The Goal of the initial storm water report is to determine the size of a stormwater facility on-site required for treatment and flow control of stormwater runoff generated from proposed on-site impervious areas.

The site is located at 13735 Lazy Creek Lane in Oregon City. It is currently developed with one existing house and a gravel driveway. The remainder of the site consists of grass and existing trees. The site generally slopes from west to east at an approximately 2 % slope. Runoff currently flows across the site to the east property line where it eventually drains towards the Lazy Creek Lane right-of-way. The site will be developed with a 20 lot residential subdivision including a new public street. Stormwater generated by the impervious area will be treated with a detention and water quality pond that will provide the required treatment and flow control. The detention pond will be located at the southeast corner of the site.

The BMP Sizing Tool will be used to size the stormwater detention and water quality pond.

AREA: Total Site Area = 97,323 SF. Of which there is Pervious Area 41,371, and Impervious Area 55,952 SF

Of the impervious area about 30,000 SF (57%) is on the lots, and 26,000 SF (43%) is in the street and sidewalk

SOIL: Per the NRCS Web Soil Survey, the site has the following soils: 8B—Bornstedt silt loam— Hydrologic Group 'C'; 8C— Bornstedt silt loam— Hydrologic Group 'C'. Per the NRCS Web Soil Survey the infiltration rate for the soil at a depth of 6 feet is 1.40 micro meters per second, which is 0.2 inches per hour.

Drainage Management Areas

DMA	Area	Hydrologic Group	Pre Developed Surface	Post Developed Surface
Pervious Area	41,371	c	Forested	Landscaped, C-Soil
1mpervious Area	55,952	c	Forested	Roofs

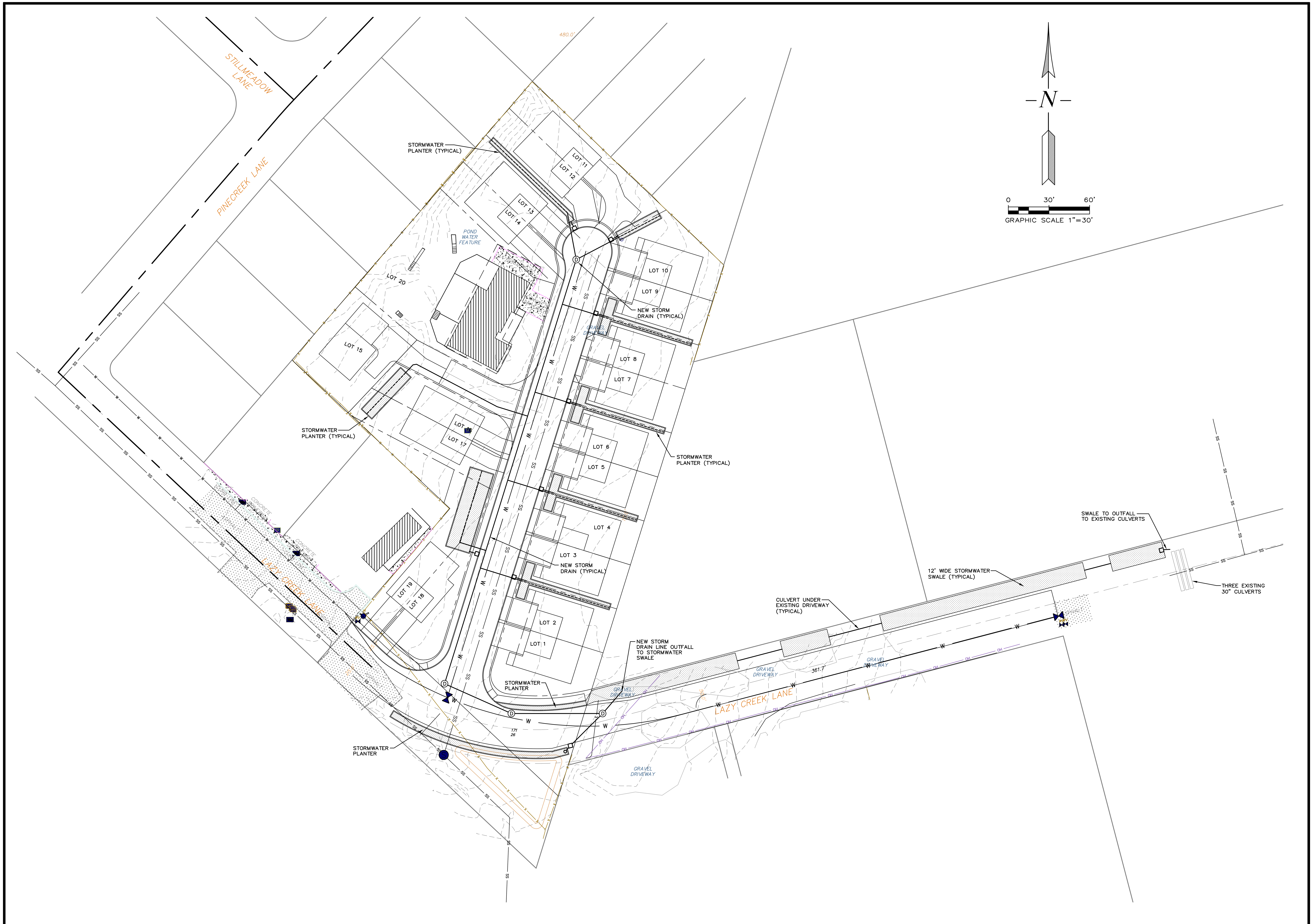
Best Management Practices

BMP Name	Infiltration Rate	Surface Area	Depth	Side slopes
Detention & WQ Pond	0.08 - 0.24 in/hr	8,400	6'	

Therefore without any treatment on each the lot the minimum required surface area for the detention pond would be 8,400 square feet. The pond would have 3 feet of drain rock/soil media and 3 feet of water storage with 1 foot of freeboard above the water storage. Per the attached WES BMP Sizing Report, an 8,400 square foot pond would be adequately sized for flow control and water quality treatment. However, the applicant can treat, and retain the storm water from each lot onsite. Thus the overall pond size could be reduced by 57% or to a 3600 SF surface. Further should the applicant be able to incorporate curb side swales along the proposed public street. There is potential for over 100-linear feet of swale along Lazy Creek Lane. The facility would be located I Tract ‘A’ adjacent to the public street, for easy maintenance, and access. The pond would outfall into a storm line that ran south into the adjacent creek through an offsite drainage easement.

Through the use of onsite treatment, and detention, drainage swales, and a water quality detention pond, and then hard-lining the treated detained water directly into the creek the proposed application can meet the City’s stormwater requirements.

Original information taken from PRELIMINARY STORM CALCULATIONS / SISUL ENGINEERING



REVISIONS	BY

LAZY CREEK LANE SUBDIVISION

MARK DANE PLANNING, INC.

Preliminary Storm Drain Plan

SISUL ENGINEERING
375 PORTLAND AVENUE
GLADSTONE, OREGON 97027
(503) 657-0188

DATE	NOV. 2019
SCALE	1"=30'
DRAWN	DJ
JOB	SGL 19-032
SHEET	1
OF 1	SHEETS

Lazy Creek Lane Subdivision

J.O. SGL 19-032

September 24, 2019
Revised November 6, 2019

PRELIMINARY STORM CALCULATIONS

REGISTERED PROFESSIONAL
ENGINEER
12,820
PRELIMINARY
OREGON
FEB 14, 1985
THOMAS J. SISUL

EXPIRES: 6/30/

SISUL ENGINEERING
A Division of Sisul Enterprises, Inc.
375 PORTLAND AVE.
Gladstone, OR 97045
phone: (503) 657-0188
fax: (503) 657-5779

NARRATIVE:

GOAL:

Determine the size of stormwater facilities required for treatment and flow control of stormwater runoff generated from proposed on-site and offsite impervious areas.

INTRODUCTION:

The site is located at 13735 Lazy Creek Lane in Oregon City. It is currently developed with one existing house and a gravel driveway. The remainder of the site consists of grass and existing trees. The site generally slopes from west to east at an approximately 6% slope. Runoff currently flows across the site to the east property line where it eventually drains towards the Lazy Creek Lane right-of-way.

The site will be developed with a 20 lot residential subdivision including a new public street. Stormwater generated by the onsite impervious area will be treated with several stormwater planters located between and around the proposed houses. The onsite stormwater planters will provide both water quality treatment and flow control. Stormwater generated by the offsite impervious area will be treated with several stormwater swales and planters located adjacent to the new street improvements. The offsite stormwater swales and planters will provide both water quality treatment and flow control.

The BMP Sizing Tool will be used to size the stormwater detention and water quality pond.

AREA:

Total Onsite and Offsite Impervious Area = 62,758 sf

Impervious Area Draining to Onsite Planters = 24,413 sf

Impervious Area Draining to Offsite Swales/Planters = 38,345 sf

SOIL:

Per the NRCS Web Soil Survey, the site has the following soil:

- 8B—Bornstedt silt loam– Hydrologic Group 'C'
- 8C— Bornstedt silt loam– Hydrologic Group 'C'

Per the NRCS Web Soil Survey the infiltration rate for the soil at a depth of 6 feet is 1.40 micro meters per second, which is 0.2 inches per hour.

(See attached Soil Reports)

WES BMP SIZING TOOL INPUT VALUES:

Drainage Management Areas

DMA	Area	Hydrologic Group	Pre Developed Surface	Post Developed Surface
Onsite Impervious Area	24,413	C	Forested	Roofs
Offsite Impervious Area	38,345	C	Forested	Conventional Concrete or Asphalt

Best Management Practices

BMP Name	Facility Infiltration Rate	Minimum Area	Planned Area
Onsite Planters	Lined Facility	3,662	3,662
Offsite Swales/ Planters	C2 (0.25 – 0.34 in/hr)	4,601	4,602

WES BMP SIZING TOOL SUMMARY:

Per the attached WES BMP Sizing Report, the Onsite Stormwater Planters have a minimum area of 3,662 square feet and the actual planned area of the planters is 3,662 square feet, therefore the onsite planters are adequately sized for flow control and water quality treatment.

Per the attached WES BMP Sizing Report, the Offsite Stormwater Swales/Planters have a minimum area of 4,601 square feet and the actual planned area of the planters is 4,602 square feet, therefore the offsite swales/planters are adequately sized for flow control and water quality treatment.

Onsite Planters

WES BMP Sizing Software Version 1.6.0.2, May 2018

WES BMP Sizing Report

Project Information

Project Name	Lazy Creek Lane Subdivision
Project Type	Subdivision
Location	13735 Lazy Creek Lane
Stormwater Management Area	24413
Project Applicant	
Jurisdiction	OutofDistrict

Drainage Management Area

Name	Area (sq-ft)	Pre-Project Cover	Post-Project Cover	DMA Soil Type	BMP
Impervious Area	24,413	Forested	Roofs	C	BMP

LID Facility Sizing Details

LID ID	Design Criteria	BMP Type	Facility Soil Type	Minimum Area (sq-ft)	Planned Areas (sq-ft)	Orifice Diameter (in)
BMP	FlowControlAndTreatment	Rain Garden - Filtration	Lined	3,662.0	3,662.0	0.9

Pond Sizing Details

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only

2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).

3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.

4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.

Offsite Swales/Planters

WES BMP Sizing Software Version 1.6.0.2, May 2018

WES BMP Sizing Report

Project Information

Project Name	Lazy Creek Lane Subdivision
Project Type	Subdivision
Location	13735 Lazy Creek Lane
Stormwater Management Area	38345
Project Applicant	
Jurisdiction	OutofDistrict

Drainage Management Area

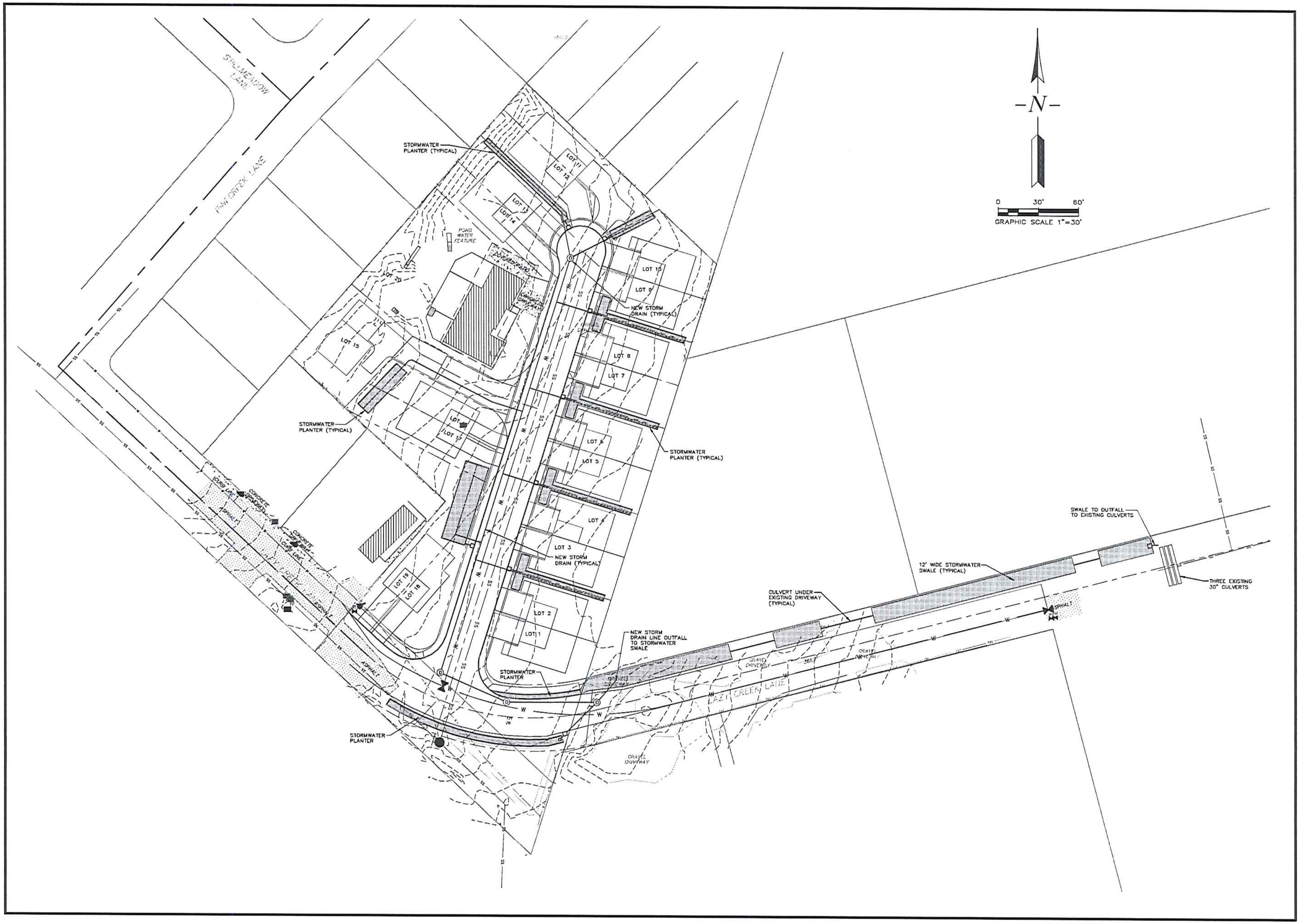
Name	Area (sq-ft)	Pre-Project Cover	Post-Project Cover	DMA Soil Type	BMP
Impervious Area	38,345	Forested	ConventionalConcrete	C	BMP

LID Facility Sizing Details

LID ID	Design Criteria	BMP Type	Facility Soil Type	Minimum Area (sq-ft)	Planned Areas (sq-ft)	Orifice Diameter (in)
BMP	FlowControlAndTreatment	Vegetated Swale - Filtration	C2	4,601.4	4,602.0	1.3

Pond Sizing Details

1. FCWQT = Flow control and water quality treatment, WQT = Water quality treatment only
2. Depth is measured from the bottom of the facility and includes the three feet of media (drain rock, separation layer and growing media).
3. Maximum volume of the facility. Includes the volume occupied by the media at the bottom of the facility.
4. Maximum water storage volume of the facility. Includes water storage in the three feet of soil media assuming a 40 percent porosity.



REVISIONS	BY

LAZY CREEK LANE SUBDIVISION
MARK DANE PLANNING, INC.

Preliminary Storm Drain Plan

SISUL ENGINEERING
375 PORTLAND AVENUE
GLADSTONE, OREGON 97027
(503) 657-0188

DATE	NOV. 2019
SCALE	1"=30'
DRAWN	DJ
JOB	SGL 19-032
SHEET	1
OF 1	SHEETS

Soil Map—Clackamas County Area, Oregon

Map Scale: 1:3,000 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0, 40, 80, 160, 240

Feet: 0, 100, 200, 400, 600

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: Clackamas County Area, Oregon
Survey Area Data: Version 14, 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: Jul 26, 2014—Sep 5, 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
8B	Bornstedt silt loam, 0 to 8 percent slopes	0.1	5.0%
8C	Bornstedt silt loam, 8 to 15 percent slopes	1.9	95.0%
Totals for Area of Interest		**2.0**	**100.0%**

Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Report—Physical Soil Properties

Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Physical Soil Properties–Clackamas County Area, Oregon														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	micro m/sec	In/In	Pct	Pct					
8B—Bornstedt silt loam, 0 to 8 percent slopes														
Bornstedt	0-8	- 9-	-67-	20-24- 27	1.30-1.40 -1.50	4.00-9.00-14.00	0.15-0.16-0. 17	0.0- 1.5- 2.9	3.0- 3.5- 4.0	.37	.37	5	6	48
	8-33	- 7-	-62-	27-31- 35	1.40-1.50 -1.60	4.00-9.00-14.00	0.13-0.15-0. 17	0.0- 1.5- 2.9	1.0- 2.0- 3.0	.37	.37			
	33-71	- 7-	-48-	40-45- 50	1.30-1.40 -1.50	0.42-0.91-1.40	0.12-0.14-0. 15	0.0- 1.5- 2.9	0.5- 0.8- 1.0	.32	.32			
8C—Bornstedt silt loam, 8 to 15 percent slopes														
Bornstedt	0-8	- 9-	-67-	20-24- 27	1.30-1.40 -1.50	4.00-9.00-14.00	0.15-0.16-0. 17	0.0- 1.5- 2.9	3.0- 3.5- 4.0	.37	.37	5	6	48
	8-33	- 7-	-62-	27-31- 35	1.40-1.50 -1.60	4.00-9.00-14.00	0.13-0.15-0. 17	0.0- 1.5- 2.9	1.0- 2.0- 3.0	.37	.37			
	33-71	- 7-	-48-	40-45- 50	1.30-1.40 -1.50	0.42-0.91-1.40	0.12-0.14-0. 15	0.0- 1.5- 2.9	0.5- 0.8- 1.0	.32	.32			

Data Source Information

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 14, Sep 18, 2018

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 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 ovendry 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.

Report—Engineering Properties

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–Clackamas 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		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
8B—Bornstedt silt loam, 0 to 8 percent slopes														
Bornstedt	85	C	0-8	Silt loam	ML	A-4	0- 0- 0	0- 0- 0	90-95-100	85-93-100	85-93-100	75-83-90	30-33-35	5-8 -10
			8-33	Silty clay loam	CL, ML	A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-98-100	90-93-95	35-38-40	10-13-15
			33-71	Silty clay, clay	ML	A-7	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-98-100	90-93-95	45-48-50	15-18-20
8C—Bornstedt silt loam, 8 to 15 percent slopes														
Bornstedt	80	C	0-8	Silt loam	ML	A-4	0- 0- 0	0- 0- 0	90-95-100	85-93-100	85-93-100	75-83-90	30-33-35	5-8 -10
			8-33	Silty clay loam	CL, ML	A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-98-100	90-93-95	35-38-40	10-13-15
			33-71	Silty clay, clay	ML	A-7	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-98-100	90-93-95	45-48-50	15-18-20

Data Source Information

Soil Survey Area: Clackamas County Area, Oregon
Survey Area Data: Version 14, Sep 18, 2018