CES|NW

TUALATIN OPERATIONS

Preliminary Storm Drainage Report

Case File No. ####-########

Developer/Applicant:
City of Tualatin
10699 SW Herman Road
Tualatin, OR 97062
503.691.3091

Engineer:
Anthony R. Weller, P.E., P.L.S.
CESNW, Inc.
13190 SW 68th Parkway, Suite 150
Tigard, OR 97223
503.968.6655

REGISTERED PROFESSIONAL ENGINEER 14061 OREGON JULY 26, 1988 ANTHONY R. WELLER
Renews 6/30/20

Prepared: Jan. 3, 2019

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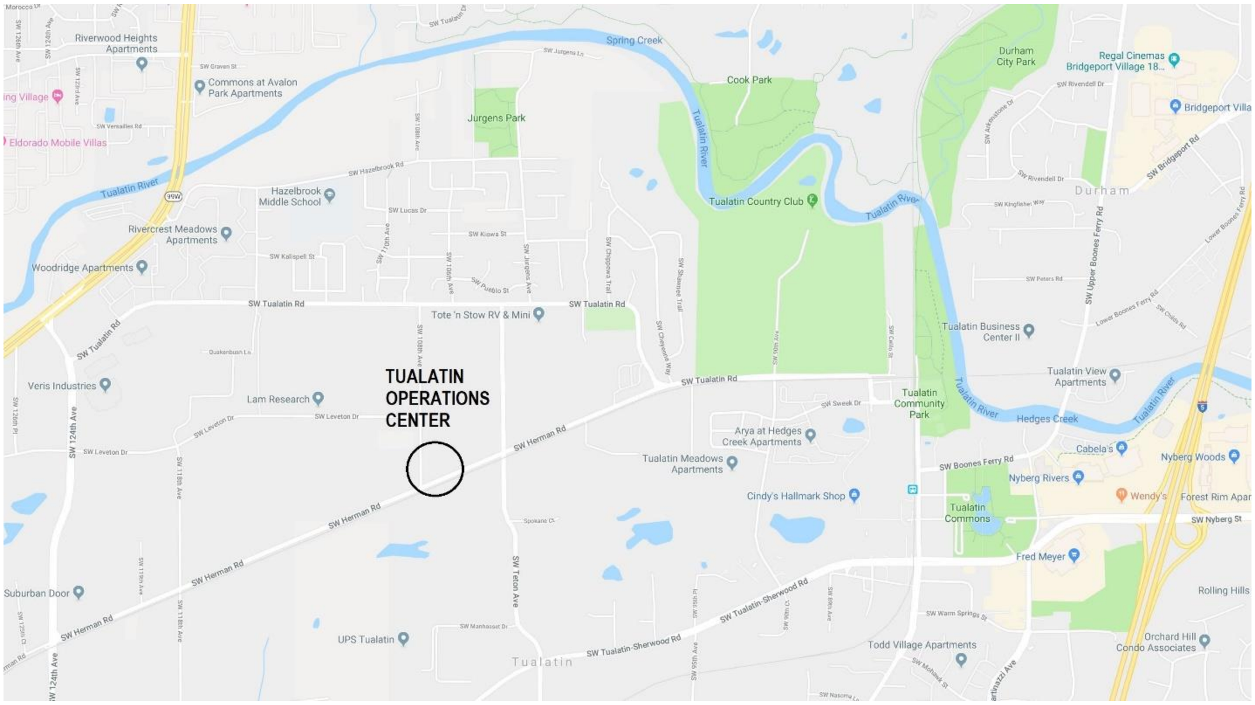

Vicinity Map

Project Description

The project site is located at 10699 SW Herman Road, tax lot 2S1W22AD 200 and 300 consists of approximately 8.7 Acres. The site is located at the northeast corner of Herman Road and 108th Aveune. The is zoned ML, and is occupied with the City's public works offices, fleet maintenance and warehouse buildings. The proposed project consists of removal of the older barn/warehouse building and the construction of a new approximately 7300 sf footprint, two story building with associated parking lot modifications.

Existing Conditions

The existing site is flat with slopes range from 0.5% to 3% and general drains from the north to the south. The site is surrounded by developed industrial buildings. The site is about 70 percent developed with the north and northeast corner being mostly undevleoped with fir trees. However some of this area is also being used for the storage of landscape materials.

The site does contain soils that allow inflitration, so it is not connected to any public storm drainage system. The existing site drainage is managed through existing shallow drywells or newer biocell/ponds with no offiste dischargel.

According to the US Natural Resources Conservation Services the site contains about 75% Hillsboro Loam and 25% Quatama Loam. The Hillsboro Loam is classified as hydrologic soil group 'B' and Quatama Loam as hydrologic soil group 'C'. Inflitration testing was performed on a prior project in the southeast corner fo the site (Quatama Loam area) which were over 20 inches per hour to over 100 inches per hour. The inflitration Report and NRCS soils reprots area attached to this report.

Developed Conditions

The proposed project consists of construction of a new approximately 7300 sf footprint new building and associated parking lot improvements. In oder to meet the Clean Water Services requirements for storm water quality treatment, a portion of the existing building is scheduled to be removed to allow construction of a raingarden to manage storm water from the roof of the new building. For the new parking lot pavement and other modified areas of impervious surfaces new stormwater filter catch basins will be installed to treat the storm water before it enters the drywells.

TUALATIN OPERATIONS CENTER						
BASIN SUMMARY						
Basin	**A**	**B**	**C**	**D**	**OFFSITE**	**TOTALS**
TOTAL AREA	**21228**	**14014**	**14178**	**22626**		**72046**
PRO IMP	19779	12133	12399	11027		
PRO PRV	1449	1881	1779	11599		
MOD IMPRV	1337	1337	7380	6747	572	**17373**
REMOVE IMPRV	291	140	564	4436		**5431**
NEW IMPR	2302	2728	72	1207		**6309**
CWS COMPLIANCE						
Treatment = New Imp + 3*(Mod Imp - Removed Imp)						
Treatment =	**42135**					

Onsite and Downstream Analysis

The existing drywells are reported to be about 6-feet deep each. Most existing catchbasins are tied to a series of about 6 of these shallow drywells. There is no information on how well these existing drywells function however there is also no reported flooding issues. Based on the prior inflitration tests (report is attached), we believe that each catch basin drainage area can be managed with 2 standard depth drywells (18-20 feet deep). The two drywells for Basin A may need to be tied to the drywells in Basin B. The attached spreadsheets reflect one half of the drainage area so that two drywells will be required for each drainage basin (A, B & C).

Since there hasn't been any reported drainage problems with the existing drywells, the City may elect to utilize the exsting drywells until there is a drainage problem and install the new deeper drywells at a later day.

Basin D is proposed to be served with a 38' by 14' biocell/rain garden (bottom with 3:1 side slopes). Both the drywells and pond are designed to fully contain the 100-year event onsite with no offsite discharge.

Water Quality Treatment

Clean Water Services requires storm water treatment for all new impervious area and treatment for any existing impervious area at 3 times the net modified existing impervious areas (Treatment area = New Imp Area + 3*(Mod Impr A – Removed Impr A). Since the exsiting drainage system is managed with drywells with no offsite discharge, we don't believe the Clean Water Services requirements apply to this project. However, DEQ does require treatment of storm water from paved areas that discharges into drywells.

Basins A through C will use drywells and mechanical treatment catch basins (Storm Water Management Cartridge type) to provide treatment. Basin D will utiilize a storm water Biocell that inflitrates which will provide its storm water treatment prior to disposal.

TUALATIN OPERATIONS SITE					
Date:	3-Jan-19				
Project No.	3418				
Storm Water Cartridge Filter					
Capacity				15	gpm
WQ Depth				0.36	inches
WQ Duration				4	hours
Basin ID	**Impv Area**	**WQ Vol**	**WQ Flow**	**No Cartridges**	
A	19779	593.37	0.04120625	2	
B	12133	363.99	0.025277083	1	
C	12399	371.97	0.02583125	1	
D	11027	330.81	0.022972917	Pond	

Operations and Maintenance

Operations and Maintenance for each of these facility types will follow Clean Water Serivces LIDA handbook recommendations and manufacturer's recommendation for the storm water filter cartridges.

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DRYWELL STORAGE ROUTING

Project:	*Operations*
Project Number:	*3418*
Date:	*1/3/19*
Basin:	*Basin A (1/2)*
Event:	*100-yr*

INFLOW HYDROGRAPH

Hydrograph Data:

Site Area =	9642	SF
Area =	0.22135	acres
Pt =	4.5	inches
dt =	10	min
Tc =	5	min
w =	0.5	routing constant

Pervious Area:

Area =	0.00721	acres
CN =	79	
S =	2.66	
0.2S =	0.53	

Impervious Area:

Area =	0.2141414	acres
CN =	98	
S =	0.20	
0.2S =	0.04	

Hydrograph Results:

Peak Runoff:	0.258	cfs
Total Volume:	3369.6	CF

DRYWELL ROUTING

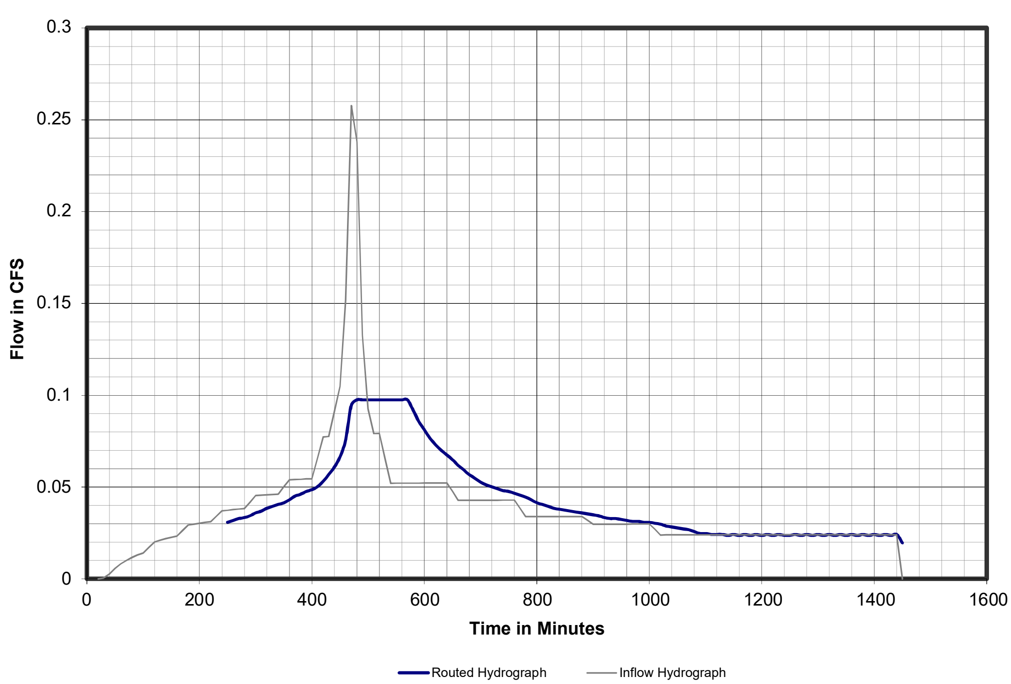
Drywell Data:

Eccentric Cone:	3	FT
Solid MH Section:	3	FT
Perforated MH Section:	12	FT
Sump (no storage)	2	FT
DW Dia	4	FT
DW Wall Thickness	6	IN
Drain Rock Wall Thickness	1	FT
Drain Rock Base Thickness	1.5	FT
Drain Rock Voids	35%	
Infli Safety Factor	2	
Total Drywell Depth:	**20**	**Feet**

Routing Results:

MAX STORAGE =	**442.9**	**Cu Ft**
MAX OUTLET =	**0.097**	**cfs**
DEPTH IN DRYWELL =	**23.30**	**Ft**

Drywell Inflow/Outflow Hydrograph



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DRYWELL STORAGE ROUTING

Project:	*Operations*
Project Number:	*3418*
Date:	*1/3/19*
Basin:	*Basin B (1/2)*
Event:	*100-YR*

INFLOW HYDROGRAPH

Hydrograph Data:

Site Area =	6662	SF
Area =	0.15294	acres
Pt =	4.5	inches
dt =	10	min
Tc =	5	min
w =	0.5	routing constant

Pervious Area:

Area =	0.01641	acres
CN =	79	
S =	2.66	
0.2S =	0.53	

Impervious Area:

Area =	0.1365243	acres
CN =	98	
S =	0.20	
0.2S =	0.04	

Hydrograph Results:

Peak Runoff:	0.172	cfs
Total Volume:	2249.9	CF

DRYWELL ROUTING

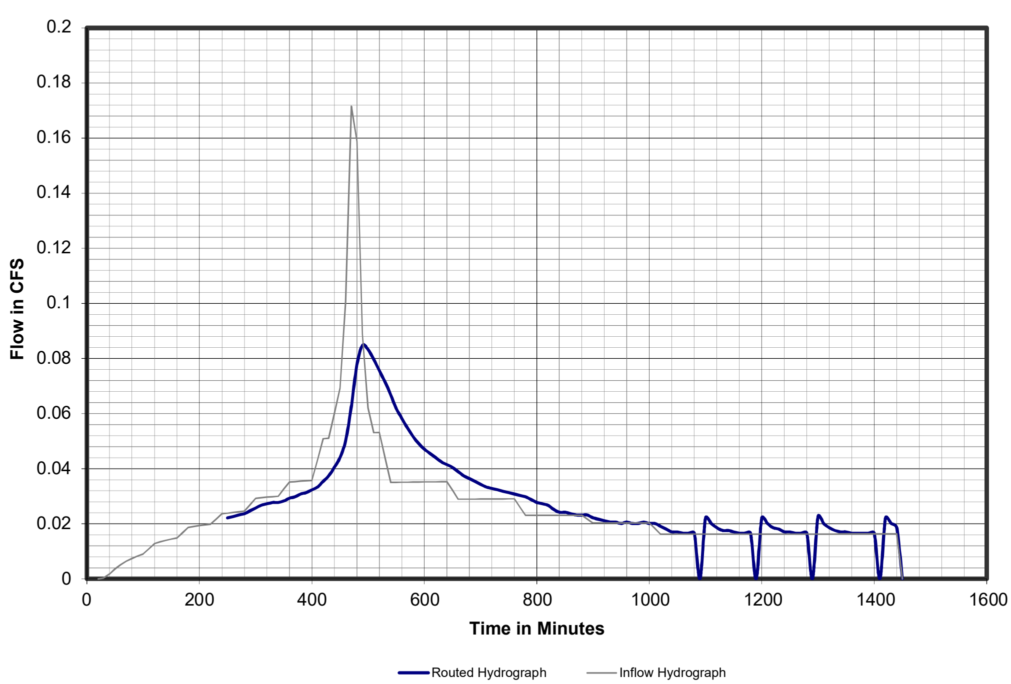
Drywell Data:

Eccentric Cone:	3	FT
Solid MH Section:	3	FT
Perforated MH Section:	12	FT
Sump (no storage)	2	FT
DW Dia	4	FT
DW Wall Thickness	6	IN
Drain Rock Wall Thickness	1	FT
Drain Rock Base Thickness	1.5	FT
Drain Rock Voids	35%	
Infli Safety Factor	2	
Total Drywell Depth:	**20**	**Feet**

Routing Results:

MAX STORAGE =	**254.3**	**Cu Ft**
MAX OUTLET =	**0.085**	**cfs**
DEPTH IN DRYWELL =	**13.50**	**Ft**

Drywell Inflow/Outflow Hydrograph



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Project: Operations
Project Number: 3418
Date: 1/3/19
Basin: Basin C (1/2)
Event: 100-YR

DRYWELL STORAGE ROUTING

INFLOW HYDROGRAPH

Hydrograph Data:

Site Area =	8597	SF
Area =	0.19736	acres
Pt =	4.5	inches
dt =	10	min
Tc =	5	min
w =	0.5	routing constant

Pervious Area:

Area =	0.0207	acres
CN =	79	
S =	2.66	
0.2S =	0.53	

Impervious Area:

Area =	0.1766644	acres
CN =	98	
S =	0.20	
0.2S =	0.04	

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Hydrograph Results:

Peak Runoff:	0.222	cfs
Total Volume:	2906.7	CF

DRYWELL ROUTING

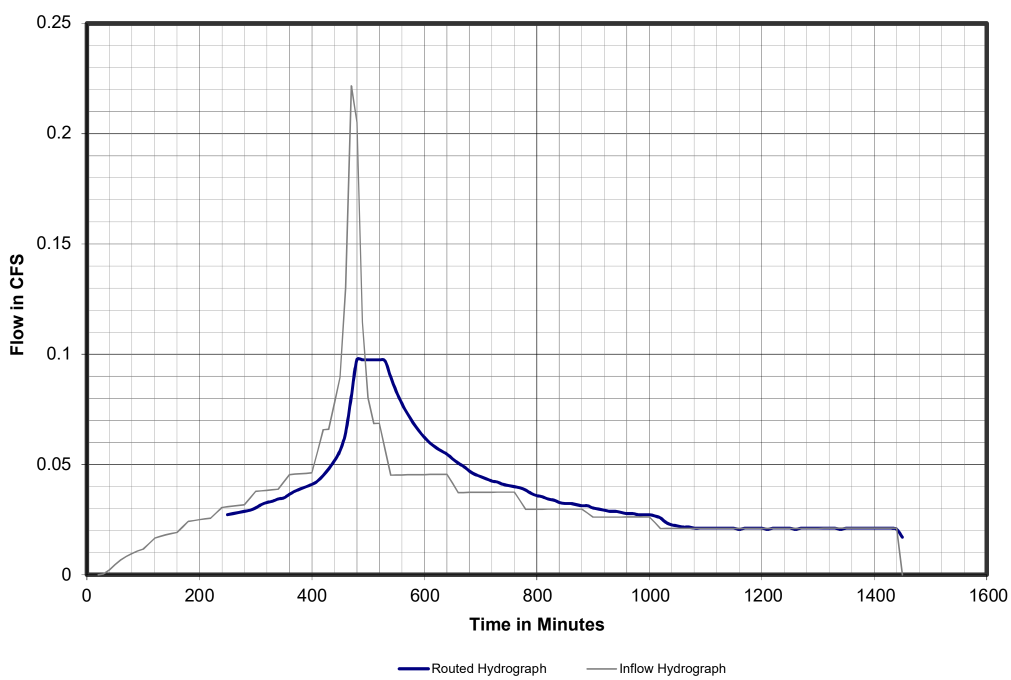
Drywell Data:

Eccentric Cone:	3	FT
Solid MH Section:	3	FT
Perforated MH Section:	12	FT
Sump (no storage)	2	FT
DW Dia	4	FT
DW Wall Thickness	6	IN
Drain Rock Wall Thickness	1	FT
Drain Rock Base Thickness	1.5	FT
Drain Rock Voids	35%	
Infli Safety Factor	2	
Total Drywell Depth:	**20**	**Feet**

Routing Results:

MAX STORAGE =	**349.8**	**Cu Ft**
MAX OUTLET =	**0.097**	**cfs**
DEPTH IN DRYWELL =	**18.50**	**Ft**

Drywell Inflow/Outflow Hydrograph



CES|NW

Project: *Operations Center*
Project Number: *3418*
Date: *1/3/19*
Basin: *Basin D*
Event: *100 Year*

PLANTER/BIO-CELL STORAGE ROUTING

INFLOW HYDROGRAPH

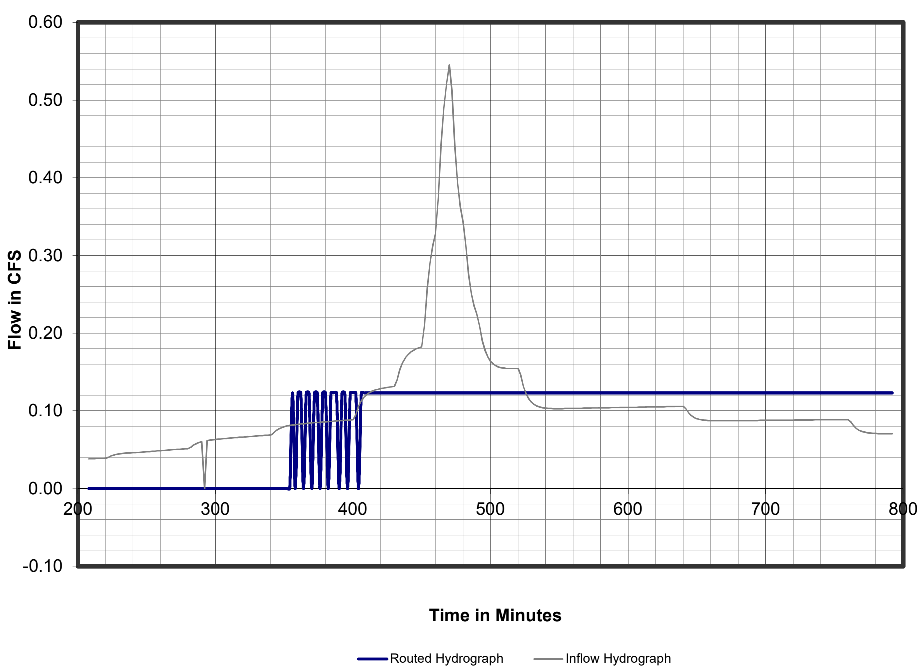
Hydrograph Data:	*Pre-*	*Post-*		*PRE-DEVELOPED*			*Impervious Area:*		
Site Area =	22626	22626	SF	*Pervious Area:*			Area =	14828	SF
Area =	0.52	0.52	acres	Area =	0.1790	acres	Area =	0.3404	acres
Pt =	4.5	4.5	inches	CN =	79		CN =	98	
dt =	2	2	min	S =	2.66		S =	0.20	
Tc =	5	5	min	0.2S =	0.53		0.2S =	0.04	
w =	0.16667	0.167	Rout. Con.						

Hydrograph Results:			*POST-DEVELOPED*			*Impervious Area:*		
			Pervious Area:			Area =	11599	SF
Pre-Developed Peak Runoff:	**0.592**	**cfs**	Area =	0.2531	acres	Area =	0.2663	acres
Pre Developed Total Volume:	6797.2	CF	CN =	79		CN =	98	
			S =	2.66		S =	0.20	
Post-Developed Peak Runoff:	**0.545**	**cfs**	0.2S =	0.53		0.2S =	0.04	
Post Developed Total Volume:	6289.7	CF						

BIO CELL ROUTING

Bio-Cell Data:			**Overflow Data:**		
Bottom Length	38.0	FT	Diameter	0	IN
Bottom Width	14.0	FT	Elevation	0	FT
Side Slope	3	Horizontal: 1 Vertical	Circ.	0.00	FT
Bottom Area	532	SF	Grate SF	0	
Depth of Effective Side Perc	0	FT			
Soil Media Depth	1.5	FT	*Routing Results:*		
Gravel Layer Depth	2.5	FT	**MAX STORAGE =**	**1441.2**	**Cu Ft**
Soil Media porosity	25%		**MAX OUTLET =**	**0.123**	**cfs**
Gravel Layer porosity	40%		**MAX Infiltration =**	**0.123**	**cfs**
Infiltration Rate	20	in/hr	**MAX Bypass =**	**0.000**	**cfs**
Infli Safety Factor	2		**MAX Depth =**	**1.000**	**ft**

BioCell Inflow/Outflow Hydrograph



TUALATIN OPERATIONS CENTER						
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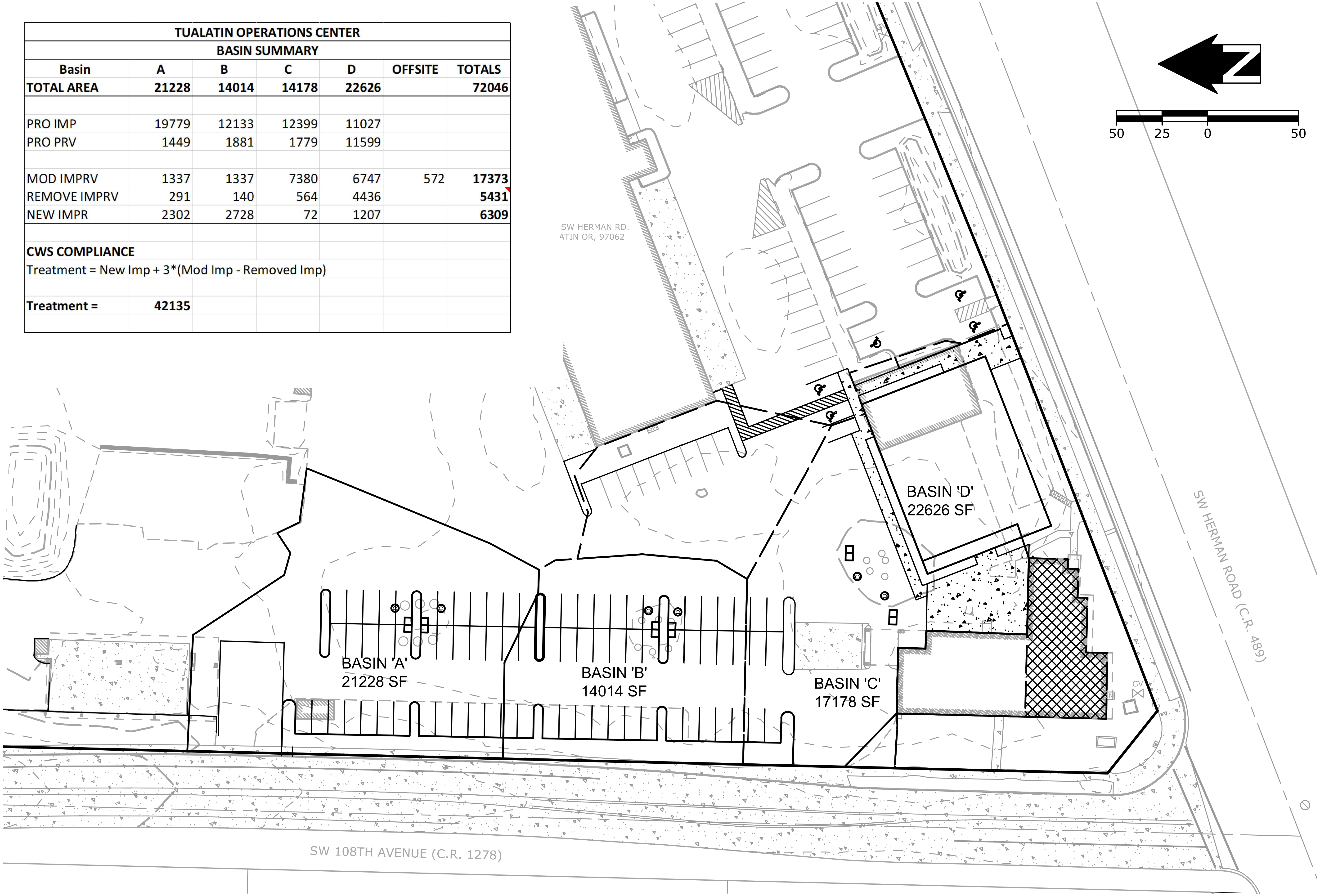

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TUALATIN OPERATIONS
CASE FILE NO. XX-XX

CITY OF TUALATIN
10699 SW HERMAN ROAD
TUALATIN, OR 97062

CES|NW
13190 SW 68th Parkway, Suite 150
Tigard, Oregon 97223
503.968.6655 www.cesnw.com

REVISIONS

3418-DBASIN_AREAS.DWG

PROJECT NO.: 3418 DATE: 12/24/18
DESIGNED BY: ARW DRAWN BY: ARW

DRAINAGE BASIN

SHEET 1 OF 1

Northwest Geotech, Inc.
9120 SW Pioneer Court, Suite B • Wilsonville, Oregon 97070 503/682-1880 FAX: 503 / 682-2753

June 25, 2007
Project No. 1872.1.1

CES│NW, Inc.
15573 SW Bangy Road, Suite 300
Lake Oswego, Oregon 97035

Attention: Mr. Tony Weller

Subject: Infiltration Testing
City of Tualatin Operations Center
Tualatin, Oregon

Dear Mr. Weller:

As requested, Northwest Geotech, Inc., (NGI) has completed field infiltration testing for use in the design of stormwater facilities at the site. The infiltration test locations are shown on the Site Plan, Figure 1.

The infiltration testing was conducted at depths of 4.5 to 5 feet in test pits excavated using a combination of a backhoe and hand equipment. The test pits were excavated, cased, and water was introduced into the casing and allowed to soak overnight (in test pits 2 and 3) prior to conducting the infiltration tests. The infiltration testing was completed in general accordance with the City of Portland Falling Head Infiltration Test Procedure. The soils encountered in the test pits generally consisted of silty sand to slightly silty sand and groundwater was encountered at a depth of 9.1 feet in test pit TP-2. The infiltration test results are summarized below.

Location	Depth (feet)	Measured Infiltration Rate (inches/hour)
TP-1	5	292
TP-2	4.5	21
TP-3	4.5	24
TP-3	5	148

As noted above the measured infiltration rates at the site are quite variable. NGI recommends that the design infiltration rate be selected based on the proposed system layout. NGI normally recommends that a minimum factor of safety of 2.0 be applied to account for loss of efficiency over time due to siltation and biologic growth. However, a higher factor of safety may be desired due to the high variability of the measured infiltration rates.

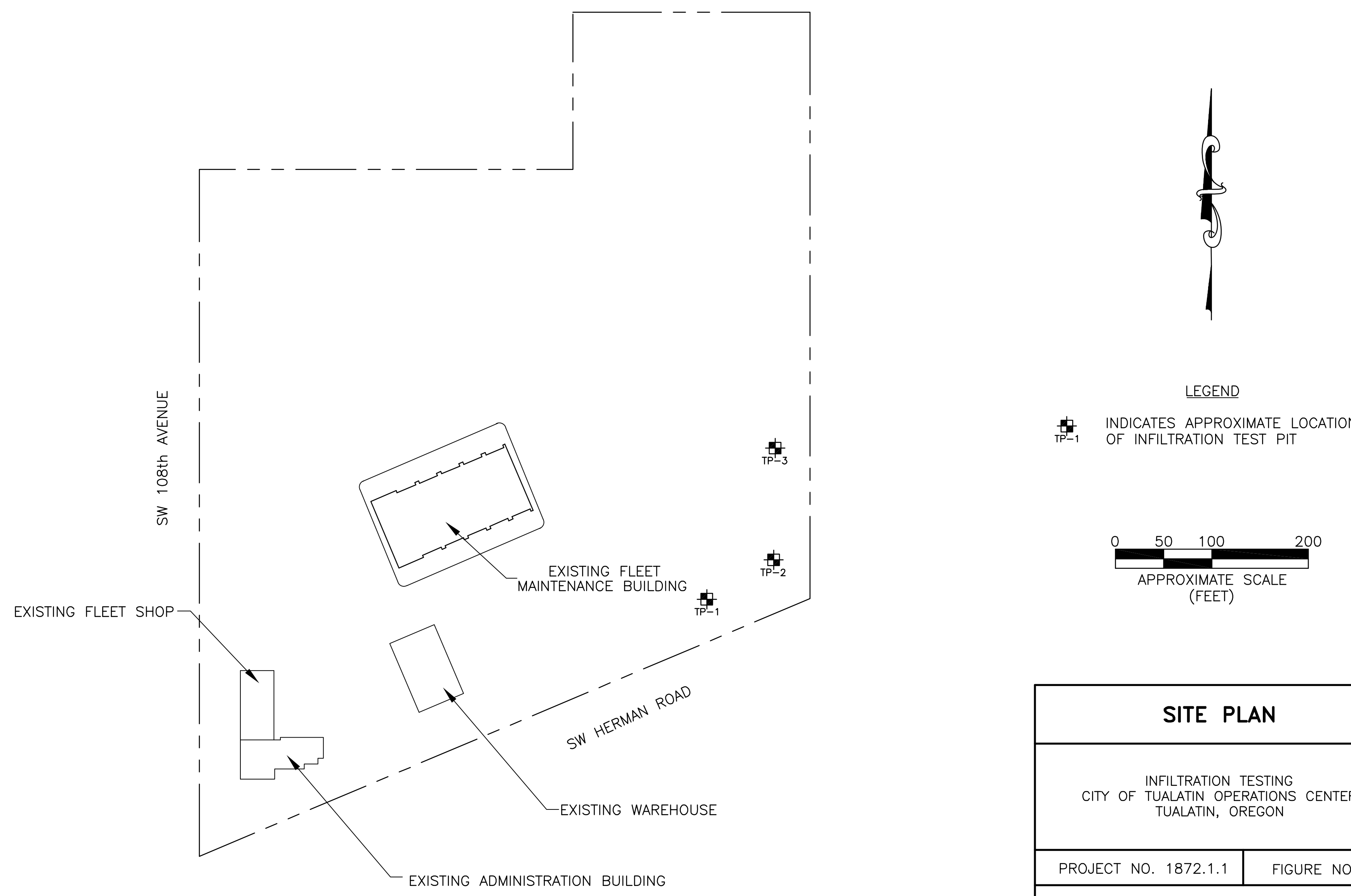
This opportunity to be of service is sincerely appreciated. Please call if you have any questions.

Respectfully submitted,

NORTHWEST GEOTECH, INC.

Wayne R. Olsen, P.E.
Project Engineer

Copies: (1) Addressee (E-mail and U.S. mail)



SITE PLAN

INFILTRATION TESTING
CITY OF TUALATIN OPERATIONS CENTER
TUALATIN, OREGON

PROJECT NO. 1872.1.1

FIGURE NO. 1

Northwest Geotech, Inc.

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

Washington County, Oregon

December 24, 2018

Preface

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

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

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

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

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

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

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Contents

How Soil Surveys Are Made

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

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

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

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

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

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

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

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

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

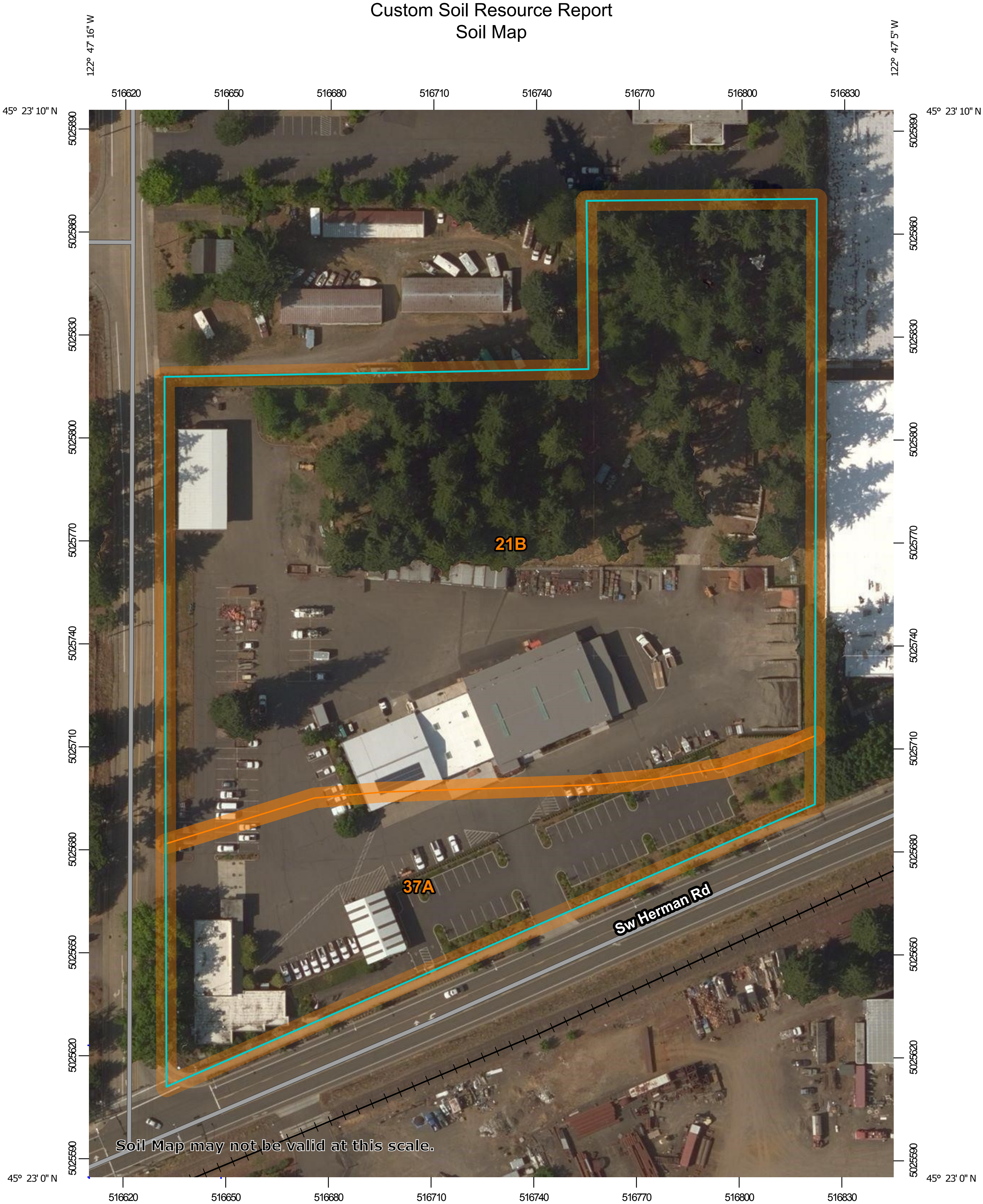
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree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

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

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

Soil Map



Map Scale: 1:1,510 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 20, 40, 80, 120

Feet: 0, 50, 100, 200, 300

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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

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

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

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

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

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

Soil Survey Area: Washington County, Oregon
Survey Area Data: Version 16, Sep 18, 2018

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

Date(s) aerial images were photographed: Aug 3, 2014—Aug 23, 2014

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
21B	Hillsboro loam, 3 to 7 percent slopes	6.6	75.4%
37A	Quatama loam, 0 to 3 percent slopes	2.1	24.6%
Totals for Area of Interest		**8.7**	**100.0%**

Map Unit Descriptions

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

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

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

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

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

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

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

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

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

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

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

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

Washington County, Oregon

21B—Hillsboro loam, 3 to 7 percent slopes

Map Unit Setting

National map unit symbol: 21y6
Elevation: 160 to 240 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Hillsboro and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Hillsboro

Setting

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

Typical profile

H1 - 0 to 15 inches: loam
H2 - 15 to 48 inches: loam
H3 - 48 to 57 inches: fine sandy loam
H4 - 57 to 81 inches: fine sand

Properties and qualities

Slope: 3 to 7 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

37A—Quatama loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 21zl
Elevation: 140 to 250 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 52 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Quatama and similar soils: 85 percent
Minor components: 4 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Quatama

Setting

Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium

Typical profile

H1 - 0 to 15 inches: loam
H2 - 15 to 30 inches: clay loam
H3 - 30 to 62 inches: loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 8.8 inches)

Interpretive groups

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

Minor Components

Huberly

Percent of map unit: 4 percent
Landform: Terraces

Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

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