Restoration Agreement

OR18 Spur: South Yamhill River Br #06758

Wetland Reserve Program Easement #660436980019N
ODOT Key No. 19389
Federal Aid No. S483(000)PE

7/2/2019

Prepared by the Oregon Department of Transportation and Natural Resource Conservation Service

Contents

Purpose

The purpose of this restoration plan is to provide a concept to restore the functions and values of the portion of the Wetland Reserve Program (WRP) easement #660436980019N (hereafter referred to as "the easement") that may be affected by the Oregon Department of Transportation (ODOT)-sponsored OR18 Spur: South Yamhill River Br #06758 project (hereafter referred to as the "project"), as well as to inform the Environmental Assessment to which this restoration plan is attached. The restoration measures included in this plan aim to go beyond the minimum requirement to restore the existing conservation functions and values of the easement lands by providing as much environmental uplift to the impacted easement area as is feasible in conjunction with the project. By doing so, ODOT intends to demonstrate that the project will result in greater conservation functions and value than existed prior to the project, further the practical administration of the easement program in the state, and result in equal or greater economic value to the United States than existed prior to the project.

Due to the potential impacts to the WRP Easement, the NRCS must evaluate and approve the action through the Agricultural Conservation Easement Program (ACEP) Administrative Action process for subordinating the United States rights temporarily while the bridge is replaced. The Oregon State Conservationist has reviewed the project proposal and has received documentation to support the criteria set forth in the ACEP Manual Title 440 – conservation Programs manual, Part 528 Subpart R – ACEP Easement Subordination, Modification, Exchange, and Terminations. This Restoration Plan will mitigate the impacts to the WRP easement so that there will be equal or greater conservation functions and value on the easement.

This plan is based on the findings of a Baseline Easement Inventory dated 1/31/2017 (hereafter referred to as "the baseline inventory") that was conducted for the easement area proposed to be impacted by the project.

ODOT-Sponsored Project Description

The wooden piles comprising the substructure of the OR18 Spur Bridge over the South Yamhill River (#06758) are rotting. A bridge inspection report dated 6/24/2015 identifies the Sufficiency Rating as 6 (out of a possible 100). Costly maintenance repairs to replace rotten piles will continue if the bridge is not replaced. This project proposes to replace the bridge with a new structure.

The bridge is a critical link between the City of McMinnville and the Willamette Valley Medical Center, so the project proposes to keep at least one lane of traffic open during construction to allow passage for emergency vehicles to the maximum extent practicable. This would require a detour structure to be constructed adjacent to the existing structure. The existing bridge will then be demolished while the detour is open to traffic. The new structure will then be constructed on the same alignment as the existing bridge.

The proposed bridge will be approximately 54 ft wide to meet current standards, which is 18.75 ft wider that the existing 35.25 ft wide bridge. The proposed temporary alignment will be constructed as close to the existing structure as practical, and is expected to extend

approximately 45 ft into the WRP easement to the west of the bridge. A small (0.072 acre) portion of the easement located east of the bridge is expected to be impacted.

The temporary alignment will be in-place for up to three years, and will require numerous temporary steel piles. Equipment will require access to the work area, so any trees impeding the work will need to be removed. Vegetation below the temporary alignment will also need to be removed to allow construction vehicles access into and through the work area. Wetlands in the construction zone will be impacted as well. Staging of equipment within the easement area will be limited to what is required to complete the work. Some additional ground disturbance will be required to remove the temporary piles when the temporary bents are removed. No permanent impacts associated with the temporary alignment are anticipated.

Project Vicinity

The easement is located along the south banks of the South Yamhill River, and is partially within the McMinnville City Limits and partially within Yamhill County (Figure 1). The Area of Potential Impact (API) for the ODOT-sponsored construction project intersects the easement along Three-Mile Lane, just north of its interchange with OR18.

Figure 1. Vicinity Map.

Restoration Area

The restoration area is the land area where the API of the ODOT-sponsored construction project intersects with the easement (Figure 2). This is the area of the easement that may be impacted by the ODOT-sponsored construction project and will be subject to restoration after construction. The location may vary depending upon final designs and such revised location shall be set forth in an amendment which shall become part of this agreement. NRCS must approve any variations to the impact area prior to becoming part of this agreement.

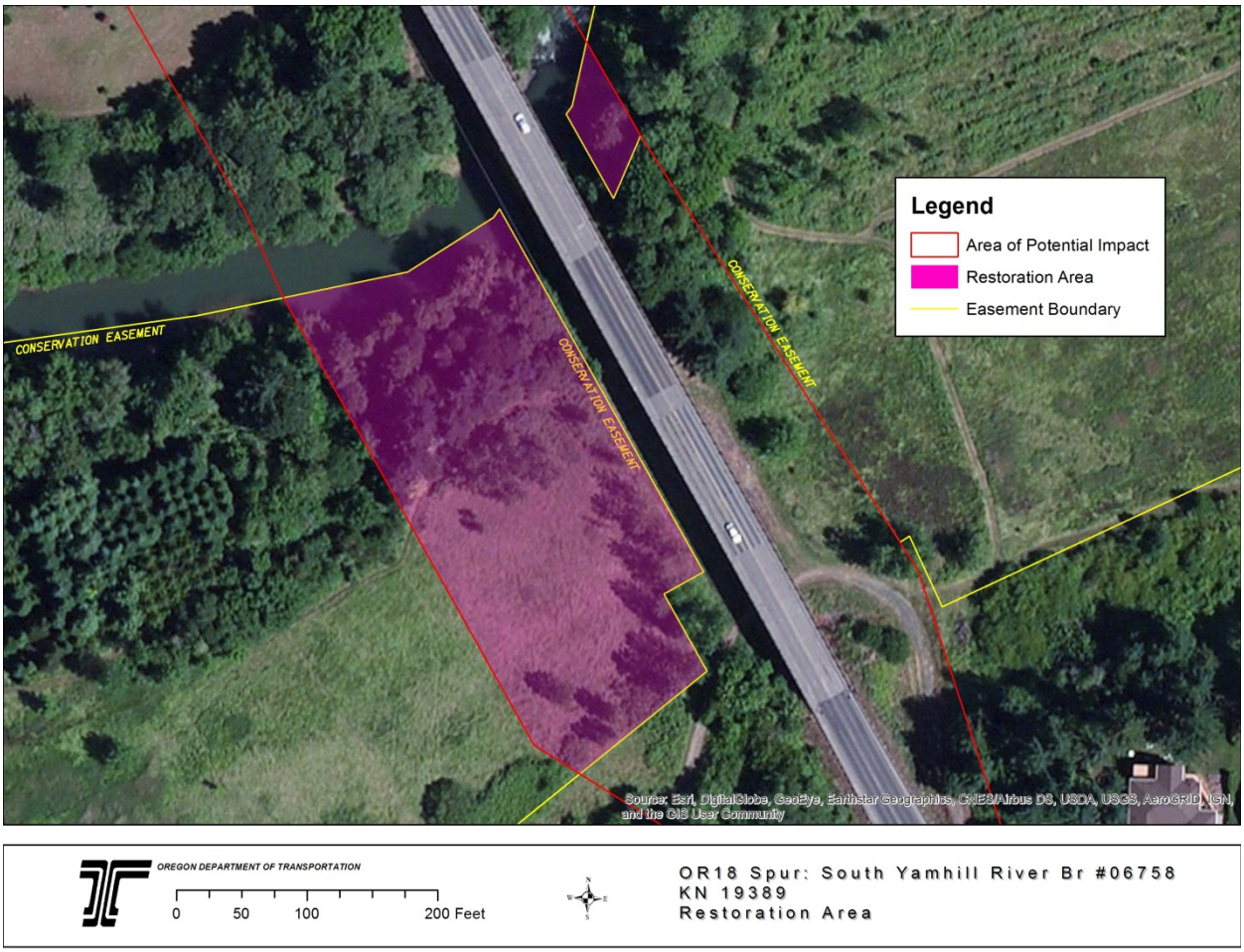

Figure 2. Restoration Area.

The baseline inventory identified four botanical zones (Figure 3) and labeled A, B, C, and D. These zones were delineated primarily by the plant communities present. Zone A is the area characterized by early WRP plantings of black cottonwood. Zone B is the area where WRP plantings are still saplings and herbaceous cover still dominates. Zones C and D are areas of riparian forest that existed prior to the establishment of the easement. Zones C and D were divided into separate zones because they are bisected by Three-Mile Ln. However, Zones C and D share similar habitat characteristics and are considered together in the Proposed Restoration Activities section of this report. Similarly, Zones A and B are also considered together in this report; Zones A and B are differentiated primarily by the presence of black cottonwood plantings which will be removed by the project.

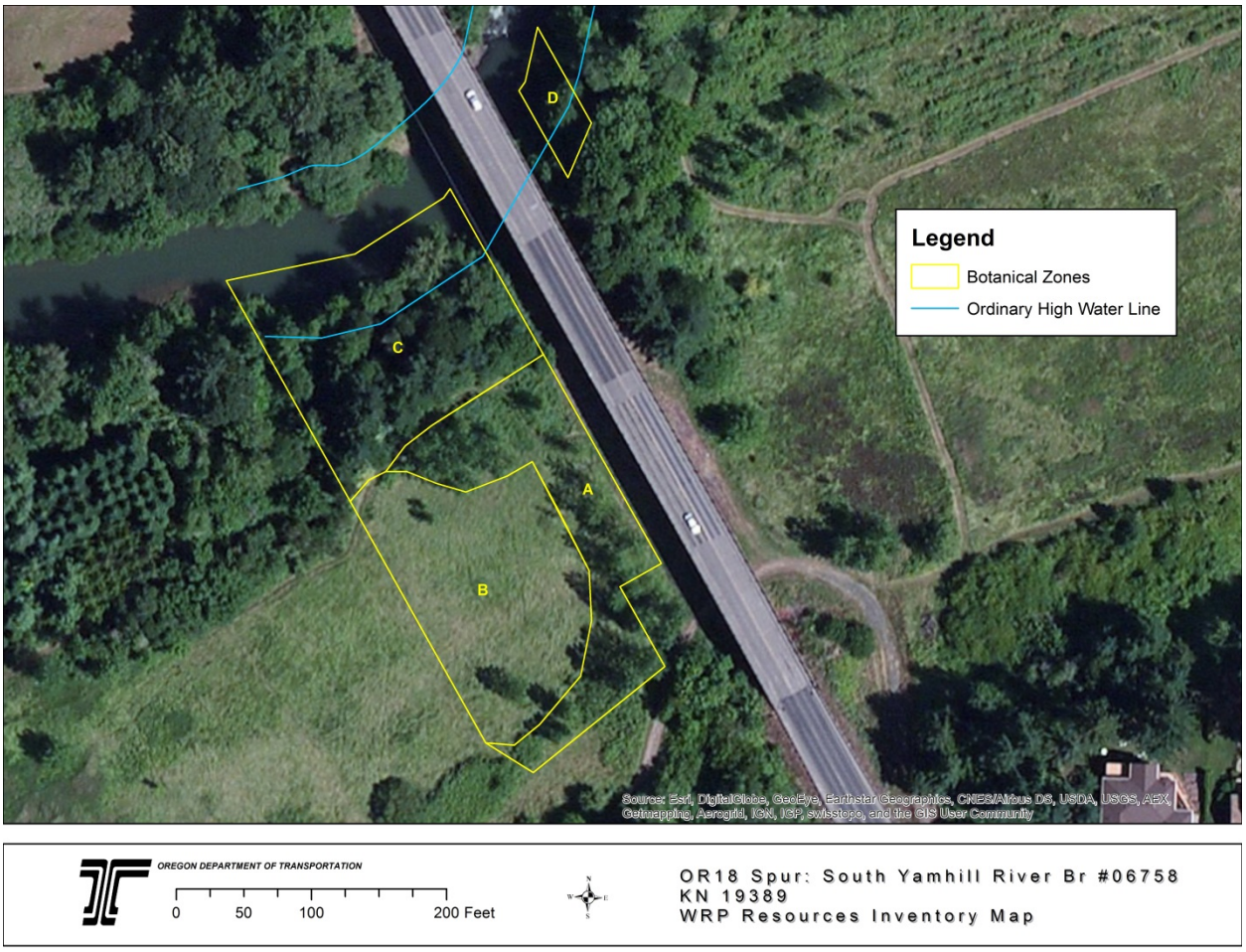

Figure 3. Botanical zones identified in the baseline inventory.

The area of each botanical zone is described in Table 1. A portion of the easement boundary includes the wetted channel, where no botanical restoration will occur. The wetted channel area (at the time of survey) was subtracted from the area of Zones C and D in the table below.

Table 1. Land Area of Botanical Zones.

Zone	Land Area (acres)
A	0.421
B	0.526
C	0.479
D	0.037
Total:	1.463

Restoration Activities

The long-term goal for the site is to return the land to a Willamette Valley riparian woodland habitat in which trees shade out invasive herbaceous species. The following restoration activities are planned to meet that goal. A soils report is attached (Exhibit B).

Restoration Activity 1: De-compact Areas and Prepare a Seedbed/Planting areas

Construction activities will compact soils in portions of the easement. Use a ripper implement on any areas heavily trafficked or otherwise with compacted soils. Soils should be ripped to at least a 20" depth. Areas to be planted/seeded within the disturbed areas should be disked smooth to prepare a seedbed. If weeds or other deleterious vegetation is present, it will be sprayed or otherwise removed prior to seeding. Prior to seeding, soil should settle or be rolled smooth such that someone walking across the surface would sink no greater than ¼ inch depth, so soils aren't too fluffy for seeding (if seed sinks too deep and can't germinate). Site preparation and seeding should be done in late-summer to fall – best timing would be to have seed down by late September so seedlings can develop with fall moisture. Site should be weed-free prior to distribution of seed. Seed rates were calculated based on broadcast seeding. After seeding, site should be rolled to compress seed to soil to improve soil contact.

At the onset of restoration, temporary seed mix 2a will be applied during the Fall in order to stabilize the site while tree and shrub competition control is being implemented. In the fourth year of restoration – after the final competition control herbicide application is complete – seed mixes 2a and 2b will be broadcast into bare areas. These seed mixes are shown in Tables 2a, 2b, and 2c.

Restoration Activity 2: Replace Existing WRP Plantings

The existing WRP plantings within the study area include 13 valley ponderosa pine, 28 Oregon ash, and 45 black cottonwood plantings. All of these plantings were located in Zones A and B. The planting plan included in the construction contract must replant any of these trees impacted at a one-to-one ratio within Zones A and B. The purpose of this restoration activity is to bring the functions and values of the restoration area back to the baseline level so that Restoration Activity 3 will represent a substantial uplift to the site.

Restoration Activity 3: Emulate Species Density and Composition of Zones C & D for all zones

Both Zones C and D represent a relatively intact Willamette Valley riparian woodland, and the project should seek to emulate this habitat. However, the tree density of Zone C (448 trees per acre) is too dense, resulting in competition for light. The tree density of Zone D (242 trees per acre) is a more appropriate target because it will allow sufficient space for mature trees to thrive.

In the herbaceous stratum, very few native species were identified during the baseline inventory; however, the impacted area will be restored with a mix of native grasses and forbs that are associated with wetlands, but can also survive periods of dry weather during the summer. Sterile wheat grass seed may be applied during the first and second construction seasons in order to

control erosion, but will not be included in the final seed mixes. The seed mixes to be planted are shown in Tables 2a, 2b, and 2c below.

Table 2a. Wet Swale area seeding (below 104 ft elevation)

Scientific Name	**Common Name**	**Pure Live Seed (lbs/acre) rate**
Agrostis exerata	Spike bentgrass	1.0
Beckmannia syzigachne	Sloughgrass	4.0
Camassia leichtlinii	Tall camas	1.0
Carex obnupta	Slough sedge	3.0
Deschampsia cespitosa	Tufted hairgrass	1.0
Hordeum brachyantherum	Meadow barley	2.0
Lupinus polyphyllus	Big-leaf lupine	0.5

Table 2b. Riparian Area seeding (above 104 ft elevation)

Scientific Name	**Common Name**	**Pure Live Seed (lbs/acre) rate**
Achillea millefolium var. occidentalis	Western yarrow	0.2
Bromus carinatus	California brome	2.0
Camassia leichtlinii	Tall camas	1.0
Clarkia amoena	Farewell to spring	0.4
Danthonia californica	California oatgrass	3.0
Elymus glaucus	Blue wildrye	3.0
Eriophylum lanatum	Oregon sunshine	0.2
Lupinus rivularis	River lupine	0.2
Madia elegans	Elegant tarweed	0.2
Prunella vulgaris var. lanceolata	Self-heal	0.5
Sidalcea campestris	Meadow checker-mallow	1.0

Table 2c. Temporary erosion control seeding

Scientific Name	**Common Name**	**Pure Live Seed (lbs/acre) rate**
Agrostis exarata	Spike bentgrass	0.07
Deschampsia cespitosa	Tufted hairgrass	1.5
Elymus glaucus	Blue wildrye	20

The cover percentage data in the baseline inventory for Zones C and D were used to develop a list of species to plant in the shrub stratum. Cover was measured at 50% and 85% in the shrub strata of Zones C and D, respectively. Given the land area of each zone, this averages to 53% cover across both zones; therefore, minimum acceptable native shrub cover in Zones C and D is 53%. Existing native cover in the shrub stratum is in Zones A and B is only 7%; therefore, 7% is the minimum acceptable native shrub cover in Zones A and B.

Native species identified during this inventory, as well as other common native species found in Willamette Valley riparian woodland habitats are recommended in Table 3. A mortality rate of 30% is assumed for the shrub stratum; therefore, a minimum of 793 shrubs per acre must be planted in order to meet the target of 555 shrubs per acre, which equates to 53% cover.

Table 3. Required shrub stratum plantings.

Common Name	Scientific Name	Mean Cover (%)	Estimated Plants per Acre to Achieve Target Cover	Moisture zone to plant in
snowberry	Symphoricarpos albus	10%	220	Drier/>104' elevation line
red osier dogwood	Cornus stolonifera	13%	103	throughout
Pacific ninebark	Physocarpus capitatus	4%	31	Wetter/<104' elevation line
Oregon grape	Mahonia aquifolium	5%	159	Drier/>104' elevation line
red elderberry	Sambucus racemosa	5%	110	Drier/>104' elevation line
salmonberry	Rubus spectabilis	3%	66	Drier/>104' elevation line
vine maple	Acer circinatum	3%	24	Drier/>104' elevation line
nootka rose	Rosa nutkana	3%	24	throughout
Sitka willow	Salix sitchensis	4%	32	Wetter/<104' elevation line
Cascara	Rhamnus purshiana	3%	24	Drier/>104' elevation line
		Total plantings per acre:	793	

Tree density sample plot data from the baseline inventory were used to develop a list of species and planting rates for the tree stratum; however, the percentage of Douglas-fir and western red cedar were reduced in order to allow for a sufficient quantity of valley ponderosa pine, Oregon ash, and black cottonwood per recommendation 1 (see Table 4).

A mortality rate of 30% is assumed for the tree stratum; therefore, a minimum of 357 trees per acre must be planted in order to meet the target of 250 trees per acre.

Table 4. Recommended tree stratum plantings.

Common Name	Scientific Name	Abundance (%)	Individuals per acre	Moisture zone to plant in
black cottonwood	Populus trichocarpa	31%	110	Drier/>104' elevation line
Oregon ash	Fraxinus latifolia	28%	100	Wetter/<104' elevation line
red alder	Alnus rubra	19%	68	Drier/>104' elevation line
valley ponderosa pine	Pinus ponderosa var. willamettensis	7%	25	Wetter/<104' elevation line
Pacific willow	Salix lasiandra	6%	21	Wetter/<104' elevation line
big leaf maple	Acer macrophyllum	3%	11	Drier/>104' elevation line
Douglas-fir	Pseudotsuga menziesii	3%	11	Drier/>104' elevation line
western red cedar	Thuja plicata	3%	11	Drier/>104' elevation line
		Total:	357	

If the above seed, shrub, or tree plantings will not be implemented as planned, the ODOT will provide NRCS with a written justification and request to modify the plan. NRCS must approve any modifications prior to purchasing or planting seed on the impacted site. The impacted area most likely will change based on actual site disturbance, at which point the plan must be updated based on final measurements.

Restoration Activity 4: Protect Plantings from Ungulates

Small trees and shrubs within the study area have been heavily browsed upon by deer (Figure 6). The success of any restoration effort will depend on protecting the plantings from ungulates. An 8-ft tall wildlife fence will be installed around the planting area in order to protect the plantings from ungulates. The fence will be installed above the ordinary high water line, and will be inspected periodically to ensure continued functionality throughout the establishment period.

Figure 6 (right). A young black cottonwood sprouted from rootstock has been eaten by deer.

Restoration Activity 5: Weed Control During and After Construction

A bid item for weed control must be either included in the construction contract or completed by another subsequent contract with ODOT. The ODOT Standard Specifications for Construction

(2018) describe weed control requirements, Exhibit C. These requirements include removal of all weeds of categories A, B, and T on the ODA weed list, as well as maintaining a weed-free work area for the duration of construction. Ensuring that no weeds are present at the end of construction will facilitate the success of plant establishment (Restoration Activity 6). NRCS will approve the seed bed and site preparation condition prior to planting, ODOT must notify the local NRCS field office contact at least 10 days prior to planting date. NRCS may require an additional weed control activity prior to ODOT planting.

After construction, weeds will continue to be controlled, primarily via spot-spraying and competition control. In the spring and fall of each year of establishment, weeds will be identified and spot-sprayed, and a 3-ft radius around each tree and shrub planting must be sprayed to control vegetative competition. ODOT will provide NRCS with the spraying plan prior to writing into the construction contract for both the construction weed control activities and post construction activities. The ODOT will provide the pesticide MSDS sheet, proposed dates and locations of pesticide application will be provided to NRCS for approval prior to entering into construction contract or applying pesticides on the WRP easement. Reed canary grass will be specifically identified in the spraying plan as a target for removal.

Restoration Activity 6: Monitoring, Plant Establishment, and Success Criteria

Monitoring is required for the duration of the plant establishment period to ensure that the restoration is successful. The plant establishment timeframe is five years. In that timeframe, shrubs and trees will be established to the point that they will be able to out-compete herbaceous weeds.

ODOT will provide NRCS with an annual monitoring report which includes the weed control activities, status of plantings and tree establishment, and any recommendations for modifying the plan for successful restoration. ODOT will provide before and after photographs along with photo points of the implemented activities. The annual monitoring report will include pictures with photo points, date of review, person (name and title) who completed the review, survival rate of plantings, and any recommend changes to compensate for changes in site conditions or mortality of plantings.

ODOT will notify NRCS at least 10 days prior to commencing planting activities and within 10 days of finalizing the planting activities for NRCS certification and approval.

The ODOT must provide NRCS with dates, rates, and pesticide application data within 10 days of application.

The following success criteria are based on the percent cover of native and invasive species and the tree density data presented in the Results section.

1. Cover of non-native plant species must be less than 50% in the herbaceous stratum.
2. No non-native tree or shrub species may be present after five years.

3. Cover of native shrub species must be 53% or more in all zones after five years.
4. Native trees must be present at a rate of 250 trees per acre after five years.

Final Status Report

ODOT will provide NRCS with a completion report soon after the five-year plant establishment period in order to demonstrate that the success criteria have been met. After NRCS acceptance of the completion report, the NRCS will assume responsibility for the site.

The information contained in this report is applicable for five years. If the ODOT construction project is constructed after that time period, the Restoration Plan must be modified to reflect current conditions and be approved by NRCS.

Signatures

Oregon Department of Transportation

Authorizing Official_____ Date_____

Title_____Name_____

Natural Resource Conservation Service

Thomas Hoskins, District Conservationist_____

Date_____

Bari Williams, Easement Program Specialist_____

Date_____

NRCS Authorizing Official_____ Date_____

Title_____Name_____

Table 6. Implementation Monitoring Record

Activity – Type, extent, location	**2018**	**2019**	**2020**	**2021**	**2022**
Example: Weed control, 5 acres, see map for location	March 15-20				
Notes					
NRCS Initial/Date					
Does the practice meet specifications					

Exhibit A: Restoration Plan Sheets

D
0.07 AC

C
0.22 AC
Below 104

C
0.14 AC
Above 104

A
0.37 AC

B
0.2 AC

SALMON RIVER HWY (OR18)

R/W

Proposed RW

Protect in place
'Checkermallow Plants'

Temp. Construction Easement

Elev. 104'

Impact Avoided

Baseline Resource Inventory Study Area

NOTE:
Exhibit showing areas A, B, C & D for area of potential impact (API), per baseline inventory report.
Acreage below elevation 104' = 0.29 AC
Acreage above elevation 104' = 0.71 AC

LEGEND

Avoided Impact

Orange Fence
To protect Sidalcea nelsoniana

OREGON DEPARTMENT OF TRANSPORTATION

OR18 SPUR: SOUTH YAMHILL RIVER BRIDGE #06758 PROJECT
McMINNVILLE SPUR HWY.
YAMHILL COUNTY

EXHIBIT MITIGATION AREA ROADSIDE DEVELOPMENT PLAN

SHEET NO. 1

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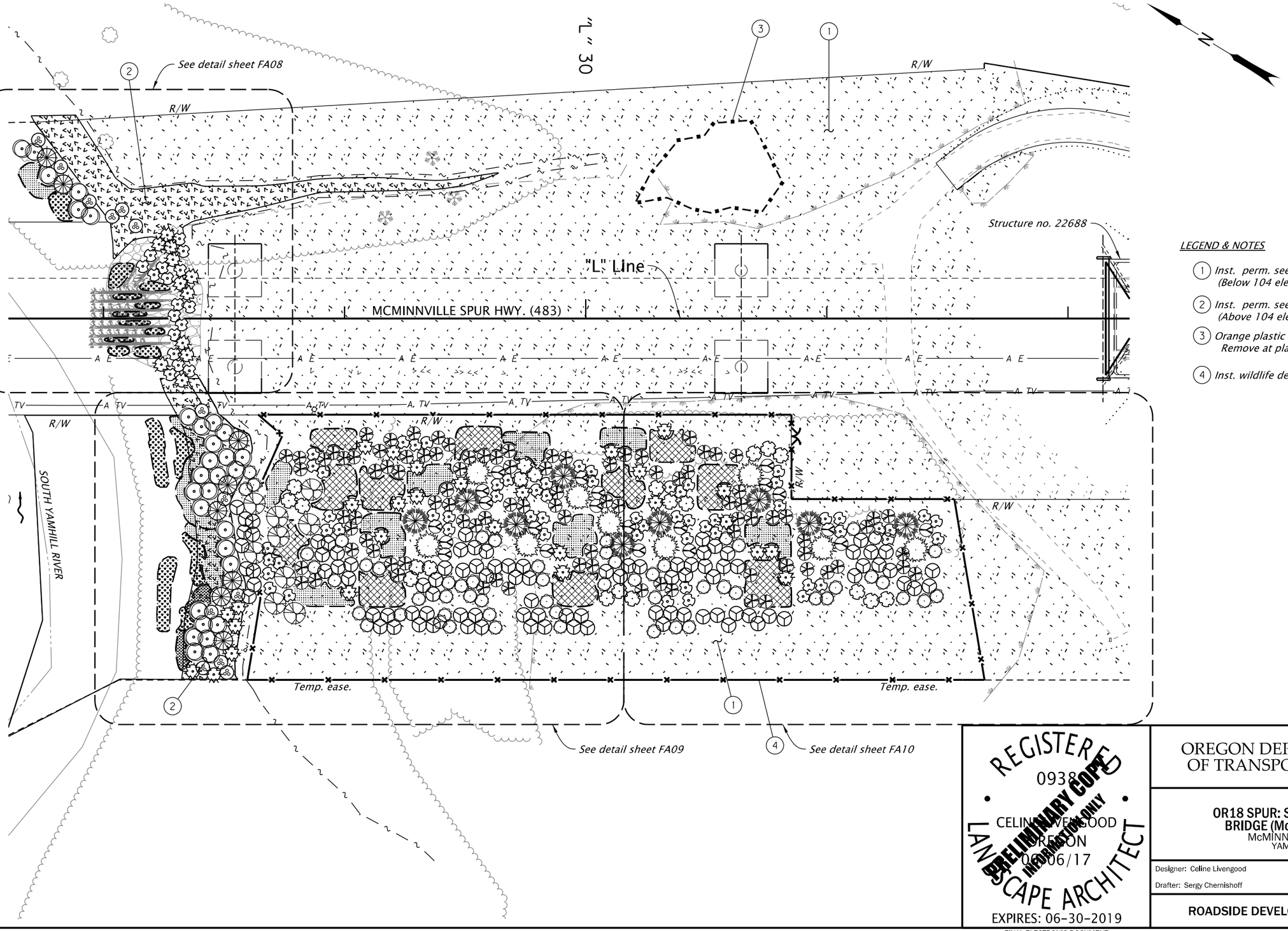

REGISTERED
0938
CELINE LIVENGOOD
OREGON
06/06/17
LANDSCAPE ARCHITECT
EXPIRES: 06-30-2019

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INFORMATION ONLY

OREGON DEPARTMENT OF TRANSPORTATION

OR18 SPUR: SOUTH YAMHILL RIVER BRIDGE (McMinnville) PROJECT
McMINNVILLE SPUR HWY.
YAMHILL COUNTY

Designer: Celine Livengood | Reviewer: Name
Drafter: Sergy Chernishoff | Checker: Name

ROADSIDE DEVELOPMENT PLAN

SHEET NO. FA03

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

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Rotation: 301.2127° Scale: 1"=40'

PLANTING, SEEDING AND MATERIALS SCHEDULE

	BOTANICAL NAME	COMMON NAME	SIZE / AMOUNT	ROOT TYPE / UNIT	PLANT CONDITION	LAYOUT/SPACING	NOTES	QUANTITY TOTAL
Trees	*Acer macrophylla*	Bigleaf Maple	1" caliper	burlap	single trunk	as shown on plan	as shown on plan	19
	Oemlaria cerasiformus	Indian Plum	4' tree	burlap	single trunk	as shown on plan	as shown on plan	16
	Pinus ponderosa var. willamettensis	Ponderosa Pine	4' tree	burlap	single trunk	as shown on plan	as shown on plan	19
	Psuedotsuga menziesii	Douglas Fir	4' tree	burlap	single trunk	as shown on plan	as shown on plan	16
	Thuga plicata	Western Red Cedar	4' tree	burlap	single trunk	as shown on plan	as shown on plan	16
	Total Trees							86
Shrubs	*Acer circinatum*	Vine Maple	#2 container	container	full branching	as shown on plan	as shown on plan	32
	Crataegus douglasii	Black Hawthorn	#2 container	container	full branching	as shown on plan	as shown on plan	11
	Physocarpus capitatus	Pacific Ninebark	#1 container	container	full branching	as shown on plan	as shown on plan	13
	Ribes spectablis	Pink Winter Currant	#1 container	container	full branching	as shown on plan	as shown on plan	29
	Rosa nutkana	Nootka Rose	#2 container	container	full branching	as shown on plan	as shown on plan	66
	Rubus spectabilis	Salmonberry	#1 container	container	full branching	as shown on plan	as shown on plan	113
	Total Shrubs							264
Seedlings	*Alnus rubra*	Red Alder	2' seedling	bare root	single stem	as shown on plan	as shown on plan	68
	Oemlaria cerasiformus	Indian Plum	2' seedling	bare root	single stem	as shown on plan	as shown on plan	34
	Rhamnus pershiana	Cascara Buckthorn	2' seedling	bare root	single stem	as shown on plan	as shown on plan	26
	Fraxinus latifolia	Oregon Ash	2' seedling	bare root	single stem	as shown on plan	as shown on plan	38
	Populus trichocarpa	Black Cottonwood	2' seedling	bare root	single stem	as shown on plan	as shown on plan	102
	Total Seedlings							268
Rooted Cuttings	*Cornus stolonifera*	Red Osier Dogwood	3/4 - 2" stem	rooted cutting	See Special Provisions 01040	2' OC & randomly arranged	as shown on plan	263
	Mahonia aquifolium	Oregon Grape	3/4 - 2" stem	rooted cutting	See Special Provisions 01040	2' OC & randomly arranged	as shown on plan	200
	Salix lasiandra	Pacific Willow	3/4 - 2" stem	rooted cutting	See Special Provisions 01040	2' OC & randomly arranged	as shown on plan	74
	Salix sitchensis	Sitka Willow	3/4 - 2" stem	rooted cutting	See Special Provisions 01040	2' OC & randomly arranged	as shown on plan	349
	Sambucus racemosa	Red Elderberry	3/4 - 2" stem	rooted cutting	See Special Provisions 01040	as shown on plan	as shown on plan	113
	Symphoricarpos albus	Snowberry	3/4 - 2" stem	rooted cutting	See Special Provisions 01040	2' OC & randomly arranged	as shown on plan	189
	Rooted Cuttings Total							1188
Grass/Shrub Seeding	Permanent Seeding No.1	Wet Mix	15 lbs	acres	pure live seed		Seeding below 104 elevation	0.48
	Permanent Seeding No.2	Upland Mix	35 lbs	acres	pure live seed		Seeding above 104 elevation	4.56
	Permanent Seeding No.3	Water Quality Swale	27 lbs	acres	pure live seed		Seeding of Swale	0.13
	Temporary Seeding No.1	Temporary Seed	22 lbs	acres	pure live seed		Temporary Seeding	5.00
	Seeding Totals (acres)							10.17

* N/A = Not Applicable to the Conservation Area Restoration Planting & Seeding Plan.

SEEDING MIXES

??V-???

	BOTANICAL NAME	COMMON NAME	SEEDS PER ACRE	PLS SEED RATE/ ACRE
	Permanent Seed #1	**Wet Mix**		
Below 104' Elevation	*Agrostis exarata*	Spike Bentgrass	5,227,200	1.0
	Beckmannia syziganche	Sloughgrass	2,221,560	4.0
	Camassia leichtlinii	Tall Camas	130,680	1.0
	Carex obnupta	Slough Sedge	1,698,840	3.0
	Deschampsia cespitosa	Tufted Hairgrass	1,306,800	1.0
	Hordeum brachyantherum	Meadow Barley	174,240	2.0
	Lupinus polyphyllus	Large leaf Lupine	21,780	0.5
	Permanent Seed #2	***Upland Mix***		
Above 104' Elevation	*Achillea Millefolium*	Western Yarrow	304,920	0.2
	Bromus carinatus	California Brome	217,800	2.0
	Camassia leichtlinii	Tall Camas	130,680	1.0
	Clarkia amoena	Farewell to Spring	566,280	0.4
	Danthonia californica	California Oatgrass	435,600	3.0
	Elymus glaucus	Blue Wildrye	392,040	3.0
	Eriophylum lanatum	Oregon Sunshine	261,360	0.2
	Madia elegans	Elegant Tarweed	43,560	0.2
	Prunella vulgare 'lanceolata'	Lance Selfheal	217,800	0.5
	Sidalcea campestris	Checker Mallow	87,120	1.0
	Permanent Seed #3	**Water Quality Swale**		
Water Quality Swale	*Festuca rubra*	Red Fescue	1,524,600	3.0
	Bromus carinatus	California Brome	653,400	6.0
	Agrostis exarata	Spike Grass	914,760	0.2
	Deschampsia cespitosa	Tufted Hairgrass	1,089,000	0.8
	Hordeum brachyantherum	Meadow Barley	1,089,000	13.0
	Clarkia amoena	Farewell to Spring	925,000	1.2
	Madia gracilis	Gumweed	653,400	2.2
	Temporary Seed #1	**Water Quality Swale**		
Temporary Seed	*Agrostis exarata*	Spike Bentgrass	5,600,000	.07
	Deschampsia cespitosa	Tufted Hairgrass	1,500,000	1.5
	Elymus glaucus	Blue Wildrye	120,000	20

REGISTERED
0938
CELINE LIVENGOOD
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06/06/17
LANDSCAPE ARCHITECT
EXPIRES: 06-30-2019

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OR18 SPUR: SOUTH YAMHILL RIVER BRIDGE (McMinnville) PROJECT
McMINNVILLE SPUR HWY.
YAMHILL COUNTY

Designer: Celine Livengood | Reviewer: Name
Drafter: Sergy Chernishoff | Checker: Name

ROADSIDE DEVELOPMENT SCHEDULE & NOTES

SHEET NO. FA06

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

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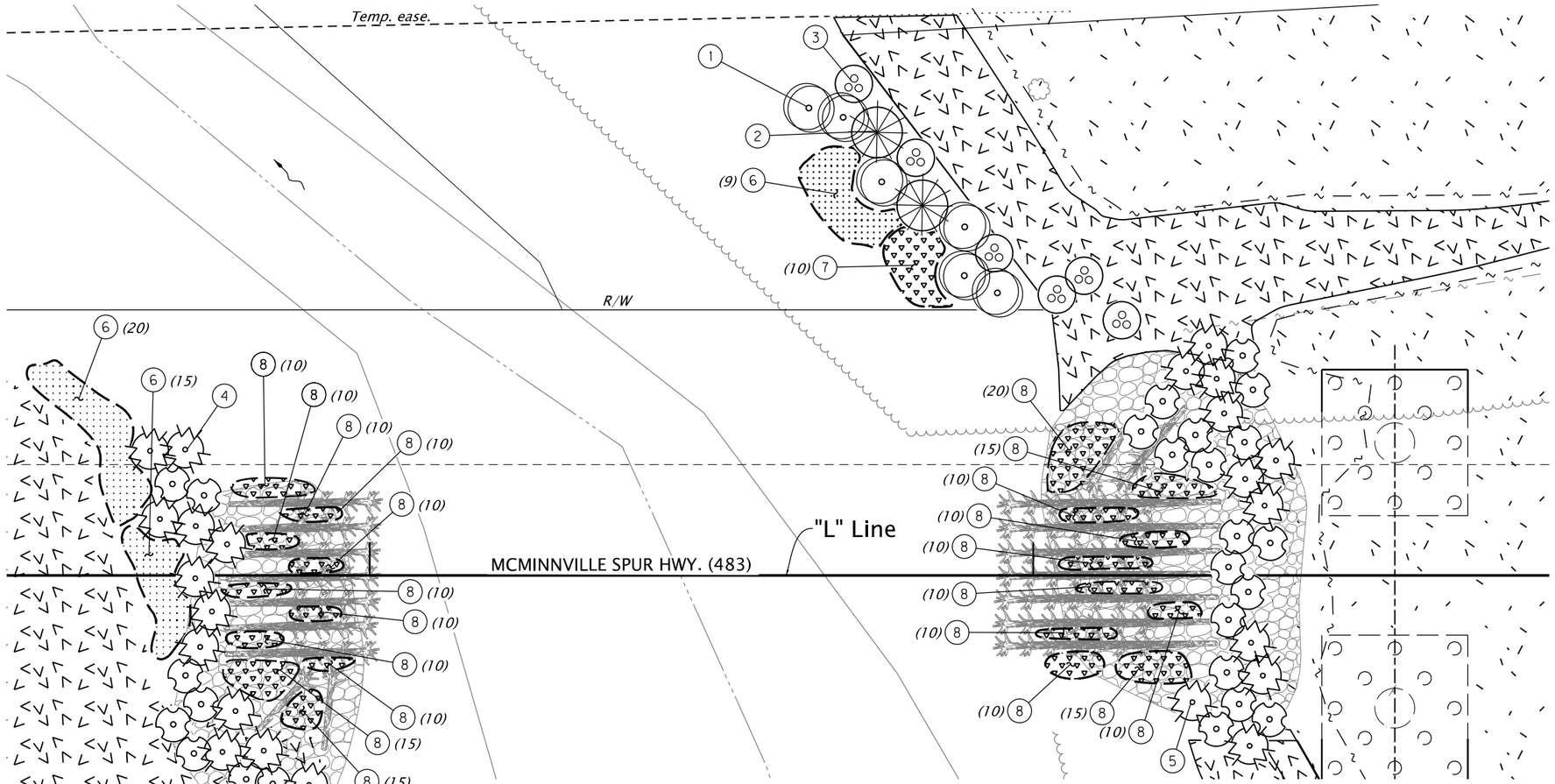


LEGEND & NOTES

1. *Plant deciduous trees, 2' seedling – 6*
   Fraxinus latifolia
   Oregon Ash
2. *Plant coniferous trees, 4' tall – 2*
   Pinus ponderosavar. Willamettensis
   Ponderosa Pine
3. *Plant shrubs, #1 container – 6*
   Physocarpus capitatus
   Pacific Ninebark
4. *Plant shrubs, #2 container – 23*
   Rosa nutkana
   Nootka Rose
5. *Plant shrubs, #2 container – 26*
   Rubus spectabilis
   Salmonberry

PLANT ROOTED CUTTINGS ZONES

Identification & Quantity — # (xx)

6. *Plant rooted cuttings – 44*
   Cornus stolonifera 'Osier'
   Redtwig Dogwood
7. *Plant rooted cuttings – 10*
   Salix lasiandra – Pacific Willow
8. *Plant rooted cuttings – 240*
   Salix sitchensis – Sitka Willow

REGISTERED
0938
CELINE LIVENGOOD
OREGON
06/06/17
LANDSCAPE ARCHITECT
EXPIRES: 06-30-2019
PRELIMINARY COPY FOR INFORMATION ONLY
FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

OREGON DEPARTMENT OF TRANSPORTATION

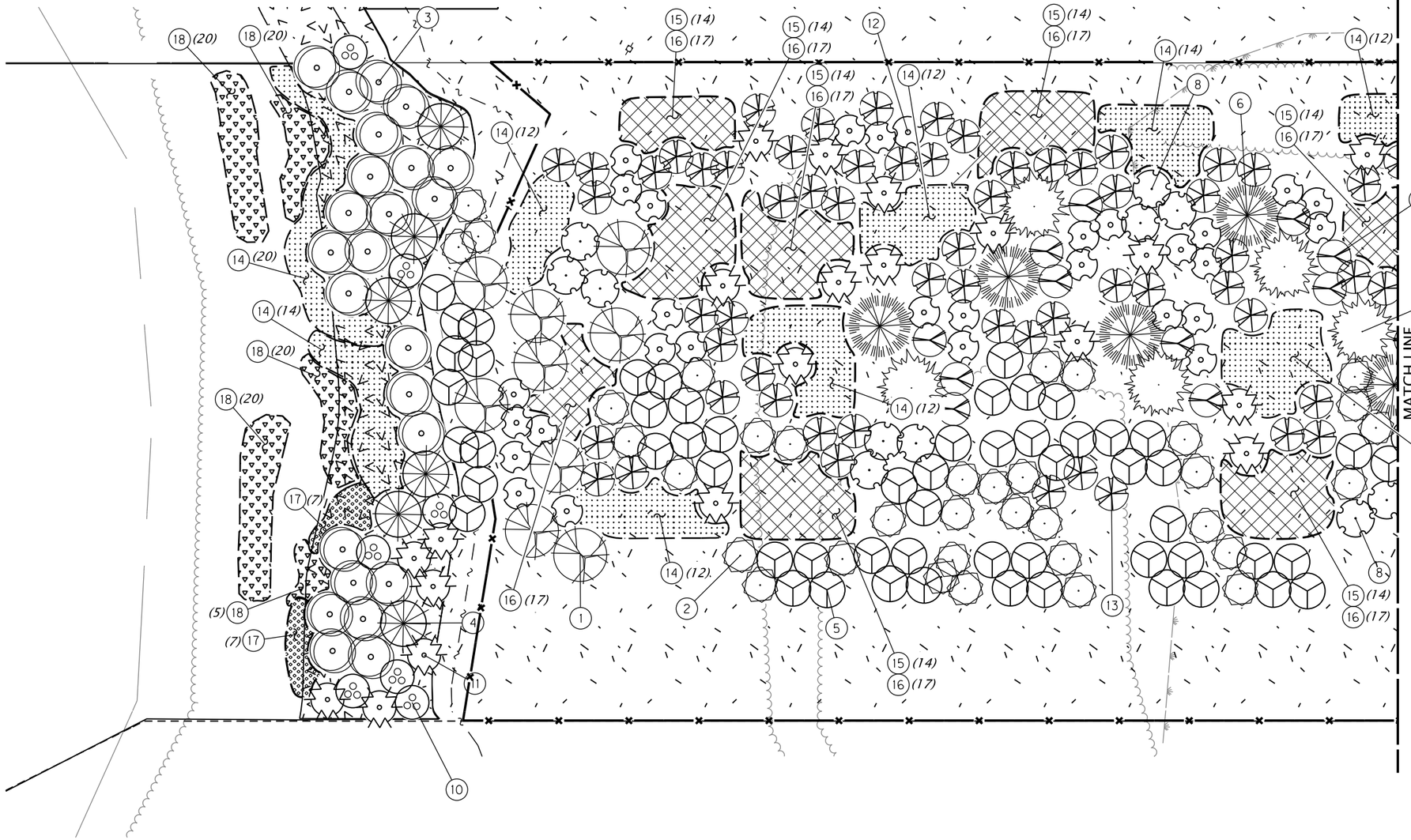
OR18 SPUR: SOUTH YAMHILL RIVER BRIDGE (McMinnville) PROJECT
McMINNVILLE SPUR HWY.
YAMHILL COUNTY

Designer: Celine Livengood	Reviewer: Name
Drafter: Sergy Chernishoff	Checker: Name

ROADSIDE DEVELOPMENT DETAILS

SHEET NO. FA08

??V-???



LEGEND & NOTES

1. *Plant deciduous trees, 1" caliper - 9*
   Acer macrophylla
   Bigleaf Maple
2. *Plant deciduous trees, 2' seedling- 35*
   Alnus rubra
   Red Alder
3. *Plant deciduous trees, 2' seedling - 24*
   Fraxinus latifolia
   Oregon Ash
4. *Plant coniferous trees, 4' tall - 6*
   Pinus ponderosavar. Willamettensis
   Ponderosa Pine
5. *Plant deciduous trees, 2' seedling - 57*
   Populus trichocarpus
   Black Cottonwood
6. *Plant coniferous trees, 4' tall - 5*
   Psuedotsuga menziesii
   Douglas Fir
7. *Plant coniferous trees, 4' tall - 5*
   Thuja plicata
   Western Red Cedar
8. *Plant shrubs, #2 container - 10*
   Rhamnus purshiana
   Cascara Buckthorn
9. *Plant shrubs, #5 container - 11*
   Acer cercinatum
   Vine Maple
10. *Plant shrubs, #1 container - 7*
    Physocarpus capitatus
    Pacific Ninebark
11. *Plant shrubs, #2 container - 20*
    Rosa nutkana
    Nootka Rose
12. *Plant shrubs, #2 container - 30*
    Rubus spectabilis
    Salmonberry
13. *Plant shrubs, #2 container - 60*
    Sambucus Racemosa
    Red Elderberry

LEGEND & NOTES

PLANT ROOTED CUTTINGS ZONES

Identification & Quantity — # (xx)

14. *Plant rooted cuttings - 120*
    Cornus stolonifera 'Osier'
    Redtwig Dogwood
15. *Plant rooted cuttings - 98*
    Mahonia aquifolium - Oregon Grape
16. *Plant rooted cuttings - 119*
    Symphoricarpus albus - Snowberry
17. *Plant rooted cuttings - 14*
    Salix lasiandra - Pacific Willow
18. *Plant rooted cuttings - 85*
    Salix sitchensis - Sitka Willow

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McMINNVILLE SPUR HWY.
YAMHILL COUNTY

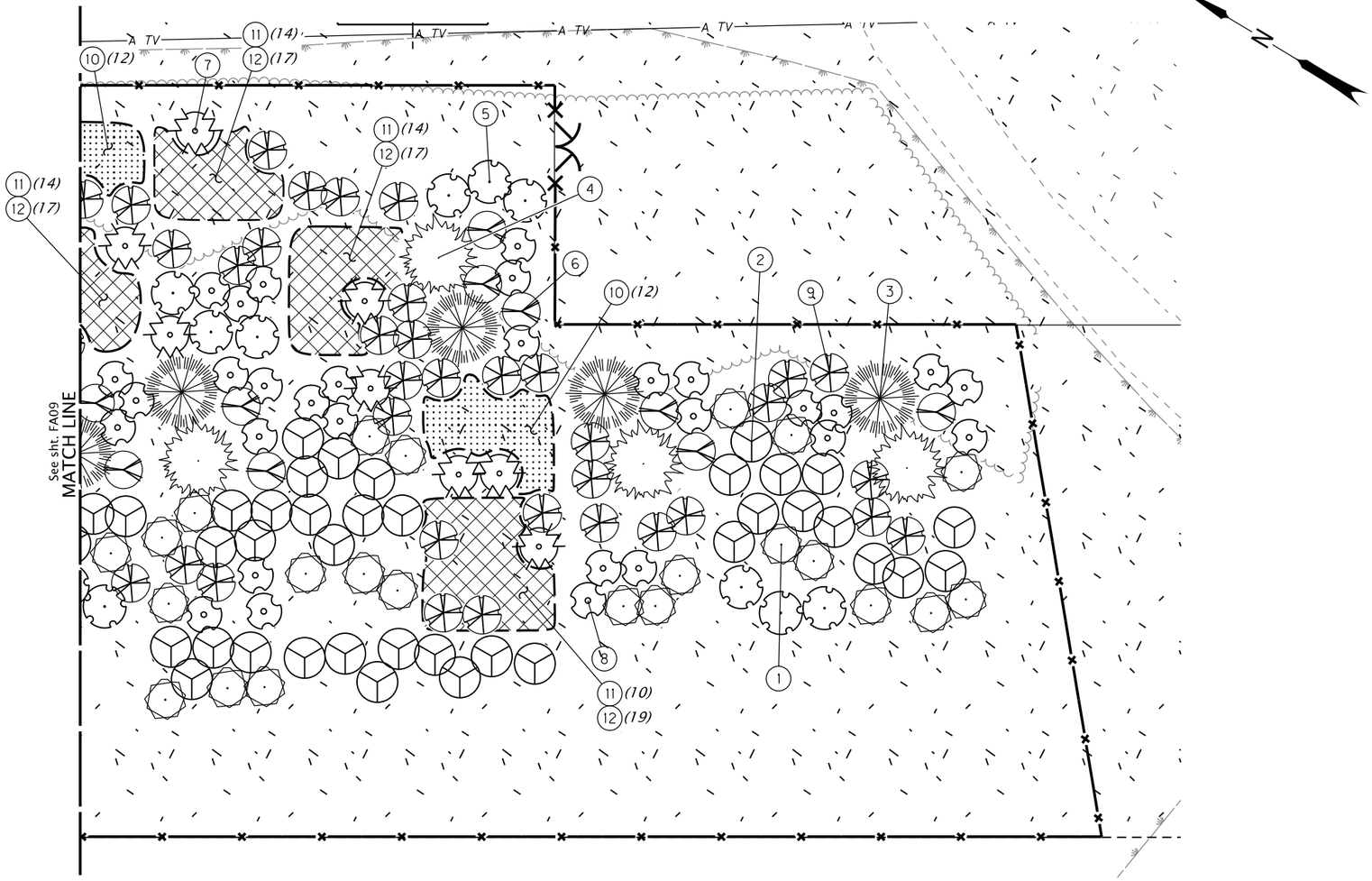
Designer: Celine Livengood | Reviewer: Name
Drafter: Sergy Chernishoff | Checker: Name

ROADSIDE DEVELOPMENT DETAILS

SHEET NO. FA09

ER_K19389_rdpl_07 :: Default 6/18/2019 3:25:38 PM hwye31g

Rotation: 301.2127° Scale: 1"=20'



LEGEND & NOTES

1. *Plant deciduous trees, 2' seedling- 23*
   Alnus rubra
   Red Alder
2. *Plant deciduous trees, 2' seedling - 39*
   Populus trichocarpus
   Black Cottonwood
3. *Plant coniferous trees, 4' tall - 4*
   Psuedotsuga menziesii
   Douglas Fir
4. *Plant coniferous trees, 4' tall - 4*
   Thuja plicata
   Western Red Cedar
5. *Plant shrubs, #2 container - 10*
   Rhamnus purshiana
   Cascara Buckthorn
6. *Plant shrubs, #5 container - 9*
   Acer cercinatum
   Vine Maple
7. *Plant shrubs, #2 container - 8*
   Rosa nutkana
   Nootka Rose
8. *Plant shrubs, #2 container - 31*
   Rubus spectabilis
   Salmonberry
9. *Plant shrubs, #2 container - 35*
   Sambucus Racemosa
   Red Elderberry

PLANT ROOTED CUTTINGS ZONES

Identification & Quantity — (#) (xx)

10. *Plant rooted cuttings - 24*
    Cornus stolonifera 'Osier'
    Redtwig Dogwood
11. *Plant rooted cuttings - 52*
    Mahonia aquifolium - Oregon Grape
12. *Plant rooted cuttings - 53*
    Symphoricarpus albus - Snowberry

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McMINNVILLE SPUR HWY.
YAMHILL COUNTY

Designer: Celine Livengood | Reviewer: Name
Drafter: Sergy Chernishoff | Checker: Name

ROADSIDE DEVELOPMENT DETAILS

SHEET NO. FA10

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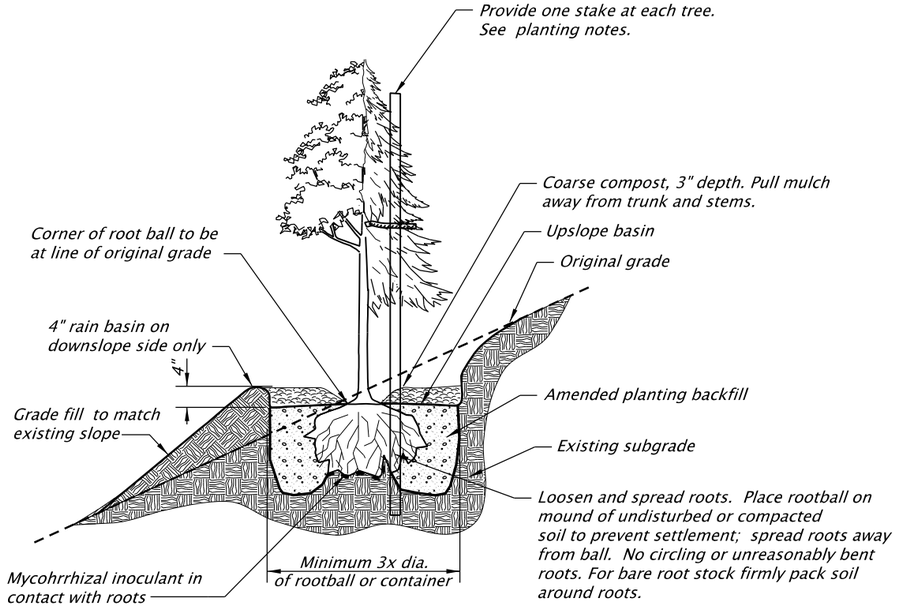
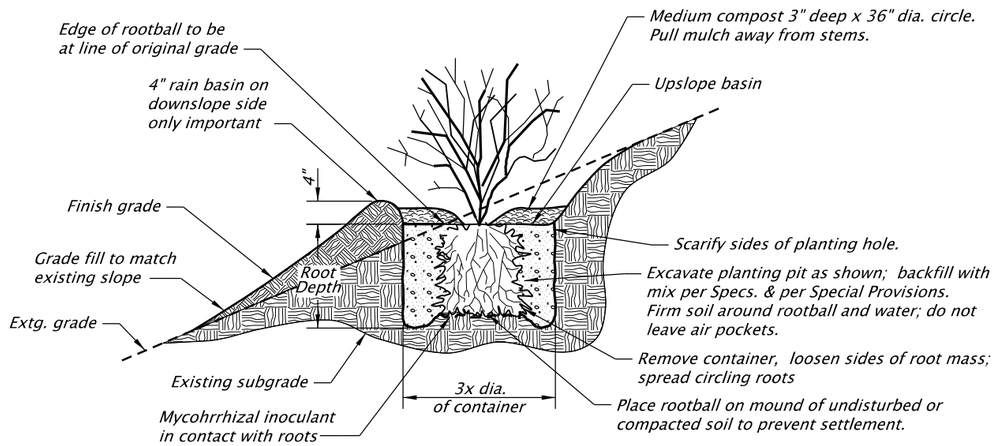
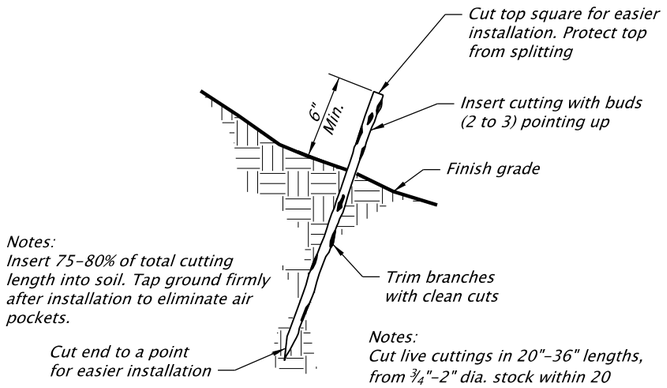


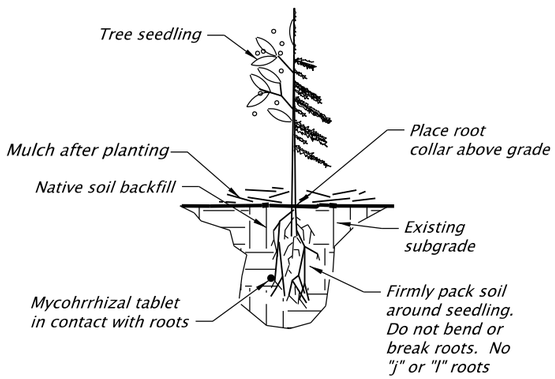
TREE SLOPE PLANTING AND STAKING WITH BROWSE PROTECTION



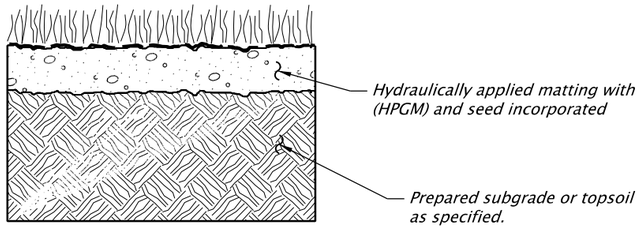
SHRUB SLOPE PLANTING WITH BROWSE PROTECTION



LIVE CUTTING INSTALLATION DETAIL



SEEDLING PLANTING DETAIL



SEEDING WITH HIGH PERF. GROWTH MEDIUM (HPGM)

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CELINE LIVENGOOD
OREGON
06/06/17
LANDSCAPE ARCHITECT
EXPIRES: 06-30-2019
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OREGON DEPARTMENT OF TRANSPORTATION

OR18 SPUR: SOUTH YAMHILL RIVER BRIDGE (McMinnville) PROJECT
McMINNVILLE SPUR HWY.
YAMHILL COUNTY

Designer: Celine Livengood | Reviewer: Name
Drafter: Sergy Chernishoff | Checker: Name

ROADSIDE DEVELOPMENT DETAILS

SHEET NO. FA11

FINAL ELECTRONIC DOCUMENT AVAILABLE UPON REQUEST

Exhibit B: Soils Report

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 Yamhill County, Oregon

South Yamhill Bridge Area

November 10, 2016

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 (http://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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

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Contents

How Soil Surveys Are Made

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

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

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

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

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

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

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

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

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

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

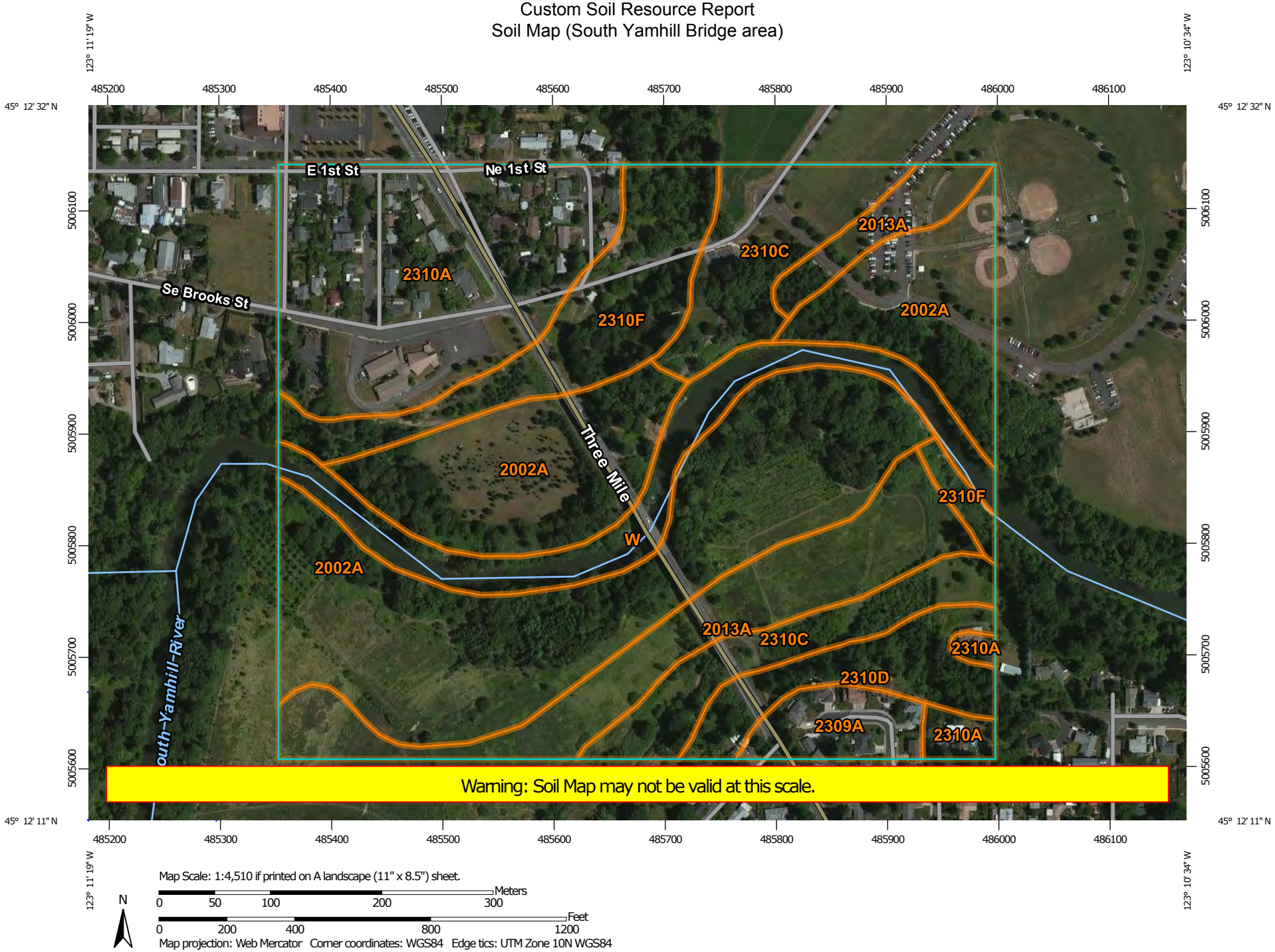
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree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

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

Soil Map

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

Custom Soil Resource Report
Soil Map (South Yamhill Bridge area)



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 1:24,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Yamhill County, Oregon
Survey Area Data: Version 3, Sep 18, 2015

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

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

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend (South Yamhill Bridge area)

Yamhill County, Oregon (OR071)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
2002A	Chehalis silty clay loam, 0 to 3 percent slopes	31.7	37.2%
2013A	Wapato silty clay loam, 0 to 3 percent slopes	10.1	11.8%
2309A	Willamette silt loam, 0 to 3 percent slopes	2.3	2.7%
2310A	Woodburn silt loam, 0 to 3 percent slopes	14.9	17.5%
2310C	Woodburn silt loam, 3 to 12 percent slopes	8.9	10.4%
2310D	Woodburn silt loam, 12 to 20 percent slopes	3.7	4.4%
2310F	Woodburn silt loam, 20 to 55 percent slopes	7.5	8.7%
W	Water	6.2	7.3%
Totals for Area of Interest		**85.2**	**100.0%**

Map Unit Descriptions (South Yamhill Bridge area)

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.

Yamhill County, Oregon

2002A—Chehalis silty clay loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2dgl4
Elevation: 30 to 1,000 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Chehalis and similar soils: 91 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Chehalis

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex, concave
Parent material: Silty and loamy alluvium

Typical profile

Ap - 0 to 8 inches: silty clay loam
A - 8 to 16 inches: silty clay loam
Bw1 - 16 to 38 inches: silty clay loam
Bw2 - 38 to 45 inches: silty clay loam
C - 45 to 60 inches: stratified fine sandy loam to silty clay loam

Properties and qualities

Slope: 0 to 3 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: Occasional
Frequency of ponding: None
Available water storage in profile: Very high (about 12.2 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

Minor Components

Wapato

Percent of map unit: 2 percent
Landform: Flood plains

Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

2013A—Wapato silty clay loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2dgl9
Elevation: 50 to 1,200 feet
Mean annual precipitation: 40 to 60 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Wapato and similar soils: 90 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wapato

Setting

Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave, linear
Parent material: Loamy alluvium

Typical profile

Ap - 0 to 9 inches: silty clay loam
A - 9 to 16 inches: silty clay loam
Bg1 - 16 to 22 inches: silty clay loam
Bg2 - 22 to 32 inches: silty clay loam
BCg - 32 to 60 inches: silty clay

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 0 to 9 inches
Frequency of flooding: Occasional
Frequency of ponding: Frequent
Available water storage in profile: Very high (about 12.4 inches)

Interpretive groups

Land capability classification (irrigated): 3w

Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: C/D
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Minor Components

Waldo
Percent of map unit: 2 percent
Landform: Flood plains
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

2309A—Willamette silt loam, 0 to 3 percent slopes

Map Unit Setting
National map unit symbol: 2lkgz
Elevation: 140 to 230 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Willamette and similar soils: 96 percent
Minor components: 1 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Willamette

Setting
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: Silty glaciolacustrine deposits

Typical profile
Ap - 0 to 6 inches: silt loam
A - 6 to 13 inches: silt loam
AB - 13 to 24 inches: silt loam
BA - 24 to 33 inches: silt loam
2Bt - 33 to 45 inches: silty clay loam
2BCt - 45 to 53 inches: silty clay loam
2C - 53 to 60 inches: silty clay loam

Properties and qualities
Slope: 0 to 3 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 (0.20 to 1.98 in/hr)
Depth to water table: About 45 to 53 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very high (about 12.2 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: B
Other vegetative classification: Well drained < 15% Slopes (G002XY002OR)
Hydric soil rating: No

Minor Components

Dayton

Percent of map unit: 1 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

2310A—Woodburn silt loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 1j8b4
Elevation: 100 to 290 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Woodburn and similar soils: 93 percent
Minor components: 2 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: Convex, linear
Parent material: Silty glaciolacustrine deposits

Typical profile

Ap - 0 to 9 inches: silt loam
A - 9 to 17 inches: silt loam
2Bt1 - 17 to 25 inches: silty clay loam
2Bt2 - 25 to 32 inches: silty clay loam
2BCt1 - 32 to 39 inches: silt loam
2BCt2 - 39 to 54 inches: silt loam
2C1 - 54 to 68 inches: silt loam
2C2 - 68 to 80 inches: stratified fine sandy loam to silt loam
3C3 - 80 to 92 inches: stratified fine sandy loam to silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 25 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very high (about 12.2 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 1
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Dayton

Percent of map unit: 2 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

2310C—Woodburn silt loam, 3 to 12 percent slopes

Map Unit Setting

National map unit symbol: 1j8b5
Elevation: 100 to 350 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Woodburn and similar soils: 93 percent
Minor components: 2 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: Convex, linear
Across-slope shape: Linear
Parent material: Silty glaciolacustrine deposits

Typical profile

Ap - 0 to 9 inches: silt loam
A - 9 to 17 inches: silt loam
2Bt1 - 17 to 25 inches: silty clay loam
2Bt2 - 25 to 32 inches: silty clay loam
2BCt1 - 32 to 39 inches: silt loam
2BCt2 - 39 to 54 inches: silt loam
2C1 - 54 to 68 inches: silt loam
2C2 - 68 to 80 inches: stratified fine sandy loam to silt loam
3C3 - 80 to 92 inches: stratified fine sandy loam to silt loam

Properties and qualities

Slope: 3 to 12 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 to high (0.20 to 1.98 in/hr)
Depth to water table: About 25 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very high (about 12.2 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Dayton

Percent of map unit: 2 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

2310D—Woodburn silt loam, 12 to 20 percent slopes

Map Unit Setting

National map unit symbol: 1j8b6
Elevation: 100 to 380 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Woodburn and similar soils: 95 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: Convex
Across-slope shape: Linear
Parent material: Silty glaciolacustrine deposits

Typical profile

Ap - 0 to 9 inches: silt loam
A - 9 to 17 inches: silt loam
2Bt1 - 17 to 25 inches: silty clay loam
2Bt2 - 25 to 32 inches: silty clay loam
2BCt1 - 32 to 39 inches: silt loam
2BCt2 - 39 to 54 inches: silt loam
2C1 - 54 to 68 inches: silt loam
2C2 - 68 to 80 inches: stratified fine sandy loam to silt loam
3C3 - 80 to 92 inches: stratified fine sandy loam to silt loam

Properties and qualities

Slope: 12 to 20 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 to high (0.20 to 1.98 in/hr)
Depth to water table: About 25 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very high (about 12.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C

Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Dayton
Percent of map unit: 1 percent
Landform: Terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Concave
Hydric soil rating: Yes

2310F—Woodburn silt loam, 20 to 55 percent slopes

Map Unit Setting
National map unit symbol: 1j8b7
Elevation: 100 to 400 feet
Mean annual precipitation: 40 to 50 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition
Woodburn and similar soils: 100 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: Convex
Across-slope shape: Linear
Parent material: Silty glaciolacustrine deposits

Typical profile
Ap - 0 to 9 inches: silt loam
A - 9 to 17 inches: silt loam
2Bt1 - 17 to 25 inches: silty clay loam
2Bt2 - 25 to 32 inches: silty clay loam
2BCt1 - 32 to 39 inches: silt loam
2BCt2 - 39 to 54 inches: silt loam
2C1 - 54 to 68 inches: silt loam
2C2 - 68 to 80 inches: stratified fine sandy loam to silt loam
3C3 - 80 to 92 inches: stratified fine sandy loam to silt loam

Properties and qualities
Slope: 20 to 55 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 to high (0.20 to 1.98 in/hr)
Depth to water table: About 25 to 32 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very high (about 12.2 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

W—Water

Map Unit Composition
Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Water

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Yes

Soil Information for All Uses

Suitabilities and Limitations for Use

The Suitabilities and Limitations for Use section includes various soil interpretations displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each interpretation.

Building Site Development

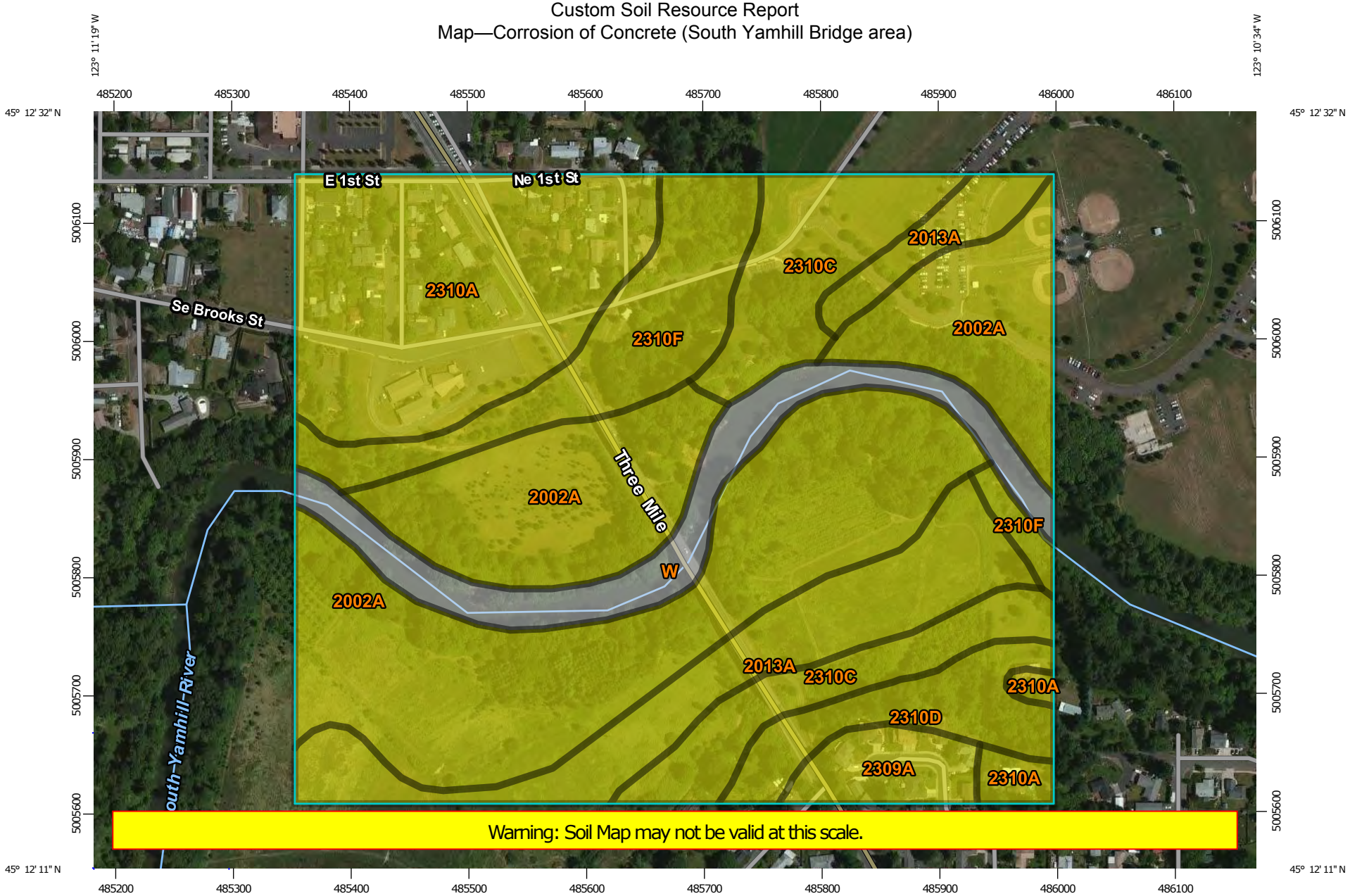
Building site development interpretations are designed to be used as tools for evaluating soil suitability and identifying soil limitations for various construction purposes. As part of the interpretation process, the rating applies to each soil in its described condition and does not consider present land use. Example interpretations can include corrosion of concrete and steel, shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping.

Corrosion of Concrete (South Yamhill Bridge area)

"Risk of corrosion" pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens concrete. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the concrete in installations that are entirely within one kind of soil or within one soil layer.

The risk of corrosion is expressed as "low," "moderate," or "high."

Custom Soil Resource Report
Map—Corrosion of Concrete (South Yamhill Bridge area)



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Background

- Aerial Photography

Soils

Soil Rating Polygons

- High
- Moderate
- Low
- Not rated or not available

Soil Rating Lines

- High
- Moderate
- Low
- Not rated or not available

Soil Rating Points

- High
- Moderate
- Low
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Yamhill County, Oregon
Survey Area Data: Version 3, Sep 18, 2015

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

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

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Corrosion of Concrete (South Yamhill Bridge area)

Corrosion of Concrete— Summary by Map Unit — Yamhill County, Oregon (OR071)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
2002A	Chehalis silty clay loam, 0 to 3 percent slopes	Moderate	31.7	37.2%
2013A	Wapato silty clay loam, 0 to 3 percent slopes	Moderate	10.1	11.8%
2309A	Willamette silt loam, 0 to 3 percent slopes	Moderate	2.3	2.7%
2310A	Woodburn silt loam, 0 to 3 percent slopes	Moderate	14.9	17.5%
2310C	Woodburn silt loam, 3 to 12 percent slopes	Moderate	8.9	10.4%
2310D	Woodburn silt loam, 12 to 20 percent slopes	Moderate	3.7	4.4%
2310F	Woodburn silt loam, 20 to 55 percent slopes	Moderate	7.5	8.7%
W	Water		6.2	7.3%
Totals for Area of Interest			**85.2**	**100.0%**

Rating Options—Corrosion of Concrete (South Yamhill Bridge area)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

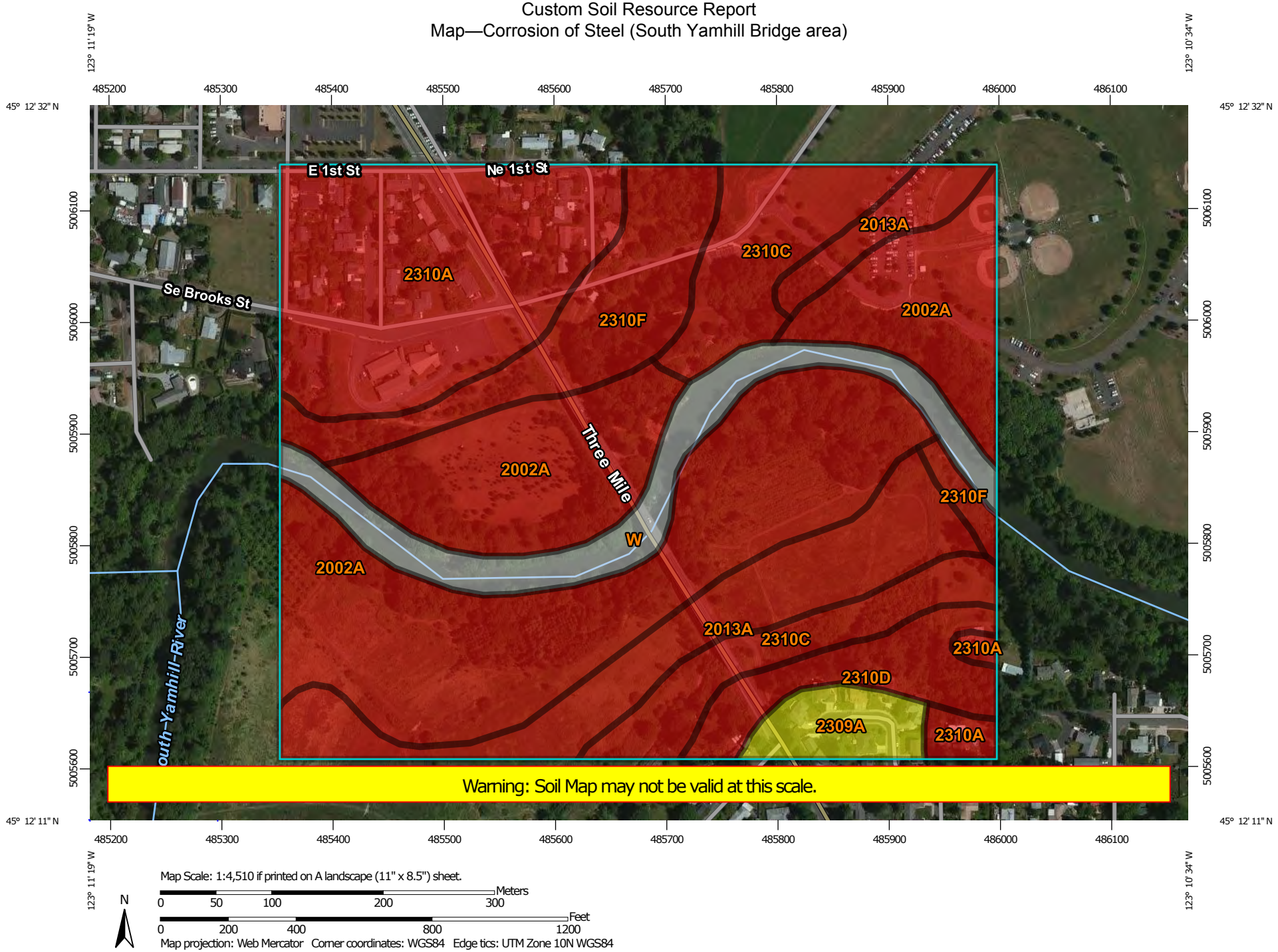
Tie-break Rule: Higher

Corrosion of Steel (South Yamhill Bridge area)

"Risk of corrosion" pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel in installations that are entirely within one kind of soil or within one soil layer.

The risk of corrosion is expressed as "low," "moderate," or "high."

Map—Corrosion of Steel (South Yamhill Bridge area)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- High
- Moderate
- Low
- Not rated or not available

Soil Rating Lines
- High
- Moderate
- Low
- Not rated or not available

Soil Rating Points
- High
- Moderate
- Low
- Not rated or not available

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 1:24,000.

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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Soil Survey Area: Yamhill County, Oregon
Survey Area Data: Version 3, Sep 18, 2015

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

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

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table—Corrosion of Steel (South Yamhill Bridge area)

Corrosion of Steel— Summary by Map Unit — Yamhill County, Oregon (OR071)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
2002A	Chehalis silty clay loam, 0 to 3 percent slopes	High	31.7	37.2%
2013A	Wapato silty clay loam, 0 to 3 percent slopes	High	10.1	11.8%
2309A	Willamette silt loam, 0 to 3 percent slopes	Moderate	2.3	2.7%
2310A	Woodburn silt loam, 0 to 3 percent slopes	High	14.9	17.5%
2310C	Woodburn silt loam, 3 to 12 percent slopes	High	8.9	10.4%
2310D	Woodburn silt loam, 12 to 20 percent slopes	High	3.7	4.4%
2310F	Woodburn silt loam, 20 to 55 percent slopes	High	7.5	8.7%
W	Water		6.2	7.3%
Totals for Area of Interest			**85.2**	**100.0%**

Rating Options—Corrosion of Steel (South Yamhill Bridge area)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Shallow Excavations (South Yamhill Bridge area)

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the specified use. "Not limited" indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. "Somewhat limited" indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected.

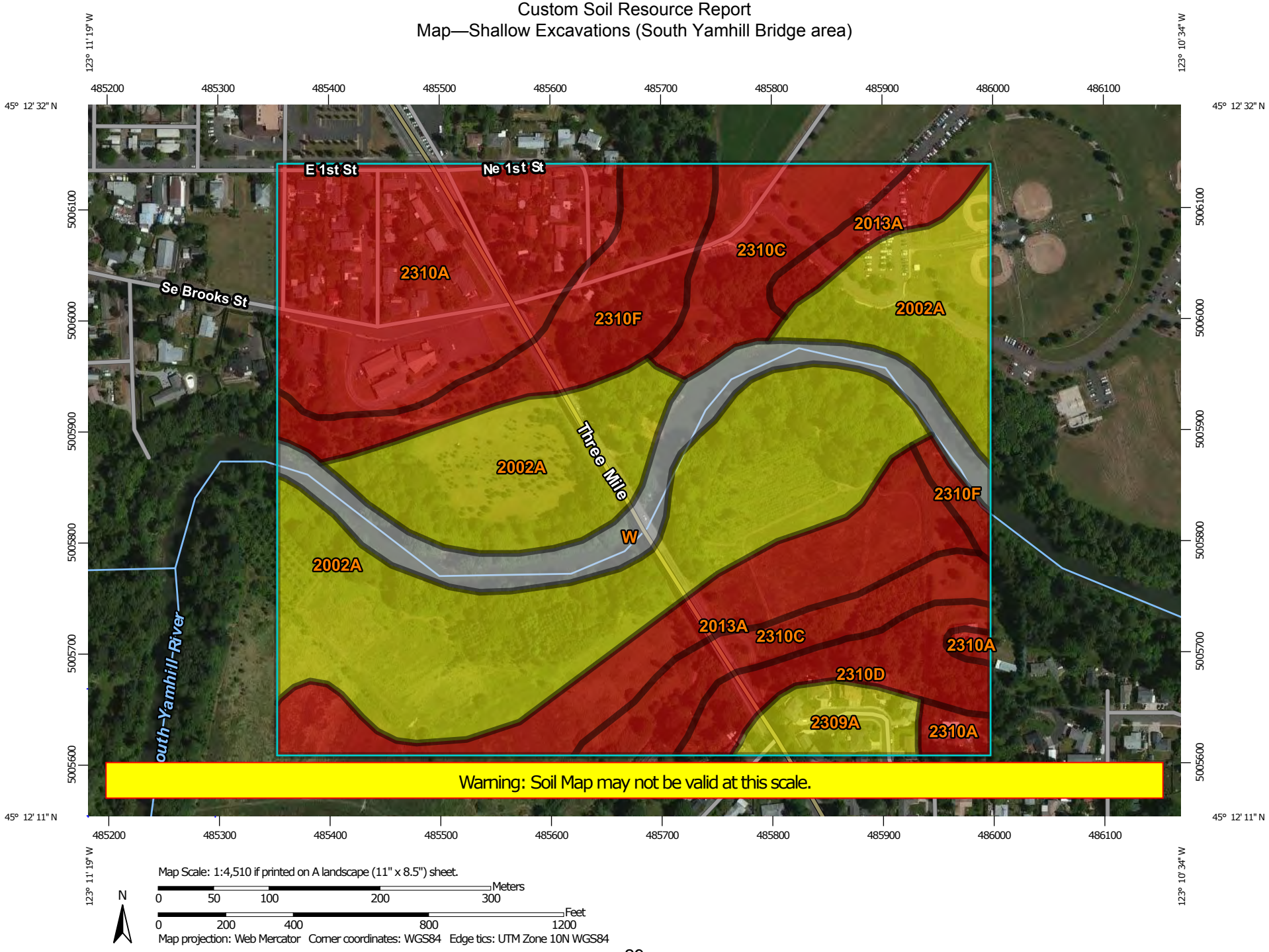
"Very limited" indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The map unit components listed for each map unit in the accompanying Summary by Map Unit table in Web Soil Survey or the Aggregation Report in Soil Data Viewer are determined by the aggregation method chosen. An aggregated rating class is shown for each map unit. The components listed for each map unit are only those that have the same rating class as listed for the map unit. The percent composition of each component in a particular map unit is presented to help the user better understand the percentage of each map unit that has the rating presented.

Other components with different ratings may be present in each map unit. The ratings for all components, regardless of the map unit aggregated rating, can be viewed by generating the equivalent report from the Soil Reports tab in Web Soil Survey or from the Soil Data Mart site. Onsite investigation may be needed to validate these interpretations and to confirm the identity of the soil on a given site.

Map—Shallow Excavations (South Yamhill Bridge area)



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

Very limited

Somewhat limited

Not limited

Not rated or not available

Soil Rating Lines

Very limited

Somewhat limited

Not limited

Not rated or not available

Soil Rating Points

Very limited

Somewhat limited

Not limited

Not rated or not available

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 1:24,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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Soil Survey Area: Yamhill County, Oregon
Survey Area Data: Version 3, Sep 18, 2015

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

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

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Tables—Shallow Excavations (South Yamhill Bridge area)

Shallow Excavations— Summary by Map Unit — Yamhill County, Oregon (OR071)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
2002A	Chehalis silty clay loam, 0 to 3 percent slopes	Somewhat limited	Chehalis (91%)	Flooding (0.60)	31.7	37.2%
				Dusty (0.02)		
				Unstable excavation walls (0.01)		
2013A	Wapato silty clay loam, 0 to 3 percent slopes	Very limited	Wapato (90%)	Ponding (1.00)	10.1	11.8%
				Depth to saturated zone (1.00)		
				Flooding (0.60)		
				Unstable excavation walls (0.17)		
				Dusty (0.02)		
			Waldo (2%)	Ponding (1.00)		
				Depth to saturated zone (1.00)		
				Unstable excavation walls (1.00)		
				Flooding (0.60)		
				Too clayey (0.50)		
2309A	Willamette silt loam, 0 to 3 percent slopes	Somewhat limited	Willamette (96%)	Depth to saturated zone (0.56)	2.3	2.7%
				Dusty (0.04)		
				Unstable excavation walls (0.01)		
2310A	Woodburn silt loam, 0 to 3 percent slopes	Very limited	Woodburn (93%)	Depth to saturated zone (1.00)	14.9	17.5%
				Dusty (0.04)		
				Unstable excavation walls (0.01)		
			Dayton (2%)	Ponding (1.00)		
				Depth to saturated zone (1.00)		
				Too clayey (0.13)		
				Dusty (0.04)		

Shallow Excavations— Summary by Map Unit — Yamhill County, Oregon (OR071)						
Map unit symbol	**Map unit name**	**Rating**	**Component name (percent)**	**Rating reasons (numeric values)**	**Acres in AOI**	**Percent of AOI**
				Unstable excavation walls (0.01)		
2310C	Woodburn silt loam, 3 to 12 percent slopes	Very limited	Woodburn (93%)	Depth to saturated zone (1.00)	8.9	10.4%
				Dusty (0.04)		
				Unstable excavation walls (0.01)		
			Dayton (2%)	Ponding (1.00)		
				Depth to saturated zone (1.00)		
				Too clayey (0.13)		
				Dusty (0.04)		
				Unstable excavation walls (0.01)		
2310D	Woodburn silt loam, 12 to 20 percent slopes	Very limited	Woodburn (95%)	Depth to saturated zone (1.00)	3.7	4.4%
				Slope (1.00)		
				Dusty (0.04)		
				Unstable excavation walls (0.01)		
			Dayton (1%)	Ponding (1.00)		
				Depth to saturated zone (1.00)		
				Too clayey (0.13)		
				Dusty (0.04)		
				Unstable excavation walls (0.01)		
2310F	Woodburn silt loam, 20 to 55 percent slopes	Very limited	Woodburn (100%)	Slope (1.00)	7.5	8.7%
				Depth to saturated zone (1.00)		
				Dusty (0.04)		
				Unstable excavation walls (0.01)		
W	Water	Not rated	Water (100%)		6.2	7.3%
Totals for Area of Interest					**85.2**	**100.0%**

Shallow Excavations— Summary by Rating Value		
Rating	**Acres in AOI**	**Percent of AOI**
Very limited	45.1	52.9%
Somewhat limited	34.0	39.8%
Null or Not Rated	6.2	7.3%
Totals for Area of Interest	**85.2**	**100.0%**

Rating Options—Shallow Excavations (South Yamhill Bridge area)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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.

Land Classifications

This folder contains a collection of tabular reports that present a variety of soil groupings. The reports (tables) include all selected map units and components for each map unit. Land classifications are specified land use and management groupings that are assigned to soil areas because combinations of soil have similar behavior for specified practices. Most are based on soil properties and other factors that directly influence the specific use of the soil. Example classifications include ecological site classification, farmland classification, irrigated and nonirrigated land capability classification, and hydric rating.

Hydric Soil List - All Components (South Yamhill Bridge area)

This table lists the map unit components and their hydric status in the survey area. This list can help in planning land uses; however, onsite investigation is recommended to determine the hydric soils on a specific site (National Research Council, 1995; Hurt and others, 2002).

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology (Cowardin and others, 1979; U.S. Army Corps of Engineers, 1987; National Research Council, 1995; Tiner, 1985). Criteria for all of the characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). These soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria

are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

Hydric soils are identified by examining and describing the soil to a depth of about 20 inches. This depth may be greater if determination of an appropriate indicator so requires. It is always recommended that soils be excavated and described to the depth necessary for an understanding of the redoximorphic processes. Then, using the completed soil descriptions, soil scientists can compare the soil features required by each indicator and specify which indicators have been matched with the conditions observed in the soil. The soil can be identified as a hydric soil if at least one of the approved indicators is present.

Map units that are dominantly made up of hydric soils may have small areas, or inclusions, of nonhydric soils in the higher positions on the landform, and map units dominantly made up of nonhydric soils may have inclusions of hydric soils in the lower positions on the landform.

The criteria for hydric soils are represented by codes in the table (for example, 2). Definitions for the codes are as follows:

1. All Histels except for Folistels, and Histosols except for Folists.
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, Pachic subgroups, or Cumulic subgroups that:
    A. Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
    B. Show evidence that the soil meets the definition of a hydric soil;
3. Soils that are frequently ponded for long or very long duration during the growing season.
    A. Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
    B. Show evidence that the soil meets the definition of a hydric soil;
4. Map unit components that are frequently flooded for long duration or very long duration during the growing season that:
    A. Based on the range of characteristics for the soil series, will at least in part meet one or more Field Indicators of Hydric Soils in the United States, or
    B. Show evidence that the soil meets the definition of a hydric soil;

Hydric Condition: Food Security Act information regarding the ability to grow a commodity crop without removing woody vegetation or manipulating hydrology.

References:

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Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.
Vasilas, L.M., G.W. Hurt, and C.V. Noble, editors. Version 7.0, 2010. Field indicators of hydric soils in the United States.

Report—Hydric Soil List - All Components (South Yamhill Bridge area)

Hydric Soil List - All Components–OR071-Yamhill County, Oregon					
Map symbol and map unit name	**Component/Local Phase**	**Comp. pct.**	**Landform**	**Hydric status**	**Hydric criteria met (code)**
2002A: Chehalis silty clay loam, 0 to 3 percent slopes	Chehalis	91	Flood plains	No	—
	Wapato	2	Flood plains	Yes	2,3
2013A: Wapato silty clay loam, 0 to 3 percent slopes	Wapato	90	Flood plains	Yes	2,3
	Waldo	2	Flood plains	Yes	2,3
2309A: Willamette silt loam, 0 to 3 percent slopes	Willamette	96	Terraces	No	—
	Dayton	1	Terraces	Yes	2,3
2310A: Woodburn silt loam, 0 to 3 percent slopes	Woodburn	93	Terraces	No	—
	Dayton	2	Terraces	Yes	2,3
2310C: Woodburn silt loam, 3 to 12 percent slopes	Woodburn	93	Terraces	No	—
	Dayton	2	Terraces	Yes	2,3
2310D: Woodburn silt loam, 12 to 20 percent slopes	Woodburn	95	Terraces	No	—
	Dayton	1	Terraces	Yes	2,3
2310F: Woodburn silt loam, 20 to 55 percent slopes	Woodburn	100	Terraces	No	—
W: Water	Water	100	—	Yes	—

Prime and other Important Farmlands (South Yamhill Bridge area)

This table lists the map units in the survey area that are considered important farmlands. Important farmlands consist of prime farmland, unique farmland, and farmland of statewide or local importance. This list does not constitute a recommendation for a particular land use.

In an effort to identify the extent and location of important farmlands, the Natural Resources Conservation Service, in cooperation with other interested Federal, State,

and local government organizations, has inventoried land that can be used for the production of the Nation's food supply.

Prime farmland is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil quality, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. The water supply is dependable and of adequate quality. Prime farmland is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. Slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

For some of the soils identified in the table as prime farmland, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures.

A recent trend in land use in some areas has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

Unique farmland is land other than prime farmland that is used for the production of specific high-value food and fiber crops, such as citrus, tree nuts, olives, cranberries, and other fruits and vegetables. It has the special combination of soil quality, growing season, moisture supply, temperature, humidity, air drainage, elevation, and aspect needed for the soil to economically produce sustainable high yields of these crops when properly managed. The water supply is dependable and of adequate quality. Nearness to markets is an additional consideration. Unique farmland is not based on national criteria. It commonly is in areas where there is a special microclimate, such as the wine country in California.

In some areas, land that does not meet the criteria for prime or unique farmland is considered to be *farmland of statewide importance* for the production of food, feed, fiber, forage, and oilseed crops. The criteria for defining and delineating farmland of statewide importance are determined by the appropriate State agencies. Generally, this land includes areas of soils that nearly meet the requirements for prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some areas may produce as high a yield as prime farmland if conditions are favorable. Farmland of statewide importance may include tracts of land that have been designated for agriculture by State law.

In some areas that are not identified as having national or statewide importance, land is considered to be *farmland of local importance* for the production of food, feed, fiber,

forage, and oilseed crops. This farmland is identified by the appropriate local agencies. Farmland of local importance may include tracts of land that have been designated for agriculture by local ordinance.

Report—Prime and other Important Farmlands (South Yamhill Bridge area)

Prime and other Important Farmlands–Yamhill County, Oregon		
Map Symbol	**Map Unit Name**	**Farmland Classification**
2002A	Chehalis silty clay loam, 0 to 3 percent slopes	All areas are prime farmland
2013A	Wapato silty clay loam, 0 to 3 percent slopes	Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
2309A	Willamette silt loam, 0 to 3 percent slopes	All areas are prime farmland
2310A	Woodburn silt loam, 0 to 3 percent slopes	All areas are prime farmland
2310C	Woodburn silt loam, 3 to 12 percent slopes	Farmland of statewide importance
2310D	Woodburn silt loam, 12 to 20 percent slopes	Farmland of statewide importance
2310F	Woodburn silt loam, 20 to 55 percent slopes	Not prime farmland
W	Water	Not prime farmland

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Glossary

Many of the terms relating to landforms, geology, and geomorphology are defined in more detail in the "National Soil Survey Handbook."

ABC soil

A soil having an A, a B, and a C horizon.

Ablation till

Loose, relatively permeable earthy material deposited during the downwasting of nearly static glacial ice, either contained within or accumulated on the surface of the glacier.

AC soil

A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep, rocky slopes.

Aeration, soil

The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil

Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil

A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvial cone

A semiconical type of alluvial fan having very steep slopes. It is higher, narrower, and steeper than a fan and is composed of coarser and thicker layers of material deposited by a combination of alluvial episodes and (to a much lesser degree) landslides (debris flow). The coarsest materials tend to be concentrated at the apex of the cone.

Alluvial fan

A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes. It is shaped like an open fan or a segment of a cone. The material was deposited by a stream at the place where it issues from a narrow mountain valley or upland valley or where a tributary stream is near or at its junction with the main stream. The fan is steepest near its apex, which points upstream, and slopes gently and convexly outward (downstream) with a gradual decrease in gradient.

Alluvium

Unconsolidated material, such as gravel, sand, silt, clay, and various mixtures of these, deposited on land by running water.

Alpha,alpha-dipyridyl

A compound that when dissolved in ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction implies reducing conditions and the likely presence of redoximorphic features.

Animal unit month (AUM)

The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions

Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Argillic horizon

A subsoil horizon characterized by an accumulation of illuvial clay.

Arroyo

The flat-floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material. It is usually dry but can be transformed into a temporary watercourse or short-lived torrent after heavy rain within the watershed.

Aspect

The direction toward which a slope faces. Also called slope aspect.

Association, soil

A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity)

The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low: 0 to 3
Low: 3 to 6
Moderate: 6 to 9
High: 9 to 12
Very high: More than 12

Backslope

The position that forms the steepest and generally linear, middle portion of a hillslope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

Backswamp

A flood-plain landform. Extensive, marshy or swampy, depressed areas of flood plains between natural levees and valley sides or terraces.

Badland

A landscape that is intricately dissected and characterized by a very fine drainage network with high drainage densities and short, steep slopes and narrow interfluves. Badlands develop on surfaces that have little or no vegetative cover overlying unconsolidated or poorly cemented materials (clays, silts, or sandstones) with, in some cases, soluble minerals, such as gypsum or halite.

Bajada

A broad, gently inclined alluvial piedmont slope extending from the base of a mountain range out into a basin and formed by the lateral coalescence of a series of alluvial fans. Typically, it has a broadly undulating transverse profile, parallel to the mountain front, resulting from the convexities of component fans. The term is generally restricted to constructional slopes of intermontane basins.

Basal area

The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation

The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

Base slope (geomorphology)

A geomorphic component of hills consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

Bedding plane

A planar or nearly planar bedding surface that visibly separates each successive layer of stratified sediment or rock (of the same or different lithology) from the preceding or following layer; a plane of deposition. It commonly marks a change

in the circumstances of deposition and may show a parting, a color difference, a change in particle size, or various combinations of these. The term is commonly applied to any bedding surface, even one that is conspicuously bent or deformed by folding.

Bedding system

A drainage system made by plowing, grading, or otherwise shaping the surface of a flat field. It consists of a series of low ridges separated by shallow, parallel dead furrows.

Bedrock

The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography

A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bench terrace

A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum

Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout (map symbol)

A saucer-, cup-, or trough-shaped depression formed by wind erosion on a preexisting dune or other sand deposit, especially in an area of shifting sand or loose soil or where protective vegetation is disturbed or destroyed. The adjoining accumulation of sand derived from the depression, where recognizable, is commonly included. Blowouts are commonly small.

Borrow pit (map symbol)

An open excavation from which soil and underlying material have been removed, usually for construction purposes.

Bottom land

An informal term loosely applied to various portions of a flood plain.

Boulders

Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breaks

A landscape or tract of steep, rough or broken land dissected by ravines and gullies and marking a sudden change in topography.

Breast height

An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management

Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Butte

An isolated, generally flat-topped hill or mountain with relatively steep slopes and talus or precipitous cliffs and characterized by summit width that is less than the height of bounding escarpments; commonly topped by a caprock of resistant material and representing an erosion remnant carved from flat-lying rocks.

Cable yarding

A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, felled trees generally are reeled in while one end is lifted or the entire log is suspended.

Calcareous soil

A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche

A general term for a prominent zone of secondary carbonate accumulation in surficial materials in warm, subhumid to arid areas. Caliche is formed by both geologic and pedologic processes. Finely crystalline calcium carbonate forms a nearly continuous surface-coating and void-filling medium in geologic (parent) materials. Cementation ranges from weak in nonindurated forms to very strong in indurated forms. Other minerals (e.g., carbonates, silicate, and sulfate) may occur as accessory cements. Most petrocalcic horizons and some calcic horizons are caliche.

California bearing ratio (CBR)

The load-supporting capacity of a soil as compared to that of standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy

The leafy crown of trees or shrubs. (See Crown.)

Canyon

A long, deep, narrow valley with high, precipitous walls in an area of high local relief.

Capillary water

Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena

A sequence, or “chain,” of soils on a landscape that formed in similar kinds of parent material and under similar climatic conditions but that have different characteristics as a result of differences in relief and drainage.

Cation

An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity

The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Catsteps

See Terracettes.

Cement rock

Shaly limestone used in the manufacture of cement.

Channery soil material

Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment

Control of unwanted vegetation through the use of chemicals.

Chiseling

Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Cirque

A steep-walled, semicircular or crescent-shaped, half-bowl-like recess or hollow, commonly situated at the head of a glaciated mountain valley or high on the side of a mountain. It was produced by the erosive activity of a mountain glacier. It commonly contains a small round lake (tarn).

Clay

As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay depletions

See Redoximorphic features.

Clay film

A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Clay spot (map symbol)

A spot where the surface texture is silty clay or clay in areas where the surface layer of the soils in the surrounding map unit is sandy loam, loam, silt loam, or coarser.

Claypan

A dense, compact subsoil layer that contains much more clay than the overlying materials, from which it is separated by a sharply defined boundary. The layer restricts the downward movement of water through the soil. A claypan is commonly hard when dry and plastic and sticky when wet.

Climax plant community

The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil

Sand or loamy sand.

Cobble (or cobblestone)

A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Cobbly soil material

Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

COLE (coefficient of linear extensibility)

See Linear extensibility.

Colluvium

Unconsolidated, unsorted earth material being transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g., direct gravitational action) and by local, unconcentrated runoff.

Complex slope

Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil

A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Concretions

See Redoximorphic features.

Conglomerate

A coarse grained, clastic sedimentary rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system

Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage

A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil

Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the “Soil Survey Manual.”

Contour stripcropping

Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section

The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Coprogenous earth (sedimentary peat)

A type of limnic layer composed predominantly of fecal material derived from aquatic animals.

Corrosion (geomorphology)

A process of erosion whereby rocks and soil are removed or worn away by natural chemical processes, especially by the solvent action of running water, but also by other reactions, such as hydrolysis, hydration, carbonation, and oxidation.

Corrosion (soil survey interpretations)

Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

Cover crop

A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Crop residue management

Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cropping system

Growing crops according to a planned system of rotation and management practices.

Cross-slope farming

Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown

The upper part of a tree or shrub, including the living branches and their foliage.

Cryoturbate

A mass of soil or other unconsolidated earthy material moved or disturbed by frost action. It is typically coarser than the underlying material.

Cuesta

An asymmetric ridge capped by resistant rock layers of slight or moderate dip (commonly less than 15 percent slopes); a type of homocline produced by differential erosion of interbedded resistant and weak rocks. A cuesta has a long, gentle slope on one side (dip slope) that roughly parallels the inclined beds; on the other side, it has a relatively short and steep or clifflike slope (scarp) that cuts through the tilted rocks.

Culmination of the mean annual increment (CMAI)

The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age,

the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave

The walls of excavations tend to cave in or slough.

Decreasers

The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing

Postponing grazing or resting grazing land for a prescribed period.

Delta

A body of alluvium having a surface that is fan shaped and nearly flat; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

Dense layer

A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depression, closed (map symbol)

A shallow, saucer-shaped area that is slightly lower on the landscape than the surrounding area and that does not have a natural outlet for surface drainage.

Depth, soil

Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

Desert pavement

A natural, residual concentration or layer of wind-polished, closely packed gravel, boulders, and other rock fragments mantling a desert surface. It forms where wind action and sheetwash have removed all smaller particles or where rock fragments have migrated upward through sediments to the surface. It typically protects the finer grained underlying material from further erosion.

Diatomaceous earth

A geologic deposit of fine, grayish siliceous material composed chiefly or entirely of the remains of diatoms.

Dip slope

A slope of the land surface, roughly determined by and approximately conforming to the dip of the underlying bedrock.

Diversion (or diversion terrace)

A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Divided-slope farming

A form of field stripcropping in which crops are grown in a systematic arrangement of two strips, or bands, across the slope to reduce the hazard of water erosion. One strip is in a close-growing crop that provides protection from erosion, and the other strip is in a crop that provides less protection from erosion. This practice is used where slopes are not long enough to permit a full stripcropping pattern to be used.

Drainage class (natural)

Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the “Soil Survey Manual.”

Drainage, surface

Runoff, or surface flow of water, from an area.

Drainageway

A general term for a course or channel along which water moves in draining an area. A term restricted to relatively small, linear depressions that at some time move concentrated water and either do not have a defined channel or have only a small defined channel.

Draw

A small stream valley that generally is shallower and more open than a ravine or gulch and that has a broader bottom. The present stream channel may appear inadequate to have cut the drainageway that it occupies.

Drift

A general term applied to all mineral material (clay, silt, sand, gravel, and boulders) transported by a glacier and deposited directly by or from the ice or transported by running water emanating from a glacier. Drift includes unstratified material (till) that forms moraines and stratified deposits that form outwash plains, eskers, kames, varves, and glaciofluvial sediments. The term is generally applied to Pleistocene glacial deposits in areas that no longer contain glaciers.

Drumlin

A low, smooth, elongated oval hill, mound, or ridge of compact till that has a core of bedrock or drift. It commonly has a blunt nose facing the direction from which the ice approached and a gentler slope tapering in the other direction. The longer axis is parallel to the general direction of glacier flow. Drumlins are products of

streamline (laminar) flow of glaciers, which molded the subglacial floor through a combination of erosion and deposition.

Duff

A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

Dune

A low mound, ridge, bank, or hill of loose, windblown granular material (generally sand), either barren and capable of movement from place to place or covered and stabilized with vegetation but retaining its characteristic shape.

Earthy fill

See Mine spoil.

Ecological site

An area where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. An ecological site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other ecological sites in kind and/or proportion of species or in total production.

Eluviation

The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Endosaturation

A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian deposit

Sand-, silt-, or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess.

Ephemeral stream

A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation

A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

Erosion

The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (accelerated)

Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Erosion (geologic)

Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion pavement

A surficial lag concentration or layer of gravel and other rock fragments that remains on the soil surface after sheet or rill erosion or wind has removed the finer soil particles and that tends to protect the underlying soil from further erosion.

Erosion surface

A land surface shaped by the action of erosion, especially by running water.

Escarpment

A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Most commonly applied to cliffs produced by differential erosion. Synonym: scarp.

Escarpment, bedrock (map symbol)

A relatively continuous and steep slope or cliff, produced by erosion or faulting, that breaks the general continuity of more gently sloping land surfaces. Exposed material is hard or soft bedrock.

Escarpment, nonbedrock (map symbol)

A relatively continuous and steep slope or cliff, generally produced by erosion but in some places produced by faulting, that breaks the continuity of more gently sloping land surfaces. Exposed earthy material is nonsoil or very shallow soil.

Esker

A long, narrow, sinuous, steep-sided ridge of stratified sand and gravel deposited as the bed of a stream flowing in an ice tunnel within or below the ice (subglacial) or between ice walls on top of the ice of a wasting glacier and left behind as high ground when the ice melted. Eskers range in length from less than a kilometer to more than 160 kilometers and in height from 3 to 30 meters.

Extrusive rock

Igneous rock derived from deep-seated molten matter (magma) deposited and cooled on the earth’s surface.

Fallow

Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown.

The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fan remnant

A general term for landforms that are the remaining parts of older fan landforms, such as alluvial fans, that have been either dissected or partially buried.

Fertility, soil

The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat)

The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity

The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

Fill slope

A sloping surface consisting of excavated soil material from a road cut. It commonly is on the downhill side of the road.

Fine textured soil

Sandy clay, silty clay, or clay.

Firebreak

An area cleared of flammable material to stop or help control creeping or running fires. It also serves as a line from which to work and to facilitate the movement of firefighters and equipment. Designated roads also serve as firebreaks.

First bottom

An obsolete, informal term loosely applied to the lowest flood-plain steps that are subject to regular flooding.

Flaggy soil material

Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

Flagstone

A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

Flood plain

The nearly level plain that borders a stream and is subject to flooding unless protected artificially.

Flood-plain landforms

A variety of constructional and erosional features produced by stream channel migration and flooding. Examples include backswamps, flood-plain splays, meanders, meander belts, meander scrolls, oxbow lakes, and natural levees.

Flood-plain splay

A fan-shaped deposit or other outspread deposit formed where an overloaded stream breaks through a levee (natural or artificial) and deposits its material (commonly coarse grained) on the flood plain.

Flood-plain step

An essentially flat, terrace-like alluvial surface within a valley that is frequently covered by floodwater from the present stream; any approximately horizontal surface still actively modified by fluvial scour and/or deposition. May occur individually or as a series of steps.

Fluvial

Of or pertaining to rivers or streams; produced by stream or river action.

Foothills

A region of steeply sloping hills that fringes a mountain range or high-plateau escarpment. The hills have relief of as much as 1,000 feet (300 meters).

Footslope

The concave surface at the base of a hillslope. A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

Forb

Any herbaceous plant not a grass or a sedge.

Forest cover

All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type

A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragipan

A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Genesis, soil

The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai

Commonly, a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils that shrink and swell considerably with changes in moisture content.

Glaciofluvial deposits

Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur in the form of outwash plains, valley trains, deltas, kames, eskers, and kame terraces.

Glaciolacustrine deposits

Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are bedded or laminated.

Gleyed soil

Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

Graded stripcropping

Growing crops in strips that grade toward a protected waterway.

Grassed waterway

A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel

Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravel pit (map symbol)

An open excavation from which soil and underlying material have been removed and used, without crushing, as a source of sand or gravel.

Gravelly soil material

Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

Gravelly spot (map symbol)

A spot where the surface layer has more than 35 percent, by volume, rock fragments that are mostly less than 3 inches in diameter in an area that has less than 15 percent rock fragments.

Green manure crop (agronomy)

A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water

Water filling all the unblocked pores of the material below the water table.

Gully (map symbol)

A small, steep-sided channel caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage whereas a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hard bedrock

Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hard to reclaim

Reclamation is difficult after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Hardpan

A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Head slope (geomorphology)

A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway. The overland waterflow is converging.

Hemic soil material (mucky peat)

Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

High-residue crops

Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Hill

A generic term for an elevated area of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline. Slopes are generally more than 15 percent. The distinction between a hill and a mountain is arbitrary and may depend on local usage.

Hillslope

A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of a hill.

Horizon, soil

A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the “Soil Survey Manual.” The major horizons of mineral soil are as follows:

O horizon: An organic layer of fresh and decaying plant residue.

L horizon: A layer of organic and mineral limnic materials, including coprogenous earth (sedimentary peat), diatomaceous earth, and marl.

A horizon: The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon: The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon: The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon: The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon: Soft, consolidated bedrock beneath the soil.

R layer: Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

M layer: A root-limiting subsoil layer consisting of nearly continuous, horizontally oriented, human-manufactured materials.

W layer: A layer of water within or beneath the soil.

Humus

The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups

Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties include depth to a seasonal high water table, the infiltration rate, and depth to a layer that significantly restricts the downward movement of water. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

Igneous rock

Rock that was formed by cooling and solidification of magma and that has not been changed appreciably by weathering since its formation. Major varieties include plutonic and volcanic rock (e.g., andesite, basalt, and granite).

Illuviation

The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil

A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers

Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration

The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity

The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate

The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate

The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Very low: Less than 0.2
Low: 0.2 to 0.4
Moderately low: 0.4 to 0.75
Moderate: 0.75 to 1.25
Moderately high: 1.25 to 1.75
High: 1.75 to 2.5
Very high: More than 2.5

Interfluve

A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways.

Interfluve (geomorphology)

A geomorphic component of hills consisting of the uppermost, comparatively level or gently sloping area of a hill; shoulders of backwearing hillslopes can narrow the upland or can merge, resulting in a strongly convex shape.

Intermittent stream

A stream, or reach of a stream, that does not flow year-round but that is commonly dry for 3 or more months out of 12 and whose channel is generally below the local water table. It flows only during wet periods or when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Invaders

On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, plants invade following disturbance of the surface.

Iron depletions

See Redoximorphic features.

Irrigation

Application of water to soils to assist in production of crops. Methods of irrigation are:

Basin: Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border: Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding: Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation: Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle): Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow: Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler: Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation: Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding: Water, released at high points, is allowed to flow onto an area without controlled distribution.

Kame

A low mound, knob, hummock, or short irregular ridge composed of stratified sand and gravel deposited by a subglacial stream as a fan or delta at the margin of a melting glacier; by a supraglacial stream in a low place or hole on the surface of the glacier; or as a ponded deposit on the surface or at the margin of stagnant ice.

Karst (topography)

A kind of topography that formed in limestone, gypsum, or other soluble rocks by dissolution and that is characterized by closed depressions, sinkholes, caves, and underground drainage.

Knoll

A small, low, rounded hill rising above adjacent landforms.

Ksat

See Saturated hydraulic conductivity.

Lacustrine deposit

Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain

A nearly level surface marking the floor of an extinct lake filled by well sorted, generally fine textured, stratified deposits, commonly containing varves.

Lake terrace

A narrow shelf, partly cut and partly built, produced along a lakeshore in front of a scarp line of low cliffs and later exposed when the water level falls.

Landfill (map symbol)

An area of accumulated waste products of human habitation, either above or below natural ground level.

Landslide

A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials caused by gravitational forces; the movement may or may not involve saturated materials. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones

Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Lava flow (map symbol)

A solidified, commonly lobate body of rock formed through lateral, surface outpouring of molten lava from a vent or fissure.

Leaching

The removal of soluble material from soil or other material by percolating water.

Levee (map symbol)

An embankment that confines or controls water, especially one built along the banks of a river to prevent overflow onto lowlands.

Linear extensibility

Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. 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. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

Liquid limit

The moisture content at which the soil passes from a plastic to a liquid state.

Loam

Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess

Material transported and deposited by wind and consisting dominantly of silt-sized particles.

Low strength

The soil is not strong enough to support loads.

Low-residue crops

Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Marl

An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal proportions; formed primarily under freshwater lacustrine conditions but also formed in more saline environments.

Marsh or swamp (map symbol)

A water-saturated, very poorly drained area that is intermittently or permanently covered by water. Sedges, cattails, and rushes are the dominant vegetation in marshes, and trees or shrubs are the dominant vegetation in swamps. Not used in map units where the named soils are poorly drained or very poorly drained.

Mass movement

A generic term for the dislodgment and downslope transport of soil and rock material as a unit under direct gravitational stress.

Masses

See Redoximorphic features.

Meander belt

The zone within which migration of a meandering channel occurs; the flood-plain area included between two imaginary lines drawn tangential to the outer bends of active channel loops.

Meander scar

A crescent-shaped, concave or linear mark on the face of a bluff or valley wall, produced by the lateral erosion of a meandering stream that impinged upon and undercut the bluff.

Meander scroll

One of a series of long, parallel, close-fitting, crescent-shaped ridges and troughs formed along the inner bank of a stream meander as the channel migrated laterally down-valley and toward the outer bank.

Mechanical treatment

Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil

Very fine sandy loam, loam, silt loam, or silt.

Mesa

A broad, nearly flat topped and commonly isolated landmass bounded by steep slopes or precipitous cliffs and capped by layers of resistant, nearly horizontal rocky material. The summit width is characteristically greater than the height of the bounding escarpments.

Metamorphic rock

Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement at depth in the earth’s crust. Nearly all such rocks are crystalline.

Mine or quarry (map symbol)

An open excavation from which soil and underlying material have been removed and in which bedrock is exposed. Also denotes surface openings to underground mines.

Mine spoil

An accumulation of displaced earthy material, rock, or other waste material removed during mining or excavation. Also called earthy fill.

Mineral soil

Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage

Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area

A kind of map unit that has little or no natural soil and supports little or no vegetation.

Miscellaneous water (map symbol)

Small, constructed bodies of water that are used for industrial, sanitary, or mining applications and that contain water most of the year.

Moderately coarse textured soil

Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil

Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon

A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

Moraine

In terms of glacial geology, a mound, ridge, or other topographically distinct accumulation of unsorted, unstratified drift, predominantly till, deposited primarily by the direct action of glacial ice in a variety of landforms. Also, a general term for a landform composed mainly of till (except for kame moraines, which are composed mainly of stratified outwash) that has been deposited by a glacier. Some types of moraines are disintegration, end, ground, kame, lateral, recessional, and terminal.

Morphology, soil

The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil

Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Mountain

A generic term for an elevated area of the land surface, rising more than 1,000 feet (300 meters) above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range. Mountains are formed primarily by tectonic activity and/or volcanic action but can also be formed by differential erosion.

Muck

Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Mucky peat

See Hemic soil material.

Mudstone

A blocky or massive, fine grained sedimentary rock in which the proportions of clay and silt are approximately equal. Also, a general term for such material as clay, silt, claystone, siltstone, shale, and argillite and that should be used only when the amounts of clay and silt are not known or cannot be precisely identified.

Munsell notation

A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Natric horizon

A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

Neutral soil

A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules

See Redoximorphic features.

Nose slope (geomorphology)

A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside. The overland waterflow is predominantly divergent. Nose slopes consist dominantly of colluvium and slope-wash sediments (for example, slope alluvium).

Nutrient, plant

Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter

Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Very low: Less than 0.5 percent
Low: 0.5 to 1.0 percent
Moderately low: 1.0 to 2.0 percent
Moderate: 2.0 to 4.0 percent
High: 4.0 to 8.0 percent
Very high: More than 8.0 percent

Outwash

Stratified and sorted sediments (chiefly sand and gravel) removed or “washed out” from a glacier by meltwater streams and deposited in front of or beyond the end moraine or the margin of a glacier. The coarser material is deposited nearer to the ice.

Outwash plain

An extensive lowland area of coarse textured glaciofluvial material. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

Paleoterrace

An erosional remnant of a terrace that retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to, a present-day stream or drainage network.

Pan

A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Parent material

The unconsolidated organic and mineral material in which soil forms.

Peat

Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped

An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedisediment

A layer of sediment, eroded from the shoulder and backslope of an erosional slope, that lies on and is being (or was) transported across a gently sloping erosional surface at the foot of a receding hill or mountain slope.

Pedon

The smallest volume that can be called “a soil.” A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation

The movement of water through the soil.

Perennial water (map symbol)

Small, natural or constructed lakes, ponds, or pits that contain water most of the year.

Permafrost

Ground, soil, or rock that remains at or below 0 degrees C for at least 2 years. It is defined on the basis of temperature and is not necessarily frozen.

pH value

A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Phase, soil

A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

Piping

Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Pitting

Pits caused by melting around ice. They form on the soil after plant cover is removed.

Plastic limit

The moisture content at which a soil changes from semisolid to plastic.

Plasticity index

The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plateau (geomorphology)

A comparatively flat area of great extent and elevation; specifically, an extensive land region that is considerably elevated (more than 100 meters) above the adjacent lower lying terrain, is commonly limited on at least one side by an abrupt descent, and has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level.

Playa

The generally dry and nearly level lake plain that occupies the lowest parts of closed depressions, such as those on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation and runoff. Playa deposits are fine grained and may or may not have a high water table and saline conditions.

Plinthite

The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

Plowpan

A compacted layer formed in the soil directly below the plowed layer.

Ponding

Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded

Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Pore linings

See Redoximorphic features.

Potential native plant community

See Climax plant community.

Potential rooting depth (effective rooting depth)

Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning

Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

Productivity, soil

The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil

A vertical section of the soil extending through all its horizons and into the parent material.

Proper grazing use

Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Rangeland

Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Reaction, soil

A measure of acidity or alkalinity of a soil, expressed as pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid: Less than 3.5
Extremely acid: 3.5 to 4.4
Very strongly acid: 4.5 to 5.0
Strongly acid: 5.1 to 5.5
Moderately acid: 5.6 to 6.0
Slightly acid: 6.1 to 6.5
Neutral: 6.6 to 7.3
Slightly alkaline: 7.4 to 7.8
Moderately alkaline: 7.9 to 8.4
Strongly alkaline: 8.5 to 9.0
Very strongly alkaline: 9.1 and higher

Red beds

Sedimentary strata that are mainly red and are made up largely of sandstone and shale.

Redoximorphic concentrations

See Redoximorphic features.

Redoximorphic depletions

See Redoximorphic features.

Redoximorphic features

Redoximorphic features are associated with wetness and result from alternating periods of reduction and oxidation of iron and manganese compounds in the soil. Reduction occurs during saturation with water, and oxidation occurs when the soil is not saturated. Characteristic color patterns are created by these processes. The reduced iron and manganese ions may be removed from a soil if vertical or lateral fluxes of water occur, in which case there is no iron or manganese precipitation in that soil. Wherever the iron and manganese are oxidized and precipitated, they

form either soft masses or hard concretions or nodules. Movement of iron and manganese as a result of redoximorphic processes in a soil may result in redoximorphic features that are defined as follows:

1. Redoximorphic concentrations.—These are zones of apparent accumulation of iron-manganese oxides, including:
   A. Nodules and concretions, which are cemented bodies that can be removed from the soil intact. Concretions are distinguished from nodules on the basis of internal organization. A concretion typically has concentric layers that are visible to the naked eye. Nodules do not have visible organized internal structure; *and*
   B. Masses, which are noncemented concentrations of substances within the soil matrix; *and*
   C. Pore linings, i.e., zones of accumulation along pores that may be either coatings on pore surfaces or impregnations from the matrix adjacent to the pores.
2. Redoximorphic depletions.—These are zones of low chroma (chromas less than those in the matrix) where either iron-manganese oxides alone or both iron-manganese oxides and clay have been stripped out, including:
   A. Iron depletions, i.e., zones that contain low amounts of iron and manganese oxides but have a clay content similar to that of the adjacent matrix; *and*
   B. Clay depletions, i.e., zones that contain low amounts of iron, manganese, and clay (often referred to as silt coatings or skeletans).
3. Reduced matrix.—This is a soil matrix that has low chroma *in situ* but undergoes a change in hue or chroma within 30 minutes after the soil material has been exposed to air.

Reduced matrix

See Redoximorphic features.

Regolith

All unconsolidated earth materials above the solid bedrock. It includes material weathered in place from all kinds of bedrock and alluvial, glacial, eolian, lacustrine, and pyroclastic deposits.

Relief

The relative difference in elevation between the upland summits and the lowlands or valleys of a given region.

Residuum (residual soil material)

Unconsolidated, weathered or partly weathered mineral material that accumulated as bedrock disintegrated in place.

Rill

A very small, steep-sided channel resulting from erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. A rill generally is not an obstacle to wheeled vehicles and is shallow enough to be smoothed over by ordinary tillage.

Riser

The vertical or steep side slope (e.g., escarpment) of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural, steplike landforms, such as successive stream terraces.

Road cut

A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments

Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rock outcrop (map symbol)

An exposure of bedrock at the surface of the earth. Not used where the named soils of the surrounding map unit are shallow over bedrock or where “Rock outcrop” is a named component of the map unit.

Root zone

The part of the soil that can be penetrated by plant roots.

Runoff

The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil

A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Saline spot (map symbol)

An area where the surface layer has an electrical conductivity of 8 mmhos/cm more than the surface layer of the named soils in the surrounding map unit. The surface layer of the surrounding soils has an electrical conductivity of 2 mmhos/cm or less.

Sand

As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone

Sedimentary rock containing dominantly sand-sized particles.

Sandy spot (map symbol)

A spot where the surface layer is loamy fine sand or coarser in areas where the surface layer of the named soils in the surrounding map unit is very fine sandy loam or finer.

Sapric soil material (muck)

The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saturated hydraulic conductivity (Ksat)

The ease with which pores of a saturated soil transmit water. Formally, the proportionality coefficient that expresses the relationship of the rate of water movement to hydraulic gradient in Darcy's Law, a law that describes the rate of water movement through porous media. Commonly abbreviated as "Ksat." Terms describing saturated hydraulic conductivity are:

Very high: 100 or more micrometers per second (14.17 or more inches per hour)

High: 10 to 100 micrometers per second (1.417 to 14.17 inches per hour)

Moderately high: 1 to 10 micrometers per second (0.1417 inch to 1.417 inches per hour)

Moderately low: 0.1 to 1 micrometer per second (0.01417 to 0.1417 inch per hour)

Low: 0.01 to 0.1 micrometer per second (0.001417 to 0.01417 inch per hour)

Very low: Less than 0.01 micrometer per second (less than 0.001417 inch per hour).

To convert inches per hour to micrometers per second, multiply inches per hour by 7.0572. To convert micrometers per second to inches per hour, multiply micrometers per second by 0.1417.

Saturation

Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Scarification

The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

Sedimentary rock

A consolidated deposit of clastic particles, chemical precipitates, or organic remains accumulated at or near the surface of the earth under normal low temperature and pressure conditions. Sedimentary rocks include consolidated equivalents of alluvium, colluvium, drift, and eolian, lacustrine, and marine deposits. Examples are sandstone, siltstone, mudstone, claystone, shale, conglomerate, limestone, dolomite, and coal.

Sequum

A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil

A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Severely eroded spot (map symbol)

An area where, on the average, 75 percent or more of the original surface layer has been lost because of accelerated erosion. Not used in map units in which “severely eroded,” “very severely eroded,” or “gullied” is part of the map unit name.

Shale

Sedimentary rock that formed by the hardening of a deposit of clay, silty clay, or silty clay loam and that has a tendency to split into thin layers.

Sheet erosion

The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Short, steep slope (map symbol)

A narrow area of soil having slopes that are at least two slope classes steeper than the slope class of the surrounding map unit.

Shoulder

The convex, erosional surface near the top of a hillslope. A shoulder is a transition from summit to backslope.

Shrink-swell

The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Shrub-coppice dune

A small, streamlined dune that forms around brush and clump vegetation.

Side slope (geomorphology)

A geomorphic component of hills consisting of a laterally planar area of a hillside. The overland waterflow is predominantly parallel. Side slopes are dominantly colluvium and slope-wash sediments.

Silica

A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio

The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt

As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone

An indurated silt having the texture and composition of shale but lacking its fine lamination or fissility; a massive mudstone in which silt predominates over clay.

Similar soils

Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Sinkhole (map symbol)

A closed, circular or elliptical depression, commonly funnel shaped, characterized by subsurface drainage and formed either by dissolution of the surface of underlying bedrock (e.g., limestone, gypsum, or salt) or by collapse of underlying caves within bedrock. Complexes of sinkholes in carbonate-rock terrain are the main components of karst topography.

Site index

A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Slickensides (pedogenic)

Grooved, striated, and/or glossy (shiny) slip faces on structural peds, such as wedges; produced by shrink-swell processes, most commonly in soils that have a high content of expansive clays.

Slide or slip (map symbol)

A prominent landform scar or ridge caused by fairly recent mass movement or descent of earthy material resulting from failure of earth or rock under shear stress along one or several surfaces.

Slope

The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope alluvium

Sediment gradually transported down the slopes of mountains or hills primarily by nonchannel alluvial processes (i.e., slope-wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/or specific gravity of rock fragments and may be separated by stone lines. Burnished peds

and sorting of rounded or subrounded pebbles or cobbles distinguish these materials from unsorted colluvial deposits.

Slow refill

The slow filling of ponds, resulting from restricted water transmission in the soil.

Slow water movement

Restricted downward movement of water through the soil. See Saturated hydraulic conductivity.

Sodic (alkali) soil

A soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Sodic spot (map symbol)

An area where the surface layer has a sodium adsorption ratio that is at least 10 more than that of the surface layer of the named soils in the surrounding map unit. The surface layer of the surrounding soils has a sodium adsorption ratio of 5 or less.

Sodicity

The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to Ca^{++} + Mg^{++}. The degrees of sodicity and their respective ratios are:

Slight: Less than 13:1

Moderate: 13-30:1

Strong: More than 30:1

Sodium adsorption ratio (SAR)

A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

Soft bedrock

Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil

A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief and by the passage of time.

Soil separates

Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand: 2.0 to 1.0
Coarse sand: 1.0 to 0.5
Medium sand: 0.5 to 0.25
Fine sand: 0.25 to 0.10
Very fine sand: 0.10 to 0.05
Silt: 0.05 to 0.002
Clay: Less than 0.002

Solum

The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Spoil area (map symbol)

A pile of earthy materials, either smoothed or uneven, resulting from human activity.

Stone line

In a vertical cross section, a line formed by scattered fragments or a discrete layer of angular and subangular rock fragments (commonly a gravel- or cobble-sized lag concentration) that formerly was draped across a topographic surface and was later buried by additional sediments. A stone line generally caps material that was subject to weathering, soil formation, and erosion before burial. Many stone lines seem to be buried erosion pavements, originally formed by sheet and rill erosion across the land surface.

Stones

Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony

Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stony spot (map symbol)

A spot where 0.01 to 0.1 percent of the soil surface is covered by rock fragments that are more than 10 inches in diameter in areas where the surrounding soil has no surface stones.

Strath terrace

A type of stream terrace; formed as an erosional surface cut on bedrock and thinly mantled with stream deposits (alluvium).

Stream terrace

One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream; represents

the remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of fluvial erosion or deposition.

Stripcropping

Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil

The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are:

Platy: Flat and laminated
Prismatic: Vertically elongated and having flat tops
Columnar: Vertically elongated and having rounded tops
Angular blocky: Having faces that intersect at sharp angles (planes)
Subangular blocky: Having subrounded and planar faces (no sharp angles)
Granular: Small structural units with curved or very irregular faces

Structureless soil horizons are defined as follows:

Single grained: Entirely noncoherent (each grain by itself), as in loose sand
Massive: Occurring as a coherent mass

Stubble mulch

Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil

Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling

Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum

The part of the soil below the solum.

Subsurface layer

Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow

The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Summit

The topographically highest position of a hillslope. It has a nearly level (planar or only slightly convex) surface.

Surface layer

The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the “plow layer,” or the “Ap horizon.”

Surface soil

The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

Talus

Rock fragments of any size or shape (commonly coarse and angular) derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose broken rock formed chiefly by falling, rolling, or sliding.

Taxadjuncts

Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

Terminal moraine

An end moraine that marks the farthest advance of a glacier. It typically has the form of a massive arcuate or concentric ridge, or complex of ridges, and is underlain by till and other types of drift.

Terrace (conservation)

An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geomorphology)

A steplike surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, lake, or seashore. The term is usually applied both to the relatively flat summit surface (tread) that was cut or built by stream or wave action and to the steeper descending slope (scarp or riser) that has graded to a lower base level of erosion.

Terracettes

Small, irregular steplike forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may be induced or enhanced by trampling of livestock, such as sheep or cattle.

Texture, soil

The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying “coarse,” “fine,” or “very fine.”

Thin layer

Otherwise suitable soil material that is too thin for the specified use.

Till

Dominantly unsorted and nonstratified drift, generally unconsolidated and deposited directly by a glacier without subsequent reworking by meltwater, and consisting of a heterogeneous mixture of clay, silt, sand, gravel, stones, and boulders; rock fragments of various lithologies are embedded within a finer matrix that can range from clay to sandy loam.

Till plain

An extensive area of level to gently undulating soils underlain predominantly by till and bounded at the distal end by subordinate recessional or end moraines.

Tilth, soil

The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toeslope

The gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

Topsoil

The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements

Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tread

The flat to gently sloping, topmost, laterally extensive slope of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural steplike landforms, such as successive stream terraces.

Tuff

A generic term for any consolidated or cemented deposit that is 50 percent or more volcanic ash.

Upland

An informal, general term for the higher ground of a region, in contrast with a low-lying adjacent area, such as a valley or plain, or for land at a higher elevation than the flood plain or low stream terrace; land above the footslope zone of the hillslope continuum.

Valley fill

The unconsolidated sediment deposited by any agent (water, wind, ice, or mass wasting) so as to fill or partly fill a valley.

Variegation

Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Varve

A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Very stony spot (map symbol)

A spot where 0.1 to 3.0 percent of the soil surface is covered by rock fragments that are more than 10 inches in diameter in areas where the surface of the surrounding soil is covered by less than 0.01 percent stones.

Water bars

Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

Weathering

All physical disintegration, chemical decomposition, and biologically induced changes in rocks or other deposits at or near the earth’s surface by atmospheric or biologic agents or by circulating surface waters but involving essentially no transport of the altered material.

Well graded

Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wet spot (map symbol)

A somewhat poorly drained to very poorly drained area that is at least two drainage classes wetter than the named soils in the surrounding map unit.

Wilting point (or permanent wilting point)

The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Windthrow

The uprooting and tipping over of trees by the wind.

Exhibit C: Excerpted ODOT Construction Specifications for Weed Control

The Oregon Department of Transportation (ODOT) Standard Specifications (2018) are required for every federal aid construction project administered by ODOT. Boilerplate Special Provisions modify the Standard Specifications, and are included in construction projects as necessary. Boilerplate Special Provisions capture contract requirements that are frequently – but not always – applicable to ODOT projects. The following pages include the Standard Specifications and Boilerplate Special Provisions, excerpted to include on those specifications applicable to weed control.

ODOT Standard Specifications (2018)

PART 01000 - RIGHT OF WAY DEVELOPMENT AND CONTROL

Section 01030 - Seeding

Description

01030.00 Scope - This Work consists of seeding and associated tasks to develop plant growth for erosion control, environmental mitigation, and Roadside development.

01030.02 Definitions:

Noxious Weed - All weed designated by the Oregon State Weed Board as injurious to public health, agriculture, recreation, wildlife, or all public or private property. The Oregon Department of Agriculture (ODA) will be the authority in determination of noxious weed species.

Specified Weeds - All noxious weeds as defined above, and all plant species identified in the Special Provisions or on the Plans as a species to be removed.

Weed Free - For these Specifications, "Weed Free" is defined as the following maximum amount of living weeds per square yard:

- Zero "Type A" or "Type T" Noxious Weeds
- One "Type B" Noxious Weed
- One of each non-noxious weed listed in the Special Provisions

The ODA Noxious Weed Policy and Classification System lists Type "A", "B", and "T" Noxious Weeds.

Weed Management Area (WMA) - A defined project area with specified weeds to remove, including areas where weeds begin growing because of Project-associated ground disturbance. A WMA may be the entire Project Site or any portion, including material source and disposal sites as shown.

Labor

01030.30 General:

(a) Weed Control Coordinator - Submit certification at the preconstruction conference that the weed control coordinator meets the following minimum requirements:

- Demonstrates ability to identify noxious and other weed species commonly seen in Oregon. Some examples of potentially acceptable credentials are at least 1 year conducting weed surveys in Oregon or Washington State or a degree in botany or horticulture from an accredited institution.
- Has successful weed control experience, with similar duties to those stated under typical duties below, on at least three construction or vegetation management projects. Two

examples of acceptable certification are an Oregon Pesticide Consultant License or Oregon Landscape Contractor's License held in the individual's name.

The weed control coordinator duties include:

- Identify Specified Weeds.
- Prepare and update the Weed Control Work Plan (WCWP).
- Coordinate Contractor's weed removal Work and records.
- Resolve weed control issues as the Contractor's representative.
- Determine when Specified Weed content exists in disposable materials and ensures the materials are disposed of at an approved off-site facility.

(b) Pesticide Applicator - Submit certification before application of pesticide Work begins, that when chemical weed control is used, that each applicator possesses an Oregon Commercial Pesticide Applicator's License held in the individual's name. Submit a certification each time a new applicator begins application Work on the Project.

Construction

01030.42 Weed Control - When the Contract Schedule of Items includes an item for "Weed Control", remove and prevent regrowth of Specified Weeds, weed plant parts, and weed seeds from areas within the Project limits.

Do not harm or disturb existing native or ornamental vegetation, unless directed to do so. Do not compact Soil with heavy Equipment in areas where Soil will not be disturbed for roadway or other construction.

If a pesticide has been approved for use, apply according to federal and State laws, including conditions and requirements of the federal registered pesticide label.

(a) Weed Control Work Plan - Depending on Project conditions such as location, sensitive environments, permit requirements, jurisdictional regulations, or other items, there may be limits on the use of chemicals or other weed control methods. Before submitting the initial WCWP, determine if there are restrictions or all potential for restrictions on weed control methods on Project Sites. At the preconstruction conference, submit a WCWP with the following:

- Name and contact information for the approved weed control coordinator.
- WMA's with existing Specified Weeds mapped on Project Plan sheets where possible.
- Botanical and common name of each species of weed to be removed.
- The proposed methods of weed removal and continuing control for each weed species listed.
- Schedule of weed control measures.
- Request to use wheeled or tracked construction Equipment in sensitive areas.

If changes of the WCWP are necessary, resubmit a revised WCWP for approval before proceeding.

(b) Weed Control Inspections - Inspect the Project for new growth of specified weeds at least monthly and apply weed control measures as appropriate. This requirement may be waived by the Engineer during the period that weeds are fully dormant. To ensure satisfactory weed removal, the last WMA inspection will occur at least 30 days after growing season has begun or as directed.

At a minimum, schedule weed control inspection with the Agency at the following times:

- After approval of WCWP and prior to beginning weed control within a WMA.
- Monthly.
- Upon request by the Agency to discuss non-compliant weed control Work.
- After completing weed control at material sources and disposal sites.

(c) Remove and Control of Weeds - Remove and control weeds according to the following:

(1) All Areas:

- At least 3 Calendar Days prior to beginning weed control activities, walk through each WMA with the Engineer and confirm the identity, location, type, and approximate number of Specified Weeds. Verify that control methods in the WCWP are acceptable as planned for each WMA before proceeding with weed control activities.
- Remove Specified Weeds and receive approval prior to beginning construction or Equipment mobilization in that area. As much as practicable, ensure that weed seeds or reproducing plant parts such as vines, runners, or rhizomes do not remain or become disbursed during control activities.
- As soon as practicable, place weeds and related materials in an approved container and transport to an approved offsite disposal facility according to applicable laws and regulations. During transport, ensure that materials are fully enclosed at all times to prevent escape.
- Keep a record of all weed material loads transported off the Project and submit documentation from the approved disposal facilities that a corresponding number of weed material loads were disposed of at that facility.
- Keep WMA's Weed Free including weeds not initially present in the walk through.

(2) Sensitive Areas:

- Unless otherwise approved in writing, use only hand or light mechanical weed control methods within 50 feet of Sensitive Areas. Hand methods include the use of hand tools. Light mechanical methods include the use of hand carried, motorized machinery.
- Inside Sensitive Areas, obtain approval before using wheeled or tracked construction Equipment. Requests will be approved only when all vegetation in the area will be cleared, such as under new Roadways or slopes.
- The Engineer will be the authority in the determination of Sensitive Areas.

(d) Weed Control Corrective Work - If corrective Work for areas identified as deficient by the Engineer is not completed within a 15 Calendar Day period, the Engineer may suspend the Work according to 00180.70. If the Contractor's weed control Work is determined to be unsatisfactory, the Agency reserves the right to do the Work at the Contractor's expense.

01030.62 Establishment Work:

(b) All Other Seeding - Ensure the establishment of wildflower, lawn, plant, water quality, Wetland, native plant, and permanent seeding by the following:

(3) Weed Control - Remove Specified Weeds prior to plants going to seed and keep WMA's and seeded areas "Weed Free" throughout the Establishment Period.

Finishing and Cleaning Up

01030.70 Cleanup - Remove weeds, trash, debris, stones, and other extraneous matter from seeded areas as directed and dispose of according to 00290.20.

Payment

01030.90 Payment - The accepted quantities of seeding and associated Work performed under this Section will be paid for at the Contract unit price, per unit of measurement, for the following items:

Pay Item	Unit of Measurement
(a) Weed Control	Acre

Item (a) includes all Work associated with the WCWP.

Boilerplate Special Provisions

SECTION 01030 - SEEDING

Comply with Section 01030 of the Standard Specifications modified as follows:

01030.42 Weed Control - Add the following paragraph and bullets after the paragraph that begins "If a pesticide has been approved for…" and before subsection (a):

The Specified Weeds and plant species to be removed include the following:

- All species designated by the ODA as “A,” “B,” or “T” designated weeds.