	2.3" Horiz. High Flow Orifice C= 0.600
#5	Primary	208.00'	8.0" Horiz. Beehive C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.05 cfs @ 8.44 hrs HW=207.39' (Free Discharge)↑ **1=Exfiltration** (Controls 0.05 cfs)**Primary OutFlow** Max=0.13 cfs @ 8.44 hrs HW=207.39' (Free Discharge)↑ **2=Pipe** (Passes 0.13 cfs of 3.13 cfs potential flow)↑ **3=Low Flow Orifice** (Orifice Controls 0.01 cfs @ 9.37 fps)↑ **4=High Flow Orifice** (Orifice Controls 0.12 cfs @ 4.00 fps)↑ **5=Beehive** (Controls 0.00 cfs)

Pond 9P: Planter 2

Hydrograph



Market Street Stormwater Analysis - 011225

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Type IA 24-hr 25-Year Rainfall=3.60"

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Summary for Subcatchment 1S: Pre-Development All Lots

Runoff = 0.17 cfs @ 8.05 hrs, Volume= 3,754 cf, Depth= 1.44"

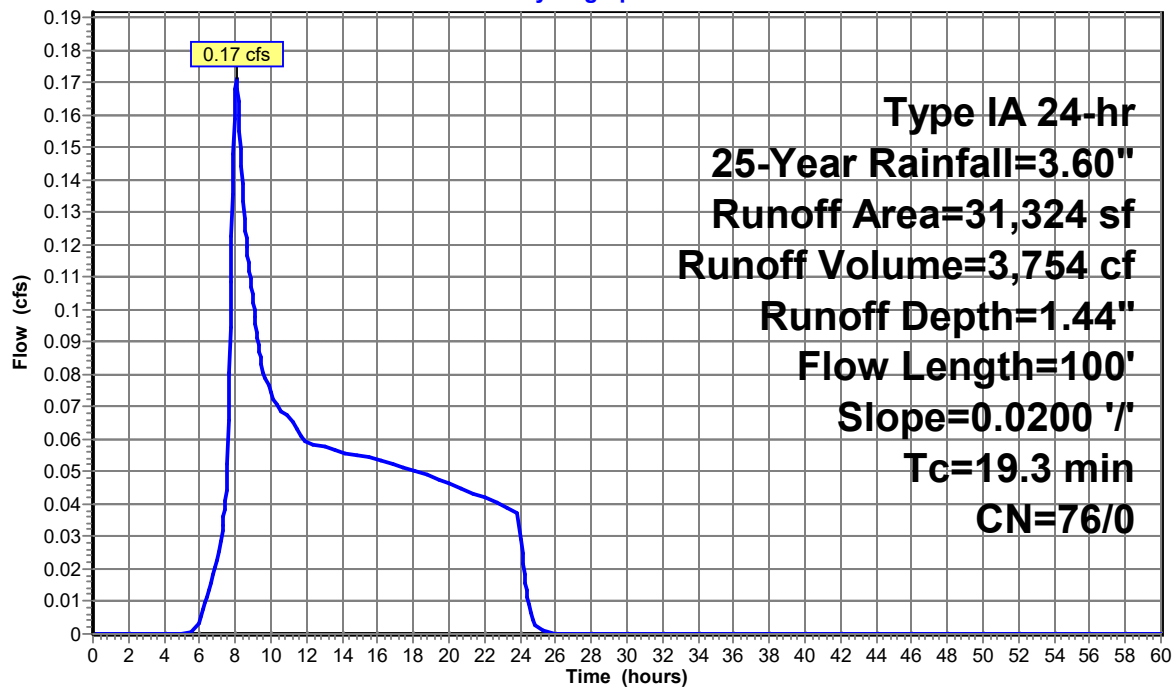
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type IA 24-hr 25-Year Rainfall=3.60"

	Area (sf)	CN	Description
*	31,324	76	Wood/Grass Combination, Type C Soil, Fair Veg
	31,324	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.3	100	0.0200	0.09		Sheet Flow, Pre-Developed Mixed Sheet Flow n= 0.300 P2= 2.50"

Subcatchment 1S: Pre-Development All Lots

Hydrograph



Summary for Pond 9P: Planter 2

[44] Hint: Outlet device #3 is below defined storage

[81] Warning: Exceeded Pond 12P by 0.72' @ 8.55 hrs

Inflow Area = 31,324 sf, 0.00% Impervious, Inflow Depth = 2.54" for 25-Year event
 Inflow = 0.47 cfs @ 7.94 hrs, Volume= 6,635 cf
 Outflow = 0.20 cfs @ 8.47 hrs, Volume= 6,635 cf, Atten= 58%, Lag= 32.1 min
 Discarded = 0.05 cfs @ 8.47 hrs, Volume= 3,080 cf
 Primary = 0.15 cfs @ 8.47 hrs, Volume= 3,555 cf

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs

Peak Elev= 207.62' @ 8.47 hrs Surf.Area= 792 sf Storage= 885 cf

Flood Elev= 208.00' Surf.Area= 792 sf Storage= 1,188 cf

Plug-Flow detention time= 49.2 min calculated for 6,629 cf (100% of inflow)

Center-of-Mass det. time= 49.2 min (789.0 - 739.8)

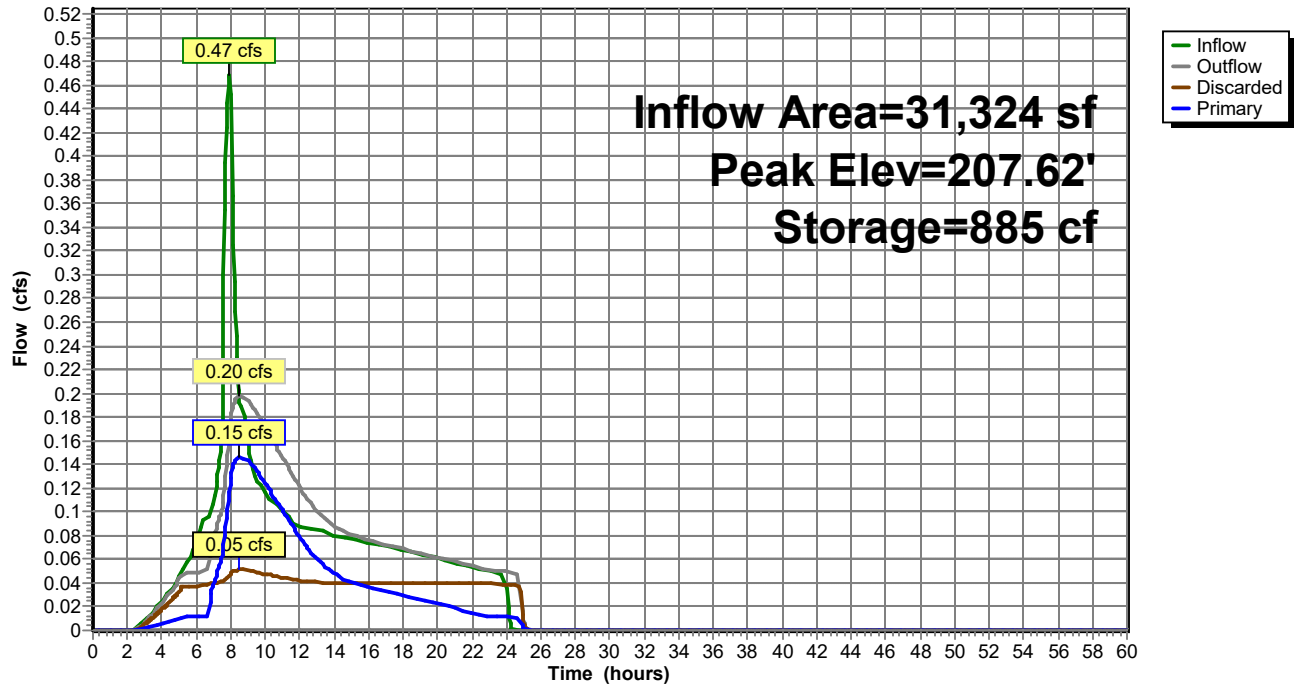
Volume	Invert	Avail.Storage	Storage Description
#1	206.50'	1,584 cf	12.00'W x 66.00'L x 2.00'H Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	206.50'	2.000 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 199.50'
#2	Primary	203.60'	8.0" Round Pipe L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 203.60' / 203.56' S= 0.0040 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#3	Device 2	203.50'	0.5" Vert. Low Flow Orifice C= 0.600 Limited to weir flow at low heads
#4	Device 2	206.70'	2.3" Horiz. High Flow Orifice C= 0.600
#5	Primary	208.00'	8.0" Horiz. Beehive C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.05 cfs @ 8.47 hrs HW=207.62' (Free Discharge)↑ **1=Exfiltration** (Controls 0.05 cfs)**Primary OutFlow** Max=0.15 cfs @ 8.47 hrs HW=207.62' (Free Discharge)↑ **2=Pipe** (Passes 0.15 cfs of 3.23 cfs potential flow)↑ **3=Low Flow Orifice** (Orifice Controls 0.01 cfs @ 9.65 fps)↑ **4=High Flow Orifice** (Orifice Controls 0.13 cfs @ 4.61 fps)↑ **5=Beehive** (Controls 0.00 cfs)

Pond 9P: Planter 2

Hydrograph



Market Street Stormwater Analysis - 011225

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Type IA 24-hr 100-Year Rainfall=4.40"

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Summary for Subcatchment 1S: Pre-Development All Lots

Runoff = 0.27 cfs @ 8.04 hrs, Volume= 5,352 cf, Depth= 2.05"

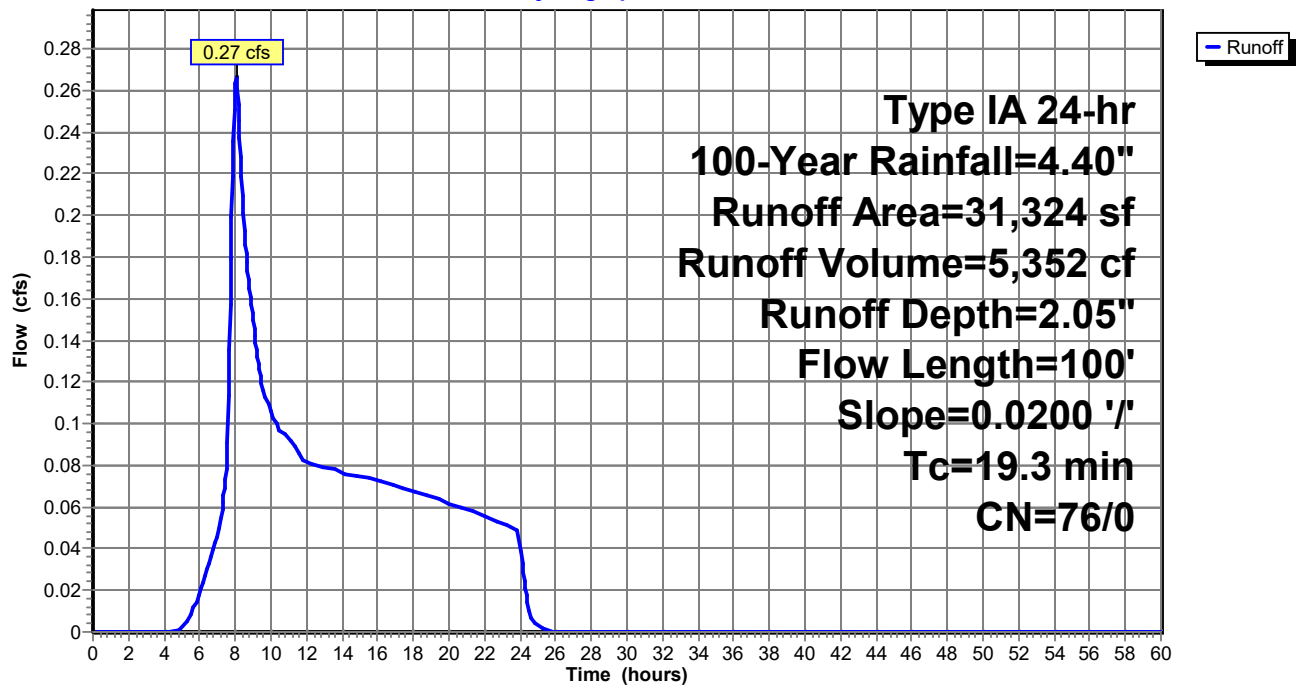
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type IA 24-hr 100-Year Rainfall=4.40"

	Area (sf)	CN	Description
*	31,324	76	Wood/Grass Combination, Type C Soil, Fair Veg
	31,324	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.3	100	0.0200	0.09		Sheet Flow, Pre-Developed Mixed Sheet Flow n= 0.300 P2= 2.50"

Subcatchment 1S: Pre-Development All Lots

Hydrograph



Summary for Pond 9P: Planter 2

[44] Hint: Outlet device #3 is below defined storage

[58] Hint: Peaked 0.05' above defined flood level

[81] Warning: Exceeded Pond 12P by 1.10' @ 8.50 hrs

Inflow Area = 31,324 sf, 0.00% Impervious, Inflow Depth = 3.30" for 100-Year event
 Inflow = 0.61 cfs @ 7.93 hrs, Volume= 8,614 cf
 Outflow = 0.30 cfs @ 8.34 hrs, Volume= 8,614 cf, Atten= 50%, Lag= 24.8 min
 Discarded = 0.06 cfs @ 8.34 hrs, Volume= 3,326 cf
 Primary = 0.25 cfs @ 8.34 hrs, Volume= 5,288 cf

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
 Peak Elev= 208.05' @ 8.34 hrs Surf.Area= 792 sf Storage= 1,226 cf
 Flood Elev= 208.00' Surf.Area= 792 sf Storage= 1,188 cf

Plug-Flow detention time= 54.6 min calculated for 8,607 cf (100% of inflow)
 Center-of-Mass det. time= 54.6 min (781.2 - 726.5)

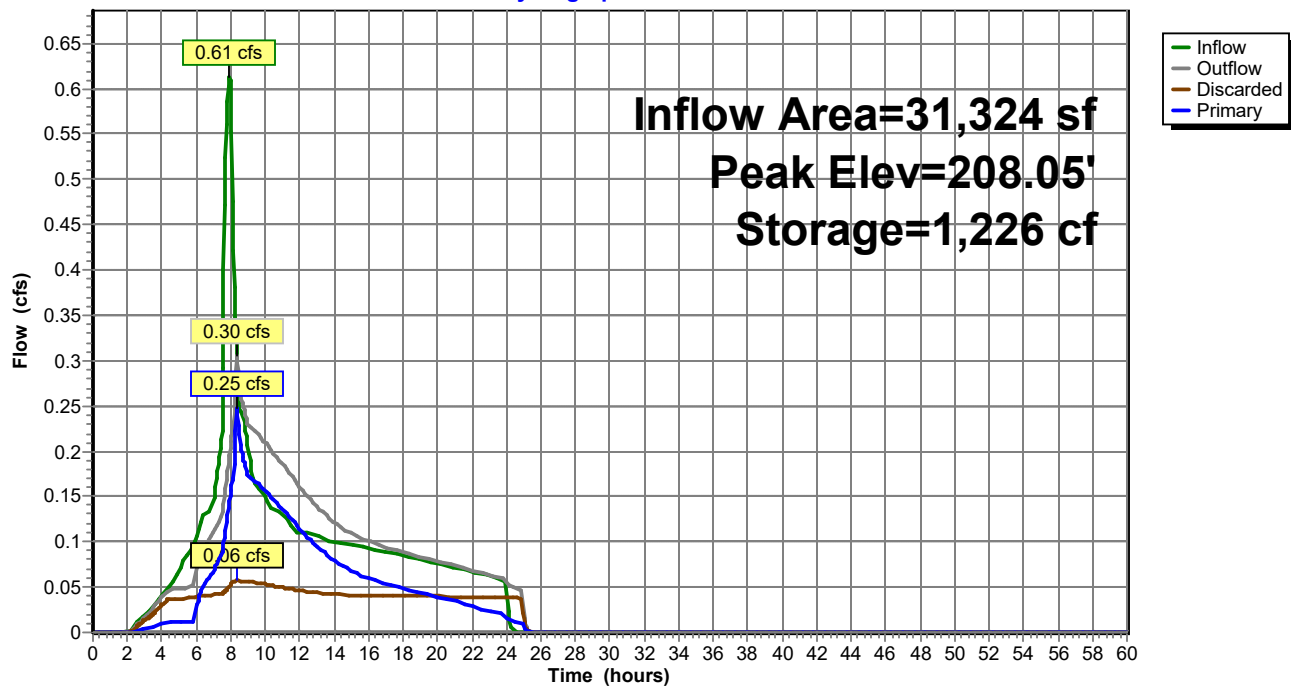
Volume	Invert	Avail.Storage	Storage Description
#1	206.50'	1,584 cf	12.00'W x 66.00'L x 2.00'H Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	206.50'	2.000 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 199.50'
#2	Primary	203.60'	8.0" Round Pipe L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 203.60' / 203.56' S= 0.0040 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#3	Device 2	203.50'	0.5" Vert. Low Flow Orifice C= 0.600 Limited to weir flow at low heads
#4	Device 2	206.70'	2.3" Horiz. High Flow Orifice C= 0.600
#5	Primary	208.00'	8.0" Horiz. Beehive C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.06 cfs @ 8.34 hrs HW=208.05' (Free Discharge)↑ **1=Exfiltration** (Controls 0.06 cfs)**Primary OutFlow** Max=0.25 cfs @ 8.34 hrs HW=208.05' (Free Discharge)↑ **2=Pipe** (Passes 0.18 cfs of 3.41 cfs potential flow)↑ **3=Low Flow Orifice** (Orifice Controls 0.01 cfs @ 10.15 fps)↑ **4=High Flow Orifice** (Orifice Controls 0.16 cfs @ 5.59 fps)↑ **5=Beehive** (Weir Controls 0.07 cfs @ 0.71 fps)

Pond 9P: Planter 2

Hydrograph



Market Street Stormwater Analysis - 011225

Type IA 24-hr Half 2-Year Rainfall=1.10"

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Summary for Subcatchment 1S: Pre-Development All Lots

Runoff = 0.00 cfs @ 20.43 hrs, Volume= 158 cf, Depth= 0.06"

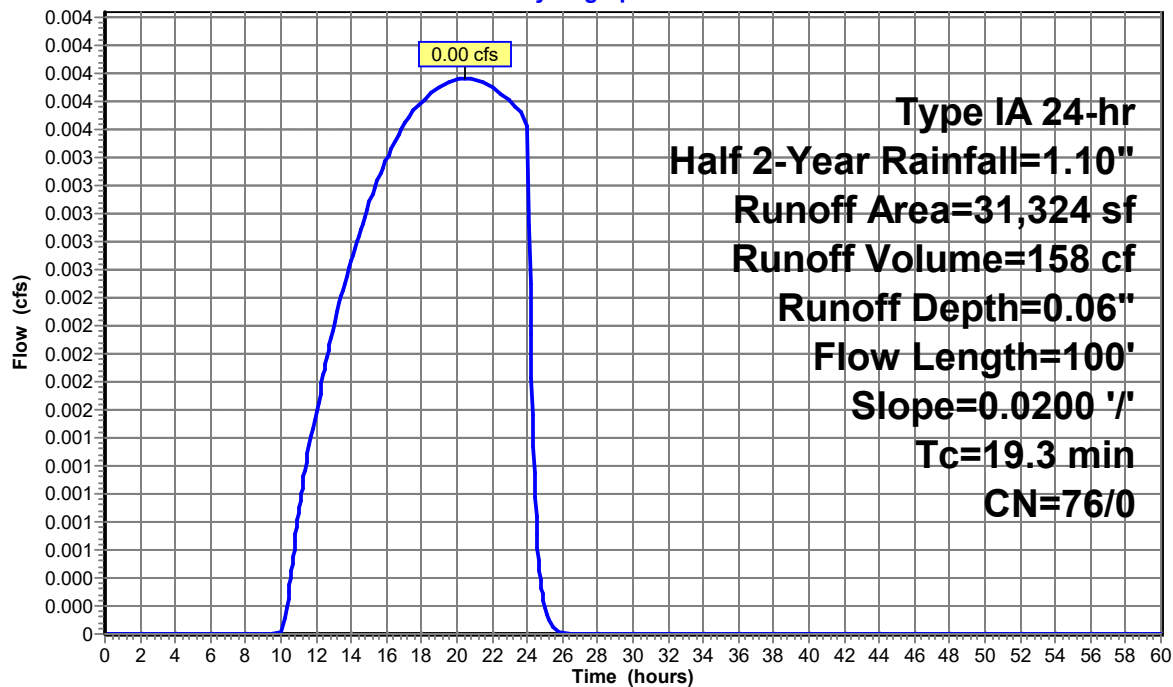
Runoff by SBUH method, Split Pervious/Imperv., Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
Type IA 24-hr Half 2-Year Rainfall=1.10"

	Area (sf)	CN	Description
*	31,324	76	Wood/Grass Combination, Type C Soil, Fair Veg
	31,324	76	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
19.3	100	0.0200	0.09		Sheet Flow, Pre-Developed Mixed Sheet Flow n= 0.300 P2= 2.50"

Subcatchment 1S: Pre-Development All Lots

Hydrograph



Summary for Pond 9P: Planter 2

[44] Hint: Outlet device #3 is below defined storage

Inflow Area = 31,324 sf, 0.00% Impervious, Inflow Depth = 0.39" for Half 2-Year event
 Inflow = 0.06 cfs @ 7.99 hrs, Volume= 1,011 cf
 Outflow = 0.05 cfs @ 8.08 hrs, Volume= 1,011 cf, Atten= 13%, Lag= 5.5 min
 Discarded = 0.04 cfs @ 8.08 hrs, Volume= 776 cf
 Primary = 0.01 cfs @ 8.08 hrs, Volume= 236 cf

Routing by Stor-Ind method, Time Span= 0.00-60.00 hrs, dt= 0.05 hrs
 Peak Elev= 206.52' @ 8.08 hrs Surf.Area= 792 sf Storage= 18 cf
 Flood Elev= 208.00' Surf.Area= 792 sf Storage= 1,188 cf

Plug-Flow detention time= 5.5 min calculated for 1,010 cf (100% of inflow)
 Center-of-Mass det. time= 5.5 min (858.6 - 853.1)

Volume	Invert	Avail.Storage	Storage Description
#1	206.50'	1,584 cf	12.00'W x 66.00'L x 2.00'H Storage

Device	Routing	Invert	Outlet Devices
#1	Discarded	206.50'	2.000 in/hr Exfiltration over Wetted area Conductivity to Groundwater Elevation = 199.50'
#2	Primary	203.60'	8.0" Round Pipe L= 10.0' Ke= 0.500 Inlet / Outlet Invert= 203.60' / 203.56' S= 0.0040 '/' Cc= 0.900 n= 0.010 PVC, smooth interior, Flow Area= 0.35 sf
#3	Device 2	203.50'	0.5" Vert. Low Flow Orifice C= 0.600 Limited to weir flow at low heads
#4	Device 2	206.70'	2.3" Horiz. High Flow Orifice C= 0.600
#5	Primary	208.00'	8.0" Horiz. Beehive C= 0.600 Limited to weir flow at low heads

Discarded OutFlow Max=0.04 cfs @ 8.08 hrs HW=206.52' (Free Discharge)
 1=Exfiltration (Controls 0.04 cfs)

Primary OutFlow Max=0.01 cfs @ 8.08 hrs HW=206.52' (Free Discharge)
 2=Pipe (Passes 0.01 cfs of 2.70 cfs potential flow)
 3=Low Flow Orifice (Orifice Controls 0.01 cfs @ 8.23 fps)
 4=High Flow Orifice (Controls 0.00 cfs)
 5=Beehive (Controls 0.00 cfs)

Pond 9P: Planter 2

Hydrograph

