ORIGINAL

COLUMBIA RIVER GORGE WINE GROWERS ASSOCIATION

December 30, 2001

Chief of Regulations
Regulations Division - 5th Floor
Bureau of Alcohol, Tobacco, and Firearms
650 Massachusetts Avenue, NW
Washington DC 20226

WNJ 1/3/02

Chief of Regulations:

Attached please find our petition for Rule Amendment to establish the **Columbia Gorge** Appellation American Viticultural Area. The submittal is based on the criteria requirements summarized in 27 CFR Sections 4.25a and 9.3. In addition, various exhibits are attached as supporting soil and climate documentation.

The proposed Columbia Gorge viticultural area is located in Hood River and Wasco Counties, Oregon and Skamania and Klickitat Counties, Washington. The required USGS 1:24,000 scale maps are also included per the CFR requirements.

We appreciate your consideration of this petition. Please do not hesitate to contact us if there are questions or if further information is needed.

Cordially,

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Portland, OR 97201
[redacted]

Kris Goodwillie, President
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Rick Martz, Vice President
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Dick Reed, Appellation Committee
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Petition to Bureau of Alcohol, Tobacco, & Firearms for Rule Amendment to Establish Columbia Gorge Appellation American Viticulture Area

Contents

(as Listed in 27 CFR Section 4.25a and 27 CFR Section 9.3)

Exhibits

(In Support of the Above Petition Evidence)

Prepared by

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Application Submitted

December 31, 2001

(1) Evidence that the Name of the Viticultural Area is Locally and/or Nationally Known as Referring to the Area Specified in the Application

Columbia River Gorge

The Columbia Gorge is a dramatic river corridor cut through the Cascades mountain range. The Gorge is the only sea-level pass through the Cascade Range. Before the river was tamed, early explorers had to concentrate their efforts to pass through and survive the Cascades just west of the proposed viticultural area. Here, huge quantities of rock had tumbled into the river making navigation treacherous.

The use of the name Columbia Gorge was already established in the late 1800's as the area began to be settled. The early pioneers considered Gorge travel as a dangerous experience and very little comment was made regarding the landscape above the immediate river canyon.

Today, this narrow winding valley with its steeply rising bluffs is commonly called "the Gorge", the "Columbia Gorge", or the "Columbia River Gorge". This can be readily demonstrated in general pamphlets and brochures. For examples, see the following pamphlets in Exhibit 1.

(1) Columbia River Gorge, National Fish Hatcheries and National Wildlife Refuges, US Fish & Wildlife Service

(2) Columbia Gorge Interpretive Center, The Museum in the Heart of the Gorge, Skamania County Historical Society, P.O. Box 396 Stevenson, Washington

(3) Gorge Maps, Columbia Gorge and Hood River, Published by Jones Graphics, Hood River, OR

(4) Experience the Columbia River Gorge, Skamania County Chamber of Commerce, Stevenson, WA

(5) Columbia River Gorge National Scenic Area, USDA Forest Service, Pacific Northwest Region

(6) Columbia Gorge Discovery Center, Wasco County Historical Museum, 5000 Discovery Drive, The Dalles, OR 97058

(7) Cascade Locks, Oregon "Heart of the Columbia Gorge", P.O. Box 355, Cascade Locks, Oregon, 97014

(8) Bonneville Lock & Dam, National Historic Landmark Serving the Northwest, Oregon & Washington, Portland District, US Army Corps of Engineers, 1997

(9) Columbia River Gorge National Scenic Area Map, USDA Forest Service, 902 Wasco Avenue, Suite 200, Hood River, OR 97031

The above listed are included as exhibits with this petition and are intended to illustrate the common and widespread use today of the term "Columbia River Gorge". Please refer to the Exhibit 1 map for a sense of the boundaries of the Columbia Gorge. Although the boundary of the Columbia River Gorge National Scenic Area is defined in detail, the generally accepted understanding of the area is loosely defined and normally focuses on the length of the gorge which is the most steep, dramatic, and wooded.

In general, the western boundary of the Gorge begins at about Crown Point and Multnomah Falls on the Oregon side and Beacon Rock on the Washington side. These features are possibly the most famous images of the Gorge today and have become popular tourist attractions due to their spectacular outdoor scenery.

Although the eastern boundary of the Columbia River Gorge National Scenic Area technically extends to the Dalles, many people consider the area where the forest vegetation stops to be the eastern limit of the Columbia River Gorge. Furthermore, it is in this transition area between Lyle and the Dalles, that the most dramatic climatic changes occur and the region becomes much more arid...similar to eastern Oregon and eastern Washington. For the purposes of defining the unique viticultural qualities of the Columbia River Gorge, this petition considers the Lyle area to be the eastern boundary of the proposed Columbia River Gorge Appellation.

(2) Historical or Current Evidence that the Boundaries of the Viticultural Area are as Specified in the Application

Historical Discovery & Development

In early May, 1792 Captain Robert Gray from Boston successfully navigated the entrance bar to the Columbia River in his ship "the Columbia Redivivus" (83 feet long, 212 ton burden, 15 foot draft). On May 20th, 1792 Gray logged his discovery and named the river.

The Columbia River remained largely unexplored until the Lewis and Clark expedition traveled extensively through the region in 1805 and 1806. Their subsequent reports and discoveries contributed to further exploration and settlement within the Gorge over the following years. Lucrative fur trading activities were one of the first industries in the area. In 1825, the Hudson's Bay Company established a headquarters at Fort Vancouver at the west end of the Gorge. (4)

Although white explorers and settlers did not arrive in the Columbia River Gorge until the 1800's, the Native American Indian population had long thrived in the region. The Indian culture in the area developed largely around the salmon. Villages lined the river, particularly around The Dalles and Cascade Locks where the river narrowed into swift channels. The area was considered the trade center of the Oregon country and many Indian tribes traveled great distances seasonally to fish and trade in the Gorge area. Archeological excavations have shown that some village sites were continuously occupied for up to 10,000 years. (10)

In 1838, Methodists Jason and Daniel Lee constructed the Wascopan Mission in The Dalles. This mission, later purchased and operated by Marcus Whitman and his family, represented the first permanent white settlement in Gorge. The subsequent killing of the Whitman family in 1847 by Cayuse Indians (in retaliation to white man diseases that were decimating the Indian population) led Congress to provide a military presence in the Northwest and to establish the Oregon Territory in 1848. (9)

During this period, The Dalles became the largest settlement in the Northwest. It was a military post and represented the terminus of the Oregon Trail. The first commercial cultivation of fruit trees began in the Gorge in the 1850's. Buildings that would later become the settlement of Hood River began to appear and in 1860, the Joslyns built the first house in Bingen.

In the early 1850's, the first steam ships appeared on the Columbia River. Their journeys were limited by the extensive rapids and falls within the Gorge until the completion of the Cascade Locks in 1896. During these steamship years, railroads were beginning to be constructed to transport passengers and goods around the impassable stretches of the river.

In 1862, the first railroad, the "Oregon Pony", was built on the south shore of the river. In 1880, the Oregon Railway and Navigation Company began construction of a railroad running the full length of the Gorge. This was ultimately linked with the transcontinental railroad system through St. Paul, Minnesota in 1883. (10)

Logging became another major industry in the Gorge with the completion of the railroads. From the steep slopes, logs were often brought down by flumes. The picturesque Broughton flume brought rough-sawn logs down from a lumber mill in Underwood until its final closure in May of 1987. (10)

The arrival of the 20th century brought extensive developments in both the shore and river transportation systems. 1915 saw the completion of both the bypass canal for Celilo Falls as well as the Columbia River Scenic Highway. Bonneville dam was constructed during the period from 1933 to 1939. The Dalles dam was built during the 1950's and in 1968, the John Day dam was completed. (3)

Today, the Gorge includes 30 state parks and parts of two national forests. There are numerous communities have developed along the Gorge. Pear, apple, and cherry orchards flourish in Hood River, Mosier, and The Dalles. Wine grapes are cultivated on both sides of the river in White Salmon, Underwood, and Hood River. (10)

Viticultural History

Grapes have been grown in the Columbia Gorge for over a century. In 1853, E.S. and Mary Joslyn arrived in the Columbia Gorge area from Massachusetts. They were the first settlers of the area on the north side of the Columbia River east of Cascades. In 1860, the Joslyns built the first house in Bingen.

The town of White Salmon was later founded by the Jewitt family in the 1880's on the bluff above Bingen. Terraces were built on a wide south facing slope and were planted with American vines which the Jewitts had brought from Illinois.

"Today, the older people of the towns tell of playing in the vineyards as children, of hiding among the vines which stretched six feet high, and helping place the wood poles which supported the heavily laden vines each autumn. At harvest time, the table grapes were picked, then sent to market in Portland aboard river boats. In winter, the vineyard terraces were a favorite place for sledding." (1)

The remains of this vineyard are still visible and are located south of Vine Street in White Salmon. (1)

Two other pioneer families brought grape cuttings to the Columbia River Gorge. John Balfour, the youngest son of English Lord Balfour, planted and raised a quantity of fine grapes in the early 1900's at Baldwin, Washington which was later named Lyle. (1)

Leonis and Elizah Meress brought grape cuttings to White Salmon from their native Adele Nord, a village in one of France's coldest regions. Some of the vinifera vines which they planted are still alive today and have withstood local temperatures of 20 to 30 degrees below zero. Before the Columbia River was dammed, it was much more shallow and would often freeze so solid that buggies could be ridden from Bingen to Hood River across the ice. Temperatures in the Gorge today are more moderate and the reservoirs behind the dams maintain warmer temperatures. (1)

Interest in grape growing in the Columbia Gorge was renewed by Charles V. Henderson of White Salmon who started an experimental plot in the early 1960's and later planted a small commercial vineyard under the direction of Dr. Walter Clore of Washington State University. Several years later, in 1973, Dr. W. McAndrews began planting grapes on Underwood Mountain. This vineyard is now known as Celilo Vineyards and is managed by Rick Ensminger. With the harvest of 1975, the Bingen Wine Cellars winery, now known as Mont Elise Vineyards, was established.

On the Oregon side of the Gorge in the Hood River area, wine grape growing started in the mid 1970's with Cliff Blanchette on the west side of Hood River County. Many other vineyards have started operations in the Hood River Valley and have been producing quality grapes for more than 10 years.

Inspired by the success of the early growers, many others planted grapes in the mid 1970's including Charles Hopper, Charles Smith, Berry Wheeler, and William Swain. Although many have since changed ownership and management, the vineyards have thrived successfully since their initial establishment. Today, the Columbia River Gorge Wine Growers Association is comprised of numerous grape growers and wineries in this unique area as follows:

Current Washington Vineyards

Celilo Vineyards	Rick Ensminger	65 Acres	Underwood
Brehm Vineyards	Peter Brehm	6 Acres	Underwood
Mountainview Vineyard	Jim Cowan	4 Acres	Underwood
Wind River Cellars	Joel Goodwillie	12 Acres	Husum
Gensler Vineyard	Don Gensler	12 Acres	White Salmon
Crystal Pheasant Vineyard	Norm Jacox	43 Acres	Snowden
Oak Ridge Vineyard	Tom Woodward	5 Acres	Husum
Ziegler Lane Vineyard	Ken Ziegler	4 Acres	Underwood
Gorge View Vineyard	Clark Ziegler	2 Acres	Underwood
Myzkowski Vineyard	Alex Myzkowski	12 Acres	White Salmon
Swift Water Vineyard	Mark Wharry	4 Acres	Underwood
Heany Vineyard	Fred Heany	5 Acres	Bingen
Huber Vineyard	Paul Huber	9 Acres	Underwood
Larson Vineyard	Don Larson	5 Acres	White Salmon
Underwood Mtn. Vineyards	Jack Brady	12 Acres	Underwood

Current Oregon Vineyards

Blue Chip Farm	Dick Reed	5 Acres	Hood River
Phelps Creek Vineyard	Bob Morus	9 Acres	Hood River
Hood River Vineyards	Bernie Lerch	30 Acres	Hood River
Flerchinger Vineyards	Don Flerchinger	6 Acres	Hood River
Bickford Orchard Vineyard	Don Bickford	5 Acres	Hood River
Wy'East Vineyard		20 Acres	Hood River
Maribel Vineyard	Rick Martz	5 Acres	Hood River
Pine Grove Vineyards	Dave Waller	5 Acres	Hood River
Country Club Vineyards	Anne Cushman	8 Acres	Hood River
Gay Vineyard	Anthony Gay	4 Acres	Hood River

(3) Evidence Relating to Geographical Features (Climate, Soil, Elevation, Physical Features, etc.) which Distinguish the Viticultural Features of the Proposed Area from the Surrounding Areas

Geologic Formation

The oldest lava formations in the Gorge can be seen along the great southwest dipping ridge north of Stevenson. Flows up to 2 miles thick tell the story of great volcanic eruptions 20 - 40 million years ago. The later Eagle Creek formations, 18 - 21 million years ago, consist of bouldery mudflows up to 1,000 feet thick.

About 12 million years ago, a final flow of Columbia basalt lava partly filled the channel. All of this volcanic activity led to numerous shifts in the path of the Columbia River from its present day course. During this period, the oceanic plate continued to push under the North American continental plate, buckling the basalt layers into ridges and basins that can be seen today. Between 4 million and 1 million years ago, various basalt lava flows from as many as 50 local volcanos dammed the river numerous times and again pushed the river course north to its present location. (9)

During the last ice age, approximately 15,000 years ago, glacial advances from Canada extended down into northern Idaho and repeatedly blocked the Clarks Fork River near Sandpoint, Idaho. An immense glacial lake was formed as water backed up behind the ice dam over successive glaciations. Lake Missoula grew to cover 3,000 square miles behind the 2,500 foot high ice dam.

As the water pressure increased, the dam eventually broke. Water, ice, boulders, rocks and dirt swept across eastern Washington and down the Columbia River channel in numerous cataclysmic events over the next several thousand years. The raging floods scoured the bottom of the Gorge and carried millions of tons of top soil from northern Idaho and eastern Washington through the Gorge and into the Willamette Valley on their way to the ocean. (4)

These raging flood water events further defined the steep cliff profile of the Gorge and created the scablands in eastern Washington that can be seen today. The steep cliff walls, particularly on the north side of the Gorge have resulted in extensive landslides over the last 2,000 years. The greatest slide area, north of Bonneville, came down around 1260 AD. This Cascade slide pushed the river out of normal course a mile to the south and formed a 200 foot high dam. There is evidence that it took 10 years for the lake behind the dam to overtop the crest and wash the slide away. When this "Bridge of the Gods" was washed away, it left the "Cascades of the Columbia" rapids...now flooded behind the Bonneville dam.

Soil Types

The predominant soil types in the appellation areas of both Skamania County and Klickitat County are Chemawa, McElroy, McGowen and Underwood Loam as outlined below.

Skamania County (10)
Chemawa Loam Series (Soil Types 21, 22, 23, 24)
McElroy Gravelly Loam Series (Soil Types 68, 69)
Underwood Loam Series (Soil Types 144, 145, 146)

Klickitat County (11)
Chemawa Loam Series (Soil Types 86A, 86B, 86C)
McGowen Loam Series (Soil Type 77)
Underwood Loam Series (Soil Types 76A, 76B, 76C)

On the Oregon side, in Hood River and Wasco Counties, the predominant soil types are Wamic Loam , Van Horn Loam , Oak Grove Loam, Parkdale Loam, and Wyest Loam as outlined below.

Hood River County
Oak Grove Loam Series (Soil Types 16B, 16C, 16D)
Parkdale Loam Series (Soil Types 17B, 17C, 17D)
Van Horn Loam Series (Soil Types 23, 24)
Wyest Silt Loam Series (Soil Types 28B, 28C)

Wasco County
Wamic Loam Series (Soil Type 49, 50, and 51)
Van Horn Loam Series (Soil Type 45)

These loam soils are all similar in nature and consist of very deep and well drained soil deposits on terraces, foot slopes and back slopes. Depending on the type of loam, typical elevations of these soil deposits can range from 500 to 2,000 feet. Permeability of these loams is slow to moderate and available water capacity is high. Effective rooting depth is 60 inches or more.

Further data on the general soil characteristics is presented from the County Soil Surveys compiled by the Natural Resource Conservation Service (11) (12) (17) (18) in Exhibit 2, Exhibit 3, Exhibit 4, and Exhibit 5..

Physical Features & Elevation

The Columbia River Gorge is quite dramatic in appearance. The Gorge was carved by the Columbia River itself and its sides can become steep cliffs as it twists and turns in its westbound course. The sides of the Gorge range from sheer rock faces comprised of volcanic outcroppings of igneous and metamorphic rock to gentle stair-step bench lands which reflect prehistoric lava flows. In some areas of the Gorge, one can see layer upon layer of lava flow. Each layer may be ten to twenty feet thick with little or no soil cover.

In the bench lands above the river, however, the soil was not scoured away when the Gorge was formed and may be quite deep. It is these bench lands that are most desirable for vineyards. On the north side of the Gorge, the lands slope beautifully to the south and offer good sun exposure.

Most of the fruit growing in the region is done at elevations ranging from 400 to 2000 feet above sea level. Higher elevations are more heavily forested and the micro-climates become increasingly influenced by Mount Adams to the north and Mount Hood to the south. When German immigrants first settled in the Columbia Gorge, the area was often compared to the Rhineland, particularly the Rheingau which is famous for its fine Rieslings. The town of Bingen, in fact, was named after Bingen-on-the-Rhine.

On the Washington side, grapes are now grown in the Underwood area up to an elevation of 1,800 feet above sea level. In the Husum valley, there are established areas for grape growing from 900 to 1,750 feet above sea level. In the Bingen / White Salmon area, the old vineyard of White Salmon is around the 700-800 feet elevation range. There are also vineyards in regions around 1,400 to 1,800 feet above sea level. In addition, there are established vineyards in the Snowden area around 1,900 feet at very select sites. Finally, the Lyle area has good grape growing sites up to around 1,500 feet elevation. Although Lyle is warmer than areas to the west, certain land forms in the immediate vicinity prevent suitable cultivation of grapes above 1,500 feet elevation.

On the Oregon side, grapes are being grown at elevations up to 1,800 feet elevation. Sites are established from the lower (north) end of Hood River valley up to the upper valley (south) area near Parkdale.

The unique topographic nature of the Columbia Gorge prevents grape growing at higher elevations. The growing heat of the summer begins late in the Gorge and higher elevations do not receive enough heat units for grape cultivation. Towards the eastern side of the proposed appellation area, the heat levels do increase, but topographic land forms typically prevent practical establishment of vineyards. Land forms become highly eroded and very rugged with steep canyons.

Climate

The climate of the Columbia River Gorge is truly unique. The Gorge acts as a funnel as it works moist marine air masses of the west and the drier air of the east back and forth. The Columbia River Gorge, with its massive east-west cut, represents an extreme transition zone and offers the only opportunity for this type of air exchange to take place the entire length of the Cascade Range.

The proposed Columbia Gorge viticultural area benefits from prevailing westerly winds. Originating over the Pacific ocean, these winds moderate temperatures which otherwise might be warmer in the summer and cooler in the winter. In addition, the westerly winds bring much appreciated moisture to a region that would otherwise tend to be more arid.

Rainfall ranges from 40" in the White Salmon area at the west end of the proposed appellation to 18" near the eastern end at Lyle. It is also interesting to note that, in general, as Gorge elevation increases, so does rainfall.

The east and west borders of the proposed appellation have been determined by yearly rainfall. West of the White Salmon and Underwood area, increased rainfall, cloud cover, and vegetative growth make the benchlands unsuitable for viticulture. At the eastern end near Lyle, the terrain becomes much more arid. Note on the USGS maps that the forest vegetation above the Gorge ends at this point as the lessening rainfall can no longer sustain forest growth.

Grapes in the west end of the Columbia River Gorge are planted on south facing slopes at higher elevations in order to receive maximum intensity of sunlight. As one travels east, vineyards are planted at lower elevations in areas of more gradual slope.

The unique climate in the Columbia Gorge, prized by pear growers for generations, promises to be a premier grape growing region in the near future. Warmer and sunnier than the Willamette Valley, yet not so baking hot as the eastern Gorge, the area's volcanic soils and gentle climate, combined with experienced agriculturalists, create excellent conditions to contribute to the Pacific Northwest's wine production.

Summary

The fundamental features which distinguish this area of the Gorge with the surrounding areas include the following.

Climate :	A unique climate which is defined and influenced by the unusual landmasses of the Gorge.
Soil:	Unique volcanic and sedimentary soil structures derived from geologic and flood activity.
Topography:	Gentle sloping valleys on both the Oregon and Washington side are ideally suited for fruit production.
History:	The area has been an established fruit and wine grape growing region.

(4) The Specific Boundaries of the Viticultural Area, Based on Features Which Can be Found on United States Geological Survey (U.S.G.S.) Maps of the Largest Applicable Scale

Proposed Appellation Boundary

The proposed Columbia Gorge viticultural area is located in Hood River and Wasco Counties, Oregon and Skamania and Klickitat Counties, Washington.

1. Point of Beginning:	West side of Section 30, R10E, T3N, on the vertical boundary between Range 9E and Range 10E near Tunnel 4 on Highway 14 at the centerline of the Columbia River.
2. Proceed North:	Proceed north on the vertical boundary between Range 9E and Range 10E approximately 10.5 miles to the NW corner of Section 6, R10E, T4N.
3. Proceed East:	Turn and proceed east on the horizontal boundary between Township 4N and Township 5N approximately 12 miles to the NE corner of Section 1, R11E, T4N.
4. Proceed South:	Turn and proceed south on the vertical boundary between Range 11E and Range 12E approximately 6 miles to the SE corner of Section 36, R11E, T4N.
5. Proceed East:	Turn and proceed east on the horizontal boundary between Township 3N and Township 4N approximately 4 miles to the NE corner of Section 3, R12E, T3N.
6. Proceed South:	Turn and proceed south approximately 6.5 miles along the east boundary of Sections 3, 10, 15, 22, 27, and 34 to the centerline of the Klickitat River.
7. Proceed Southwest:	Following the centerline of the Klickitat River, proceed generally southwest approximately 0.5 miles to the centerlines of the confluence of the Klickitat River and Columbia River.
8. Proceed Southeast:	Following the centerline of the Columbia River, proceed generally southeast approximately 2 mile to the intersection of the Columbia River centerline and the vertical boundary of Range 12E and Range 13E on the Oregon side of the Columbia River.

9. Proceed South:	Turn and proceed south on the vertical boundary between Range 12E and Range 13E approximately 11.25 miles to the SE corner of Section 36, R12E, T1N.
10. Proceed West:	Turn and proceed west along the horizontal boundary between Township 1N and Township 1S (BASELINE) approximately 6 miles to the SW corner of Section 31, R12E, T1N.
11. Proceed North:	Turn and proceed north on the vertical boundary between Range 11E and Range 12E approximately 6 miles to the NW corner of Section 6, R12E, T1N.
12. Proceed West:	Turn and proceed west on the horizontal boundary between Township 1N and Township 2N approximately 6 miles to the SW corner of Section 31, R11E, T2N.
13. Proceed South:	Turn and proceed south on the vertical boundary between Range 10E and Range 11E east approximately 6 miles to the SE corner of Section 36, R10E, T1N.
14. Proceed West:	Turn and proceed west along the horizontal boundary (BASELINE) between Township 1N and Township 1S approximately 2 miles to the NE corner of Section 4, R10E, T1S.
15. Proceed South:	Turn and proceed south approximately 1 mile along the east boundary of Section 4 to the SE corner of Section 4, R10E, T1S.
16. Proceed West:	Turn and proceed west approximately 3 miles along the south border of Sections 4, 5, and 6 to the SW corner of Section 6, R10E, T1S.
17. Proceed North:	Turn and proceed north along the vertical boundary between Range 9E and Range 10E approximately 1 mile to the northwest corner of Section 6, R10E, T1S.
18. Proceed West:	Turn and proceed west along the horizontal boundary between Township 1N and Township 1S (BASELINE) approximately 1.25 miles to the SW corner of Section 31, R10E, T1N
19. Proceed North:	Turn and proceed north along the vertical boundary between Range 9E and Range 10E approximately 3 miles to the SE corner of Section 13, R9E, T1N and the centerline of the Columbia River.

20. Proceed West:	Turn and proceed west approximately 2 miles along the south border of Sections 13 and 14 to the SW corner of Section 14, R9E, T1N.
21. Proceed North:	Turn and proceed north approximately 1 mile to the NW corner of Section 14, R9E, T1N.
22. Proceed East:	Turn and proceed east approximately 1 mile to the NE corner of Section 14, R9E, T1N.
23. Proceed North:	Turn and proceed north approximately 2 miles along the west border of Sections 12 and 1 to the NW corner of Section 1, R9E, T1N.
24. Proceed East:	Turn and proceed east approximately 1 mile to the NE corner of Section 1, R9E, T1N.
25. Proceed North:	Turn and proceed north along the vertical boundary between Range 9E and 10E approximately 7 miles to the NW corner of Section 31, R10E, T3N and the centerline of the Columbia River.
26. Proceed Northeast:	Following the centerline of the Columbia River, turn and proceed northeast approximately 1 mile to the Point of Beginning.

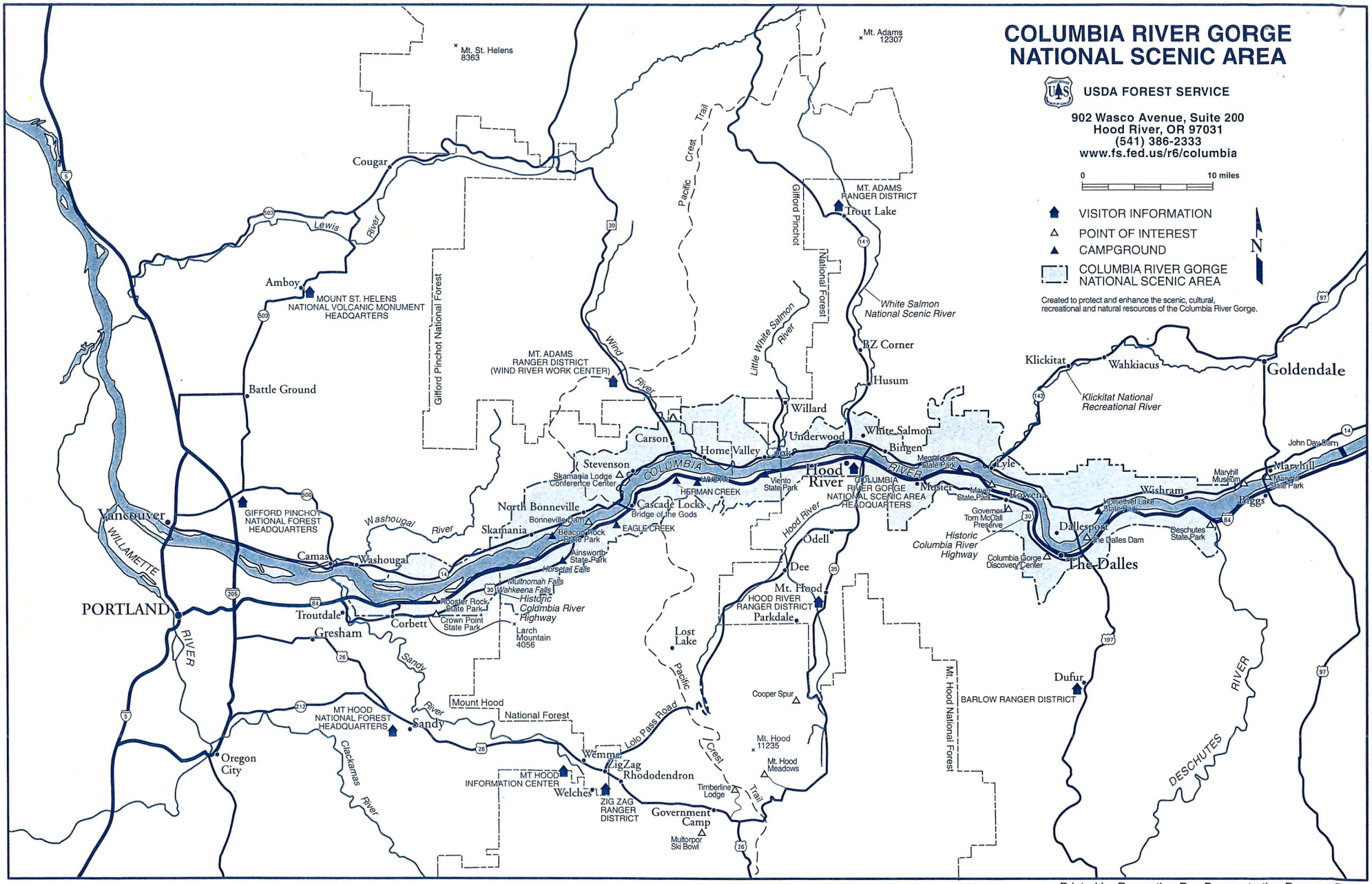
(5) Copy of the Appropriate U.S.G.S. Maps with Boundaries Prominently Marked

For purposes of overall orientation, a small scale USGS map has been included as Exhibit 9 to illustrate the general configuration in a single page.

In addition, formal copies of the appropriate 12 USGS maps accompany this petition in Exhibit 10 to demonstrate the physical boundaries of the proposed appellation. The map orientation is illustrated below.

Willard Washington	Northwestern Lake Washington	Husum Washington	Appleton Washington
Mount Defiance Oregon	Hood River Oregon	White Salmon Washington	Lyle Washington
Dee Oregon	Parkdale Oregon	Ketchum Reservoir Oregon	Brown Creek Oregon

Exhibit 1
Columbia Gorge Brochures



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U.S. Fish & Wildlife Service

Columbia River Gorge

National Fish Hatcheries and National Wildlife Refuges

COLUMBIA GORGE INTERPRETIVE CENTER

Stevenson, Washington

The Museum in the Heart of the Gorge

COLUMBIA GORGE

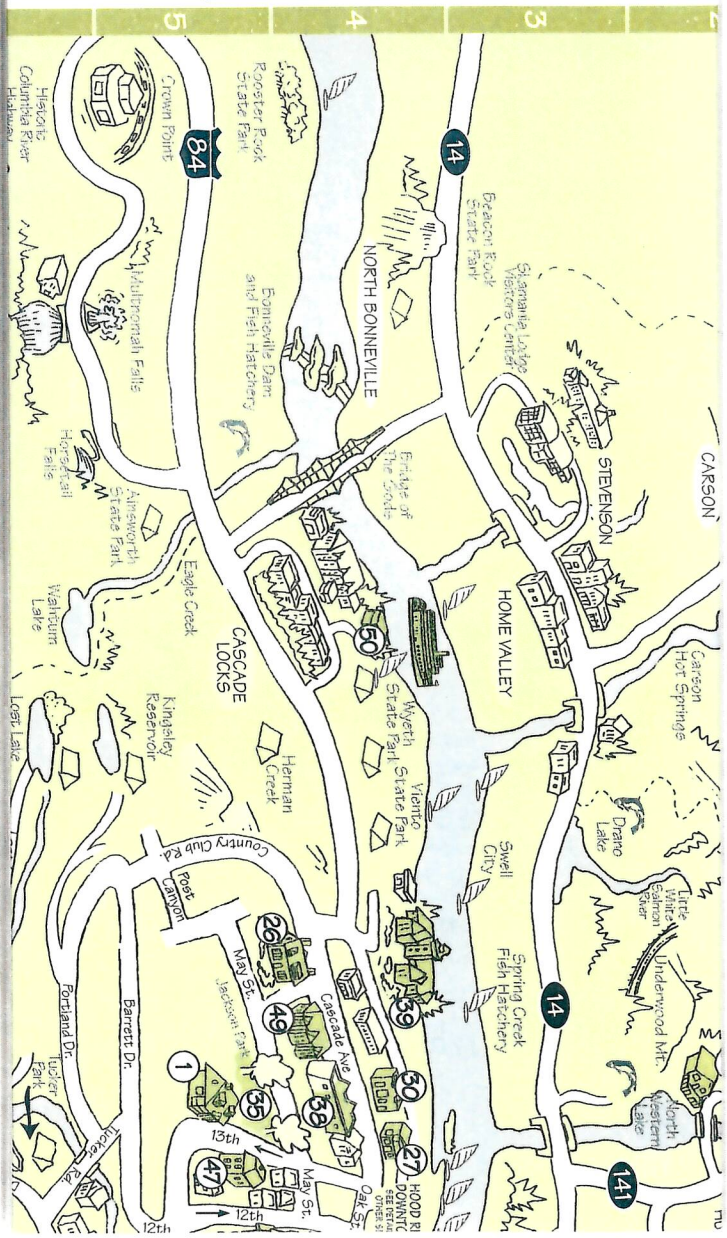
FREE

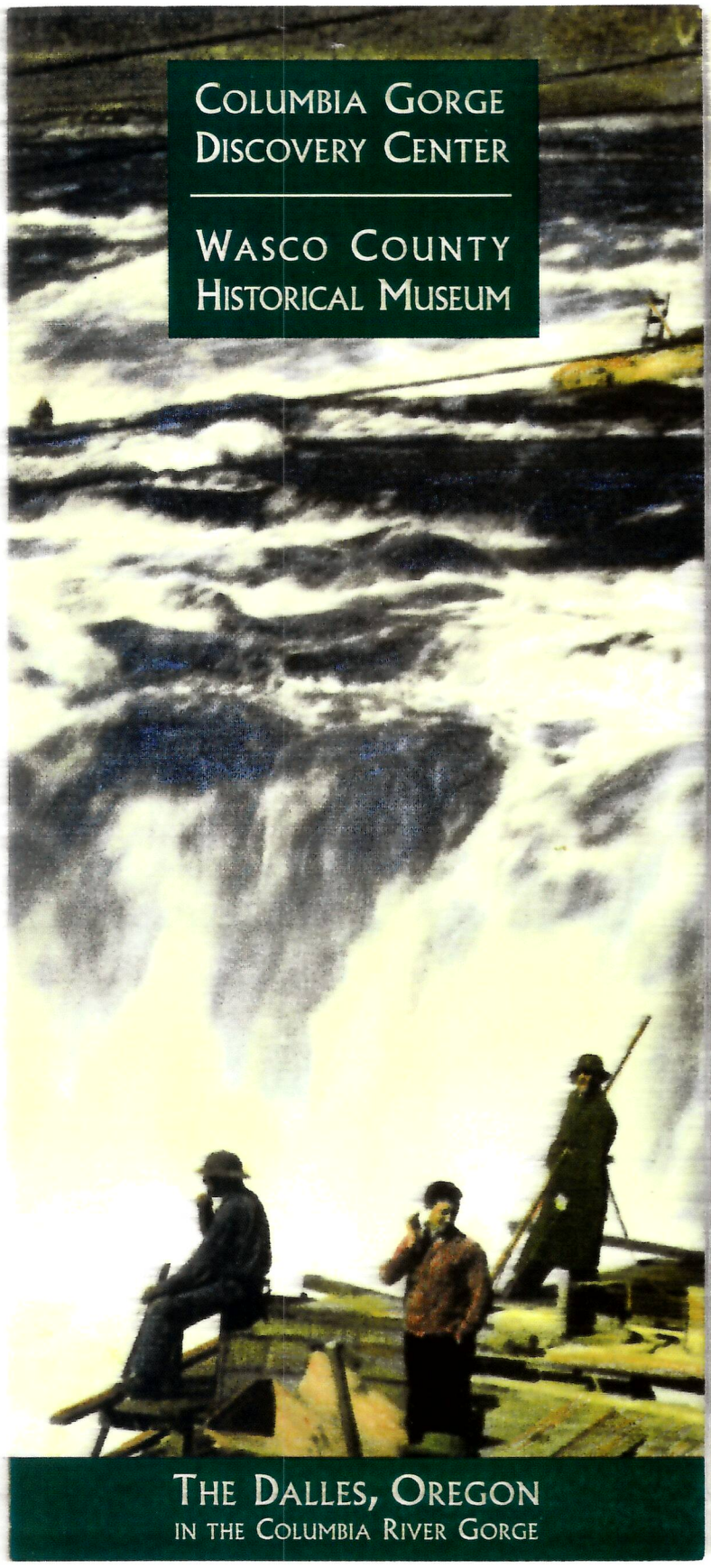
GORGE MAPS

1998

HOOD RIVER

Published by JONES GRAPHICS, Hood River, OR • 541.386.9240 • © 1998



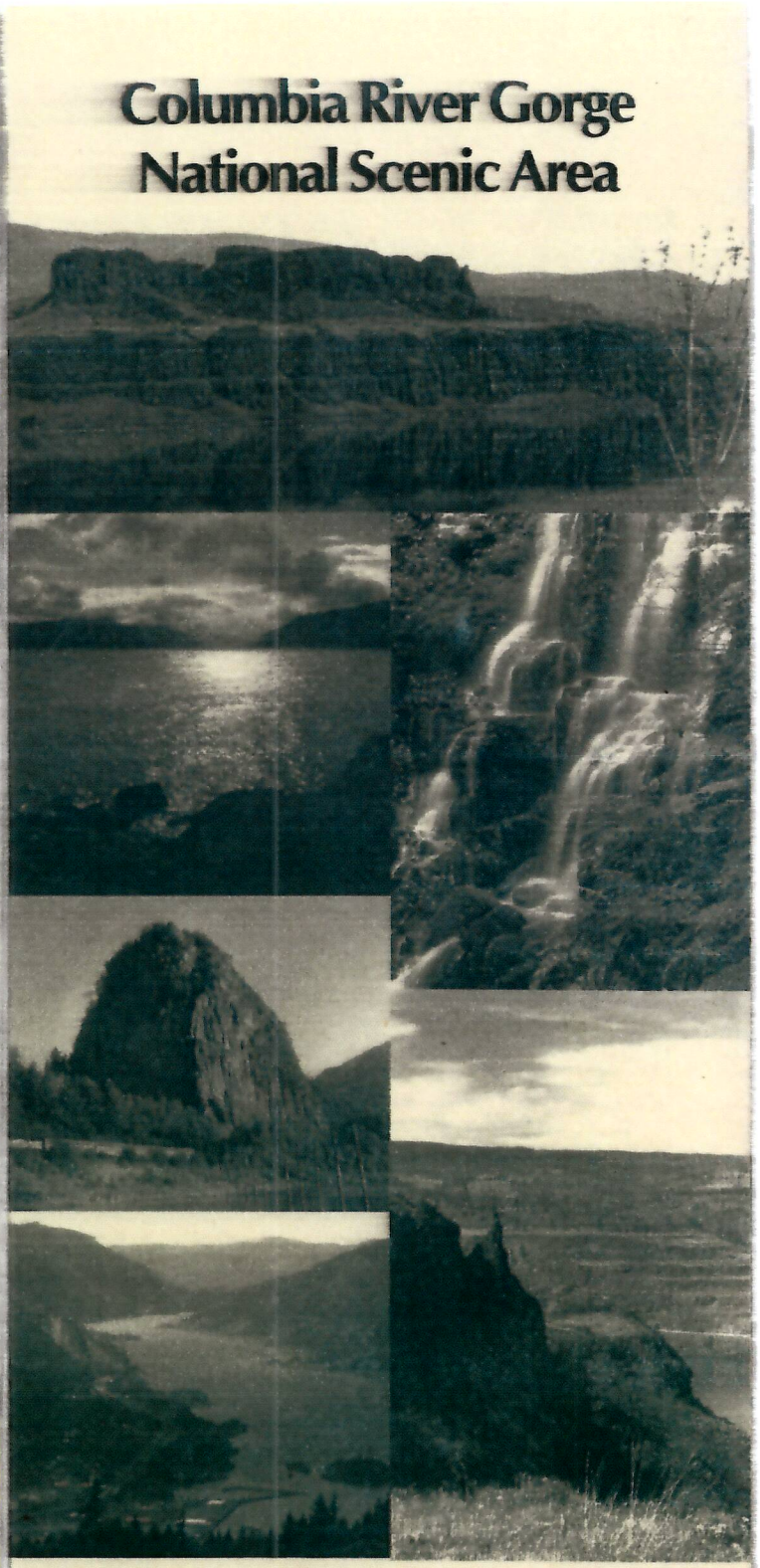


COLUMBIA GORGE DISCOVERY CENTER

WASCO COUNTY HISTORICAL MUSEUM

THE DALLES, OREGON
IN THE COLUMBIA RIVER GORGE

Columbia River Gorge National Scenic Area



USDA United States Department of Agriculture

Forest Service Pacific Northwest Region

Columbia River Gorge National Scenic Area

Cascade Locks, Oregon "Heart of The Columbia Gorge"™

Tour Guide

Bonneville Lock and Dam

A National Historic Landmark Serving the Northwest

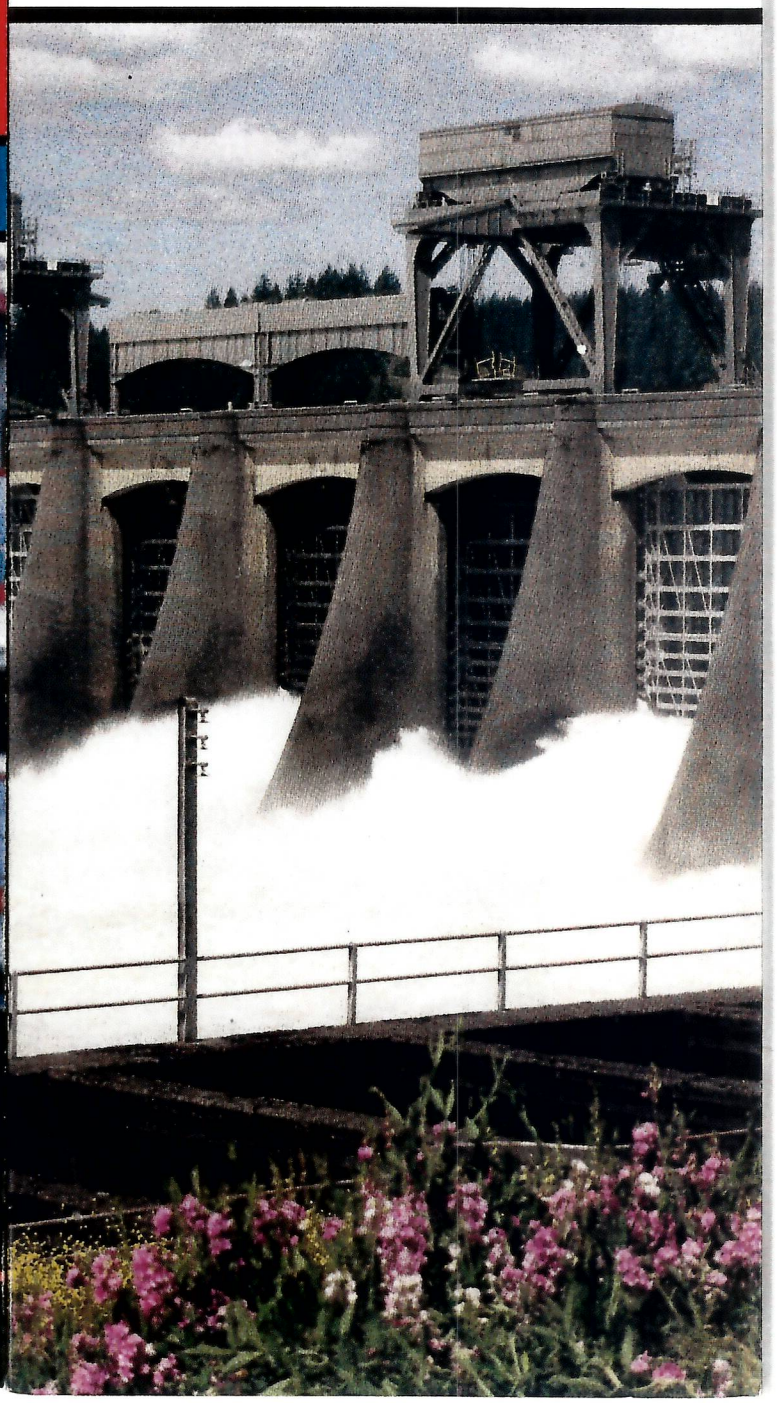


Exhibit 2
References

References

1. The Winemakes of the Pacific Northwest, by J. Elizabeth Purser and Lawrence Allen, Harbor House, 1977

2. Columbia River Gorge, Discovering Old Oregon Series, Marty Sherman, Frank Amato Publications, 1984

3. Konepee's Eden - Historic and Scenic Handbook The Columbia River Gorge, Oral Bullard, TMS Book Service, 1985

4. Columbia River Gorge, The Story Behind the Scenery, Roberta Hilbruner, KC Publications, 1999

5. Soil Survey of Skamania County Area, USDA Soil Conservation Service, Goldendale, Washington, 1990

6. Soil Survey of Klickitat County Area, Draft Soil Data, USDA Soil Conservation Service, Goldendale, Washington

7. The Columbia River, A Historical Travel Guide, JoAnn Roe, Fulcrum Publishing, 1992

8. Climatic Data, Hood River Experimental Station, Oregon Climate Service Website, www.ocs.orst.edu

9. The Columbia Gorge, A Unique American Treasure, Compiled by Michael Spranger, Washington State University Cooperative Extension, Reprinted October 1996

10. Columbia River Gorge, Graphic Arts Publishing Company, P.O. Box 10306, Portland, Oregon

11. Soil Survey of Wasco County, Oregon, Northern Part, USDA Soil Conservation Service, Oregon Agricultural Experimental Station, 19982

12. Soil Survey of Hood River County Area, Oregon,USDA Soil Conservation Service, Oregon Agricultural Experimental Station , 1981

Exhibit 3
Skamania County Soil Types
Washington

United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Washington State
Department of Natural
Resources and
Washington State
University Agriculture
Research Center

Soil Survey of Skamania County Area, Washington

percent pumice fragments; slightly acid; clear wavy boundary.

Bs3—15 to 30 inches; strong brown (7.5YR 5/6) extremely cindery sand, reddish yellow (7.5YR 7/6) dry; single grain; loose; common fine and medium roots and few coarse roots; many coarse irregular pores; 80 percent pumice fragments; slightly acid; abrupt wavy boundary.

2Eb—30 to 32 inches; brown (7.5YR 5/2) gravelly loam, pinkish gray (7.5YR 6/2) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; few fine and medium roots; few fine and medium irregular pores; 10 percent pumice fragments and 30 percent pebbles; slightly acid; abrupt irregular boundary.

2Bsb—32 to 54 inches; dark yellowish brown (10YR 4/4) extremely gravelly loam, light yellowish brown (10YR 6/4) dry; weak medium and coarse subangular blocky structure; soft, friable, nonsticky and nonplastic; weakly smeary; few fine, medium, and coarse roots; common fine pores; 50 percent pebbles and 25 percent cobbles; slightly acid; abrupt irregular boundary.

3R—54 inches; fractured andesite.

Depth to bedrock is 40 to 60 inches. Depth to the buried layers is 30 to 35 inches. The lower part of the control section is 50 to 85 percent rock fragments. Reaction of the profile is moderately acid or slightly acid throughout.

Chemawa Series

The Chemawa series consists of very deep, well drained soils on terraces, foot slopes, and back slopes. These soils formed in pyroclastic flows consisting mostly of volcanic ash. Slope is 2 to 50 percent. Elevation is 800 to 1,200 feet. The average annual precipitation is about 50 inches, the average annual air temperature is about 47 degrees F, and the average frost-free season is 110 to 160 days.

These soils are medial, mesic Andic Xerumbrepts.

Typical pedon of Chemawa loam, 30 to 50 percent slopes, about 3 miles northwest of Underwood; 1,100 feet south and 600 feet west of the northeast corner of sec. 19, T. 3 N., R. 10 E., W.M.

O1—1.5 inches to 0.5 inch; litter of needles, leaves, and twigs.

O2—0.5 inch to 0; decomposed organic material.

Ac1—0 to 4 inches; dark brown (7.5YR 3/3) loam, brown (7.5YR 5/3) dry; weak medium granular structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine and fine roots and few coarse roots; many fine irregular pores; 30 percent shotlike aggregates 2 to 4 millimeters in size; neutral; clear smooth boundary.

Ac2—4 to 14 inches; dark brown (7.5YR 3/3) loam, brown (7.5YR 5/3) dry; weak coarse granular structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine and fine roots, common medium roots, and few coarse roots; many very fine and common fine irregular pores; 25 percent shotlike aggregates 2 to 4 millimeters in size; neutral; clear wavy boundary.

Bw1—14 to 31 inches; dark brown (7.5YR 4/4) loam, reddish yellow (7.5YR 6/6) dry; weak fine and medium subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; weakly smeary; common very fine and fine roots and few medium roots; common fine irregular pores; 10 percent shotlike aggregates 2 to 4 millimeters in size; neutral; gradual smooth boundary.

Bw2—31 to 60 inches; strong brown (7.5YR 5/6) loam, reddish yellow (7.5YR 6/6) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; weakly smeary; common fine roots; common fine irregular pores; 5 percent shotlike aggregates 2 to 4 millimeters in size; neutral.

Content of shotlike aggregates ranges from 10 to 30 percent in the Ac horizon and decreases with increasing depth. The volcanic ash influence extends to a depth of 60 inches or more. The umbric epipedon is 10 to 14 inches thick. Content of rock fragments in the control section ranges from 0 to 5 percent.

The Ac horizon has hue of 5YR to 10YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 2 or 3 when moist and 3 or 4 when dry. Reaction is slightly acid to neutral.

The Bw horizon has hue of 5YR to 10YR, value of 3 to 5 when moist and 5 to 7 when dry, and chroma of 4 to 6 when moist or dry. Reaction is moderately acid to neutral. The horizon is loam or silt loam.

Cinnamon Series

The Cinnamon series consists of very deep, well drained soils on terraces, foot slopes, and back slopes of mountains. These soils formed in pyroclastic flows of volcanic ash. Slope is 2 to 90 percent. Elevation is 1,600 to 2,800 feet. The average annual precipitation is about 125 inches, the average annual air temperature is

Sitka alder, common beargrass, Oregongrape, longtube twinflower, western brackenfern, and bunchberry dogwood.

This map unit is in capability subclass VIIe.

21—Chemawa loam, 2 to 8 percent slopes. This very deep, well drained soil is on terraces and foot slopes. It formed in pyroclastic flows consisting mostly of volcanic ash. The vegetation in areas not cultivated is mainly mixed conifers and shrubs. Elevation is 800 to 1,200 feet. The average annual precipitation is about 50 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is 110 to 160 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 2 inches thick. The surface layer is dark brown loam 14 inches thick. The subsoil is dark brown and strong brown loam to a depth of 60 inches or more.

Included in this unit are small areas of McElroy and Underwood soils. Also included are small areas of Chemawa soils that have slopes of more than 8 percent. Included areas make up about 10 percent of the total acreage.

Permeability of this Chemawa soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

This unit is used for woodland, orchards, hayland, pastureland, homesites, wildlife habitat, and recreation.

Douglas fir and grand fir are the main woodland species on this unit. On the basis of a 100-year site curve, the mean site index is 150 for Douglas fir. On the basis of a 50-year site curve, the mean site index is 114 for Douglas fir and 105 for grand fir. The culmination of the mean annual increment (CMAI) for Douglas fir is 158 cubic feet per acre per year at age 60, and for grand fir it is 163 cubic feet at age 86. Among the trees of limited extent are red alder and bigleaf maple.

The main limitation for harvesting timber is seasonal soil wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and damages the roots of trees. Unsurfaced roads and skid trails are soft and slippery and can be impassable when wet. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available in this unit. Disturbance of the protective layer of duff can be reduced with the careful use of wheeled and tracked equipment.

Seedling establishment is the main concern in the production of timber. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by grand fir occurs periodically. If the canopy is opened, brush invades and can prevent the establishment of Douglas fir seedlings and can delay natural reforestation by grand fir unless controlled.

Among the common forest understory plants are vine maple, common snowberry, false Solomons seal, western brackenfern, and trailing blackberry.

If this unit is used for orchard crops, the main limitation is the hazard of erosion. If the soil is plowed in fall, runoff and erosion can be reduced by seeding to a cover crop.

This unit is well suited to use as hayland and pastureland. It has few limitations. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Mowing at least twice a year helps to maintain uniform growth and discourages selective grazing.

This unit has few limitations as homesites. Population growth has resulted in increased construction of homes on this unit. Preserving the existing plant cover during construction helps to control erosion. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants. The soil in this unit is limited for the construction of roads and streets because of the potential for frost action.

This map unit is in capability subclass IIe.

22—Chemawa loam, 8 to 15 percent slopes. This very deep, well drained soil is on foot slopes. It formed in pyroclastic flows consisting mostly of volcanic ash. The vegetation in areas not cultivated is mainly mixed conifers and shrubs. Elevation is 800 to 1,200 feet. The average annual precipitation is about 50 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is 110 to 160 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 2 inches thick. The surface layer is dark brown loam 14 inches thick. The subsoil is dark brown and strong brown loam to a depth of 60 inches or more.

Included in this unit are small areas of McElroy and Underwood soils. Also included are small areas of Chemawa soils that have slopes of less than 8 percent or more than 15 percent. Included areas make up about 12 percent of the total acreage.

Permeability of this Chemawa soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for woodland, orchards, hayland, pastureland, homesites, wildlife habitat, and recreation.

Douglas fir and grand fir are the main woodland species on this unit. On the basis of a 100-year site curve, the mean site index is 143 for Douglas fir. On the basis of a 50-year site curve, the mean site index is 110 for Douglas fir and 105 for grand fir. The culmination of the mean annual increment (CMAI) for Douglas fir is 149 cubic feet per acre per year at age 65, and for grand fir it is 163 cubic feet at age 86. Among the trees of limited extent are red alder and bigleaf maple.

The main limitation for harvesting timber is seasonal soil wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and damages the roots of trees. Unsurfaced roads and skid trails are soft and slippery and can be impassable when wet. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available in this unit. Disturbance of the protective layer of duff can be reduced with the careful use of wheeled and tracked equipment.

Seedling establishment is the main concern in the production of timber. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by grand fir occurs periodically. If the canopy is opened, brush invades and can prevent the establishment of Douglas fir seedlings and can delay natural reforestation by grand fir unless controlled.

Among the common forest understory plants are vine maple, common snowberry, false Solomons seal, western brackenfern, and trailing blackberry.

If this unit is used for orchard crops, the main limitation is the hazard of erosion. If the soil is plowed in fall, runoff and erosion can be reduced by seeding to a cover crop.

This unit is well suited to use as hayland and pastureland. It has few limitations. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition. Mowing at least twice a year helps to maintain uniform growth and discourages selective grazing. In some years, supplemental irrigation is needed.

This unit has few limitations for use as homesites. Population growth has resulted in increased construction of homes on this unit. The main limitations are steepness of slope and the hazard of erosion in the steeper areas. Only that part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants. The soil in this unit is susceptible to frost action, which may limit construction of roads and streets.

This map unit is in capability subclass IIIe.

23—Chemawa loam, 15 to 30 percent slopes. This very deep, well drained soil is on foot slopes and back slopes. It formed in pyroclastic flows consisting mostly of volcanic ash. The native vegetation is mainly mixed conifers and shrubs. Elevation is 800 to 1,200 feet. The average annual precipitation is about 50 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is 110 to 160 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 2 inches thick. The surface layer is dark brown loam 14 inches thick. The subsoil to a depth of 60 inches or more is dark brown and strong brown loam.

Included in this unit are small areas of McElroy, Underwood, and Undusk soils. Also included are small areas of Chemawa soils that have slopes of less than 15 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Chemawa soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for woodland, orchards, hayland, pastureland, homesites, wildlife habitat, and recreation.

Douglas fir and grand fir are the main woodland species on this unit. On the basis of a 100-year site curve, the mean site index is 136 for Douglas fir. On the basis of a 50-year site curve, the mean site index is 104 for Douglas fir and 105 for grand fir. The culmination of the mean annual increment (CMAI) for Douglas fir is 139 cubic feet per acre per year at age 70, and for grand fir it is 163 cubic feet at age 86. Among the trees of limited extent are red alder and bigleaf maple.

The main limitation for harvesting timber is seasonal soil wetness. Use of wheeled and tracked equipment when the soil is wet produces ruts, compacts the soil, and damages the roots of trees. Unsurfaced roads and skid trails are soft and slippery, and they can be impassable when wet. Logging roads for year-round use need to be surfaced. Rock for road construction is not readily available in this unit. Establishing plant cover on steeper slopes that have been cut or filled reduces erosion. Disturbance of the protective layer of duff can be reduced with the careful use of wheeled and tracked equipment.

Seedling establishment is the main concern in the production of timber. Reforestation can be accomplished by planting Douglas fir seedlings. If seed

trees are present, natural reforestation of cutover areas by grand fir occurs periodically. If the canopy is opened, brush invades and can prevent the establishment of Douglas fir seedlings and can delay natural reforestation by grand fir unless controlled.

Among the common forest understory plants are vine maple, common snowberry, false Solomons seal, western brackenfern, and trailing blackberry.

If this unit is used for orchard crops, the main limitation is the hazard of erosion. If the soil is plowed in fall, runoff and erosion can be reduced by seeding to a cover crop.

This unit is well suited to use as hayland and pastureland. The main limitations are steepness of slope and the hazard of erosion. Erosion can be controlled by growing pasture. The use of equipment is limited by steepness of slope. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Mowing at least twice a year helps to maintain uniform growth and discourages selective grazing.

The main limitations of this unit for use as homesites are steepness of slope and the hazard of erosion in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion. Plant cover can be established and maintained through proper fertilizing, seeding, mulching, and shaping of the slopes. Slope is a concern in installing septic tank absorption fields. Absorption lines should be installed on the contour.

Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum. The soil in this unit is susceptible to frost action, which may limit construction of roads and streets.

This map unit is in capability subclass IVe.

24—Chemawa loam, 30 to 50 percent slopes. This very deep, well drained soil is on back slopes. It formed in pyroclastic flows consisting mostly of volcanic ash. The native vegetation is mainly mixed conifers and shrubs. Elevation is 800 to 1,200 feet. The average annual precipitation is about 50 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is 110 to 160 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 2 inches thick. The surface layer is dark brown loam 14 inches thick. The subsoil to a depth of 60 inches or more is dark brown and strong brown loam.

Included in this unit are small areas of McElroy, Underwood, and Undusk soils. Also included are small areas of Chemawa soils that have slopes of less than 30 percent. Included areas make up about 15 percent of the total acreage.

Permeability of this Chemawa soil is moderate. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for woodland, wildlife habitat, and recreation.

Douglas fir and grand fir are the main woodland species on this unit. On the basis of a 100-year site curve, the mean site index is 136 for Douglas fir. On the basis of a 50-year site curve, the mean site index is 104 for Douglas fir and 105 for grand fir. The culmination of the mean annual increment (CMAI) for Douglas fir is 139 cubic feet per acre per year at age 70, and for grand fir it is 163 cubic feet at age 86. Among the trees of limited extent are red alder and bigleaf maple.

The main limitation for harvesting timber is steepness of slope, which restricts the use of wheeled and tracked equipment in skidding. Cable yarding systems generally are safer and disturb the soil less. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and damages the roots of trees. Unsurfaced roads and skid trails are soft and slippery and can be impassable when wet. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available in this unit. Establishing plant cover on steeper slopes that have been cut or filled reduces erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless plant cover is maintained or adequate water bars are provided.

Seedling establishment is the main concern in the production of timber. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by grand fir occurs periodically. If the canopy is opened, brush invades and can prevent the establishment of Douglas fir seedlings and can delay natural reforestation by grand fir unless controlled.

Among the common forest understory plants are vine maple, common snowberry, false Solomons seal, western brackenfern, and trailing blackberry.

This map unit is in capability subclass VIIe.

25—Cinnamon sandy loam, 2 to 30 percent slopes. This very deep, well drained soil is on terraces, foot

TABLE 13A.--ENGINEERING INDEX PROPERTIES (PREERUPTION)--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In		—		Pct					Pct	
18, 19, 20------- Cattcreek	0-6	Very cindery loamy sand.	SM, SP-SM	A-1	0	75-90	25-50	15-30	5-15	---	NP
	6-15	Very cindery sand, very cindery loamy sand.	SP-SM, SP	A-1	0	75-90	25-50	15-35	0-10	---	NP
	15-30	Extremely cindery sand, very gravelly sand.	SP	A-1	0	70-90	10-35	5-20	0-5	---	NP
	30-54	Very gravelly sandy loam, extremely gravelly loam.	GM, GP-GM	A-1, A-2	10-35	20-35	10-35	10-20	5-20	25-45	NP-10
	54	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
21, 22, 23, 24--- Chemawa	0-14	Loam----------	ML	A-4	0	100	95-100	80-95	70-85	30-40	NP-5
	14-60	Loam, silt loam	ML	A-4	0	95-100	90-100	85-95	80-90	30-40	NP-5
25, 26, 27------- Cinnamon	0-3	Sandy loam-------	SM	A-2, A-4	0	100	90-100	55-70	30-40	30-40	NP-5
	3-22	Loamy sand, sandy loam.	SM	A-1, A-2, A-4	0	100	90-100	45-75	15-40	25-35	NP-5
	22-60	Sandy loam, loam	ML, SM	A-2, A-4	0	85-100	75-90	55-85	30-55	30-40	NP-5
28, 29, 30, 31, 32, 33---------- Colter	0-6	Cindery sandy loam.	SM	A-1, A-2	0	90-95	55-75	35-50	15-30	---	NP
	6-33	Very cindery loamy sand, very cindery sand, extremely cindery sand.	SP, SP-SM, SM	A-1	0	75-90	10-50	10-30	0-15	---	NP
	33-54	Cindery sandy loam, sandy loam, cindery loamy sand.	SM	A-1, A-2	0	85-95	60-90	40-50	20-30	25-45	NP-10
	54-60	Extremely cindery sand.	SP	A-1	0	75-95	10-25	5-20	0-5	---	NP
34*: Colter----------	0-6	Cindery sandy loam.	SM	A-1, A-2	0	90-95	55-75	35-50	15-30	---	NP
	6-33	Very cindery loamy sand, very cindery sand, extremely cindery sand.	SP, SP-SM, SM	A-1	0	75-90	10-50	10-30	0-15	---	NP
	33-54	Cindery sandy loam, sandy loam, cindery loamy sand.	SM	A-1, A-2	0	85-95	60-90	40-50	20-30	25-45	NP-10
	54-60	Extremely cindery sand.	SP	A-1	0	75-95	10-25	5-20	0-5	---	NP
Rock outcrop----	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14A.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS (PREERUPTION)

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
						K	T	
	In	In/hr	In/in	pH				Pct
1----------	0-17	0.6-2.0	0.12-0.16	5.6-6.0	Low----------	0.20	5	5-10
Andic	17-23	0.6-2.0	0.13-0.17	5.6-6.0	Low----------	0.20		
Cryumbrepts	23-39	0.6-2.0	0.09-0.13	5.6-6.0	Moderate-----	0.10		
	39-60	0.6-2.0	0.13-0.17	5.6-6.0	Moderate-----	0.17		
2----------	0-24	2.0-6.0	0.11-0.15	5.6-6.5	Low----------	0.20	5	0-2
Arents	24-60	0.6-6.0	0.05-0.12	5.6-6.5	Low----------	0.05		
3, 4----------	0-12	0.6-2.0	0.08-0.10	5.1-6.0	Low----------	0.15	5	2-3
Aschoff	12-47	0.6-2.0	0.08-0.12	5.1-6.0	Low----------	0.10		
	47-60	0.6-2.0	0.08-0.10	5.1-6.0	Low----------	0.10		
5*:								
Aschoff---------	0-12	0.6-2.0	0.08-0.10	5.1-6.0	Low----------	0.15	5	2-3
	12-47	0.6-2.0	0.08-0.12	5.1-6.0	Low----------	0.10		
	47-60	0.6-2.0	0.08-0.10	5.1-6.0	Low----------	0.10		
Rock outcrop----	0-60	---	---	---	----------	---	---	---
6*----------	0-60	---	---	---	----------	---	---	---
Badland								
7, 8----------	0-7	2.0-6.0	0.10-0.12	5.6-6.5	Low----------	0.17	2	<2
Bandid	7-15	2.0-6.0	0.10-0.12	5.6-6.5	Low----------	0.17		
	15-60	>20	0.05-0.08	5.6-6.5	Low----------	0.02		
9, 10, 11--------	0-5	2.0-6.0	0.08-0.13	5.6-6.5	Low----------	0.17	2	<2
Bandid	5-15	2.0-6.0	0.08-0.13	5.6-6.5	Low----------	0.17		
	15-27	>20	0.05-0.08	5.6-6.5	Low----------	0.02		
	27-60	2.0-6.0	0.08-0.13	5.6-6.5	Low----------	0.15		
12, 13, 14-------	0-4	2.0-6.0	0.11-0.13	5.6-6.5	Low----------	0.15	4	1-3
Bannel	4-10	>20	0.03-0.07	5.6-6.5	Low----------	0.10		
	10-50	2.0-6.0	0.11-0.15	5.6-7.3	Low----------	0.24		
	50-60	>20	0.03-0.07	6.1-7.3	Low----------	0.15		
15, 16----------	0-6	2.0-6.0	0.11-0.13	5.6-6.5	Low----------	0.10	5	5-10
Benham	6-28	6.0-20	0.07-0.11	5.6-6.5	Low----------	0.05		
	28-38	2.0-6.0	0.11-0.15	5.6-6.5	Low----------	0.15		
	38-60	>20	0.07-0.11	5.6-6.5	Low----------	0.02		
17----------	0-6	2.0-6.0	0.08-0.10	5.6-6.0	Low----------	0.10	5	1-2
Bonneville	6-12	2.0-6.0	0.06-0.08	5.6-6.0	Low----------	0.05		
	12-60	>20	0.03-0.05	5.6-6.5	Low----------	0.02		
18, 19, 20-------	0-6	6.0-20	0.08-0.12	5.6-6.5	Low----------	0.10	3	3-8
Cattcreek	6-15	6.0-20	0.07-0.11	5.6-6.5	Low----------	0.05		
	15-30	>20	0.06-0.10	5.6-6.5	Low----------	0.02		
	30-54	0.6-2.0	0.05-0.10	5.6-6.5	Low----------	0.05		
	54	---	---	---	----------	---		
21, 22, 23, 24---	0-14	0.6-2.0	0.16-0.19	6.1-7.3	Low----------	0.43	5	2-3
Chemawa	14-60	0.6-2.0	0.16-0.21	5.6-7.3	Low----------	0.49		

See footnote at end of table.

thin clay films on faces of peds and few moderately thick clay films in pores; moderately acid; gradual smooth boundary.

BC—31 to 43 inches; brown (10YR 4/3) silt loam, pale brown (10YR 6/3) and reddish yellow (7.5YR 6/6) dry; many fine and medium prominent strong brown (7.5YR 5/6) and yellowish red (5YR 4/6) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; hard, firm, slightly sticky and slightly plastic; common fine and few medium roots; many fine tubular pores; few thin clay films on faces of peds and few moderately thick clay films in pores; moderately acid; diffuse smooth boundary.

C—43 to 60 inches; brown (10YR 5/3) silt loam, very pale brown (10YR 7/3) and reddish yellow (7.5YR 6/6) dry; many medium prominent strong brown (7.5YR 5/6) and yellowish red (5YR 4/6) mottles; massive; hard, firm, slightly sticky and slightly plastic; few fine roots; many fine and few medium tubular pores; moderately acid.

The mollic epipedon is 20 to 34 inches thick.

The A and BA horizons have value of 2 or 3 when moist and 4 or 5 when dry.

The Bw and BC horizons have hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 2 to 4 when moist or dry. Texture is silt loam, clay loam, or silty clay loam.

The C horizon has common to many, medium, prominent mottles.

McDoug Series

The McDoug series consists of very deep, moderately well drained soils on flood plains. These soils formed in mixed alluvium derived dominantly from basic igneous rock. Slope is 0 to 3 percent. Elevation is 600 to 1,600 feet. The average annual precipitation is about 50 inches, the average annual air temperature is about 48 degrees F, and the average frost-free season is 130 to 150 days.

These soils are fine-loamy, mixed, mesic Cumulic Haploxerolls.

Typical pedon of McDoug silt loam, about 4 miles north of Willard; 500 feet south and 1,200 feet east of the northwest corner of sec. 15, T. 4 N., R. 9 E.

O—1 inch to 0; leaves and twigs.

A—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, dark brown (10YR 3/3) dry; weak fine and medium granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many fine irregular pores; moderately acid; clear wavy boundary.

AB—6 to 12 inches; dark brown (10YR 3/3) silt loam, dark yellowish brown (10YR 4/4) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine irregular pores and few fine tubular pores; moderately acid; clear wavy boundary.

BA—12 to 25 inches; dark brown (10YR 3/3) clay loam, yellowish brown (10YR 5/4) dry; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many fine and medium irregular pores and common fine and medium tubular pores; slightly acid; abrupt wavy boundary.

Bw—25 to 38 inches; dark yellowish brown (10YR 4/4) loam, light yellowish brown (10YR 6/4) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few fine, medium, and coarse roots; many fine irregular pores and common medium and coarse tubular pores; slightly acid; clear wavy boundary.

C—38 to 60 inches; dark yellowish brown (10YR 4/4) clay loam, light yellowish brown (10YR 6/4) dry; common medium distinct dark grayish brown (10YR 4/2) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine and medium tubular pores; slightly acid.

The mollic epipedon is 24 to 30 inches thick. Depth to grayish brown mottles is 30 to 40 inches.

The A, AB, and BA horizons have hue of 7.5YR or 10YR, value of 2 or 3 when moist and 3 to 5 when dry, and chroma of 2 to 4 when moist or dry.

The Bw horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist or dry. It is loam or clay loam.

The C horizon has hue of 7.5YR or 10YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 3 or 4 when moist or dry. It is clay loam or silt loam.

McElroy Series

The McElroy series consists of very deep, well drained soils on back slopes and foot slopes of mountains. These soils formed in colluvium derived dominantly from basalt with a mantle of volcanic ash. Slope is 5 to 65 percent. Elevation is 400 to 2,300 feet. The average annual precipitation is about 55 inches,

the average annual air temperature is about 46 degrees F, and the average frost-free season is 105 to 125 days.

These soils are medial-skeletal, mesic Andic Xerumbrepts.

Typical pedon of McElroy gravelly loam, 30 to 65 percent slopes, about 2 miles south of Willard; 2,640 feet south and 300 feet west of the northeast corner of sec. 12, T. 3 N., R. 9 E.

O1—2 inches to 0.5 inch; needles, leaves, and twigs.
O2—0.5 inch to 0; decomposed organic material.
A1—0 to 4 inches; dark brown (7.5YR 3/2) gravelly loam, brown (7.5YR 5/4) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine and fine roots; many fine irregular pores; 25 percent pebbles; moderately acid; abrupt smooth boundary.
A2—4 to 10 inches; dark brown (7.5YR 3/3) gravelly loam, brown (7.5YR 5/4) dry; weak fine subangular blocky structure parting to weak fine granular structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many very fine and fine roots; many fine irregular pores; 25 percent pebbles; moderately acid; clear wavy boundary.
BA—10 to 24 inches; dark brown (7.5YR 4/4) very gravelly loam, strong brown (7.5YR 5/6) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many very fine and fine roots and few medium roots; common fine irregular and tubular pores; 30 percent pebbles and 10 percent cobbles; moderately acid; gradual wavy boundary.
Bw1—24 to 43 inches; dark brown (7.5YR 4/4) very cobbly loam, strong brown (7.5YR 5/6) dry; weak fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; many very fine and fine roots and few medium and coarse roots; common fine irregular pores and common fine and medium tubular pores; 30 percent pebbles and 20 percent cobbles; moderately acid; gradual wavy boundary.
Bw2—43 to 60 inches; dark brown (7.5YR 4/4) very cobbly loam, strong brown (7.5YR 5/6) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine and fine roots and few medium and coarse roots; common fine tubular pores; 30 percent pebbles, 15 percent cobbles, and 5 percent stones; moderately acid.

The control section averages 35 to 60 percent rock fragments and 0 to 10 percent saprolitic fragments. Volcanic ash is most prominent in the upper 9 to 13 inches. The umbric epipedon is 10 to 13 inches thick. Reaction is moderately acid or slightly acid throughout.

The A horizon has hue of 5YR or 7.5YR, value of 2 or 3 when moist and 4 or 5 when dry, and chroma of 4 or 5 when dry. It is gravelly loam or very stony loam.

The BA horizon has hue of 7.5YR or 5YR, value of 4 or 5 when dry and 2 to 4 when moist, and chroma of 4 to 6 when moist or dry.

The Bw horizon has hue of 5YR or 7.5YR, value of 5 or 6 when dry, and chroma of 4 to 6 when dry. It is very gravelly loam, very cobbly loam, or extremely gravelly loam. It has 35 to 55 percent pebbles and 10 to 20 percent cobbles and stones.

Minniepeak Series

The Minniepeak series consists of very deep, well drained soils on back slopes and ridgetops of mountains. These soils formed in aerially deposited volcanic ash and pumice. Slope is 5 to 90 percent. Elevation is 2,800 to 4,500 feet. The average annual precipitation is about 130 inches, the average annual air temperature is about 41 degrees F, and the average frost-free season is 75 to 95 days.

These soils are cindery Entic Cryandepts.

Typical pedon of Minniepeak cindery sandy loam, 30 to 65 percent slopes, about 3 miles southwest of Curtis Lake; 900 feet south and 750 feet west of the northeast corner of sec. 20, T. 9 N., R. 6 E.

O—2 inches to 0; needles, leaves, and twigs.
A1—0 to 3 inches; dark brown (10YR 4/3) cindery sandy loam (volcanic ash and cinders), brown (10YR 5/3) dry; weak fine and medium granular structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine and fine roots, common medium roots, and few coarse roots; common fine irregular pores; 20 percent pumice fragments; slightly acid; abrupt smooth boundary.
A2—3 to 8 inches; black (10YR 2/1) loamy sand (volcanic ash), dark gray (10YR 4/1) dry; single grain; loose; common fine and medium roots and few coarse roots; many very fine irregular pores; slightly acid; abrupt smooth boundary.
AB—8 to 12 inches; very dark gray (10YR 3/1) very cindery sandy loam (volcanic ash and cinders), gray (10YR 5/1) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; weakly smeary; many very fine and fine roots and common medium roots; many very fine irregular pores and few fine tubular pores; 40

Among the common forest understory plants are creambush oceanspray, vine maple, western hazel, Pacific dogwood, thimbleberry, Oregongrape, dwarf rose, common snowberry, and common yarrow.

This unit is well suited to use as hayland and pastureland. The main limitations are steepness of slope and the hazard of erosion. Erosion can be controlled by growing pasture. The use of equipment is limited by steepness of slope. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Mowing at least twice a year helps to maintain uniform growth and discourages selective grazing.

The main limitation of this unit for use as homesites is the steepness of slope. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion. Plant cover can be established and maintained through proper fertilizing, seeding, mulching, and shaping of the slopes. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants. Restricted permeability and steepness of slope increase the possibility of failure of septic tank absorption fields. Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass IVe.

58—McElroy gravelly loam, 30 to 65 percent slopes. This very deep, well drained soil is on back slopes of mountains. It formed in colluvium derived dominantly from basalt with a mantle of volcanic ash. The native vegetation is mainly mixed conifers and shrubs. Elevation is 400 to 2,300 feet. The average annual precipitation is about 55 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is 105 to 125 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 2 inches thick. The surface layer is dark brown gravelly loam 10 inches thick. The subsoil to a depth of 60 inches or more is dark brown very gravelly loam and very cobbly loam.

Included in this unit are small areas of Chemawa, Timberhead, Underwood, and Undusk soils. Also included are small areas of McElroy soils that have slopes of less than 30 percent. Included areas make up about 10 percent of the total acreage.

Permeability of this McElroy soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for woodland, wildlife habitat, recreation, and watershed.

Douglas fir, ponderosa pine, and grand fir are the main woodland species on this unit. On the basis of a 100-year site curve, the mean site index is 133 for Douglas fir, and on the basis of a 50-year site curve, the mean site index is 100. The culmination of the mean annual increment (CMAI) for Douglas fir is 134 cubic feet per acre per year at age 70. Estimates of the site index or CMAI for ponderosa pine and grand fir have not been made. Among the trees of limited extent are Oregon white oak and bigleaf maple.

The main limitation for harvesting timber is steepness of slope, which restricts the use of wheeled and tracked equipment in skidding. Cable yarding systems generally are safer and disturb the soil less. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and damages the roots of trees. Unsurfaced roads and skid trails are soft and slippery and can be impassable when wet. Logging roads require suitable surfacing for year-round use. Rock for road construction is readily available in this unit. Occasional snowpack hinders the use of equipment and limits access in winter. Establishing plant cover on steeper slopes that have been cut or filled reduces erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless plant cover is maintained or adequate water bars are provided.

Seedling establishment and mortality are the main concerns in the production of timber. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine and grand fir occurs periodically. Droughtiness of the surface layer reduces seedling survival, especially on south- and southwest-facing slopes. If the canopy is opened, brush invades and can delay establishment of Douglas fir seedlings.

Among the common forest understory plants are creambush oceanspray, vine maple, western hazel, Pacific dogwood, thimbleberry, Oregongrape, dwarf rose, common snowberry, and common yarrow.

This map unit is in capability subclass VIe.

69—McElroy very stony loam, 5 to 15 percent slopes. This very deep, well drained soil is on foot slopes of mountains. It formed in colluvium derived dominantly from basalt with a mantle of volcanic ash. The native vegetation is mainly mixed conifers and

shrubs. Elevation is 500 to 1,200 feet. The average annual precipitation is about 55 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is 105 to 125 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 2 inches thick. About 3 to 8 percent of the surface is covered with stones. The surface layer is very dark grayish brown very stony loam 10 inches thick. The subsoil is dark brown very cobbly loam 22 inches thick. The substratum to a depth of 60 inches or more is dark brown very gravelly loam and very cobbly loam.

Included in this unit are small areas of McElroy gravelly loam and Underwood soils. Also included are small areas of soils that do not have stones on the surface. Included areas make up about 7 percent of the total acreage.

Permeability of this McElroy soil is moderate. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used as woodland, pastureland, and wildlife habitat. A few areas are used as homesites.

Douglas fir, ponderosa pine, and grand fir are the main woodland species on this unit. On the basis of a 100-year site curve, the mean site index is 133 for Douglas fir, and on the basis of a 50-year site curve, the mean site index is 100. The culmination of the mean annual increment (CMAI) for Douglas fir is 134 cubic feet per acre per year at age 70. Estimates of the site index or CMAI for ponderosa pine and grand fir have not been made. Among the trees of limited extent are Oregon white oak and bigleaf maple.

The main limitation for harvesting timber is the very stony surface layer. Stones on the surface hinder harvesting operations and can cause breakage of timber when felled. Unsurfaced roads and skid trails are soft and slippery and can be impassable when wet. Logging roads require suitable surfacing for year-round use. Rock for road construction is readily available in this unit. Disturbance of the protective layer of duff can be reduced with the careful use of wheeled and tracked equipment.

Seedling mortality is the main concern in the production of timber. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine occurs periodically. Droughtiness of the surface layer reduces seedling survival, especially on south- and southwest-facing slopes. If the canopy is opened, brush invades and can delay the establishment of Douglas fir seedlings.

Among the common forest understory plants are creambush oceanspray, vine maple, western hazel, Pacific dogwood, thimbleberry, Oregongrape, dwarf rose, common snowberry, and common yarrow.

This unit is well suited to use as pastureland. The main limitation is the stones on the surface, which interfere with mowing, seeding, and spreading of animal manure. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion.

The main limitations of this unit for use as homesites are the stones on the surface and steepness of slope. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion. Removal of pebbles, cobbles, and stones in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

This map unit is in capability subclass VIs.

70—Minniepeak cindery sandy loam, 5 to 30 percent slopes. This very deep, well drained soil is on back slopes and ridgetops of mountains. It formed in aerially deposited volcanic ash and pumice. The native vegetation is mainly mixed conifers and shrubs. Elevation is 2,800 to 4,500 feet. The average annual precipitation is about 130 inches, the average annual air temperature is about 41 degrees F, and the average frost-free period is 75 to 95 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 2 inches thick. The upper part of the surface layer is dark brown cindery sandy loam 3 inches thick, the next 5 inches is black loamy sand, and the lower part is very dark gray very cindery sandy loam 4 inches thick. The subsoil to a depth of 60 inches or more is light gray and dark brown extremely cindery sand and extremely cindery coarse sand.

Included in this unit are small areas of Bandid, Pelee, and Sinnice soils. Also included are small areas of Rock outcrop. Included areas make up about 10 percent of the total acreage.

Permeability of this Minniepeak soil is rapid. Available water capacity is low. Effective rooting depth is 60 inches or more. Runoff is slow, and the hazard of water erosion is slight.

TABLE 13A.--ENGINEERING INDEX PROPERTIES (PREERUPTION)--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
64---------- McBee	0-13	Silt loam--------	CL-ML	A-4	0	100	100	90-100	70-90	25-35	5-10
	13-43	Silt loam, clay loam, silty clay loam.	CL	A-6	0	100	100	95-100	75-90	30-40	15-25
	43-60	Silt loam, clay loam, loam.	CL-ML	A-4	0	100	100	90-100	70-90	25-35	5-10
65---------- McDoug	0-12	Silt loam--------	CL-ML	A-4	0	100	100	95-100	75-90	20-30	5-10
	12-38	Clay loam, loam, sandy clay loam.	CL	A-6	0	100	90-100	85-95	55-75	25-40	10-20
	38-60	Clay loam, sandy clay loam, gravelly sandy loam.	CL, SM-SC, SC	A-6, A-4	0-5	80-100	60-100	50-85	40-60	20-35	5-15
66, 67, 68------- McElroy	0-10	Gravelly loam----	ML, SM, GM	A-4	0-5	60-80	55-70	50-70	35-55	25-30	NP-5
	10-60	Very gravelly loam, very cobbly loam, extremely gravelly loam.	GM	A-2, A-1	20-40	30-60	20-50	15-40	10-35	25-35	NP-5
69---------- McElroy	0-10	Very stony loam	SM	A-4	10-25	70-80	60-75	50-70	35-50	20-25	NP-5
	10-60	Very gravelly loam, very cobbly loam, extremely gravelly loam.	GM	A-2, A-1	20-35	45-65	30-50	25-45	20-35	25-30	NP-5
70, 71, 72------- Minniepeak	0-3	Cindery sandy loam.	SM	A-1, A-2	0	80-90	65-75	40-50	20-30	30-40	NP-5
	3-8	Loamy sand, sandy loam.	SM	A-1, A-2	0	100	85-100	45-75	15-30	30-40	NP-5
	8-60	Very cindery sandy loam, extremely cindery sand, extremely cindery coarse sand.	SP	A-1	0-5	75-85	10-45	5-30	0-5	---	NP
73, 74---------- Mossyrock	0-27	Silt loam--------	OH, MH, ML, OL	A-5, A-7	0	100	100	90-100	70-85	45-65	5-20
	27-60	Silt loam--------	ML, MH	A-5, A-7	0	100	100	90-100	70-85	40-60	5-20
75, 76, 77------- Mountzion	0-17	Clay loam--------	ML	A-7	0	100	75-90	70-80	60-75	40-50	10-15
	17-60	Silty clay loam, clay loam, gravelly clay loam.	ML	A-7	0	95-100	70-90	65-90	55-85	40-50	10-15

See footnote at end of table.

TABLE 14A.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS (PREERUPTION)--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
						K	T	
	In	In/hr	In/in	pH				Pct
53----------	0-13	0.6-2.0	0.30-0.40	5.1-5.5	Low----------	0.00	5	40-70
Histic	13-21	6.0-20.0	0.06-0.10	5.6-6.0	Low----------	0.17		
Cryaquepts	21-31	2.0-6.0	0.08-0.12	5.6-6.0	Low----------	0.15		
	31-35	0.6-2.0	0.30-0.40	5.1-5.5	Low----------	0.00		
	35-60	>20	0.02-0.06	5.6-6.0	Low----------	0.05		
54, 55----------	0-4	0.6-2.0	0.05-0.09	5.6-6.5	Low----------	0.10	3	1-5
Hoffstadt	4-36	0.6-2.0	0.05-0.09	5.6-6.5	Low----------	0.10		
	36-55	0.6-2.0	0.03-0.05	5.6-6.5	Low----------	0.05		
	55	---	---	---	----------	---		
56----------	0-8	0.6-2.0	0.19-0.21	5.6-6.5	Low----------	0.43	5	2-5
Hood	8-60	0.6-2.0	0.19-0.21	5.6-6.5	Low----------	0.55		
57, 58, 59-------	0-12	0.6-2.0	0.16-0.18	5.1-6.5	Low----------	0.37	5	4-8
Kinney	12-28	0.6-2.0	0.16-0.21	4.5-5.5	Low----------	0.24		
	28-60	0.6-2.0	0.15-0.18	4.5-5.5	Low----------	0.24		
60----------	0-2	2.0-6.0	0.09-0.13	5.6-6.0	Low----------	0.17	1	5-10
Lithic Umbric	2-6	6.0-20	0.02-0.06	5.6-6.0	Low----------	0.10		
Vitrandepts	6	---	---	---	----------	---		
61, 62, 63-------	0-7	0.6-2.0	0.13-0.18	5.6-6.5	Low----------	0.15	5	6-8
Lonestar	7-14	0.6-2.0	0.11-0.15	5.6-6.5	Low----------	0.15		
	14-28	2.0-6.0	0.08-0.12	6.1-7.3	Low----------	0.15		
	28-51	0.6-2.0	0.11-0.18	5.6-6.5	Low----------	0.32		
	51-60	0.6-2.0	0.16-0.21	5.1-5.5	Low----------	0.32		
64----------	0-13	0.6-2.0	0.19-0.21	5.6-6.5	Low----------	0.43	5	3-4
McBee	13-43	0.6-2.0	0.16-0.21	5.6-6.5	Moderate-----	0.43		
	43-60	0.6-2.0	0.19-0.21	5.6-6.5	Low----------	0.43		
65----------	0-12	0.6-2.0	0.19-0.21	5.6-6.5	Low----------	0.43	5	3-4
McDoug	12-38	0.6-2.0	0.15-0.20	5.6-6.5	Moderate-----	0.37		
	38-60	0.6-2.0	0.10-0.18	5.6-6.5	Moderate-----	0.32		
66, 67, 68-------	0-10	0.6-2.0	0.12-0.14	5.6-6.5	Low----------	0.20	5	2-3
McElroy	10-60	0.6-2.0	0.05-0.10	5.6-6.5	Low----------	0.10		
69----------	0-10	0.6-2.0	0.09-0.12	5.6-6.5	Low----------	0.15	5	1-2
McElroy	10-60	0.6-2.0	0.03-0.05	5.6-6.0	Low----------	0.15		
70, 71, 72-------	0-3	2.0-6.0	0.09-0.13	5.6-6.5	Low----------	0.15	5	1-2
Minniepeak	3-8	2.0-6.0	0.08-0.11	5.6-6.5	Low----------	0.20		
	8-60	6.0-20	0.04-0.06	5.6-6.5	Low----------	0.10		
73, 74----------	0-27	0.6-2.0	0.21-0.25	5.6-6.5	Low----------	0.28	5	5-15
Mossyrock	27-60	0.6-2.0	0.18-0.22	5.1-7.3	Low----------	0.32		
75, 76, 77-------	0-17	0.6-2.0	0.19-0.21	5.1-6.0	Moderate-----	0.28	5	1-2
Mountzion	17-60	0.6-2.0	0.17-0.21	4.5-5.5	Moderate-----	0.24		
78, 79, 80-------	0-7	2.0-6.0	0.11-0.15	5.6-6.5	Low----------	0.20	5	1-3
Pelee	7-32	>20	0.04-0.07	5.6-6.5	Low----------	0.02		
	32-60	2.0-6.0	0.11-0.15	5.6-6.5	Low----------	0.20		
81*:								
Pelee----------	0-7	2.0-6.0	0.11-0.15	5.6-6.5	Low----------	0.20	5	1-3
	7-32	>20	0.04-0.07	5.6-6.5	Low----------	0.02		
	32-60	2.0-6.0	0.11-0.15	5.6-6.5	Low----------	0.20		

See footnote at end of table.

fragments and 15 percent cobbles; moderately acid; abrupt smooth boundary.

2Eb—42 to 51 inches; dark grayish brown (10YR 4/2) cindery sandy loam, light brownish gray (10YR 6/2) dry; massive; soft, friable, nonsticky and nonplastic; weakly smeary; common fine roots and few medium roots; many fine irregular pores and few fine tubular pores; moderately acid; gradual wavy boundary.

2Bwb—51 to 60 inches; dark brown (10YR 4/3) very gravelly sandy loam, pale brown (10YR 6/3) dry; massive; soft, friable, nonsticky and nonplastic; weakly smeary; few fine roots; many medium and coarse irregular pores; 30 percent pumice fragments and 40 percent pebbles; moderately acid.

The 10- to 40-inch particle-size control section averages 35 to 55 percent pumice fragments. Depth to the buried profile is 40 to 50 inches or more.

The A horizon has hue of 2.5Y, 10YR, or 7.5YR, value of 2 or 5 when moist and 4 to 8 when dry, and chroma of 0 to 3 when moist or dry.

The Bs1 horizon has hue of 7.5YR or 5YR, value of 3 or 4 when moist and 5 or 6 when dry, and chroma of 2 to 6 when moist or dry. It is 15 to 30 percent pebble-sized pumice fragments.

The Bs2 horizon has hue of 7.5YR or 5YR, value of 4 to 6 when moist and 6 to 8 when dry, and chroma of 2 to 6 when moist or dry. It is 30 to 55 percent pebble-sized pumice fragments and 0 to 15 percent hard pebbles.

The Bs3 and Bs4 horizons have hue of 7.5YR or 5YR, value of 4 to 6 when moist and 5 to 8 when dry, and chroma of 2 to 8 when moist or dry. They are 60 to 80 percent pumice fragments and 0 to 15 percent pebbles.

The 2Eb and 2Bwb horizons are 15 to 55 percent pebbles and 0 to 20 percent pumice fragments.

Underwood Series

The Underwood series consists of very deep, well drained soils on foot slopes and back slopes of mountains and benches. These soils formed in residuum and colluvium derived from basalt and andesite with a thin mantle of volcanic ash. Slope is 2 to 50 percent. Elevation is 500 to 2,000 feet. The average annual precipitation is about 50 inches, the average annual air temperature is about 46 degrees F, and the average frost-free season is 100 to 150 days.

These soils are fine-loamy, mixed, mesic Ultic Haploxeralfs.

Typical pedon of Underwood loam, 30 to 50 percent slopes, about 1 mile south of Willard; 200 feet south and 1,700 feet west of the northwest corner of sec. 11, T. 3 N., R. 9 E.

O1—2 inches to 0.75 inch; needles, leaves, and twigs.

O2—0.75 inch to 0; decomposed organic material.

Ac—0 to 5 inches; dark brown (7.5YR 3/2) loam, brown (7.5YR 4/4) dry; weak coarse granular structure; soft, very friable, slightly sticky and nonplastic; weakly smeary; many fine roots and common medium roots; many coarse irregular pores; 35 percent fine shotlike aggregates 2 to 4 millimeters in size; slightly acid; clear smooth boundary.

BA—5 to 19 inches; dark brown (7.5YR 3/4) loam, brown (7.5YR 5/4) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common fine and medium roots; many fine irregular pores and few fine tubular pores; few pebbles; moderately acid; clear smooth boundary.

Bt—19 to 35 inches; dark brown (7.5YR 3/4) clay loam, brown (7.5YR 5/4) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and plastic; few fine, medium, and coarse roots; many fine irregular pores and few fine tubular pores; 5 percent soft pebbles; common moderately thick clay films in pores and on faces of peds; strongly acid; clear wavy boundary.

C—35 to 60 inches; dark yellowish brown (10YR 4/6) loam, brownish yellow (10YR 6/6) dry; common medium distinct mottles that are yellowish red (5YR 4/6) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common medium irregular and tubular pores; 15 percent soft pebbles; strongly acid.

Thickness of the solum is 30 to 40 inches. The upper 4 to 6 inches of the profile is dominated by volcanic ash and has 15 to 35 percent shotlike aggregates. The 19- to 35-inch particle-size control section is 25 to 35 percent clay, 5 to 25 percent soft, weathered rock fragments, and 0 to 15 percent hard pebbles and cobbles. The profile has 0 to 25 percent rock fragments below the control section.

The A and AB horizons have hue of 5YR or 7.5YR, value of 4 or 5 when dry, and chroma of 2 to 4 when moist or dry.

The Bt horizon has hue of 5YR or 7.5YR and value of 3 or 4 when moist. It is loam or clay loam. Reaction is strongly acid or moderately acid.

The C horizon has hue of 5YR, 7.5YR, or 10YR, and it has value of 4 or 5 when moist and 5 or 6 when dry. It is loam, gravelly loam, or clay loam. Reaction is strongly acid or moderately acid.

seedlings and can delay reforestation by noble fir and western hemlock unless controlled. Droughtiness of the surface layer reduces seedling survival, especially on south- and southwest-facing slopes.

Among the common forest understory plants are vine maple, red huckleberry, western hazel, Oregongrape, trailing blackberry, and western brackenfern.

This map unit is in capability subclass VIe.

144—Underwood loam, 2 to 15 percent slopes. This very deep, well drained soil is on benches and foot slopes of mountains. It formed in residuum and colluvium derived dominantly from basalt, andesite, and a thin mantle of volcanic ash. The native vegetation is mainly mixed conifers and shrubs. Elevation is 500 to 2,000 feet. The average annual precipitation is about 50 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is 100 to 150 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 2 inches thick. The surface layer is dark brown loam 5 inches thick. The upper 14 inches of the subsoil is dark brown loam, and the lower 16 inches is dark brown clay loam. The substratum to a depth of 60 inches or more is dark yellowish brown loam.

Included in this unit are small areas of Chemawa and McElroy soils on terraces and foot slopes and Timberhead and Undusk soils on ridgetops. Also included are small areas of soils that are more than 35 percent clay. Included areas make up about 10 percent of the total acreage.

Permeability of this Underwood soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for woodland, hayland, pastureland, orchards, homesites, wildlife habitat, and recreation.

Douglas fir, ponderosa pine, and grand fir are the main woodland species on this unit. On the basis of a 100-year site curve, the mean site index is 153 for Douglas fir, and on the basis of a 50-year site curve, the mean site index is 116. The culmination of the mean annual increment (CMAI) for Douglas fir is 162 cubic feet per acre per year at age 60. Estimates of the site index or CMAI for ponderosa pine and grand fir have not been made. Among the trees of limited extent are Oregon white oak and bigleaf maple.

The main limitation for harvesting timber is seasonal soil wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and damages the roots of trees. Unsurfaced roads and skid trails are soft and can be impassable when wet. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available in this unit. Occasional snowpack hinders the use of equipment and limits access in winter. Disturbance of the protective layer of duff can be reduced with the careful use of wheeled and tracked equipment.

Seedling establishment is the main concern in the production of timber. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine and grand fir occurs periodically. If the canopy is opened, brush invades and can prevent the establishment of Douglas fir and ponderosa pine seedlings and can delay natural reforestation by grand fir unless controlled.

Among the common forest understory plants are vine maple, Pacific dogwood, common snowberry, Oregongrape, cascara buckthorn, western brackenfern, and princes pine.

If this unit is used for orchard crops, the main limitation is the hazard of erosion. If the ground is plowed in fall, runoff and erosion can be reduced by seeding to a cover crop.

This unit is well suited to use as hayland and pastureland. It has few limitations. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Mowing helps to maintain uniform growth and discourages selective grazing. In some years, supplemental irrigation is also needed.

The main limitations of this unit for use as homesites are steepness of slope, shrink-swell potential, moderately slow permeability, and the hazard of erosion in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion. Plant cover can be established and maintained through proper fertilizing, seeding, mulching, and shaping of the slopes. In summer, irrigation is needed for lawn grasses, shrubs, vines, shade trees, and ornamental trees.

Use of sandy backfill for the trench and long absorption lines helps to compensate for the moderately slow permeability of the soil. During the rainy season, effluent from onsite sewage disposal systems may seep at points downslope. If the density of housing is moderate to high, community sewage systems are needed to prevent contamination of water supplies as a result of seepage from onsite disposal systems. The effects of shrinking and swelling can be minimized by

using proper engineering designs. Buildings and roads should be designed to offset the limited ability of the soil in this unit to support a load.

This map unit is in capability subclass IIIe.

145—Underwood loam, 15 to 30 percent slopes. This very deep, well drained soil is on back slopes of mountains. It formed in residuum and colluvium derived dominantly from basalt, andesite, and a thin mantle of volcanic ash. The native vegetation is mainly mixed conifers and shrubs. Elevation is 500 to 2,000 feet. The average annual precipitation is about 50 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is 100 to 150 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 2 inches thick. The surface layer is dark brown loam 5 inches thick. The upper 14 inches of the subsoil is dark brown loam, and the lower 16 inches is dark brown clay loam. The substratum to a depth of 60 inches or more is dark yellowish brown loam.

Included in this unit are small areas of Chemawa and McElroy soils on back slopes and Timberhead and Undusk soils on ridgetops. Also included are small areas of soils that are more than 35 percent clay. Included areas make up about 10 percent of the total acreage.

Permeability of this Underwood soil is moderately slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for woodland, hayland, pastureland, wildlife habitat, recreation, and watershed.

Douglas fir, ponderosa pine, and grand fir are the main woodland species on this unit. On the basis of a 100-year site curve, the mean site index is 153 for Douglas fir, and on the basis of a 50-year site curve, the mean site index is 116. The culmination of the mean annual increment (CMAI) for Douglas fir is 162 cubic feet per acre per year at age 60. Estimates of the site index or CMAI for ponderosa pine and grand fir have not been made. Among the trees of limited extent are Oregon white oak and bigleaf maple.

The main limitations for harvesting timber are seasonal soil wetness and snowpack. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and damages the roots of trees. Unsurfaced roads and skid trails are soft and can be impassable when wet. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available in this unit. Snowpack hinders the use of equipment and limits access in winter. Establishing plant cover on steeper slopes that have been cut or filled reduces erosion. Disturbance of the protective layer of duff can be reduced with the careful use of wheeled and tracked equipment.

Seedling establishment is the main concern in the production of timber. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine and grand fir occurs periodically. If the canopy is opened, brush invades and can delay establishment of Douglas fir seedlings and natural reforestation unless controlled.

Among the common forest understory plants are vine maple, Pacific dogwood, common snowberry, Oregongrape, cascara buckthorn, western brackenfern, and princes pine.

This map unit is well suited to use as hayland and pastureland. The main limitations are steepness of slope and the hazard of erosion. Erosion can be controlled by growing pasture. The use of equipment is limited by steepness of slope. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Mowing helps to maintain uniform growth and discourages selective grazing.

This map unit is in capability subclass IVe.

146—Underwood loam, 30 to 50 percent slopes. This very deep, well drained soil is on back slopes of mountains. It formed in colluvium derived dominantly from basalt, andesite, and a thin mantle of volcanic ash. The native vegetation is mainly mixed conifers and shrubs. Elevation is 500 to 2,000 feet. The average annual precipitation is about 50 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is 100 to 150 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 2 inches thick. The surface layer is dark brown loam 5 inches thick. The upper 14 inches of the subsoil is dark brown loam, and the lower 16 inches is dark brown clay loam. The substratum to a depth of 60 inches or more is dark yellowish brown loam.

Included in this unit are small areas of Chemawa, McElroy, Timberhead, and Undusk soils. Also included are small areas of soils that are more than 35 percent clay and small areas of Rock outcrop. Included areas make up about 10 percent of the total acreage.

Permeability of this Underwood soil is moderately

slow. Available water capacity is high. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used as woodland, wildlife habitat, recreation areas, and watershed.

Douglas fir, ponderosa pine, and grand fir are the main woodland species on this unit. On the basis of a 100-year site curve, the mean site index is 153 for Douglas fir, and on the basis of a 50-year site curve, the mean site index is 116. The culmination of the mean annual increment (CMAI) for Douglas fir is 162 cubic feet per acre per year at age 60. Estimates of the site index or CMAI for ponderosa pine and grand fir have not been made. Among the trees of limited extent are Oregon white oak and bigleaf maple.

The main limitation for harvesting timber is steepness of slope. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and damages the roots of trees. Unsurfaced roads and skid trails are soft and can be impassable when wet. Logging roads require suitable surfacing for year-round use. Rock for road construction is not readily available in this unit. Occasional snowpack hinders the use of equipment and limits access in winter. Establishing plant cover on steeper slopes that have been cut or filled reduces erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless plant cover is maintained or adequate water bars are provided.

Seedling establishment is the main concern in the production of timber. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine and grand fir occurs periodically. If the canopy is opened, brush invades and can delay establishment of Douglas fir and ponderosa pine seedlings and natural reforestation by grand fir unless controlled.

Among the common forest understory plants are vine maple, Pacific dogwood, common snowberry, Oregongrape, cascara buckthorn, western brackenfern, and princes pine.

This map unit is in capability subclass VIIe.

147—Undusk gravelly loam, 5 to 30 percent slopes. This very deep, well drained soil is on back slopes of mountains. It formed in residuum derived dominantly from basalt with a thin mantle of volcanic ash. The native vegetation is mainly mixed conifers and shrubs. Elevation is 2,000 to 2,800 feet. The average annual precipitation is about 55 inches, the average annual air temperature is about 44 degrees F, and the average frost-free period is 90 to 120 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 2 inches thick. The surface layer is dark brown gravelly loam 15 inches thick. The subsoil to a depth of 60 inches or more is dark brown very gravelly loam and extremely gravelly loam.

Included in this unit are small areas of Chemawa, McElroy, Timberhead, and Underwood soils on ridges and back slopes and St. Martin soils on landslides. Also included are small areas of soils that are less than 35 percent rock fragments and soils that are shallow to bedrock. Included areas make up about 12 percent of the total acreage.

Permeability of this Undusk soil is moderate. Available water capacity is moderately high. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

This unit is used for woodland, wildlife habitat, recreation, and watershed.

Douglas fir, grand fir, and western hemlock are the main woodland species on this unit. On the basis of a 100-year site curve, the mean site index is 118 for Douglas fir, and on the basis of a 50-year site curve, the mean site index is 88. The culmination of the mean annual increment (CMAI) for Douglas fir is 111 cubic feet per acre per year at age 60. Estimates of the site index or CMAI for grand fir and western hemlock have not been made. Among the trees of limited extent are red alder and western redcedar. Areas on ridgetops that are subject to strong, persistent winds are less productive than other areas of this unit.

The main limitation for harvesting timber is seasonal soil wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and damages the roots of trees. Unsurfaced roads and skid trails are soft and can be impassable when wet. Logging roads require suitable surfacing for year-round use. Rock for road construction is readily available in this unit. Occasional snowpack hinders the use of equipment and limits access in winter. Establishing plant cover on steeper slopes that have been cut or filled reduces erosion. Disturbance of the protective layer of duff can be reduced with the careful use of wheeled and tracked equipment.

Seedling establishment is the main concern in the production of timber. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by grand fir and western hemlock occurs periodically. If the canopy is opened, brush invades and can delay the establishment of seedlings unless controlled. Logging

TABLE 13A.--ENGINEERING INDEX PROPERTIES (PREERUPTION)--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
144, 145, 146---- Underwood	0-5	Loam----------	ML	A-4	0	95-100	90-100	75-95	50-75	20-30	NP-5
	5-35	Loam, clay loam	CL	A-6	0	85-100	75-100	60-95	50-75	30-40	10-15
	35-60	Loam, clay loam, gravelly loam.	CL-ML, SM-SC, CL, SC	A-6, A-4	0-5	75-100	60-100	50-95	40-75	25-35	5-15
147, 148--------- Undusk	0-15	Gravelly loam----	ML, GM, SM	A-4	0	60-80	55-75	50-70	35-55	20-30	NP-5
	15-60	Very cobbly loam, very gravelly loam, extremely gravelly loam.	SM-SC, GM-GC	A-2	0-45	40-80	25-50	20-50	15-35	25-30	5-10
149, 150, 151, 152, 153-------- Vanson	0-16	Sandy loam-------	SM	A-4, A-2	0	90-100	75-95	55-70	25-40	---	NP
	16-24	Very gravelly loamy sand, gravelly sandy loam, loamy sand.	SM	A-1, A-2	0	75-90	40-90	30-50	10-30	---	NP
	24-45	Very gravelly loam, very gravelly sandy loam, extremely cobbly sandy loam.	GM	A-1, A-2	20-55	30-60	20-50	15-40	10-35	30-50	NP-10
	45	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
154*, 155*, 156*: Vanson----------	0-16	Sandy loam-------	SM	A-4, A-2	0	90-100	75-95	55-70	25-40	---	NP
	16-24	Very gravelly loamy sand, gravelly sandy loam, loamy sand.	SM	A-1, A-2	0	75-90	40-90	30-50	10-30	---	NP
	24-45	Very gravelly loam, very gravelly sandy loam, extremely cobbly sandy loam.	GM	A-1, A-2	20-55	30-60	20-50	15-40	10-35	30-50	NP-10
	45	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop----	0-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14A.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS (PREERUPTION)--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
						K	T	
	In	In/hr	In/in	pH				Pct
130, 131, 132----	0-12	0.6-2.0	0.11-0.13	5.6-6.5	Low----------	0.15	5	2-3
Swift	12-27	0.6-2.0	0.06-0.08	5.6-6.5	Low----------	0.20		
	27-60	0.6-2.0	0.10-0.12	5.6-6.5	Low----------	0.10		
133*, 134*:								
Swift----------	0-12	0.6-2.0	0.11-0.13	5.6-6.5	Low----------	0.15	5	2-3
	12-27	0.6-2.0	0.06-0.08	5.6-6.5	Low----------	0.20		
	27-60	0.6-2.0	0.10-0.12	5.6-6.5	Low----------	0.10		
Rock outcrop----	0-60	---	---	---	----------	---	---	---
135, 136---------	0-10	0.6-2.0	0.09-0.14	5.6-6.0	Low----------	0.20	5	2-3
Timberhead	10-40	0.6-2.0	0.09-0.12	5.1-6.0	Low----------	0.24		
	40-60	0.6-2.0	0.16-0.18	5.1-6.0	Low----------	0.43		
137, 138, 139,								
140, 141, 142---	0-5	0.6-2.0	0.11-0.15	5.1-6.0	Low----------	0.20	5	1-5
Tradedollar	5-26	2.0-6.0	0.11-0.15	5.1-6.0	Low----------	0.10		
	26-42	>20	0.06-0.10	5.1-6.0	Low----------	0.02		
	42-60	2.0-6.0	0.09-0.13	5.1-6.0	Low----------	0.15		
143----------	0-10	0.6-2.0	0.19-0.21	6.1-6.5	Low----------	0.32	5	2-3
Typic	10-41	0.6-2.0	0.07-0.11	5.6-6.0	Low----------	0.05		
Dystrandepts	41-60	0.6-2.0	0.11-0.15	5.6-6.0	Low----------	0.10		
144, 145, 146----	0-5	0.6-2.0	0.16-0.18	6.1-6.5	Low----------	0.37	5	2-5
Underwood	5-35	0.2-0.6	0.19-0.21	5.1-6.5	Moderate-----	0.28		
	35-60	0.6-2.0	0.16-0.21	5.1-6.0	Low----------	0.32		
147, 148---------	0-15	0.6-2.0	0.15-0.18	6.1-7.3	Low----------	0.24	5	1-2
Undusk	15-60	0.6-2.0	0.10-0.12	6.1-7.3	Low----------	0.10		
149, 150, 151,								
152, 153--------	0-16	2.0-6.0	0.11-0.13	5.1-6.5	Low----------	0.28	3	1-5
Vanson	16-24	2.0-6.0	0.09-0.13	6.1-7.3	Low----------	0.28		
	24-45	0.6-2.0	0.07-0.11	5.6-6.0	Low----------	0.10		
	45	---	---	---	----------	---		
154*, 155*, 156*:								
Vanson----------	0-16	2.0-6.0	0.11-0.13	5.1-6.5	Low----------	0.28	3	1-5
	16-24	2.0-6.0	0.09-0.13	6.1-7.3	Low----------	0.28		
	24-45	0.6-2.0	0.07-0.11	5.6-6.0	Low----------	0.10		
	45	---	---	---	----------	---		
Rock outcrop----	0-60	---	---	---	----------	---	---	---
157----------	0-5	2.0-6.0	0.16-0.18	4.5-5.5	Low----------	0.32	2	2-3
Washougal	5-22	0.6-2.0	0.08-0.12	4.5-5.5	Low----------	0.20		
	22-30	0.6-2.0	0.05-0.08	5.1-5.5	Low----------	0.20		
	30-36	2.0-6.0	0.05-0.08	5.1-5.5	Low----------	0.17		
	36-60	>20	0.02-0.04	5.1-5.5	Low----------	0.02		
158, 159, 160----	0-11	0.6-2.0	0.12-0.17	4.5-5.5	Low----------	0.20	3	2-3
Washougal	11-44	0.6-2.0	0.05-0.08	5.1-5.5	Low----------	0.10		
	44-60	2.0-6.0	0.05-0.08	5.1-5.5	Low----------	0.10		
161*:								
Xerorthents-----	0-6	0.6-2.0	0.11-0.15	6.1-6.5	Low----------	0.20	2	.5-1
	6-31	2.0-6.0	0.08-0.12	6.1-6.5	Low----------	0.10		
	31	---	---	---	----------	---		

See footnote at end of table.

Exhibit 4
Klickitat County Soil Types
Washington

Soil Survey of Klickitat County Area, Washington

DRAFT
SOIL
DATA

from the
National Resource Conservation Service
Spokane, Washington
509-323-2900

NONTECHNICAL SOILS DESCRIPTION REPORT

wharry

Map Symbol	Soil name and description
23B	GUNN LOAM, 8 TO 30 PERCENT SLOPES The Gunn soil is very deep, and well drained. It formed in loess and residuum from basalt on plateaus. A typical profile is: 0 to 15 inches - brown loam, 15 to 32 inches - brown clay loam, 32 to 60 inches - reddish brown clay loam. Elevation is 1200 to 2500 feet. Slope is 8 to 30 percent. The average annual precipitation is 18 to 23 inches, the average annual air temperature is 46 to 49 degrees F. , and the average frost free season is 100 to 140 days.
25B	LEIDL-OREOKE COMPLEX, 30 TO 75 PERCENT SLOPES This map unit consists of about 50 percent Leidl soils and about 30 percent Oreoke soils. The remaining 20 percent is soils of minor extent. The Leidl soil is moderately deep, and well drained. It formed in colluvium and residuum from basalt on canyon sideslopes. A typical profile is: 0 to 2 inches - brown extremely cobbly loam, 2 to 7 inches - reddish brown clay loam, 7 to 17 inches - reddish brown very gravelly clay loam, 17 to 35 inches - brown extremely gravelly clay loam, 35+ inches - basalt. The Oreoke soil is very deep, and well drained. It formed in colluvium from basalt on canyon sideslopes. A typical profile is: 0 to 5 inches - brown very stony silt loam, 5 to 15 inches - brown gravelly silt loam, 15 to 22 inches - brown very gravelly silt loam, 22 to 42 inches - brown very gravelly clay loam, 42 to 60 inches - dark yellowish brown extremely gravelly clay loam. Elevation is 900 to 2800 feet. Slope is 30 to 75 percent. The average annual precipitation is 20 to 25 inches, the average annual air temperature is 46 to 49 degrees F. , and the average frost free season is 120 to 140 days.
76A	UNDERWOOD LOAM, 8 TO 15 PERCENT SLOPES

Map Symbol	Soil name and description
	The Underwood soil is very deep, and well drained. It formed in residuum from basalt on plateaus. A typical profile is: 0 to 3 inches - reddish brown loam, 3 to 20 inches - brown loam, 20 to 60 inches - strong brown loam. Elevation is 1700 to 2700 feet. Slope is 8 to 15 percent. The average annual precipitation is 35 to 45 inches, the average annual air temperature is 45 to 48 degrees F. , and the average frost free season is 110 to 130 days.
76B	UNDERWOOD LOAM, 15 TO 30 PERCENT SLOPES
	The Underwood soil is very deep, and well drained. It formed in residuum from basalt on plateaus. A typical profile is: 0 to 4 inches - reddish brown loam, 4 to 19 inches - brown loam, 19 to 60 inches - strong brown loam. Elevation is 1700 to 2700 feet. Slope is 15 to 30 percent. The average annual precipitation is 35 to 45 inches, the average annual air temperature is 45 to 48 degrees F. , and the average frost free season is 110 to 130 days.
76C	UNDERWOOD GRAVELLY LOAM, 30 TO 50 PERCENT SLOPES
	The Underwood soil is very deep, and well drained. It formed in residuum and colluvium from basalt on backslopes. A typical profile is: 0 to 14 inches - reddish brown gravelly loam, 14 to 60 inches - reddish brown and light reddish brown clay loam. Elevation is 1200 to 2300 feet. Slope is 30 to 50 percent. The average annual precipitation is 35 to 45 inches, the average annual air temperature is 45 to 48 degrees F. , and the average frost free season is 110 to 130 days.
77A	MCGOWAN LOAM, 2 TO 8 PERCENT SLOPES

Map Symbol	Soil name and description
	The McGowan soil is very deep, and well drained. It formed in alluvium and residuum from basalt on plateaus. A typical profile is: 0 to 4 inches - light brown loam, 4 to 10 inches - brown loam, 10 to 60 inches - brown clay loam. Elevation is 500 to 2500 feet. Slope is 2 to 8 percent. The average annual precipitation is 35 to 45 inches, the average annual air temperature is 45 to 50 degrees F. , and the average frost free season is 120 to 140 days.
86A	CHEMAWA LOAM, 2 TO 8 PERCENT SLOPES
	The Chemawa soil is very deep, and well drained. It formed in pyroclastic flows composed of volcanic ash on terraces and footslopes. A typical profile is: 0 to 6 inches - brown loam, 6 to 26 inches - yellowish brown loam, 26 to 60 inches - light yellowish brown silt loam. Elevation is 800 to 2500 feet. Slope is 2 to 8 percent. The average annual precipitation is 45 to 55 inches, the average annual air temperature is 46 to 48 degrees F. , and the average frost free season is 110 to 160 days.
86B	CHEMAWA LOAM, 8 TO 15 PERCENT SLOPES
	The Chemawa soil is very deep, and well drained. It formed in pyroclastic flows composed of volcanic ash on footslopes. A typical profile is: 0 to 6 inches - brown loam, 6 to 26 inches - yellowish brown loam, 26 to 60 inches - light yellowish brown silt loam. Elevation is 800 to 2500 feet. Slope is 8 to 15 percent. The average annual precipitation is 45 to 55 inches, the average annual air temperature is 46 to 48 degrees F. , and the average frost free season is 110 to 160 days.
86C	CHEMAWA LOAM, 15 TO 30 PERCENT SLOPES

Map Symbol	Soil name and description
	The Chemawa soil is very deep, and well drained. It formed in pyroclastic flows composed of volcanic ash on footslopes and backslopes. A typical profile is: 0 to 5 inches - brown loam, 5 to 30 inches - yellowish brown loam, 30 to 60 inches - light yellowish brown silt loam. Elevation is 800 to 2500 feet. Slope is 15 to 30 percent. The average annual precipitation is 45 to 55 inches, the average annual air temperature is 46 to 48 degrees F. , and the average frost free season is 110 to 160 days.
90A	HOOD LOAM, 8 TO 15 PERCENT SLOPES
	The Hood soil is very deep, and well drained. It formed in lacustrine sediments on terraces and terrace escarpments. A typical profile is: 0 to 15 inches - brown loam, 15 to 27 inches - pale brown silt loam, 27 to 60 inches - brown and light yellowish brown silt loam. Elevation is 400 to 800 feet. Slope is 8 to 15 percent. The average annual precipitation is 35 to 45 inches, the average annual air temperature is 49 to 51 degrees F. , and the average frost free season is 115 to 130 days.
90B	HOOD LOAM, 15 TO 30 PERCENT SLOPES
	The Hood soil is very deep, and well drained. It formed in lacustrine sediments on terrace escarpments. A typical profile is: 0 to 10 inches - brown loam, 10 to 27 inches - pale brown silt loam, 27 to 60 inches - brown and light yellowish brown silt loam. Elevation is 400 to 800 feet. Slope is 15 to 30 percent. The average annual precipitation is 35 to 45 inches, the average annual air temperature is 49 to 51 degrees F. , and the average frost free season is 115 to 130 days.
90C	HOOD LOAM, 30 TO 65 PERCENT SLOPES

Map Symbol	Soil name and description
	The Hood soil is very deep, and well drained. It formed in lacustrine sediments on terrace escarpments. A typical profile is: 0 to 7 inches - brown loam, 7 to 25 inches - pale brown silt loam, 25 to 60 inches - brown and light yellowish brown silt loam. Elevation is 400 to 800 feet. Slope is 30 to 65 percent. The average annual precipitation is 35 to 45 inches, the average annual air temperature is 49 to 51 degrees F. , and the average frost free season is 115 to 130 days.
92	HUSUM GRAVELLY LOAM, 0 TO 5 PERCENT SLOPES
	The Husum soil is very deep, and well drained. It formed in alluvium from basalt and andesite mixed with volcanic ash on terraces. A typical profile is: 0 to 10 inches - dark brown gravelly loam, 10 to 28 inches - yellowish brown very gravelly loam, 28 to 60 inches - yellowish brown extremely cobbly loamy sand. Elevation is 350 to 800 feet. Slope is 0 to 5 percent. The average annual precipitation is 35 to 45 inches, the average annual air temperature is 47 to 50 degrees F. , and the average frost free season is 105 to 120 days.
721	ROCK OUTCROP-RUBBLE LAND-HAPLOXEROLLS COMPLEX, VERY STEEP
	This map unit consists of about 75 percent Rock Outcrop-Rubble Land soils and about 10 percent Haploxerolls soils. The remaining 15 percent is soils of minor extent. The Rock Outcrop-Rubble Land soil is moderately deep to very deep, and well drained to excessively drained. It formed in colluvium from basalt on mountain sideslopes. The Haploxerolls soil is very deep, and well drained. It formed in colluvium from basalt on mountain sideslopes. A typical profile is: need profile. Elevation is 200 to 1800 feet. Slope is 30 to 90 percent. The average annual precipitation is 9 to 35 inches, the average annual air temperature is 46 to 53 degrees F. , and the average frost free season is 100 to 170 days.
725	CAULEY SILT LOAM, 5 TO 10 PERCENT SLOPES

Map Symbol	Soil name and description
	The Cauley soil is very deep, and well drained. It formed in flood water alluvium and loess on scoured historic flood water terraces. A typical profile is: 0 to 15 inches - dark grayish brown and dark brown silt loam, 15 to 60 inches - yellowish brown silt loam and gravelly silt loam. Elevation is 200 to 600 feet. Slope is 5 to 10 percent. The average annual precipitation is 18 to 25 inches, the average annual air temperature is 46 to 49 degrees F. , and the average frost free season is 100 to 140 days.
726	CAULEY SILT LOAM, 10 TO 15 PERCENT SLOPES
	The Cauley soil is very deep, and well drained. It formed in flood water alluvium and loess on scoured historic flood water terraces. A typical profile is: 0 to 15 inches - dark grayish brown and dark brown silt loam, 15 to 60 inches - yellowish brown silt loam and gravelly silt loam. Elevation is 100 to 550 feet. Slope is 10 to 15 percent. The average annual precipitation is 18 to 25 inches, the average annual air temperature is 46 to 49 degrees F. , and the average frost free season is 100 to 140 days.

ENGINEERING INDEX PROPERTIES

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Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
23B:												
GUNN	0-15	Loam	CL-ML	A-4	0	0	90-100	80-100	70-95	50-75	20-30	5-10
	15-32	Loam, clay loam	CL, CL-ML	A-4, A-6	0	0	95-100	90-100	80-100	60-80	25-35	5-15
	32-60	Clay loam, gravelly clay loam	CL, GC, SC	A-6	0	0	55-100	50-100	40-100	35-80	30-40	10-20
25B:												
LEIDL	0-5	Extremely cobbly loam	GM	A-1	0-5	30-40	50-60	25-35	20-30	15-25	20-30	NP-5
	5-25	Very gravelly clay loam, extremely gravelly clay loam	GC	A-2	0-5	15-40	20-55	15-45	10-45	10-35	35-45	15-20
	25-35	Unweathered bedrock			0	0	0	0	0	0	---	NP
OREOKE	0-5	Very stony silt loam	CL	A-6	10-25	0-10	85-95	75-85	70-80	60-75	25-35	10-15
	5-15	Gravelly silt loam	CL	A-6	0	5-15	80-90	75-85	65-75	55-70	25-35	10-15
	15-22	Very gravelly silt loam, very gravelly loam	GC	A-2, A-6	0	10-15	50-70	40-50	35-45	30-40	25-35	10-15
	22-60	Very gravelly clay loam, extremely gravelly clay loam, extremely gravelly loam	GC	A-2	0	25-40	35-50	25-40	20-30	15-25	35-45	15-25
76A:												
UNDERWOOD	0-7	Loam	ML	A-4	0	0	95-100	90-100	75-95	50-75	20-30	NP-5
	7-20	Loam, clay loam	CL	A-6	0	0	85-100	75-100	60-95	50-75	30-40	10-15
	20-60	Loam, clay loam, gravelly loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-5	75-100	60-100	50-95	40-75	25-35	5-15

ENGINEERING INDEX PROPERTIES--Continued

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Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
76B:												
UNDERWOOD	0-7	Loam	ML	A-4	0	0	95-100	90-100	75-95	50-75	20-30	NP-5
	7-19	Loam, clay loam	CL	A-6	0	0	85-100	75-100	60-95	50-75	30-40	10-15
	19-60	Loam, clay loam, gravelly loam	CL, CL-ML, SC, SC-SM	A-4, A-6	0	0-5	75-100	60-100	50-95	40-75	25-35	5-15
76C:												
UNDERWOOD	0-14	Gravelly loam	SM	A-4	0	0-5	85-95	60-75	50-75	40-50	20-30	NP-5
	14-60	Loam, clay loam	CL	A-6	0	0	85-100	75-100	60-95	50-75	30-40	10-15
77A:												
MCGOWAN	0-10	Loam	CL-ML	A-4	0	0	90-100	80-100	70-95	50-75	20-30	5-10
	10-15	Clay loam, loam	CL	A-6	0	0	100	90-100	75-100	60-80	25-35	10-15
	15-42	Clay loam, loam	CL	A-6	0	0-15	85-100	80-100	60-100	50-80	25-35	10-15
	42-60	Clay loam, gravelly clay loam, loam	CL	A-6	0	0-15	75-100	70-100	60-100	50-80	25-35	10-15
86A:												
CHEMAWA	0-26	Loam	ML	A-4	0	0	100	95-100	80-95	70-85	30-40	NP-5
	26-60	Loam, silt loam	ML	A-4	0	0	95-100	90-100	85-95	80-90	30-40	NP-5
86B:												
CHEMAWA	0-26	Loam	ML	A-4	0	0	100	95-100	80-95	70-85	30-40	NP-5
	26-60	Loam, silt loam	ML	A-4	0	0	95-100	90-100	85-95	80-90	30-40	NP-5
86C:												
CHEMAWA	0-26	Loam	ML	A-4	0	0	100	95-100	80-95	70-85	30-40	NP-5
	26-60	Loam, silt loam	ML	A-4	0	0	95-100	90-100	85-95	80-90	30-40	NP-5
90A:												
HOOD	0-15	Loam	ML	A-4	0	0	100	100	90-95	70-75	25-30	NP-5
	15-60	Silt loam, loam	CL-ML, ML	A-4	0	0	100	100	80-90	75-80	20-30	NP-10
90B:												
HOOD	0-10	Loam	ML	A-4	0	0	100	100	90-95	70-75	25-30	NP-5
	10-60	Silt loam, loam	CL-ML, ML	A-4	0	0	100	100	80-90	75-80	20-30	NP-10
90C:												
HOOD	0-7	Loam	ML	A-4	0	0	100	100	90-95	70-75	25-30	NP-5
	7-60	Silt loam, loam	CL-ML, ML	A-4	0	0	100	100	80-90	75-80	20-30	NP-10

ENGINEERING INDEX PROPERTIES--Continued

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Map symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				Pct	Pct					Pct	
92:												
HUSUM	0-10	Gravelly loam	ML, SM	A-4	0	0-15	70-85	60-75	50-70	35-55	20-30	NP-5
	10-28	Very gravelly loam, extremely gravelly loam	GM	A-1, A-2	0-5	5-30	25-50	20-40	15-35	10-30	20-30	NP-5
	28-60	Extremely cobbly loamy sand, extremely gravelly loamy sand, extremely gravelly sandy loam	GP-GM	A-1	0-5	20-50	25-45	15-30	10-20	5-10	0-14	NP
721:												
ROCK OUTCROP	0-60	Unweathered bedrock	---	---	---	---	---	---	---	---	---	---
RUBBLE LAND	0-60	Fragmental material	GP	A-1	40-50	40-50	0-10	0-5	0-5	0	0-14	NP
725:												
CAULEY	0-15	Silt loam	CL-ML	A-4	0	0	100	100	90-95	70-80	20-25	5-10
	15-60	Silt loam, gravelly silt loam	CL, CL-ML	A-4, A-6	0	0	75-95	70-90	65-85	60-80	20-30	5-15
726:												
CAULEY	0-15	Silt loam	CL-ML	A-4	0	0	100	100	90-95	70-80	20-25	5-10
	15-60	Silt loam, gravelly silt loam	CL, CL-ML	A-4, A-6	0	0	75-95	70-90	65-85	60-80	20-30	5-15

ENGINEERING INDEX PROPERTIES

Endnote -- ENGINEERING INDEX PROPERTIES

This report gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

DEPTH to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the published Soil Survey for each soil series under "Soil Series and Their Morphology."

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

Classification of the soils is determined according to the Unified soil classification system and the system adopted by the American Association of State Highway and Transportation Officials.

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

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection. If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock FRAGMENTS larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage of soil particles passing designated sieves (PERCENTAGE PASSING SIEVE NUMBER--)is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

LIQUID LIMIT and PLASTICITY INDEX (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in this report.

CHEMICAL PROPERTIES OF THE SOILS

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Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	Pct	meq/100g	pH	Pct	Pct	mmhos/cm	
23B:								
GUNN	0-15	15-20	10.0-20.0	5.6-6.5	---	---	---	---
	15-32	22-32	10.0-20.0	5.6-6.5	---	---	---	---
	32-60	28-35	15.0-25.0	5.6-6.5	---	---	---	---
25B:								
LEIDL	0-5	10-20	10.0-20.0	6.1-6.5	---	---	---	---
	5-25	27-35	15.0-30.0	6.1-7.3	---	---	---	---
	25-35	---	---	---	---	---	---	---
OREOKE	0-5	15-20	10.0-15.0	5.6-6.5	---	---	---	---
	5-15	15-20	10.0-15.0	5.6-6.5	---	---	---	---
	15-22	18-25	10.0-18.0	5.6-6.5	---	---	---	---
	22-60	25-35	15.0-25.0	5.6-7.3	---	---	---	---
76A:								
UNDERWOOD	0-7	18-25	15.0-25.0	6.1-6.5	---	---	---	---
	7-20	25-35	20.0-30.0	5.1-6.5	---	---	---	---
	20-60	20-30	15.0-20.0	5.1-6.0	---	---	---	---
76B:								
UNDERWOOD	0-7	18-25	15.0-25.0	6.1-6.5	---	---	---	---
	7-19	25-35	20.0-30.0	5.1-6.5	---	---	---	---
	19-60	20-30	15.0-20.0	5.1-6.0	---	---	---	---
76C:								
UNDERWOOD	0-14	18-25	15.0-25.0	6.6-7.3	---	---	---	---
	14-60	25-35	20.0-30.0	5.1-6.5	---	---	---	---
77A:								
MCGOWAN	0-10	10-15	10.0-20.0	5.6-6.5	---	---	---	---
	10-15	18-33	10.0-15.0	5.6-6.5	---	---	---	---
	15-42	20-30	10.0-15.0	5.6-6.5	---	---	---	---
	42-60	20-28	10.0-15.0	5.6-6.5	---	---	---	---
86A:								
CHEMAWA	0-26	7-18	1.0-10.0	6.1-7.3	---	---	---	---
	26-60	10-18	1.0-10.0	5.6-7.3	---	---	---	---
86B:								
CHEMAWA	0-26	7-18	1.0-10.0	6.1-7.3	---	---	---	---
	26-60	10-18	1.0-10.0	5.6-7.3	---	---	---	---

CHEMICAL PROPERTIES OF THE SOILS--Continued
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Map symbol and soil name	Depth	Clay	Cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	Pct	meq/100g	pH	Pct	Pct	mmhos/cm	
86C:								
CHEMAWA	0-26	7-18	1.0-10.0	6.1-7.3	---	---	---	---
	26-60	10-18	1.0-10.0	5.6-7.3	---	---	---	---
90A:								
HOOD	0-15	15-20	5.0-15.0	5.6-6.5	---	---	---	---
	15-60	18-25	5.0-15.0	5.6-6.5	---	---	---	---
90B:								
HOOD	0-10	15-20	5.0-15.0	5.6-6.5	---	---	---	---
	10-60	18-25	5.0-15.0	5.6-6.5	---	---	---	---
90C:								
HOOD	0-7	15-20	5.0-15.0	5.6-6.5	---	---	---	---
	7-60	18-25	5.0-15.0	5.6-6.5	---	---	---	---
92:								
HUSUM	0-10	10-15	5.0-15.0	5.6-6.5	---	---	---	---
	10-28	10-15	5.0-15.0	5.6-6.5	---	---	---	---
	28-60	0-2	5.0-10.0	5.6-6.5	---	---	---	---
721:								
ROCK OUTCROP	0-60	---	---	---	---	---	---	---
RUBBLE LAND	0-60	---	---	---	---	---	---	---
725:								
CAULEY	0-15	15-20	7.0-12.0	6.1-7.3	---	---	---	---
	15-60	18-27	10.0-17.0	5.6-6.5	---	---	---	---
726:								
CAULEY	0-15	15-20	7.0-12.0	6.1-7.3	---	---	---	---
	15-60	18-27	10.0-17.0	5.6-6.5	---	---	---	---

CHEMICAL PROPERTIES OF THE SOILS

Endnote -- CHEMICAL PROPERTIES OF THE SOILS

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

CLAY as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this report, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

CATION EXCHANGE CAPACITY (CEC) is the total amount of cations held in a soil in such a way that they can be removed only by exchanging with another cation in the natural soil solution. CEC is a measure of the ability of a soil to retain cations, some of which are plant nutrients. Soils with low CEC hold few cations and may require more frequent applications of fertilizers than soils with high CEC. Soils with high CEC have the potential to retain cations, thus reducing the possibility of pollution of ground water.

SOIL REACTION is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

CALCIUM CARBONATE is the percentage by weight of calcium carbonate in the fine-earth material, less than 2 millimeters in size.

GYPSUM is the percentage by weight of hydrated calcium sulfates 20 millimeters or smaller in size, in the soil.

SALINITY is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils.

The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the report. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

SODIUM ADSORPTION RATIO (SAR) expresses the relative activity of sodium ions in exchange reactions in the soil. SAR is a measure of the amount of sodium relative to calcium and magnesium in the water extract from saturated soil paste.

PHYSICAL PROPERTIES OF SOILS

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(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodability index" apply only to the surface layer)

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
23B:												
GUNN	0-15	15-20	1.10-1.30	0.60-2.00	0.17-0.21	Low	2.0-4.0	0.37	0.37	5	5	56
	15-32	22-32	1.15-1.50	0.10-0.60	0.17-0.19	Moderate	0.0-2.0	0.37	0.37			
	32-60	28-35	1.30-1.65	0.10-0.60	0.16-0.18	Moderate	0.0-2.0	0.32	0.37			
25B:												
LEIDL	0-5	10-20	1.10-1.30	0.60-2.00	0.12-0.14	Low	2.0-4.0	0.20	0.32	2	8	---
	5-25	27-35	1.30-1.50	0.60-2.00	0.09-0.11	Low	0.5-1.0	0.10	0.32			
	25-35	---	---	0.00-20.00	---	Low	---	---	---			
OREOKE	0-5	15-20	1.20-1.35	0.60-2.00	0.18-0.20	Low	3.0-5.0	0.20	0.32	5	7	---
	5-15	15-20	1.20-1.40	0.60-2.00	0.16-0.19	Low	1.0-3.0	0.28	0.32			
	15-22	18-25	1.25-1.45	0.60-2.00	0.15-0.18	Low	0.5-1.0	0.15	0.37			
	22-60	25-35	1.30-1.50	0.10-0.60	0.16-0.20	Moderate	0.5-1.0	0.10	0.32			
76A:												
UNDERWOOD	0-7	18-25	1.10-1.30	0.60-2.00	0.16-0.18	Low	2.0-5.0	0.37	0.37	5	5	56
	7-20	25-35	1.25-1.45	0.10-0.60	0.19-0.21	Moderate	1.0-3.0	0.28	0.28			
	20-60	20-30	1.25-1.45	0.60-2.00	0.16-0.21	Low	0.5-1.0	0.32	0.37			
76B:												
UNDERWOOD	0-7	18-25	1.10-1.30	0.60-2.00	0.16-0.18	Low	2.0-5.0	0.37	0.37	5	5	56
	7-19	25-35	1.25-1.45	0.10-0.60	0.19-0.21	Moderate	1.0-3.0	0.28	0.28			
	19-60	20-30	1.25-1.45	0.60-2.00	0.16-0.21	Low	0.5-1.0	0.32	0.37			
76C:												
UNDERWOOD	0-14	18-25	1.10-1.30	0.60-2.00	0.13-0.18	Low	2.0-5.0	0.24	0.32	5	6	48
	14-60	25-35	1.25-1.45	0.10-0.60	0.19-0.21	Moderate	1.0-3.0	0.28	0.28			
77A:												
MCGOWAN	0-10	10-15	1.10-1.30	0.60-2.00	0.16-0.19	Low	2.0-5.0	0.32	0.32	5	5	56
	10-15	18-33	1.25-1.45	0.60-2.00	0.16-0.19	Low	0.5-2.0	0.32	0.32			
	15-42	20-30	1.25-1.45	0.60-2.00	0.16-0.19	Low	0.0-0.5	0.28	0.28			
	42-60	20-28	1.25-1.45	0.60-2.00	0.14-0.17	Low	0.0-0.5	0.28	0.32			
86A:												
CHEMAWA	0-26	7-18	0.80-0.90	0.60-2.00	0.16-0.19	Low	2.0-3.0	0.43	0.43	5	5	56
	26-60	10-18	0.80-0.90	0.60-2.00	0.16-0.21	Low	1.0-2.0	0.49	0.49			

PHYSICAL PROPERTIES OF SOILS--Continued

wharry

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Shrink-swell potential	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
								K	Kf	T		
	In	Pct	g/cc	In/hr	In/in		Pct					
86B:												
CHEMAWA	0-26	7-18	0.80-0.90	0.60-2.00	0.16-0.19	Low	2.0-3.0	0.43	0.43	5	5	56
	26-60	10-18	0.80-0.90	0.60-2.00	0.16-0.21	Low	1.0-2.0	0.49	0.49			
86C:												
CHEMAWA	0-26	7-18	0.80-0.90	0.60-2.00	0.16-0.19	Low	2.0-3.0	0.43	0.43	5	5	56
	26-60	10-18	0.80-0.90	0.60-2.00	0.16-0.21	Low	1.0-2.0	0.49	0.49			
90A:												
HOOD	0-15	15-20	1.10-1.30	0.60-2.00	0.19-0.21	Low	2.0-5.0	0.37	0.37	5	5	56
	15-60	18-25	1.20-1.50	0.60-2.00	0.19-0.21	Low	0.2-2.0	0.55	0.55			
90B:												
HOOD	0-10	15-20	1.10-1.30	0.60-2.00	0.19-0.21	Low	2.0-5.0	0.37	0.37	5	5	56
	10-60	18-25	1.20-1.50	0.60-2.00	0.19-0.21	Low	0.2-2.0	0.55	0.55			
90C:												
HOOD	0-7	15-20	1.10-1.30	0.60-2.00	0.19-0.21	Low	2.0-5.0	0.37	0.37	5	5	56
	7-60	18-25	1.20-1.50	0.60-2.00	0.19-0.21	Low	0.2-2.0	0.55	0.55			
92:												
HUSUM	0-10	10-15	0.65-0.85	0.60-2.00	0.11-0.14	Low	1.0-2.0	0.20	0.32	3	6	48
	10-28	10-15	0.65-0.85	0.60-2.00	0.05-0.08	Low	0.5-1.0	0.20	0.32			
	28-60	0-2	1.10-1.35	6.00-20.00	0.03-0.07	Low	0.5-1.0	0.05	0.28			
721:												
ROCK OUTCROP	0-60	---	---	---	---	Low	---	---	---	---	8	---
RUBBLE LAND	0-60	---	1.70-2.35	>20.00	0.00-0.10	Low	0.0-0.1	---	---	---	8	---
725:												
CAULEY	0-15	15-20	1.10-1.25	0.60-2.00	0.16-0.21	Low	2.0-3.0	0.43	0.43	5	5	56
	15-60	18-27	1.25-1.40	0.60-2.00	0.12-0.20	Moderate	0.5-1.0	0.28	0.37			
726:												
CAULEY	0-15	15-20	1.10-1.25	0.60-2.00	0.16-0.21	Low	2.0-3.0	0.43	0.43	5	5	56
	15-60	18-27	1.25-1.40	0.60-2.00	0.12-0.20	Moderate	0.5-1.0	0.28	0.37			

PHYSICAL PROPERTIES OF SOILS

Endnote -- PHYSICAL PROPERTIES OF SOILS

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

CLAY as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this report, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

MOIST BULK DENSITY is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this report, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

PERMEABILITY refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

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

SHRINK-SWELL POTENTIAL is the potential for volume change in a soil with a loss or gain of moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils. If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed. Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are "Low," a change of less than 3 percent; "Moderate," 3 to 6 percent; and "High," more than 6 percent. "Very high," greater than 9 percent, is sometimes used.

PHYSICAL PROPERTIES OF SOILS

Endnote -- PHYSICAL PROPERTIES OF SOILS--Continued

ORGANIC MATTER is the plant and animal residue in the soil at various stages of decomposition. In report J, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

EROSION FACTOR K indicates the susceptibility of the whole soil (including rocks and rock fragments) to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

EROSION FACTOR Kf is like EROSION FACTOR K but it is for the fine-earth fraction of the soil. Rocks and rock fragments are not considered.

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

WIND ERODIBILITY GROUPS are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

1. Coarse sands, sands, fine sands, and very fine sands. These soils are generally not suitable for crops. They are extremely erodible, and vegetation is difficult to establish.

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

PHYSICAL PROPERTIES OF SOILS

Endnote -- PHYSICAL PROPERTIES OF SOILS--Continued

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

7. Silts, noncalcareous silty clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

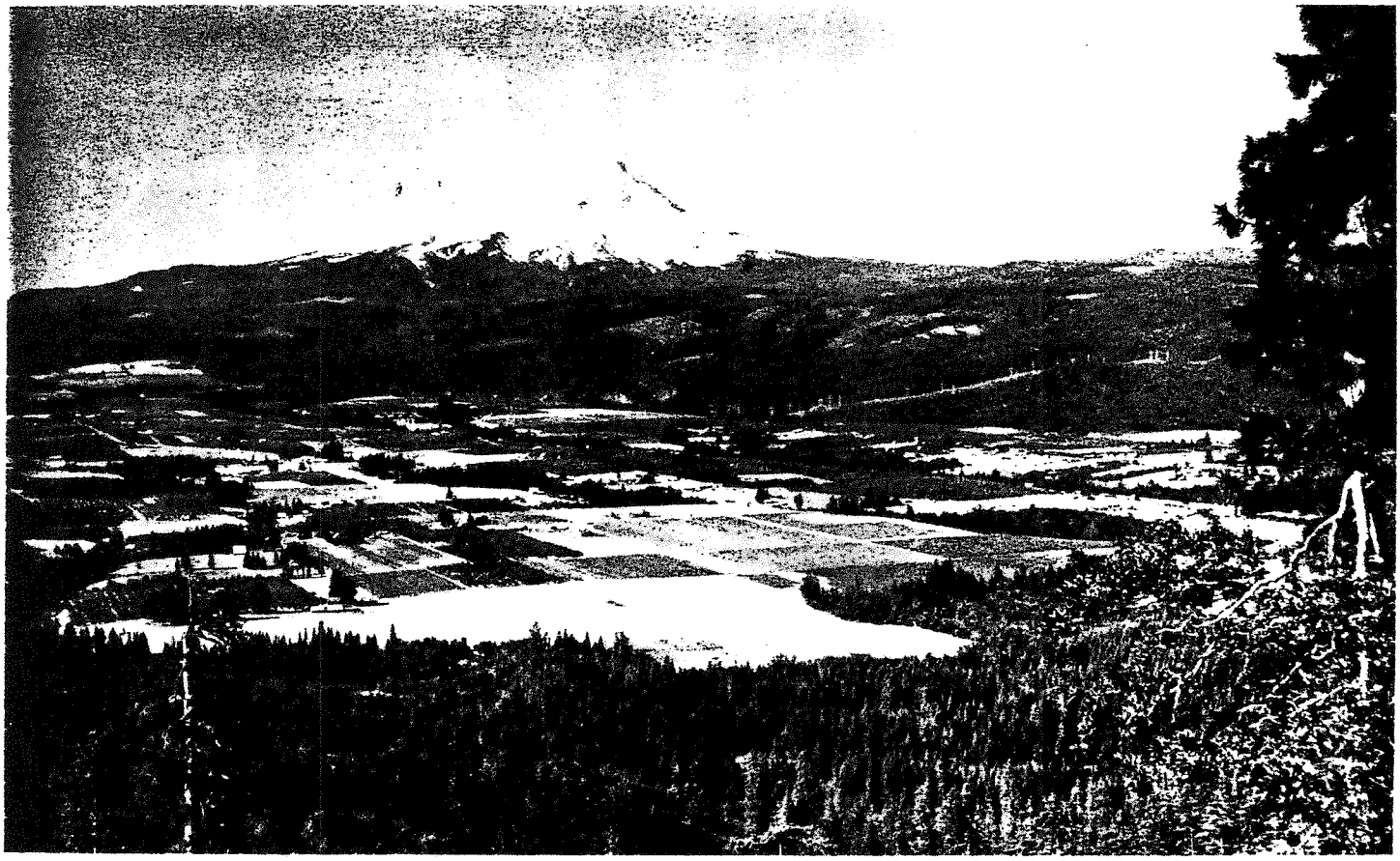
8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

The WIND ERODIBILITY INDEX is used in the wind erosion equation (WEQ). The index number indicates the amount of soil lost in tons per acre per year. The range of wind erodibility index numbers is 0 to 300.

Exhibit 5
Hood River County Soil Types
Oregon

SOIL SURVEY OF

Hood River County Area, Oregon



United States Department of Agriculture
Soil Conservation Service
in cooperation with
Oregon Agricultural Experiment Station

The B2t horizon is loam, heavy loam, or clay loam that is 0 to 30 percent rock fragments. Depth to bedrock is 40 to 60 inches or more.

14E—Ketchly loam, 3 to 30 percent slopes. This nearly level to steep soil occurs on broad ridgetops. It has the profile described as representative of the series. A representative mapping unit is in the SE¼NW¼ NW¼ sec. 4, T. 1 N., R. 11 E. Included in mapping were areas of Bins, Bindle, Frailey, and Bald soils and areas of shallow stony loams, all of which make up as much as 15 percent of this mapping unit.

Runoff is slow, and the hazard of erosion is moderate. Capability subclass VIe; woodland suitability group 4o1; wildlife group 2.

14F—Ketchly loam, 30 to 65 percent slopes. This very steep soil occurs on long narrow ridges. It has a profile similar to the one described as representative of the series. A representative mapping unit is in the NW¼NE¼ sec. 10, T. 1 N., R. 11 E. Included in mapping were areas of Bins, Bindle, Frailey, and Bald soils that make up as much as 15 percent of this mapping unit.

Runoff is rapid, and the hazard of erosion is high. Capability subclass VIIe; woodland suitability group 4r1; wildlife group 2.

Lava Flows

15—Lava flows occurs as a long, narrow area on the west side of Dee Flat. These flows are recent. A representative mapping unit is in the NE¼NE¼SW¼ sec. 12, T. 1 S., R. 10 E. Capability subclass VIIIs.

Oak Grove Series

The Oak Grove series consists of well drained soils on uplands. These soils formed in deep clayey mudflows and alluvial materials. Slopes are 0 to 60 percent. Elevation is 500 to 1,800 feet. The vegetation is Douglas-fir, ponderosa pine, Oregon white oak, forbs, and shrubs. The dominant understory plants are mountain brome, blue wildrye, tall oregongrape, trailing blackberry, common snowberry, deerbrush, Pacific dogwood, and western hazel. Average annual precipitation is 35 to 45 inches, the average annual air temperature is 48° to 51° F., and the frost-free period is 120 to 180 days.

In a representative profile the surface layer is dark brown loam about 13 inches thick. The upper 13 inches of the subsoil is dark brown loam, the middle 8 inches is dark reddish brown clay loam, and the lower 44 inches is dark reddish brown and reddish brown clay. Depth to bedrock is more than 60 inches. The soil is strongly acid and medium acid in the surface layer and slightly acid and medium acid in the subsoil.

Permeability is moderately slow. Available water capacity is 9 to 10 inches. Water-supplying capacity is 13 to 16 inches. Effective rooting depth is more than 60 inches.

Oak Grove soils are used for fruit orchards, pasture, woodland, wildlife habitat, and water supply.

Representative profile of Oak Grove loam, 0 to 8 percent slopes, 65 feet east and 415 feet north of the quarter corner in SW¼SW¼NW¼ sec. 9, T. 2 N., R. 10 E.

Ap—0 to 7 inches; dark brown (7.5YR 3/2) loam, brown (7.5YR 5/3) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; few concretions 1–2 millimeters in diameter; strongly acid; clear smooth boundary.

A3—7 to 13 inches; dark brown (7.5YR 3/2) loam, brown (7.5YR 5/3) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; few concretions 1–2 millimeters in diameter; medium acid; clear wavy boundary.

B11—13 to 26 inches; dark brown (7.5YR 3/4) loam, brown (7.5YR 5/4) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; common very fine roots; many very fine tubular pores; common clean sand grains on peds; few concretions 1–5 millimeters in diameter; slightly acid; clear wavy boundary.

B12—26 to 34 inches; dark reddish brown (5YR 3/4) clay loam, reddish brown (5YR 5/4) dry; moderate medium and fine subangular blocky structure; hard, firm, very sticky and very plastic; common very fine roots; many very fine tubular pores; few thin clay films in pores; common clean sand grains on peds; few concretions 1–2 millimeters in diameter; medium acid; clear smooth boundary.

B21t—34 to 52 inches; dark reddish brown (5YR 3/4) clay, yellowish red (5YR 5/6) dry; moderate medium blocky structure; very hard, very firm, very sticky and very plastic; few roots; many very fine tubular pores; few moderately thick and many thin clay films on peds and in pores; few concretions 1–2 millimeters in diameter; many large black stains; medium acid; clear wavy boundary.

B22t—52 to 66 inches; dark reddish brown (5YR 3/4) clay, yellowish red (5YR 5/6) dry; moderate medium and fine blocky structure; very hard, very firm, very sticky and very plastic; very few roots; many very fine tubular pores; few thin clay films on peds and thick clay films in pores; few concretions 1 millimeter or less in diameter; many black stains; slightly acid; clear wavy boundary.

B3—66 to 78 inches; reddish brown (5YR 4/4) clay, yellowish red (5YR 5/6) dry; moderate fine and medium blocky structure; hard, firm, very sticky and very plastic; few roots; many very fine tubular pores; few thin clay films; few black stains; medium acid.

The A horizon is brown, reddish gray, or reddish brown when dry and dark brown or dark reddish brown when moist. The B2t horizon is clay loam to clay that is more than 35 percent clay. The content of rock fragments ranges from 0 to 15 percent. Depth to bedrock is more than 60 inches.

16B—Oak Grove loam, 0 to 8 percent slopes. This nearly level to gently sloping soil occurs as broad, irregularly shaped areas. It has the profile described as representative of the series. A representative mapping unit is in the SW¼SW¼NW¼ sec. 9, T. 2 N., R. 10 E. Included in mapping were areas of Culbertson and Rockford soils that make up about 5 percent of the mapping unit.

Runoff is slow, and the hazard of erosion is slight. Capability unit IIe–1; woodland suitability group 4o1; wildlife group 1.

16C—Oak Grove loam, 8 to 12 percent slopes. This moderately sloping soil occurs as broad, irregularly shaped areas. It has a profile similar to the one described as representative of the series. A representative mapping unit is in the SE¼SW¼NW¼ sec. 8, T. 2 N., R. 10 E. Included in mapping were areas of Culbertson and Rockford soils that make up about 10 percent of the mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe–1; woodland suitability group 4o1; wildlife group 1.

16D—Oak Grove loam, 12 to 20 percent slopes. This moderately steep soil occurs as irregularly shaped areas. It has a profile similar to the one described as representative of the series. A representative mapping unit is in the SW¼NW¼SE¼ sec. 18, T. 2 N., R. 10 E. Included in mapping were areas of Culbertson and Rockford soils that make up about 10 percent of the mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe–1; woodland suitability group 4o1; wildlife group 1.

16E—Oak Grove loam, 20 to 35 percent slopes. This steep soil occurs as narrow, irregularly shaped areas. It has a profile similar to the one described as representative of the series. A representative mapping unit is in the NE¼NW¼SE¼ sec. 7, T. 2 N., R. 10 E. Included in mapping were areas of Culbertson and Rockford soils that make up about 10 percent of the mapping unit.

Runoff is rapid, and the hazard of erosion is high. Capability unit IVe–1; woodland suitability group 4o1; wildlife group 1.

16F—Oak Grove loam, 35 to 60 percent slopes. This very steep soil occurs as narrow, irregularly shaped areas. It has a profile similar to the one described as representative of the series. A representative mapping unit is in the NW¼SW¼SW¼ sec. 33, T. 1 N., R. 10 E. Included in mapping were areas of Culbertson and Rockford soils that make up about 15 percent of the mapping unit.

Runoff is very rapid, and the hazard of erosion is high. Capability subclass VIe; woodland suitability group 4r1; wildlife group 1.

Parkdale Series

The Parkdale series consists of well drained soils on uplands. These soils formed in deep mudflows high in pyroclastic materials. Slopes are 0 to 40 percent. Elevation is 1,000 to 2,500 feet. The vegetation is Douglas-fir, ponderosa pine, grand pine, forbs, and shrubs. The dominant understory plants are blue wildrye, tall oregongrape, trailing blackberry, common snowberry, deerbrush, Pacific dogwood, and western hazel. Average annual precipitation is 35 to 50 inches, the average annual air temperature is 45° to 49° F., and the frost-free period is 100 to 120 days.

In a representative profile the surface layer is dark brown loam about 10 inches thick. The subsoil is brown silt loam about 8 inches thick. The upper 32 inches of the substratum is brown silt loam. The lower 25 inches is yellowish brown loam. Depth to bedrock is more than 60 inches. The soil is slightly acid in the surface layer and neutral in the soil below.

Permeability is moderate. Available water capacity is 15 to 17 inches. Water-supplying capacity is 16 to 18 inches. Effective rooting depth is more than 60 inches.

Parkdale soils are used for fruit orchards, woodland, wildlife habitat, and water supply.

Representative profile of Parkdale loam, 0 to 8 percent slopes, 130 feet west and 50 feet south of the quarter corner in NE¼NE¼SE¼ sec. 6, T. 1 S., R. 10 E.

Ap1—0 to 5 inches; dark brown (7.5YR 4/3) loam, brown (7.5YR 4/3) dry; weak fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine roots; many very fine irregular pores; 5 percent shot 1–5 millimeters in diameter; slightly acid; clear smooth boundary.

Ap2—5 to 10 inches; dark brown (7.5YR 3/2) loam, brown (7.5YR 4/3) dry; weak fine granular structure; soft, very friable, nonsticky and slightly plastic; common very fine and fine roots; common very fine tubular pores; 5 percent shot 1–5 millimeters in diameter; neutral; abrupt wavy boundary.

B2—10 to 18 inches; brown (7.5YR 4/4) silt loam, brown (7.5YR 5/4) dry; weak very fine granular structure; soft, very friable, nonsticky and slightly plastic; common very fine or fine roots; few very fine tubular pores; 5 percent shot 1–5 millimeters in diameter; neutral; clear wavy boundary.

C1—18 to 27 inches; brown (7.5YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; massive; soft, very friable, nonsticky and slightly plastic; common very fine and fine roots; common very fine tubular pores; 5 percent shot 1–5 millimeters in diameter; neutral; clear wavy boundary.

C2—27 to 50 inches; brown (7.5YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; massive; soft, very friable, nonsticky and slightly plastic; common very fine roots; many very fine tubular pores; common 10 percent firm nodules or shot 5–10 millimeters in diameter; neutral; clear smooth boundary.

C3—50 to 75 inches; yellowish brown (10YR 5/4) loam, very pale brown (10YR 7/4) dry; massive; soft, friable, nonsticky and slightly plastic; common very fine and fine roots; many very fine tubular pores; 10 percent nodules and shot 5–10 millimeters in diameter; neutral.

The A horizon is brown, dark grayish brown or grayish brown when dry and dark brown, very dark brown or very dark grayish brown when moist. It is up to 30 percent shot 1 to 5 millimeters in diameter. The C horizon below 50 inches is up to 15 percent nodules and shot 2 to 10 millimeters in diameter.

17B—Parkdale loam, 0 to 8 percent slopes. This soil occurs as broad areas on ridgetops. Slopes average 5 percent. The profile is the one described as representative of the series. A representative mapping unit is in the NE¼NE¼SE¼ sec. 6, T. 1 S., R. 10 E. Included in mapping were areas of a soil that is similar to this Parkdale soil but has a gravelly or cobbly surface layer and areas of Dee soils, all of which make up less than 5 percent of the mapping unit.

Runoff is slow, and the hazard of erosion is slight. Capability unit IIe–1; woodland suitability group 3o1; wildlife group 1.

17C—Parkdale loam, 8 to 12 percent slopes. This soil occurs as broad irregularly shaped areas on ridgetops. It has a profile similar to the one described as representative of the series. A representative mapping unit is in the NE¼SW¼SE¼ sec. 18, T. 1 N., R. 10 E. Included in mapping were areas of a soil that is similar to this Parkdale soil but has a gravelly or cobbly surface layer and areas of Dee soils, all of which make up less than 5 percent of the mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe–1; woodland suitability group 3o1; wildlife group 1.

17D—Parkdale loam, 12 to 20 percent slopes. This moderately steep soil occurs as broad, irregularly shaped areas. It has a profile similar to the one described as representative of the series. A representative mapping unit is in the NE¼SW¼SE¼ sec. 18, T. 1 N., R. 10 E. Included in mapping were areas of a soil that is similar to this Parkdale soil but has a gravelly or cob-

bly surface layer and areas of Dee soils, all of which make up less than 5 percent of the mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe–1; woodland suitability group 3o1; wildlife group 1.

17E—Parkdale loam, 20 to 40 percent slopes. This steep soil occurs as narrow, irregularly shaped areas. It has a profile similar to the one described as representative of the series. A representative mapping unit is in the NE¼NE¼SW¼ sec. 5, T. 1 S., R. 10 E. Included in mapping were areas of a soil that is similar to this Parkdale soil but has a gravelly or cobbly surface layer and areas of Dee soils, all of which make up less than 5 percent of the mapping unit.

Runoff is rapid, and the hazard of erosion is high. Capability unit IVe–1; woodland suitability group 3o1; wildlife group 1.

Riverwash

18—Riverwash occurs as narrow, irregular strips in the bends of stream channels along the Columbia and Hood Rivers and along drainageways in the soil survey area. The strips, 2 to 10 feet above the normal waterline, are 40 to 200 yards wide and consist of sand, gravel, and well-rounded stones and boulders, chiefly of basalt. The surface generally is uneven. A representative mapping unit is in the NE¼NW¼SE¼ sec. 1, T. 2 N., R. 10 E.

Riverwash supports little or no vegetation. It is subject to overflow when the water is high and is extremely droughty when the water is low. During each overflow, new deposits are received and some material is removed. Adjacent river sandbars are included in mapping.

Riverwash is used for wildlife habitat and sand and gravel. Capability subclass VIIIw; wildlife group 1.

Rock Outcrop

Rock outcrop is exposed bedrock, commonly so small and so intermingled with soil or other soil material that it is impractical to map it separately. The Rock outcrop in the Hood River Area is mostly basalt. It provides recreation areas and wildlife habitat.

19E—Rock outcrop-Bodell-Bald complex, 0 to 30 percent slopes. This mapping unit occurs only along the Columbia River in the western part of the survey area. These areas at one time were part of the Columbia River channel, but are now terraces above the river. Stream action has scoured holes in the basalt flows and deposited mixed sand and silt colluvium weathered from basalt (fig. 4). A representative mapping unit is in the NE¼NE¼NE¼ sec. 4, T. 2 N., R. 10 E.

This mapping unit is about 55 percent Rock outcrop, 20 percent Bodell soils, and 15 percent Bald soils. The profiles of the Bodell and Bald soils are similar to those described for their respective series but in some places they contain waterworn gravel and have a sandy loam surface layer. As much as 10 percent of the unit is included areas of Wind River, Culbertson, and Wamic soils.

Runoff is slow, and the hazard of erosion is slight.

This mapping unit is poor for grazing and woodland. Large areas are idle because they are not readily accessible. Wildlife group 2; capability subclass VIIs. Bald soil in woodland suitability group 4f5; Bodell soil not assigned.

20—Rock outcrop-Rubble land complex. This mapping unit is about 65 to 75 percent Rock outcrop and 20 to 30 percent Rubble land. It is on uplands. A representative mapping unit is in the SE¼SE¼SW¼ sec. 30, T. 3 N., R 11 E.

Except in the small areas of included soils, there is little or no vegetation. Elevation is 100 to 4,500 feet. Average annual precipitation is 22 to 80 inches, and the average annual air temperature is 40° to 51°. The frost-free period is 30 to 180 days.

This unit is limited by steep and very steep slopes, some of which are severely eroded. The Rock outcrop part of the unit occurs as basalt cliffs that have extremely stony and rocky foot slopes. The almost perpendicular cliffs are as much as 500 feet high. The slope range is 30 to 100 percent.

Included in mapping were small areas of Wyeth, Bindle, and Yallani soils that make up as much as 15 percent of the acreage.

This mapping unit is used mainly for wildlife habitat and water supply. Wildlife group 2; capability subclass VIIIs.

Rockford Series

The Rockford series consists of well drained soils on uplands. These soils formed in very stony, medium textured and moderately fine textured glacial outwash from basalt and andesite. Slopes are 0 to 30 percent. Elevation is 100 to 2,000 feet. The vegetation is Douglas-fir, ponderosa pine, Oregon white oak, forbs, and shrubs. The dominant understory plants are blue wildrye, strawberry, Himalaya blackberry, tall oregongrape, cascara, Pacific serviceberry, and western hazel. Average annual precipitation is 30 to 45 inches, the average annual air temperature is 45° to 51° F., and the frost-free period is 120 to 180 days.

In a representative profile (fig. 5) the upper 7 inches of the surface layer is dark brown stony loam. The lower 5 inches is dark reddish brown cobbly loam. The subsoil is dark reddish brown very cobbly loam about 12 inches thick. The substratum is dark brown very cobbly loam about 36 inches thick. The soil is medium acid.

Permeability is moderately slow. Available water capacity is 4 to 7 inches. Water-supplying capacity is 10 to 14 inches. Effective rooting depth is 40 to 60 inches or more.

Rockford soils are used for pasture, hay, fruit orchards, woodland, wildlife habitat, and water supply.

Representative profile of Rockford stony loam, 0 to 8 percent slopes, ½ mile west of Rockford in a field northwest of junction of the Country Club Road and Barrett Road in SE¼SW¼SE¼ sec. 4, T. 2 N., R. 10 E.

Ap—0 to 7 inches; dark brown (7.5YR 3/2) stony loam, brown (10YR 5/3) dry; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; few very fine irregular pores; 10 percent stones, 10 percent cobbles, 5 percent pebbles; medium acid; clear wavy boundary.

A3—7 to 12 inches; dark reddish brown (5YR 3/3) cobbly

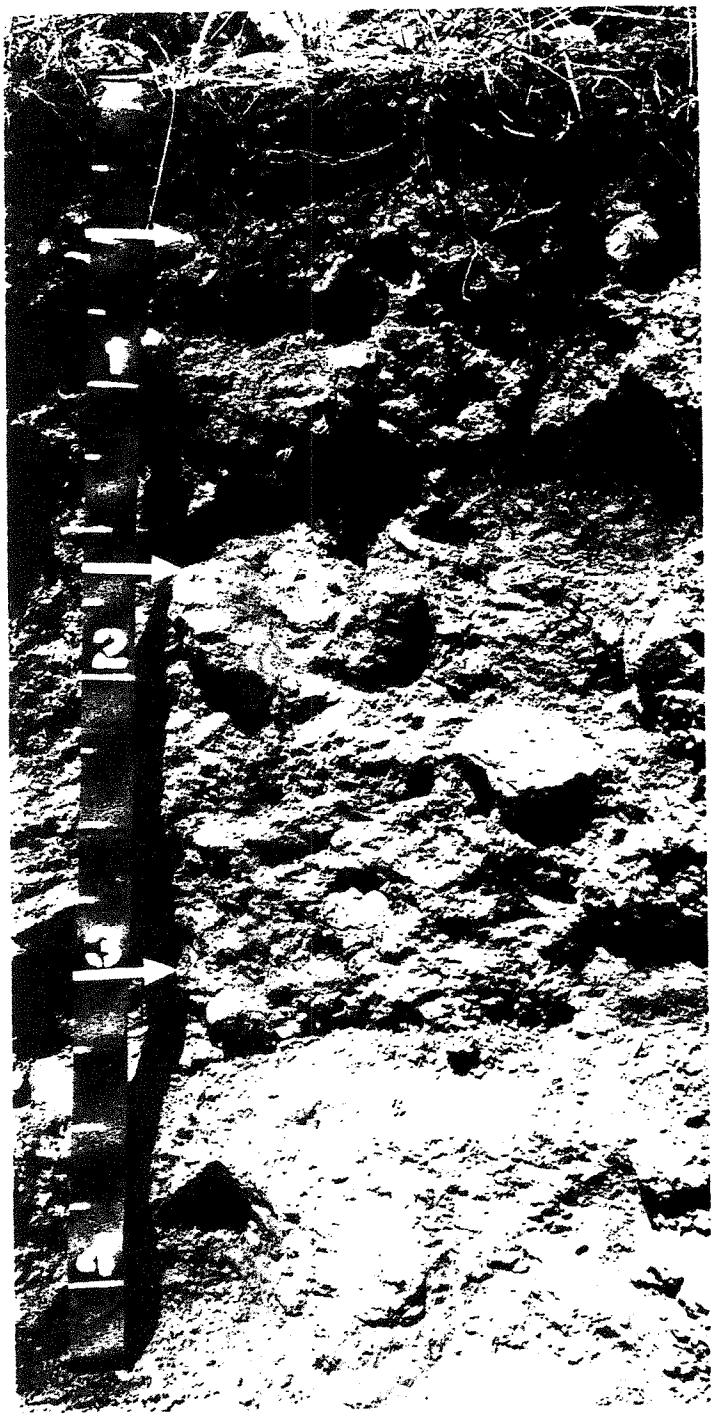


Figure 5.—**Profile of Rockford stony loam, 0 to 8 percent slopes.**

slopes. This nearly level to moderately steep soil occurs as narrow, irregularly shaped areas. It has a profile similar to the one described as representative of the series but the surface layer is very stony. A representative mapping unit is in the SE¼SW¼SE¼ sec. 27, T. 2 N., R. 10 E. Included in mapping were areas of Rockford stony loam and areas of Oak Grove, Wind River, and Van Horn soils, all of which make up about 10 percent of the mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability subclass VIIs; woodland suitability group 3x1; wildlife group 1.

Rubble Land

Rubble land is 90 percent or more stones, boulders, and talus. Practically no soil material is exposed. This land is so intermingled with basalt cliffs of Rock outcrop and with other soils that it is impractical to map it separately.

Rubble land is used for wildlife habitat.

Van Horn Series

The Van Horn series consists of well drained soils on uplands. These soils formed in stratified alluvial deposits. Slopes are 0 to 12 percent. Elevation is 100 to 850 feet. The vegetation is Douglas-fir, ponderosa pine, forbs, and shrubs. The dominant understory plants are blue wildrye, strawberry, Himalaya blackberry, tall oregongrape, cascara, and Pacific serviceberry. Average annual precipitation is 25 to 35 inches, the average annual air temperature is 49° to 52° F., and the frost-free period is 150 to 180 days.

In a representative profile the surface layer is very dark grayish brown and dark brown fine sandy loam about 14 inches thick. The subsoil is brown and dark yellowish brown fine sandy loam and sandy clay loam about 47 inches thick. The substratum is dark brown sandy loam 11 or more inches thick. The depth to coarse textured glacial outwash or bedrock is more than 60 inches. The soil is slightly acid.

Permeability is moderate. Available water capacity is 8 to 10 inches. Water-supplying capacity is 12 to 15 inches. Effective rooting depth is more than 60 inches.

Van Horn soils are used for fruit orchards, hay, pasture, wildlife habitat, and water supply.

Representative profile of Van Horn fine sandy loam, 0 to 8 percent slopes, 1,240 feet east of southwest section corner, 100 feet north and 150 feet west of a water box in NE¼SW¼SW¼ sec. 1, T. 2 N., R. 10 E.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; slightly acid; clear smooth boundary.

A3—7 to 14 inches; dark brown (10YR 3/3) fine sandy loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine tubular pores; slightly acid; gradual smooth boundary.

B1—14 to 22 inches; brown (10YR 4/3) fine sandy loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine tubular pores; slightly acid; gradual smooth boundary.

B21t—22 to 35 inches; dark yellowish brown (10YR 4/4) sandy clay loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; few thin clay films on peds and common moderately thick clay films in pores; slightly acid; gradual smooth boundary.

B22t—35 to 61 inches; dark yellowish brown (10YR 4/4) sandy clay loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; hard,

friable, sticky and slightly plastic; many very fine roots; many very fine tubular pores; few thin clay films on peds and common thick clay films in pores; few black stains on peds; thin gray coatings of sand grains on peds and in pores; slightly acid; gradual smooth boundary.

C—61 to 72 inches; dark brown (10YR 4/3) sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; slightly acid.

The A horizon is grayish brown or brown when dry and very dark grayish brown or dark brown when moist. It is very fine sandy loam, fine sandy loam, or loam. The B2t horizon is light brownish gray, pale brown, brown, or yellowish brown when dry and dark brown, dark yellowish brown, or dark grayish brown when moist. It is sandy clay loam, or clay loam that is 22 to 35 percent clay.

23B—Van Horn fine sandy loam, 0 to 8 percent slopes. This gently sloping soil occurs as broad, irregularly shaped areas. It has the profile described as representative of the series. A representative mapping unit is in the NE¼SW¼SW¼ sec. 1, T. 2 N., R. 10 E. Included in mapping were areas of Hood, Rockford, and Wind River soils that make up about 10 percent of the mapping unit.

Runoff is slow, and the hazard of erosion is slight. Capability unit IIe–1; wildlife group 1.

23C—Van Horn fine sandy loam, 8 to 12 percent slopes. This moderately sloping soil occurs as broad, irregularly shaped areas. It has a profile similar to the one described as representative of the series. A representative mapping unit is in the SW¼SE¼SW¼ sec. 1, T. 2 N., R. 10 E. Included in mapping were areas where slopes are 12 to 20 percent and areas of Hood, Rockford, and Wind River soils, all of which make up about 20 percent of the mapping unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe–1; wildlife group 1.

Van Horn Variant

The Van Horn variant consists of somewhat poorly drained soils on uplands. These soils formed in alluvial deposits. Slopes are 0 to 8 percent. Elevation is 100 to 850 feet. The vegetation is Douglas-fir, ponderosa pine, forbs, and shrubs. Average annual precipitation is 30 to 35 inches, the average annual air temperature is 49° to 52° F., and the frost-free period is 150 to 180 days.

In a representative profile the surface layer is very dark grayish brown loam about 15 inches thick. The subsoil is dark brown and dark grayish brown gravelly loam about 28 inches thick. The substratum is dark grayish brown very cobbly loam about 17 or more inches thick. Depth to very cobbly material is 40 to 60 inches or more. The soil is medium acid in the surface layer and slightly acid in the subsoil and substratum.

Permeability is moderate. Available water capacity is 6 to 9 inches. Effective rooting depth is 40 to 60 inches or more. The water table is at a depth of 3 to 4 feet.

The Van Horn variant is used for fruit orchards, hay, pasture, wildlife habitat, and water supply.

Representative profile of Van Horn variant loam, 0 to 8 percent slopes, in SE¼NE¼SW¼ sec. 3, T. 2 N., R. 10 E.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; weak fine to medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 10 percent pebbles; medium acid; clear smooth boundary.

A3—6 to 15 inches; very dark grayish brown (10YR 3/2) loam, grayish brown (10YR 5/2) dry; few fine yellowish red (5YR 4/6) moist mottles; moderate medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 15 percent pebbles; slightly acid; gradual smooth boundary.

B21—15 to 28 inches; dark brown (10YR 4/3) gravelly loam, light brownish gray (10YR 6/2) dry; common fine yellowish red (5YR 4/6) and dark grayish brown (10YR 4/2) moist mottles; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 25 percent pebbles; few black manganese and iron concretions and stains; slightly acid; gradual smooth boundary.

B22—28 to 43 inches; dark grayish brown (10YR 4/2) gravelly loam, light brownish gray (10YR 6/2) dry; many medium dark brown (7.5 4/4) moist mottles; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; 20 percent pebbles and 10 percent cobbles; slightly acid; gradual smooth boundary.

C—43 to 60 inches; dark grayish brown (10YR 4/2) very cobbly loam, light brownish gray (10YR 6/2) dry; many medium dark brown (7.5YR 4/4) moist mottles; massive; common very fine roots; common very fine tubular pores; 10 percent gravel, 50 percent cobbles, 5 percent stones; slightly acid.

The A horizon is grayish brown or brown when dry and very dark grayish brown or dark brown when moist. The B horizon is light brownish gray or pale brown when dry. The C horizon is light brownish gray or pale brown when dry and dark grayish brown or brown when moist. It is very cobbly loam to very cobbly sandy clay loam that is 50 to 60 percent cobbles, 2 to 15 percent stones, and 5 to 15 percent pebbles.

24B—Van Horn variant loam, 0 to 8 percent slopes. This soil occurs as narrow, irregularly shaped areas. It has the profile described as representative of the variant. A representative mapping unit is in the SE¼NE¼SW¼ sec. 3, T. 2 N., R. 10 E. Included in mapping were areas of Rockford and Wind River soils that make up about 5 percent of the mapping unit.

Runoff is slow, and the hazard of erosion is slight. Capability unit IIw–1; wildlife group 1.

Wamic Variant

The Wamic variant consists of well drained soils on uplands. These soils formed in mixed loess and volcanic ash deposited on moderately fine textured colluvium. Slopes are 5 to 40 percent. Elevation is 1,000 to 2,000 feet. The vegetation is ponderosa pine, Douglas-fir, Oregon white oak, shrubs, and forbs. The dominant understory plants are Idaho fescue, elk sedge, arrowleaf balsamroot, and antelope bitterbrush. Average annual precipitation is 25 to 35 inches, the average annual air temperature is 46° to 51° F., and the frost-free period is 100 to 140 days.

In a representative profile the surface layer is dark brown loam about 10 inches thick. The subsoil is dark brown loam and clay loam about 19 inches thick. The substratum is dark brown clay loam 16 or more inches thick. Basalt is at a depth of 45 inches. The soil is neutral.

Permeability is moderately slow. Available water

dark brown, or dark brown when moist. They are mostly gravelly sandy loam that is 15 to 30 percent gravel 2 millimeters to 5 millimeters in size. The C1 horizon is brown, grayish brown, or dark grayish brown when dry and very dark grayish brown, very dark brown, or dark brown when moist. It is gravelly sandy loam or gravelly fine sandy loam that is 20 to 40 percent gravel 2 millimeters to 5 millimeters in size. The IIC2 horizon is grayish brown, yellowish brown, or brown when dry and dark yellowish brown, dark brown, or very dark grayish brown when moist. It is very gravelly loamy sand to very gravelly sand that is 55 to 80 percent gravel 2 millimeters to 5 millimeters in size.

27B—Wind River variant gravelly sandy loam, 0 to 8 percent slopes. This soil occurs as irregularly shaped areas on ridgetops. It has the profile described as representative of the variant. A representative mapping unit is in the SW¼SW¼SW¼ sec. 35, T. 1 N., R.10 E. Included in mapping were areas of Rockford, Van Horn, and Wind River soils that make up about 10 percent of the mapping unit.

Runoff is slow, and the hazard of erosion is slight. Capability unit IIIs–1; wildlife group 1.

27E—Wind River variant gravelly sandy loam, 8 to 30 percent slopes. This soil occurs as irregularly shaped areas. It has a profile similar to the one described as representative of the series. A representative mapping unit is in the NE¼NW¼NW¼ sec. 2, T. 2 N., R. 10 E. Included in mapping were areas of Rockford, Van Horn, and Wind River soils that make up 10 percent of the mapping unit.

Runoff is medium to rapid, and the hazard of erosion is moderate to high. Capability unit IVe–3; wildlife group 1.

Wyeast Series

The Wyeast series consists of somewhat poorly drained soils on uplands. These soils formed in deep silty lacustrine deposits. Slopes are 0 to 12 percent. Elevation is 500 to 800 feet. The vegetation is Douglas-fir, willow, alders, forbs, and shrubs. Average annual precipitation is 30 to 35 inches, the average annual air temperature is 49° to 51° F., and the frost-free period is 150 to 180 days.

In a representative profile the upper 5 inches of the surface layer is very dark grayish brown silt loam. The lower 4 inches is dark brown silt loam. The upper 19 inches of the subsoil is dark brown silt loam. The lower 11 inches is dark brown heavy silt loam. The substratum is dark brown silt loam about 13 inches thick. Depth to the fragipan is 20 to 36 inches, and depth to bedrock or coarse textured glacial outwash is more than 60 inches. The soil is mostly slightly acid. The lower part of the subsoil is medium acid.

Permeability is moderate to the fragipan and slow in the fragipan. Available water capacity is 8 to 11 inches. Effective rooting depth is 28 to 45 inches. The water table is at a depth of 1 to 2 feet.

Wyeast soils are used for fruit orchards, hay, pasture (fig. 7), and wildlife habitat.

Representative profile of Wyeast silt loam, 0 to 8 percent slopes, in NE¼NE¼NW¼ sec. 22, T. 2 N., R. 10 E.

Ap1—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; moderate fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine irregular pores; few 1 to 2 millimeter concretions; slightly acid; abrupt smooth boundary.

Ap2—5 to 9 inches; dark brown (10YR 3/3) silt loam, light brownish gray (10YR 6/2) dry; moderate very fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine and fine tubular pores; few 1 to 2 millimeter concretions; slightly acid; abrupt wavy boundary.

B21—9 to 16 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; common, dark grayish brown (10YR 4/2) mottles; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; few 1 to 2 millimeter concretions; slightly acid; clear smooth boundary.

B22—16 to 28 inches; dark brown (10YR 4/3) silt loam, light gray (10YR 7/2) dry; thin grayish brown (10YR 5/2) coatings on peds; many fine strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; hard, firm, slightly brittle, slightly sticky and slightly plastic; common fine roots; many very fine and few fine tubular pores; common black stains; slightly acid; abrupt smooth boundary.

IIBx—28 to 39 inches; dark brown (10YR 4/3) heavy silt loam, light yellowish brown (10YR 6/4) dry; light brownish gray (10YR 6/2) coatings on peds; many fine dark brown (7.5YR 4/4) mottles; moderate medium subangular blocky structure; hard, very firm, brittle, slightly sticky and slightly plastic; many very fine and fine tubular pores; thick clay films in pores; many black stains; medium acid; abrupt smooth boundary.

IICx—39 to 52 inches; dark brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; light brownish gray (10YR 6/2) coatings on peds; weak very coarse prismatic structure; hard, firm, brittle, slightly sticky and slightly plastic; many very fine and fine tubular pores; thick clay films in pores; few manganese stains; slightly acid.

The A horizon is grayish brown, brown, or pale brown when dry and very dark grayish brown or dark brown when moist. It has weak fine granular, weak coarse prismatic, or weak medium subangular blocky structure. The B horizon is pale brown, light gray, or light yellowish brown when dry and brown, dark brown, or grayish brown when moist. It is silt loam or heavy silt loam. The structure is coarse prismatic or moderate thick platy.

28B—Wyeast silt loam, 0 to 8 percent slopes. This soil occurs as broad, irregular concave areas. It has the profile described as representative of the series. A representative mapping unit is in the NE¼NE¼NW¼ sec. 22, T. 2 N., R. 10 E. Included in mapping were small areas of Hood soils.

Runoff is slow, and the hazard of erosion is slight. Capability unit IIw–1; wildlife group 1.

28C—Wyeast silt loam, 8 to 12 percent slopes. This moderately sloping soil occurs as broad, irregularly shaped areas. It has a profile similar to the one described as representative of the series. A representative mapping unit is in the NE¼SW¼NE¼ sec 22, T. 2 N., R. 10 E. Included in mapping were areas of Hood soils.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIw–1; wildlife group 1.

Wyeth Series

The Wyeth series consists of well drained soils on uplands. These soils formed in loess, volcanic ash, and colluvium weathered from basalt. Slopes are 5 to 75 percent. Elevation is 200 to 2,500 feet. The vegetation

TABLE 9.—*Engineering properties and classifications*—Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments >3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				*Pct*					*Pct*	
Wind River variant: 27B, 27E	0–28	Gravelly sandy loam	SM	A–2	0	75–90	55–75	30–50	15–30		NP
	28–60	Very gravelly sand	SP	A–1	0	70–80	20–40	10–30	0–5		NP
Wyeast: 28B, 28C	0–28	Silt loam	ML	A–4	0	100	100	90–100	75–85		NP
	28–78	Silt loam	ML	A–4	0	100	100	95–100	85–95		NP
Wyeth: 29E, 29F	0–22	Very gravelly loam	GM	A–1, A–2	15–25	30–55	25–55	20–50	15–35	25–30	NP–5
	22–62	Very cobbly loam, very gravelly loam.	GM	A–1, A–2, A–4	25–65	25–70	20–65	15–60	15–45	25–30	NP–5
Xerofluvents: [2]30A	0–60	Variable.									
Xerumbrepts: [2]31F	0–30	Variable.									
	30	Weathered bedrock.									
Yallani: 32E, 32F	0–13	Stony loam	GM	A–2, A–4	15–30	55–70	50–65	40–60	30–50		NP
	13–60	Very cobbly loam, very gravelly loam.	GM	A–2, A–4	45–65	55–60	40–55	40–50	25–40		NP

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

[2] Properties too variable to estimate. Onsite investigation required.

Soil name and map symbols	Depth	Soil description	Unified	AASHO	Percentage passing sieve number 4	Percentage passing sieve number 10	Percentage passing sieve number 40	Percentage passing sieve number 200	Liquid limit	Plasticity index
Hood: 12A, 12B, 12C, 12D, 12E	0–6	Loam	ML	A–4	0	100	100	90–95	70–75		NP
	6–98	Loam, silt loam	ML, CL-ML	A–4	0	100	100	95–100	70–95	25–30	NP–10
Hutson: 13E, 13F	0–29	Fine sandy loam	SM, ML	A–4	0	100	100	70–85	40–55		NP
	29–45	Fine sandy loam, loam	SM, ML	A–2, A–4	0–15	70–95	65–95	45–90	25–70		NP
	45–62	Loam, gravelly loam	SM, ML	A–4	5–30	75–95	70–95	60–90	40–70		NP
Ketchly: 14E, 14F	0–12	Loam	ML, SM	A–4	0	75–95	70–95	60–90	40–70		NP
	12–45	Clay loam, loam	CL, GC	A–6	0	60–95	55–95	50–95	40–75	30–35	10–15
	45–48	Stony clay loam, very cobbly clay loam.	CL	A–6	30–50	90–95	85–90	75–90	60–70	30–35	10–15
Lava flows: 15.											
Oak Grove: 16B, 16C, 16D, 16E, 16F	0–34	Loam	ML	A–4	0	100	95–100	85–95	60–75	30–35	5–10
	34–78	Clay	CL	A–6, A–7	0	100	100	90–95	75–85	40–50	20–25
Parkdale: 17B, 17C, 17D, 17E	0–10	Loam	ML	A–5	0	95–100	95–100	85–90	55–60	40–45	NP
	10–75	Loam, silt loam	ML	A–4, A–5	0	95–100	95–100	85–95	50–65	35–50	NP–5
Riverwash: [2] 18.											
Rock outcrop: [1] 19E: Rock outcrop part.											
Bodell part	0–3	Cobbly loam	GM, ML	A–2, A–4	30–45	55–85	45–80	40–75	25–60	25–30	NP–5
	3–17	Very cobbly loam, very cobbly clay loam.	GM	A–4	45–70	55–65	50–60	45–55	35–50	25–35	NP–10
	17	Unweathered bedrock.									
Bald part	0–6	Very cobbly loam	GM, ML	A–2, A–4	50–60	50–90	40–85	35–80	25–65		NP
	6–36	Very cobbly loam, very gravelly loam.	GM	A–2, A–4	30–60	50–60	40–50	35–50	25–40	30–35	5–10
	36	Unweathered bedrock.									
[1] 20: Rock outcrop part. Rubble land part.											
Rockford: 21B, 21C	0–12	Stony loam	ML	A–4	15–40	85–95	80–90	70–85	50–70	25–30	NP–5
	12–60	Very cobbly loam	GM	A–2, A–4	45–65	55–60	45–55	40–50	25–40	30–35	5–10
22E	0–12	Very stony loam	SM, GM, ML	A–4	30–45	65–85	55–80	45–75	35–60	25–30	NP–5
	12–60	Very cobbly loam	GM	A–2, A–4	45–65	55–60	45–55	40–50	25–40	30–35	5–10
Van Horn: 23B, 23C	0–22	Fine sandy loam	ML, SM	A–4	0	100	100	80–90	40–60	20–25	NP–5
	22–61	Sandy clay loam, clay loam	CL, SC	A–6	0	100	100	80–90	35–55	30–40	10–15
	61–72	Sandy loam, loam	SM	A–2, A–4	0	100	100	60–70	30–40		NP
Van Horn variant: 24B	0–15	Loam	SM, ML	A–4	0	75–95	70–95	60–90	40–70	25–30	NP–5
	15–43	Gravelly loam	GM, SM	A–4	0–15	65–75	60–70	50–65	35–50	30–35	5–10
	43–60	Very cobbly loam	GM	A–2, A–4	45–65	55–60	45–55	40–50	25–40	25–30	NP–5
Wamic variant: 25C, 25D, 25E	0–10	Loam	ML	A–4	0	95–100	95–100	85–95	55–75	20–25	NP–5
	10–45	Loam, clay loam	ML	A–4, A–6	0	95–100	95–100	85–95	60–80	30–40	5–15
	45	Unweathered bedrock.									
Wind River: 26B, 26C	0–39	Fine sandy loam	SM	A–2, A–4	0	100	100	90–100	25–40		NP
	39–60	Loamy fine sand, sand	SM	A–2	0	100	100	90–100	10–35		NP

TABLE 10.—*Physical and chemical properties of soils*

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors	
							Uncoated steel	Concrete	K	T
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm*					
Bald: 1E, 2F	0–6	0.6–2.0	0.11–0.15	6.1–7.3		Low	Low	Low	0.24	2
	6–36	0.6–2.0	0.06–0.11	6.1–7.3		Low	Low	Low	0.24	
	36									
Bins: [1] 3E, [1] 3F:										
Bins part	0–19	0.6–2.0	0.14–0.17	5.6–6.5		Low	Low	Low	0.28	3
	19–45	0.2–0.6	0.18–0.21	5.1–5.5		Low	Moderate	Moderate	0.24	
	45									
Bindle part	0–13	0.6–2.0	0.10–0.14	6.1–7.3		Low	Low	Low	0.20	3
	13–22	0.6–2.0	0.06–0.11	6.1–6.5		Low	Low	Low	0.15	
	22									
Bodell: 4E, 5F	0–3	0.6–2.0	0.06–0.14	6.6–7.3		Low	Low	Low	0.17	1
	3–17	0.6–2.0	0.06–0.11	6.6–7.3		Low	Moderate	Low	0.17	
	17									
Culbertson:										
6B, 6C, 6D, 6E, 6F	0–22	0.6–2.0	0.14–0.17	5.6–6.5		Low	Moderate	Moderate	0.24	5
	22–60	0.2–0.6	0.18–0.21	5.6–6.5		Low	Moderate	Moderate	0.37	
Cumulic Haplaquolls:										
[2] 7A	0–60									
Cumulic Haploxerolls:										
[2] 8A	0–60									
Dee: 9B, 9C	0–8	0.6–2.0	0.25–0.28	6.1–6.5		Low	High	Low	0.49	5
	8–45	0.6–2.0	0.25–0.28	5.6–6.5		Low	High	Moderate	0.49	
	45–72	2.0–6.0	0.25–0.28	5.6–6.0		Low	High	Moderate	0.37	
Divers: 10E, 10F	0–46	2.0–6.0	0.12–0.20	5.1–6.5		Low	Moderate	Moderate	0.10	3
	46–60	>6.0	0.04–0.08	5.1–6.5		Low	Moderate	Moderate	0.10	
Frailey: 11F	0–60	0.6–2.0	0.13–0.17	6.1–6.5		Low	Low	Low	0.32	5
Hood: 12A, 12B, 12C, 12D, 12E	0–6	0.6–2.0	0.19–0.21	5.6–6.5		Low	Low	Low	0.43	5
	6–98	0.6–2.0	0.19–0.21	5.6–6.5		Low	Low	Low	0.55	
Hutson: 13E, 13F	0–29	2.0–6.0	0.20–0.25	6.1–6.5	<2	Low	Moderate	Low	0.20	5
	29–45	2.0–6.0	0.20–0.25	6.1–6.5	<2	Low	Moderate	Low	0.20	
	45–62	2.0–6.0	0.12–0.20	5.6–6.5	<2	Low	Moderate	Low	0.37	
Ketchly: 14E, 14F	0–12	0.6–2.0	0.14–0.17	6.6–7.3	<2	Low	Low	Low	0.32	4
	12–45	0.2–0.6	0.14–0.20	6.1–6.5	<2	Low	Moderate	Low	0.32	
	45–48	0.2–0.6	0.11–0.14	6.1–6.5	<2	Low	Moderate	Low	0.24	
Lava flows: 15.										
Oak Grove:										
16B, 16C, 16D, 16E, 16F.	0–34	0.6–2.0	0.16–0.18	5.1–6.0	<2	Low	Moderate	Moderate	0.32	5
	34–78	0.2–0.6	0.14–0.16	5.6–6.0	<2	High	High	Moderate	0.28	
Parkdale:	0–10	0.6–2.0	0.25–0.28	6.1–7.3	<2	Low	High	Low	0.43	5
17B, 17C, 17D, 17E.	10–75	0.6–2.0	0.25–0.28	6.1–7.3	<2	Low	High	Low	0.55	
Riverwash: [2] 18.										
Rock outcrop:										
[1] 19E:										
Rock outcrop part.										

TABLE 10.—*Physical and chemical properties of soils*—Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors	
							Uncoated steel	Concrete	K	T
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm*					
Bodell part	0–3	0.6–2.0	0.06–0.14	6.6–7.3	<2	Low	Low	Low	0.17	1
	3–17	0.6–2.0	0.06–0.11	6.6–7.3	<2	Low	Moderate	Low	0.17	
	17									
Bald part	0–6	0.6–2.0	0.06–0.11	6.1–7.3	<2	Low	Low	Low	0.24	2
	6–36	0.6–2.0	0.06–0.11	6.1–7.3	<2	Low	Low	Low	0.24	
	36									
[1] 20: Rock outcrop part.										
Rubble land part.										
Rockford: 21B, 21C	0–12	0.6–2.0	0.11–0.15	5.6–6.5	<2	Low	Moderate	Moderate	0.17	4
	12–60	0.2–0.6	0.06–0.11	5.6–6.5	<2	Low	Moderate	Moderate	0.15	
22E	0–12	0.6–2.0	0.06–0.11	5.6–6.5	<2	Low	Moderate	Moderate	0.10	4
	12–60	0.2–0.6	0.06–0.11	5.6–6.5	<2	Low	Moderate	Moderate	0.15	
Van Horn: 23B, 23C	0–22	2.0–6.0	0.14–0.16	6.1–6.5	<2	Low	Low	Low	0.24	5
	22–61	0.6–2.0	0.14–0.18	6.1–6.5	<2	Moderate	Moderate	Low	0.20	
	61–72	6.0–20	0.11–0.16	6.1–6.5	<2	Low	Low	Low	0.20	
Van Horn variant: 24B.	0–15	0.6–2.0	0.16–0.18	5.6–6.5	<2	Low	High	Moderate	0.32	3
	15–43	0.6–2.0	0.08–0.15	5.6–6.5	<2	Low	High	Moderate	0.28	
	43–60	0.6–2.0	0.06–0.11	5.6–6.5	<2	Low	High	Moderate	0.28	
Wamic variant: 25C, 25D, 25E.	0–10	0.6–2.0	0.19–0.22	6.6–7.3	<2	Low	Moderate	Low	0.43	
	10–45	0.2–0.6	0.13–0.15	6.6–7.3	<2	Low	Moderate	Low	0.37	
	45									
Wind River: 26B, 26C	0–39	2.0–6.0	0.13–0.15	6.1–7.3	<2	Low	Low	Low	0.15	5
	39–60	2.0–6.0	0.09–0.10	6.1–7.3	<2	Low	Low	Low	0.10	
Wind River variant: 27B, 27E	0–28	2.0–6.0	0.08–0.11	6.1–7.3		Low	Low	Low	0.10	5
	28–60	6.0–20	0.03–0.05	6.1–7.3		Low	Low	Low	0.10	
Wyeast: 28B, 28C	0–28	0.6–2.0	0.19–0.21	5.6–6.5		Low	High	Moderate	0.49	5
	28–52	0.06–0.2	0.10–0.16	6.1–7.3		Low	High	Low	0.55	
Wyeth: 29E, 29F	0–22	0.6–2.0	0.06–0.15	6.1–7.3		Low	Low	Low	0.20	5
	22–62	0.6–2.0	0.06–0.11	6.1–6.5		Low	Low	Low	0.20	
Xerofluvents: [2] 30A	0–60									
Xerumbrepts: [2] 31F	0–30									
	30									
Yallani: 32E, 32F	0–13	2.0–6.0	0.08–0.15	5.6–6.5		Low	Moderate	Moderate	0.24	5
	13–60	2.0–6.0	0.06–0.11	5.6–6.5		Low	Moderate	Moderate	0.24	

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

[2] Properties too variable to estimate. Onsite investigation required.

Exhibit 6
Wasco County Soil Types
Oregon

SOIL SURVEY OF

Wasco County, Oregon Northern Part

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
In cooperation with
Oregon Agricultural Experiment Station

C2—17 to 30 inches; dark grayish brown (10YR 4/2) fine sandy loam, gray (10YR 6/1) dry; many prominent reddish brown (5YR 4/4) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine tubular pores; 2 percent gravel; neutral; clear wavy boundary.

C3—30 to 41 inches; dark gray (10YR 4/1) sandy loam, gray (10YR 6/1) dry; common medium prominent reddish brown (5YR 4/4) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine tubular pores; 2 percent gravel; few black (10YR 2/1) manganese stains; neutral; clear wavy boundary.

C4—41 to 46 inches; gray and dark gray (10YR 5/1-4/1) loamy sand, light gray (10YR 7/1) dry; common large prominent reddish brown (5YR 4/4) mottles; single grained; loose, nonsticky and nonplastic; few very fine roots; common very fine tubular pores; 5 percent gravel; neutral; clear wavy boundary.

IIC5—46 to 60 inches; gray to dark gray (10YR 5/1-4/1) very gravelly sand, light gray (10YR 7/1) dry; common large prominent reddish brown (5YR 4/4) mottles; single grained; loose, nonsticky and nonplastic; few very fine roots; few very fine irregular pores; 75 percent pebbles and 5 percent cobbles; neutral.

The A horizon is fine sandy loam or very fine sandy loam. It has weak fine granular structure or is single grained. The C horizon is fine sandy loam, silt loam, or loam and has thin lenses that range from silt to medium gravel. Common to many, fine to medium, dark brown or reddish brown when moist mottles are below a depth of about 10 inches. They increase in size and number with depth.

44—Tygh fine sandy loam. A representative mapping unit is in the NE¼NW¼SW¼ section 33, T. 1 S., R. 13 E. This soil is adjacent to streams in long strips that are about 100 to 150 feet wide. Slopes are 0 to 3 percent.

Included with this soil in mapping were areas of Endersby, Hermiston, and Pedigo soils and cobbly soils. These soils make up about 10 percent of the unit.

Runoff is slow, and the hazard of erosion is slight. The hazard of streambank erosion is severe (fig. 6). Capability unit IIIw-1; Semi-Moist Bottom range site.

Van Horn Series

The Van Horn series consists of well drained soils formed in stratified old alluvial deposits on uplands. Slopes are 0 to 35 percent. Elevation is 100 to 850 feet. In uncultivated areas, the vegetation is Douglas-fir, ponderosa pine, forbs, and shrubs. The average annual precipitation is 20 to 25 inches, the average annual air temperature is 49° to 52° F, and the frost-free period is 150 to 180 days at 32° and 180 to 210 days at 28°.

In a representative profile the surface layer is very dark grayish brown and dark brown loam about 11 inches thick. The subsoil is dark brown loam and clay loam about 38 inches thick. The substratum is dark brown loam 11 inches or more thick. The soil material in the profile is slightly acid or neutral.

Permeability is moderate, and the available water capacity is 8 to 9 inches. Water-supplying capacity is 12 to 15 inches. Effective rooting depth is more than 60 inches.

These soils are used mostly for fruit orchards, hay, pasture, and wildlife habitat and for some range.

Representative profile of Van Horn loam, 8 to 12 percent slopes, in the NE¼SW¼NW¼ section 18, T. 2N., R. 11 E.:

A1p—0 to 5 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; weak medium granular structure; slightly hard, very friable, slightly sticky

Figure 6.—Streambank erosion on Tygh fine sandy loam.

and slightly plastic; many very fine roots; many very fine irregular pores; slightly acid; abrupt smooth boundary.

A12—5 to 11 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; common very fine tubular pores; slightly acid; clear smooth boundary.

B1—11 to 21 inches; dark brown (10YR 3/3) loam, grayish brown (10YR 5/3) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; slightly acid; clear smooth boundary.

B21t—21 to 33 inches; dark brown (10YR 3/3) heavy loam, brown (10YR 6/3) dry; moderate medium subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; few thin clay films on ped faces and common moderately thick clay films in pores; many gray (10YR 7/2) sand coatings on peds; slightly acid; gradual smooth boundary.

B22t—33 to 49 inches; dark brown (10YR 3/3) clay loam, pale brown (10YR 6/3) dry; moderate medium subangular blocky structure; very hard, firm, sticky and slightly plastic; few very fine roots; many very fine tubular pores; few thin clay films on ped faces and common thin clay films in pores; many gray (10YR 7/2) sand coatings on peds; neutral; gradual smooth boundary.

C—49 to 60 inches; dark brown (10YR 4/3) loam, pale brown (10YR 6/3) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral.

The A horizon is grayish brown or brown when dry and very dark grayish brown or dark brown when moist. It is very fine sandy loam, fine sandy loam, or loam. The B2 horizon is light brownish gray, pale brown, brown, or yellowish brown when dry and dark brown, dark yellowish brown, or dark grayish brown when moist. It is clay loam, sandy clay loam, or heavy loam and is 22 to 35 percent clay.

45B—Van Horn loam, 0 to 8 percent slopes. A representative mapping unit is in the NW¼SE¼NW¼ section 7, T. 2 N., R. 12 E. This soil is in broad, irregularly shaped areas.

Included with this soil in mapping were areas of Chenoweth, Cherryhill, and Wind River soils. These soils make up about 10 percent of the unit.

Runoff is slow, and the hazard of erosion is slight. Capability unit IIe-1; Pine-Oak-Fescue range site.

45C—Van Horn loam, 8 to 12 percent slopes. A representative mapping unit is in the NE¼SW¼NW¼ section 18, T. 2 N., R. 11 E. This soil is in broad, irregularly shaped areas. It has the profile described as representative of the series.

Included with this soil in mapping were areas of Chenoweth, Cherryhill, and Wind River soils. These soils make up about 10 percent of the unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe-2; Pine-Oak-Fescue range site.

45D—Van Horn loam, 12 to 20 percent slopes. A representative mapping unit is in the NW¼NW¼ NW¼ section 7, T. 2 N., R. 12 E. This soil is in long, narrow, irregularly shaped areas.

Included with this soil in mapping were areas of Chenoweth, Cherryhill, and Wind River soils. These soils make up about 10 percent of the unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe-2; Pine-Oak-Fescue range site.

45E—Van Horn loam, 20 to 35 percent slopes. A representative mapping unit is in the SE¼SE¼SW¼ section 6, T. 2 N., R. 12 E. This soil is in narrow, irregularly shaped areas.

Included with this soil in mapping were areas of Chenoweth, Cherryhill, and Wind River soils. These soils make up about 10 percent of the unit.

Runoff is rapid, and the hazard of erosion is severe. Capability unit IVe-1; Pine-Oak-Fescue range site.

Walla Walla Series

The Walla Walla series consists of well drained soils formed in loess on uplands. Slopes are 3 to 50 percent. Elevation is 300 to 2,000 feet. In uncultivated areas, the vegetation is bunchgrasses, forbs, and shrubs. The average annual precipitation is 12 to 14 inches, the average annual air temperature is 49° to 52° F, and the frost-free period is 150 to 170 days at 32° and 170 to 210 days at 28°.

In a representative profile the surface layer is very dark brown silt loam about 13 inches thick. The subsoil is dark brown and brown silt loam about 18 inches thick. The substratum is dark yellowish brown silt loam to a depth of 82 inches or more. The surface layer is slightly acid and neutral, the subsoil is neutral, and the substratum is neutral and mildly alkaline.

Permeability is moderate, and the available water capacity is 7 to 12 inches. Water-supplying capacity is 8 to 12 inches. Effective rooting depth is 40 to 60 inches or more.

These soils are used for dryfarmed small grain, hay, pasture, range, and wildlife habitat.

Representative profile of Walla Walla silt loam, 12 to 20 percent north slopes, about 600 feet north of the line between sections 12 and 13 in the SE¼SW¼SW¼ section 12, T. 1 N., R. 14 E.:

Ap—0 to 7 inches; very dark brown (10YR 2/2) silt loam, dark grayish brown (10YR 4/2) dry; weak thin platy structure parting to weak fine granular; soft to slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; slightly acid; abrupt smooth boundary.

A12—7 to 13 inches; very dark brown (10YR 2/2) silt loam, grayish brown (10YR 5/2) dry; weak medium platy structure parting to weak fine granular; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral; abrupt smooth boundary.

B1—13 to 20 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak coarse prismatic structure parting to very weak medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine pores; neutral; clear smooth boundary.

B2—20 to 31 inches; brown (10YR 4/3) silt loam, brown (10YR 5/3) dry; weak coarse prismatic structure parting to very weak medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral; gradual smooth boundary.

C11—31 to 44 inches; dark yellowish brown (10YR 3/4) silt loam, pale brown (10YR 6/3) dry; massive;

very fine and common fine tubular pores; about 2 percent very fine pebbles; light gray (10YR 7/2) when dry coatings of very fine sand on peds; neutral; abrupt wavy boundary.

IIC—28 to 44 inches; dark brown (10YR 4/3) heavy loam, pale brown (10YR 4/3) dry; massive; very hard, firm, sticky and plastic; few fine roots; many very fine and common fine tubular pores; about 2 percent very fine pebbles; brown (7.5YR 4/4) when dry thick clay films in nearly all pores and on faces of fractures; neutral.

IIIR—44 inches; basalt bedrock.

The A horizon is light brownish gray or pale brown when dry and very dark grayish brown or dark brown when moist. It is loam, very fine sandy loam, or silt loam. It has weak granular or subangular blocky structure. The B horizon is light brownish gray, pale brown, or light yellowish brown when dry and dark brown, brown, or dark yellowish brown when moist. It is loam or silt loam, is 18 to 22 percent clay, and is more than 15 percent particles coarser textured than very fine sand. The substratum is pale brown or light yellowish brown when dry and brown or dark yellowish brown when moist. It is heavy loam, loam, or sandy clay loam and is 20 to 30 percent clay. The amount of ash in the soil ranges from 20 to 60 percent. Depth to bedrock is 40 to 60 inches or more.

49B—Wamic loam, 1 to 5 percent slopes. A representative mapping unit is in the SW¼SE¼SW¼ section 25, T. 1 N., R. 12 E. This soil is on ridgetops in broad, smooth, convex areas.

Included with this soil in mapping were areas of Bald, Bodell, Hesslan, Skyline, and Frailey soils. These soils make up about 5 percent of the unit.

Runoff is slow, and the hazard of erosion is slight. Capability unit IIIe-1; Pine-Oak-Fescue range site; woodland group 5o.

49C—Wamic loam, 5 to 12 percent north slopes. A representative mapping unit is in the SE¼NW¼ NW¼ section 35, T. 2 S., R. 12 E. This soil is on ridgetops in broad, smooth areas.

Included with this soil in mapping were areas of Bald, Bodell, Hesslan, Skyline, and Frailey soils. These soils make up about 10 percent of the unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe-4; Pine-Oak-Fescue range site; woodland group 5o.

50C—Wamic loam, 5 to 12 percent south slopes. A representative mapping unit is in the NE¼NW¼ NW¼ section 26, T. 2 S., R. 12 E. This soil is in long, irregularly shaped areas and has south-facing slopes. It has the profile described as representative of the series.

Included with this soil in mapping were areas of Bald, Bodell, Hesslan, Skyline, and Frailey soils. These soils make up about 10 percent of the unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe-5; Oak South Exposure range site.

50D—Wamic loam, 12 to 20 percent slopes. A representative mapping unit is in the SE¼SE¼SE¼ section 14, T. 2 S., R. 14 E. This soil is in irregularly shaped areas.

Included with this soil in mapping were areas of Bald, Bodell, Hesslan, Skyline, and Frailey soils. These soils make up about 10 percent of the unit.

Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe-4; Pine-Oak-Fescue range site; woodland group 5o.

50E—Wamic loam, 20 to 40 percent slopes. A representative mapping unit is in the NE¼NE¼NE¼ section 31, T. 2 S., R. 13 E. This soil is in long, broad areas and narrow, irregularly shaped areas.

Included with this soil in mapping were areas of Bald, Hesslan, Skyline, and Frailey soils. These soils make up about 10 percent of the unit.

Runoff is rapid, and the hazard of erosion is severe. Capability subclass VIe; Pine-Douglas Fir-Sedge range site; woodland group 5r.

50F—Wamic loam, 40 to 70 percent slopes. A representative mapping unit is in the NE¼SW¼SW¼ section 10, T. 2 N., R. 12 E. This soil is in long, narrow, irregularly shaped areas. It has a profile similar to the one described as representative of the series, but the surface layer is darker colored.

Included with this soil in mapping were areas of Bald, Hesslan, Frailey, and Skyline soils. These soils make up as much as 20 percent of the unit.

Runoff is rapid, and the hazard of erosion is severe. Capability subclass VIIe; Pine-Douglas Fir-Sedge range site; woodland group 5r.

51D—Wamic-Skyline complex, 2 to 20 percent slopes. A representative mapping unit is in the NW¼ NW¼NE¼ section 36, T. 2 S., R. 12 E. This complex is about 45 to 70 percent a Wamic loam and about 15 to 40 percent a Skyline very cobbly loam. The Wamic soil is on ridgetops or side slopes in circular or elongated mounds. The Skyline soil is in areas where the ridgetops break off into canyons.

Included with this complex in mapping were areas of very shallow, very stony, and deep stony soils. These soils make up about 20 percent of the unit.

Runoff is medium, and the hazard of erosion is moderate. This complex is used for range and wildlife habitat. Capability subclass VIe; Wamic soil in Oak South Exposure range site; Skyline soil in Oak Steep South range site.

Wapinitia Series

The Wapinitia series consists of well drained soils formed in loess and volcanic ash on uplands. Slopes are 0 to 35 percent. Elevation is 1,800 to 3,400 feet. In uncultivated areas, the vegetation is bunchgrasses, forbs, and shrubs. The average annual precipitation is 13 to 16 inches, the average annual air temperature is 48° to 50° F, and the frost-free period is 120 to 170 days at 32° and 170 to 200 days at 28°.

In a representative profile the surface layer is very dark brown silt loam about 6 inches thick. The upper 13 inches of the subsoil is very dark brown silt loam, and the lower 10 inches is dark brown silty clay loam. The upper 7 inches of the substratum is dark yellowish brown fine sandy loam, and the lower 14 inches is dark brown clay loam. Basalt bedrock is at a depth of about 50 inches. The surface layer and upper part of the subsoil are slightly acid, and the lower part of the subsoil and the substratum is neutral.

Wamic:											
49B, 49C, 50C, 50D, 50E, 50F	0–28	0.6–2.0	0.19–0.22	6.6–7.3	<2	Low	Moderate	Low	0.49	4	
	28–44	0.2–0.6	0.13–0.15	6.6–7.3	<2	Low	Moderate	Low	0.43		
	44										
[1]51D:											
Wamic part	0–28	0.6–2.0	0.19–0.22	6.6–7.3	<2	Low	Moderate	Low	0.49	4	
	28–44	0.2–0.6	0.13–0.15	6.6–7.3	<2	Low	Moderate	Low	0.43		
	44										
Skyline part	0–9	0.6–2.0	0.10–0.15	6.6–7.3	<2	Low	Low	Low	0.17	1	
	9–14	0.6–2.0	0.10–0.15	6.6–7.3	<2	Low	Low	Low	0.20		
	14										
Wapinitia variant: 52B	0–12	0.6–2.0	0.19–0.21	6.6–7.3	<2	Low	Moderate	Low	0.37	3	
	12–22	0.2–0.6	0.19–0.21	6.6–7.3	<2	Moderate	Moderate	Low	0.43		
	22–53	0.06–0.2	0.14–0.16	6.6–7.8	<2	High	High	Low	0.32		
	53–60										
Warden: 53E	0–6	0.6–2.0	0.19–0.21	6.6–7.8	<2	Low	High	Low	0.55	5	5
	6–19	0.6–2.0	0.16–0.20	7.4–7.8	<2	Low	High	Low	0.55		
	19–60	0.6–2.0	0.19–0.21	7.9–9.0	<2	Low	High	Low	0.55		
Watama: [1]54B, 54C, 54D, 54E:											
Watama part	0–10	0.6–2.0	0.19–0.21	6.6–7.3	<2	Low	Low	Low	0.37	2	
	10–24	0.6–2.0	0.16–0.18	6.6–7.3	<2	Low	Low	Low	0.32		
	24–34	0.2–0.6	0.19–0.21	6.6–7.3	<2	Moderate	Moderate	Low	0.32		
	34										
Wapinitia part	0–19	0.6–2.0	0.19–0.21	6.1–6.5	<2	Low	Moderate	Low	0.37	3	
	19–29	0.2–0.6	0.19–0.21	6.6–7.3	<2	Moderate	Moderate	Low	0.43		
	29–36	0.6–2.0	0.13–0.15	6.6–7.3	<2	Low	Moderate	Low	0.32		
	36–50	0.2–0.6	0.19–0.21	6.6–7.3	<2	Moderate	Moderate	Low	0.43		
	50										
Wato: 55B, 55C, 55D, 55E	0–66	0.2–6.0	0.15–0.17	6.6–7.8	<2	Low	Moderate	Low	0.49	3	3
Wind River: 56B, 56C, 46D	0–61	2.0–6.0	0.13–0.15	6.1–7.3	<2	Low	Low	Low	0.15	5	
	61–80	2.0–6.0	0.09–0.10	6.1–7.3	<2	Low	Low	Low	0.10		
Wrentham: [1]57F:											
Wrentham part	0–21	0.6–2.0	0.15–0.21	6.1–7.3	<2	Low	Low	Low	0.37	2	
	21–38	0.2–0.6	0.09–0.14	6.6–7.3	<2	Low	Moderate	Low	0.20		
	32										
Rock outcrop part.											

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 13. — *Engineering Properties and Classifications* — Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments >3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				*Pct*					*Pct*	
Sinamox: Cont.	49–59	Silty clay	CH	A–7	0–5	90–100	85–100	75–95	70–95	50–60	25–30
	59	Weathered bedrock.									
Skyline: [1]43F:											
Skyline part	0–9	Very cobbly loam	ML, GM, SM	A–2, A–4	15–50	60–85	50–80	40–75	30–60		NP
	9–14	Gravelly loam	ML, SM, GM	A–4, A–2	5–15	65–80	60–75	50–70	35–55		NP
	14	Weathered bedrock.									
Hesslan part	0–9	Stony loam	ML	A–4	5–20	85–95	80–95	70–90	50–70	20–25	NP–5
	9–23	Cobbly loam	ML	A–4	10–30	85–95	80–95	70–90	50–70	20–25	NP–5
	23	Weathered bedrock.			0						
Tygh: 44	0–30	Fine sandy loam	SM, ML	A–4	0	95–100	95–100	65–85	40–55		NP
	30–41	Sandy loam	SM	A–2, A–4	0	90–100	90–100	55–70	25–40		NP
	41–46	Loamy sand	SM	A–2	0	85–95	80–95	40–70	10–30		NP
	46–60	Very gravelly sand	GW, GP	A–1	0–5	15–30	10–25	5–20	0–5		NP
Van Horn: 45B, 45C, 45D, 45E.	0–21	Loam	ML, SM	A–4	0	100	100	80–90	40–60	20–25	NP–5
	21–49	Sandy clay loam, clay loam.	CL, SC	A–6	0	100	100	80–90	35–55	30–40	10–15
	49–60	Sandy loam, loam	SM	A–2, A–4	0	100	100	60–70	30–40		NP
Walla Walla: 46B, 46C, 46D, 47D, 47E, 48E, 48F.	0–13	Silt loam	ML	A–4	0	100	100	95–100	70–100	20–30	NP–5
	13–44	Silt loam	ML	A–4	0	100	100	95–100	80–100	20–35	NP–10
	44–82	Silt loam	ML	A–4	0	100	100	95–100	80–100	20–25	NP–5
Wamic:											
49B, 49C, 50C, 50D, 50E, 50F.	0–28	Loam	ML	A–4	0	95–100	95–100	90–95	55–75	20–25	NP–5
	28–44	Loam, clay loam	ML	A–4	0	95–100	95–100	90–95	55–75	30–35	5–10
	44	Unweathered bedrock.									
[1]51D:											
Wamic part	0–28	Loam	ML	A–4	0	95–100	95–100	90–95	55–75	20–25	NP–5
	28–44	Loam, clay loam	ML	A–4	0	95–100	95–100	90–95	55–75	30–35	5–10
	44	Unweathered bedrock.									
Skyline part	0–9	Very cobbly loam	ML, GM, SM	A–2, A–4	15–50	60–85	50–80	40–75	30–60		NP
	9–14	Gravelly loam	ML, SM, GM	A–4, A–2	5–15	65–80	60–75	50–70	35–55		NP
	14	Weathered bedrock.									
Wapinitia variant: 52B	0–12	Silt loam	ML	A–4	0	95–100	95–100	90–100	65–90	30–35	NP–5
	12–22	Silty clay loam	CL	A–6	0	95–100	95–100	90–100	80–95	35–40	10–15
	22–53	Clay	CH	A–7	0	95–100	95–100	85–100	70–95	50–65	25–35
	53–60	Unweathered bedrock.									
Warden: 53E	0–8	Silt loam	ML	A–4	0	95–100	95–100	85–100	70–90	25–30	NP–5
	8–21	Very fine sandy loam, silt loam.	ML	A–4	0	95–100	95–100	85–100	70–90	25–30	NP–5
	21–60	Silt loam, very fine sandy loam.	ML	A–4	0	95–100	95–100	85–100	70–90	25–30	NP–5
Watama: [1]54B, 54C, 54D, 54E:											
Watama part	0–10	Silt loam	ML	A–4	0	95–100	95–100	90–100	65–90	30–35	NP–5
	10–24	Loam	ML	A–4	0	95–100	95–100	80–95	55–75	30–35	NP–5
	24–34	Clay loam	ML	A–6	0–5	95–100	95–100	85–100	65–80	35–40	10–15
	34	Unweathered bedrock.									
Wapinitia part	0–19	Silt loam	ML	A–4	0	95–100	95–100	90–100	65–90	30–35	NP–5
	19–29	Silty clay loam	ML	A–6	0	95–100	95–100	90–100	80–95	35–40	10–15
	29–36	Fine sandy loam	SM, ML	A–4	0	95–100	95–100	65–85	40–55	20–25	NP–5

Exhibit 7
Columbia Gorge Hood River
Experimental Station Climatic Data

Monthly Means and Extremes

Hood River Exper. St., Oregon Period: 1961-1990

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Temperature (F)													
Maximum	40.6	46.8	53.7	60.0	67.5	74.2	80.1	80.5	74.0	63.4	49.3	41.3	61.0
Minimum	28.2	31.2	34.4	38.4	43.8	50.0	53.4	52.8	45.8	38.1	34.4	29.4	40.0
Mean	34.4	39.0	44.1	49.2	55.6	62.1	66.8	66.7	59.9	50.8	41.9	35.3	50.5
Extreme Temperature (F)													
Maximum	62	66	76	88	102	104	104	108	99	88	68	66	108
Minimum	-6	-5	14	25	28	32	37	36	26	19	-5	-10	-10
Precipitation (inches)													
Monthly mean	5.36	3.91	2.93	1.63	.95	.69	.25	.59	1.14	2.20	5.11	6.00	31.05
Extreme 24 hour	2.45	2.59	1.75	1.20	.88	1.74	.87	1.27	1.73	2.67	1.83	3.05	3.05
Snowfall (inches)													
Monthly mean	14.04	6.44	1.49	.00	.00	.00	.00	.00	.00	.00	3.44	9.87	36.47
Average number of days													
Temperature													
Maximum 90 or more	.0	.0	.0	.0	.6	2.3	5.4	6.0	1.3	.0	.0	.0	16.0
Maximum 32 or less	5.0	1.2	.0	.0	.0	.0	.0	.0	.0	.0	.6	3.9	10.9
Minimum 32 or less	20.5	15.5	11.8	5.1	.8	.1	.0	.0	.7	6.5	11.4	19.9	91.7
Minimum 0 or less	.5	.3	.0	.0	.0	.0	.0	.0	.0	.0	.0	.5	1.2
Precipitation													
.01 inches or more	16.3	13.9	14.3	11.5	8.4	5.6	2.7	3.8	6.0	10.0	18.0	16.8	128.0
.10 inches or more	10.4	9.1	8.1	5.2	3.2	2.0	.7	1.7	2.7	5.5	12.0	11.5	72.6
.50 inches or more	3.8	2.3	1.4	.5	.1	.2	.1	.3	.7	1.2	3.4	3.9	18.0
1.00 inches or more	1.2	.8	.2	.1	.0	.1	.0	.0	.1	.3	.7	1.4	5.0
Degree Days													
Heating days @ 65F	949	735	649	475	303	138	55	51	177	442	694	920	5580
Growing days @ 50F	1	1	10	62	194	363	519	516	300	84	6	1	2066

Oregon Climate Service

Station Number 354003
Element : DAILY MAX TEMPERATURE Quantity : MONTHLY AVERAGE
Units : DEGREES F
a = 1 day missing, b = 2 days missing, c = 3 days, ..etc..,
z = 26 or more days missing, A = Accumulations present
Long-term means based on columns; thus, the monthly row may not sum (or average) to the long-term annual value.

Maximum allowable number of missing days : 5

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1961	42.90	49.89	53.06	57.97	65.94	80.90	83.11c	86.00a	71.23	62.50c	47.13	42.87	61.96
1962	43.32	46.82	49.39	64.33	60.43a	74.83	79.00a	77.63a	74.86b	63.65	52.27	46.23	61.06
1963	40.35	49.68	54.48	56.10	68.94	71.73	74.52	78.87	78.50	64.10	50.37	38.42	60.50
1964	44.71	51.59	51.39	58.13	65.26	70.50	78.32	75.77	71.37	63.84	45.53	38.26	59.56
1965	41.13	49.07	56.35	62.60	64.77	72.70	82.81	80.06	72.50	67.06	51.87	42.52	61.95
1966	41.19	46.82	53.58	62.87	70.84	71.50	77.55	79.74	76.90	63.39	52.07	43.97	61.70
1967	46.68	51.25	50.87	55.60	68.81	78.27	82.90	88.26	80.43	63.19	51.63	43.23	63.43
1968	42.06	51.72	57.77	58.40	67.03	73.60	81.71	75.87	73.60	60.29	50.00	39.77	60.99
1969	31.23	42.11	56.87	60.20	72.58	77.93	79.29	77.97	73.87	60.35	51.83	41.74	60.50
1970	39.03	50.63a	54.39	56.00	68.77	78.90	80.84	81.87	69.53	61.61	48.60	40.10	60.86
1971	44.81	49.70a	47.94	57.77	68.16	68.30	82.61	84.13	70.00	61.19	49.20	42.68	60.54
1972	41.61	45.93	55.35	55.43	71.19	74.47	83.32	84.48	70.03	63.42	50.53	35.55	60.94
1973	38.32	47.57	53.52	61.83	70.06	72.77	82.00	77.42	74.03	61.26	44.23	44.94	60.66
1974	36.16	47.93	52.87	57.20	63.13	75.73	78.35	81.71	79.67	66.42	51.67	46.10	61.41
1975	43.00	42.68	49.94	55.23	67.16	71.47	79.68	75.06	77.53	59.35	48.43	44.90	59.54
1976	9999.00z	45.03	49.97	58.30	69.26	70.53	78.68	75.35	73.17	65.16	52.97	45.06	62.14
1977	36.42	49.18	51.61	66.23	63.00	76.90	79.19	86.42	69.80	63.48	46.97	43.61	61.07
1978	39.55	45.86	57.74	58.57	64.16	77.10a	80.84	78.29	68.17	67.13	46.27	41.84	60.46
1979	28.39	43.11	56.32	58.63	69.68	76.17	81.32	77.55	77.47	65.77	44.50	44.03	60.24
1980	35.52	40.90	51.10	63.00	66.00	68.50	79.58	76.52	74.07	65.10	49.70	44.94	59.58
1981	43.45	46.32	56.77	58.87	66.52	69.21a	78.19	85.70a	75.27	61.65	52.00a	42.90	61.40
1982	43.00	45.29	53.45	56.90	68.00	76.67	79.74	80.94	73.23	59.48	44.97	41.68	60.28
1983	45.23	46.11	55.45	61.50	71.71	71.30	75.26	79.29	70.40	63.45	50.73	32.23	60.22
1984	41.94	46.97	55.45	56.93	63.45	70.10	82.23	81.65	71.30	57.61	46.53	39.00	59.43
1985	34.74	43.61	52.32	62.87	68.77	75.07	87.58	78.45	68.50	60.35	38.70	29.26	58.35
1986	41.00	45.75	58.32	59.23	68.58	79.00	75.29	86.65	69.60	66.39	50.77	38.81	61.62
1987	39.71	47.46	53.13a	65.87	70.94	78.90	76.94	83.43a	79.24a	70.10	52.90	40.52	63.26
1988	38.81	50.76	54.58	61.30	66.68	72.43	81.81	80.87	75.93	70.52	49.93	43.39	62.25
1989	46.13	37.21	50.16	65.53	68.84	77.10	76.65	77.48	78.80	63.55	53.30	42.19	61.41
1990	46.61	46.18	57.61	65.60	65.71	72.90	84.94	81.97	80.00	60.71	53.97	36.74	62.74
1991	41.77	53.46	52.10	59.03	63.06	69.33	82.52	83.71	80.87	66.26	49.37	44.39	62.16
1992	45.68	50.55	61.71	63.03	75.48	80.53	82.71	83.77	72.87	65.23	48.60	40.16	64.19

1993	33.71	40.96	50.97	57.87	72.65	71.80	72.19	80.06	80.37	68.23	46.73	40.61	59.68
1994	48.68	42.71	58.52	63.60	70.87	73.13	84.68	81.10	80.53	63.39	46.27	42.71	63.02
1995	39.19	51.79	54.74	60.37	71.26	73.27	81.45	78.23	77.97	61.77	53.57	40.97	62.05
1996	42.71	41.52	54.52	61.30	64.19	73.83	86.87	84.16	73.07	62.48	48.50	40.35	61.13
1997	41.35	48.39	53.16	58.97	73.42	73.43	80.87	84.26	76.80	61.61	51.33	43.42	62.25
1998	41.90	48.96	55.55	61.97	64.97	74.87	84.10	84.74	80.97	63.00	51.10	42.71	62.90
1999	47.29	46.68	53.13	60.67	65.84	71.27	81.29	82.94	79.07	65.29	52.77	45.29	62.63
2000	40.23	46.34	53.71	66.13	67.90	9999.00z	9999.00z	9999.00z	9999.00z	9999.00z	9999.00z	9999.00z	54.86
Mean	41.01	46.86	54.00	60.30	67.85	74.02	80.54	80.98	74.91	63.57	49.43	41.49	61.26
S.D.	4.39	3.60	2.93	3.23	3.32	3.38	3.29	3.54	4.00	2.88	3.23	3.59	1.28
Skew	-0.78	-0.47	0.24	0.29	0.03	0.26	-0.26	0.11	0.00	0.40	-1.04	-1.46	0.08
Max	48.68	53.46	61.71	66.23	75.48	80.90	87.58	88.26	80.97	70.52	53.97	46.23	64.19
Min	28.39	37.21	47.94	55.23	60.43	68.30	72.19	75.06	68.17	57.61	38.70	29.26	58.35
Yrs	39	40	40	40	40	39	39	39	39	39	39	39	38

Station Number 354003
Element : DAILY MIN TEMPERATURE Quantity : MONTHLY AVERAGE
Units : DEGREES F
a = 1 day missing, b = 2 days missing, c = 3 days, ..etc..,
z = 26 or more days missing, A = Accumulations present
Long-term means based on columns; thus, the monthly row may not
sum (or average) to the long-term annual value.

Maximum allowable number of missing days : 5

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1961	31.68	36.54	36.81	39.53	44.48	51.70	53.14c	53.63a	42.23	38.07c	28.27	30.39	40.54
1962	27.16	30.64	32.52	40.77	42.70a	47.23	50.60a	51.50a	44.54b	39.65	36.57	32.61	39.71
1963	22.71	33.14	33.77	37.43	43.23	50.10	51.61	51.48	50.13	40.77	36.33	28.48	39.93
1964	31.87	30.41	33.19	37.13	40.81	47.37	51.71	49.77	43.67	36.58	32.07	24.65	38.27
1965	30.26	33.79	30.48	39.00	42.19	49.27	53.03	54.16	42.77	40.42	38.33	27.87	40.13
1966	29.87	31.96	32.32	38.60	43.00	48.87	52.29	51.45	47.57	37.68	36.03	34.13	40.31
1967	35.19	32.07	33.29	35.67	43.52	52.60	55.00	54.10	50.43	41.61	34.20	31.32	41.58
1968	29.55	32.59	37.06	36.83	44.52	50.20	53.97	52.84	48.33	36.77	35.70	28.48	40.57
1969	19.74	29.96	32.65	38.50	45.06	54.33	52.35	51.32	48.57	37.68	34.50	31.39	39.67
1970	28.77	34.26a	33.52	36.87	42.42	52.07	55.71	52.65	43.60	35.68	34.37	29.58	39.96
1971	29.71	32.19a	31.16	36.50	45.45	48.13	53.61	54.16	42.97	37.42	33.63	30.94	39.66
1972	28.48	31.52	36.48	35.63	44.90	49.67	52.81	52.58	43.83	35.94	37.50	22.19	39.29
1973	24.90	31.18	34.71	38.20	43.87	50.63	53.32	50.77	47.47	40.45	33.03	34.06	40.22
1974	23.16	33.21	33.94	40.03	43.03	50.17	51.68	53.29	44.83	35.00	36.40	33.52	39.86
1975	30.23	29.00	31.94	34.43	43.13	50.17	56.55	51.45	44.17	42.29	33.37	32.65	39.95
1976	9999.00z	30.34	31.65	37.73	42.29	45.70	52.68	52.03	47.47	35.45	34.33	27.90	39.78
1977	24.00	31.96	34.39	39.20	40.71	52.07	52.68	56.77	45.43	36.77	31.83	33.42	39.94

1978	29.77	33.64	35.77	38.90	42.68	50.07a	54.23	53.74	45.87	35.32	26.97	26.32	39.44
1979	13.61	27.61	34.74	40.07	45.10	49.30	54.55	53.65	47.33	41.74	33.13	32.97	39.48
1980	20.06	31.03	35.45	39.90	45.39	47.87	53.52	51.19	47.10	37.39	36.87	32.65	39.87
1981	35.90	31.57	35.68	39.60	44.90	49.76a	52.81	53.77a	45.67	36.71	34.67	32.23	41.10
1982	30.26	28.32	32.55	34.30	41.52	50.97	52.39	53.74	46.80	38.45	30.20	30.03	39.13
1983	31.39	36.04	39.48	37.40	45.55	49.03	53.16	54.16	43.87	36.65	38.93	21.94	40.63
1984	29.06	32.48	37.74	39.00	42.61	48.00	54.13	52.90	44.87	38.03	34.10	27.13	40.01
1985	27.52	26.29	31.68	39.93	44.55	48.50	55.65	50.16	42.87	37.52	25.00	20.16	37.48
1986	30.39	31.39	38.81	37.70	45.61	53.27	52.39	54.71	45.33	37.84	37.27	30.29	41.25
1987	27.68	33.04	36.55	40.37	46.94	50.50	54.00	51.03	46.20	34.61	35.83	29.61	40.53
1988	28.13	29.24	34.90	40.70	44.42	48.93	53.74	51.61	45.93	42.35	37.47	31.97	40.78
1989	32.61	20.96	34.16	40.40	44.32	50.73	52.55	53.23	44.57	38.87	38.63	31.13	40.18
1990	33.84	29.25	34.68	41.90	44.42	51.20	55.84	55.84	49.60	38.94	37.47	22.32	41.27
1991	27.03	35.36	33.29	39.43	45.16	49.00	55.39	55.58	46.17	37.29	36.57	34.32	41.22
1992	34.58	37.41	36.81	41.00	46.52	54.03	55.77	53.16	45.73	40.87	37.00	28.19	42.59
1993	22.42	26.64	33.71	39.83	47.45	50.63	52.84	52.90	43.47	39.65	25.03	31.55	38.84
1994	33.29	28.82	34.29	41.57	46.65	49.20	55.65	54.10	47.40	37.84	31.30	31.23	40.94
1995	30.45	32.71	33.97	37.70	45.84	50.20	56.45	50.52	48.87	39.55	38.43	31.90	41.38
1996	30.55	23.86	35.10	40.67	42.23	47.47	53.58	51.13	42.40	38.03	32.93	28.06	38.83
1997	27.10	30.93	34.48	37.47	45.61	49.87	52.77	53.00	47.10	37.84	34.83	30.74	40.15
1998	29.00	32.82	34.68	37.90	46.97	51.63	58.26	52.94	47.97	36.45	37.80	27.32	41.14
1999	31.84	31.39	32.94	35.20	41.39	50.23	50.03	54.45	41.37	36.39	38.93	36.29	40.04
2000	31.19	32.69	34.19	41.30	46.52	9999.00z	9999.00z	9999.00z	9999.00z	9999.00z	9999.00z	9999.00z	37.18
Mean	28.59	31.21	34.39	38.61	44.19	50.02	53.65	52.86	45.76	38.12	34.51	29.79	40.15
S.D.	4.56	3.21	2.02	1.96	1.78	1.85	1.73	1.61	2.30	2.05	3.59	3.72	0.97
Skew	-1.14	-0.89	0.46	-0.44	-0.14	0.21	0.43	0.16	0.14	0.45	-1.14	-0.87	-0.18
Max	35.90	37.41	39.48	41.90	47.45	54.33	58.26	56.77	50.43	42.35	38.93	36.29	42.59
Min	13.61	20.96	30.48	34.30	40.71	45.70	50.03	49.77	41.37	34.61	25.00	20.16	37.48
Yrs	39	40	40	40	40	39	39	39	39	39	39	39	38

Station Number 354003

Element : DAILY MEAN TEMPERATURE Quantity : MONTHLY AVERAGE

Units : DEGREES F

a = 1 day missing, b = 2 days missing, c = 3 days, ..etc..,

z = 26 or more days missing, A = Accumulations present

Long-term means based on columns; thus, the monthly row may not sum (or average) to the long-term annual value.

Maximum allowable number of missing days : 5

Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANN
1961	37.29	43.21	44.94	48.75	55.21	66.30	68.12c	69.82a	56.73	50.59d	37.70	36.63	51.27
1962	35.24	38.73	40.95	52.55	51.57a	61.03	64.57b	64.57a	59.70b	51.65	44.42	39.42	50.37

1963	31.53	41.41	44.13	46.77	56.08	60.92	63.06	65.18	64.32	52.44	43.35	33.45	50.22
1964	38.29	41.00	42.29	47.63	53.03	58.93	65.02	62.77	57.52	50.21	38.80	31.45	48.91
1965	35.69	41.43	43.42	50.80	53.48	60.98	67.92	67.11	57.63	53.74	45.10	35.19	51.04
1966	35.53	39.39	42.95	50.73	56.92	60.18	64.92	65.60	62.23	50.53	44.05	39.05	51.01
1967	40.94	41.66	42.08	45.63	56.16	65.43	68.95	71.18	65.43	52.40	42.92	37.27	52.51
1968	35.81	42.16	47.42	47.62	55.77	61.90	67.84	64.35	60.97	48.53	42.85	34.13	50.78
1969	25.48	36.04	44.76	49.35	58.82	66.13	65.82	64.65	61.22	49.02	43.17	36.56	50.08
1970	33.90	42.44a	43.95	46.43	55.60	65.48	68.27	67.26	56.57	48.65	41.48	34.84	50.41
1971	37.26	40.94a	39.55	47.13	56.81	58.22	68.11	69.15	56.48	49.31	41.42	36.81	50.10
1972	35.05	38.72	45.92	45.53	58.05	62.07	68.06	68.53	56.93	49.68	44.02	28.87	50.12
1973	31.61	39.38	44.11	50.02	56.97	61.70	67.66	64.10	60.75	50.85	38.63	39.50	50.44
1974	29.66	40.57	43.40	48.62	53.08	62.95	65.02	67.50	62.25	50.71	44.03	39.81	50.63
1975	36.61	35.84	40.94	44.83	55.15	60.82	68.11	63.26	60.85	50.82	40.90	38.77	49.74
1976	9999.00z	37.69	40.81	48.02	55.77	58.12	65.68	63.69	60.32	50.31	43.65	36.48	50.96
1977	30.21	40.57	43.00	52.72	51.85	64.48	65.94	71.60	57.62	50.13	39.40	38.52	50.50
1978	34.66	39.75	46.76	48.73	53.42	63.59a	67.53	66.02	57.02	51.23	36.62	34.08	49.95
1979	21.00	35.36	45.53	49.35	57.39	62.73	67.94	65.60	62.40	53.76	38.82	38.50	49.86
1980	27.79	35.97	43.27	51.45	55.69	58.18	66.55	63.85	60.58	51.24	43.28	38.79	49.72
1981	39.68	38.95	46.23	49.23	55.71	59.36b	65.50	69.73a	60.47	49.18	43.34a	37.56	51.24
1982	36.63	36.80	43.00	45.60	54.76	63.82	66.06	67.34	60.02	48.97	37.58	35.85	49.70
1983	38.31	41.07	47.47	49.45	58.63	60.17	64.21	66.73	57.13	50.05	44.83	27.08	50.43
1984	35.50	39.72	46.60	47.97	53.03	59.05	68.18	67.27	58.08	47.82	40.32	33.06	49.72
1985	31.13	34.95	42.00	51.40	56.66	61.78	71.61	64.31	55.68	48.94	31.85	24.71	47.92
1986	35.69	38.57	48.56	48.47	57.10	66.13	63.84	70.68	57.47	52.11	44.02	34.55	51.43
1987	33.69	40.25	44.68a	53.12	58.94	64.70	65.47	67.37a	62.52a	52.35	44.37	35.06	51.88
1988	33.47	40.00	44.74	51.00	55.55	60.68	67.77	66.24	60.93	56.44	43.70	37.68	51.52
1989	39.37	29.09	42.16	52.97	56.58	63.92	64.60	65.35	61.68	51.21	45.97	36.66	50.80
1990	40.23	37.71	46.15	53.75	55.06	62.05	70.39	68.90	64.80	49.82	45.72	29.53	52.01
1991	34.40	44.41	42.69	49.23	54.11	59.17	68.95	69.65	63.52	51.77	42.97	39.35	51.69
1992	40.13	43.98	49.26	52.02	61.00	67.28	69.24	68.47	59.30	53.05	42.80	34.18	53.39
1993	28.06	33.80	42.34	48.85	60.05	61.22	62.52	66.48	61.92	53.94	35.88	36.08	49.26
1994	40.98	35.77	46.40	52.58	58.76	61.17	70.16	67.60	63.97	50.61	38.78	36.97	51.98
1995	34.82	42.25	44.35	49.03	58.55	61.73	68.95	64.37	63.42	50.66	46.00	36.44	51.71
1996	36.63	32.69	44.81	50.98	53.21	60.65	70.23	67.65	57.73	50.26	40.72	34.21	49.98
1997	34.23	39.66	43.82	48.22	59.52	61.65	66.82	68.63	61.95	49.73	43.08	37.08	51.20
1998	35.45	40.89	45.11	49.93	55.97	63.25	71.18	68.84	64.47	49.73	44.45	35.02	52.02
1999	39.56	39.04	43.03	47.93	53.61	60.75	65.66	68.69	60.22	50.84	45.85	40.79	51.33
2000	35.71	39.52	43.95	53.72	57.21	9999.00z	9999.00z	9999.00z	9999.00z	9999.00z	9999.00z	9999.00z	46.02
Mean	34.80	39.03	44.19	49.45	56.02	62.02	67.09	66.92	60.33	50.85	41.97	35.64	50.71
S.D.	4.32	3.16	2.17	2.38	2.27	2.44	2.22	2.31	2.70	1.74	3.21	3.52	1.07
Skew	-1.06	-0.91	0.24	0.07	0.07	0.37	-0.02	0.09	0.05	0.96	-1.08	-1.24	-0.08
Max	40.98	44.41	49.26	53.75	61.00	67.28	71.61	71.60	65.43	56.44	46.00	40.79	53.39

Min	21.00	29.09	39.55	44.83	51.57	58.12	62.52	62.77	55.68	47.82	31.85	24.71	47.92
Yrs	39	40	40	40	40	39	39	39	39	39	39	39	38

Hood River, Oregon

Latitude: 45° 40'

Longitude: 121° 31'

Elevation: 500 ft.

County: Hood River

Station Number: 354003

Agency: Oregon State University Agricultural Experiment Station

Station History:

Latitude	Longitude	Elevation	Start Date	End Date
45° 40'	121° 31'	820	1/1/1884	12/31/1899
45° 42'	121° 30'	243	3/11/1900	5/6/04
45° 42'	121° 30'	243	5/9/04	6/30/07
45° 41'	121° 31'	300	7/1/07	5/15/23
45° 41'	121° 31'	275	5/15/23	11/30/26
45° 41'	121° 31'	500	12/1/26	8/4/41
45° 41'	121° 31'	500	8/4/41	7/1/48
45° 41'	121° 31'	500	7/1/48	8/1/59
45° 41'	121° 31'	500	8/1/59	10/1/65
45° 41'	121° 31'	500	10/1/65	1/1/68
45° 41'	121° 31'	500	2/1/68	8/1/72
45° 41'	121° 31'	500	8/1/72	present

Monthly Means and Extremes
Hood River, Oregon

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Temperature (°F)													
Maximum	40.6	46.8	53.7	60.0	67.5	74.2	80.1	80.5	74.0	63.4	49.3	41.3	60.9
Minimum	28.2	31.2	34.4	38.4	43.8	50.0	53.4	52.8	45.8	38.1	34.4	29.4	40.0
Mean	34.4	39.0	44.1	49.2	55.6	62.1	66.8	66.6	59.9	50.8	41.9	35.3	50.5
Extreme Temperature (°F)													
Maximum	62	66	76	88	102	104	104	108	99	88	68	66	108
Minimum	-6	-5	14	25	28	32	37	36	26	19	-5	-10	-10
Precipitation (inches)													
Monthly mean	5.36	3.91	2.93	1.63	.95	.69	.25	.59	1.14	2.20	5.11	6.00	30.76
Extreme 24 hr.	2.45	2.59	1.75	1.20	.88	1.74	.87	1.27	1.73	2.67	1.83	3.05	3.05
Average number of days													
Temperature													
Maximum 90° or more					.6	2.3	5.4	6.0	1.3				15.6
Maximum 32° or less	5.0	1.2									.6	3.9	10.7
Minimum 32° or less	20.5	15.5	11.8	5.1	.8	.1			.7	6.5	11.4	19.9	92.3
Minimum 0° or less	.5	.3										.5	1.2
Precipitation													
.01 inches or more	16.3	13.9	14.3	11.5	8.4	5.6	2.7	3.8	6.0	10.0	18.0	16.8	127.3
.10 inches or more	10.4	9.1	8.1	5.2	3.2	2.0	.7	1.7	2.7	5.5	12.0	11.5	72.1
.50 inches or more	3.8	2.3	1.4	.5	.1	.2	.1	.3	.7	1.2	3.4	3.9	17.9
1.00 inches or more	1.2	.3	.2	.1		.1			.1	.3	.7	1.4	4.8
Degree Days													
Heating days @ 65°F	949	733	649	475	302	138	55	52	176	440	693	920	5581
Growing days @ 50°F	1	1	10	62	194	362	517	514	299	83	6	1	2049

Total Monthly Precipitation (in inches)

Hood River, Oregon

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1961	3.69	9.96	5.62	1.88	.98	.18	.16	.23	1.56	2.62	4.40	6.68	37.96
1962	.66	2.55	5.60	2.80	2.62	.11	.00	1.09	1.67	4.10	6.27	3.29	30.76
1963	1.13	4.09	4.39	2.54	1.22	.20	.16	.07	.76	1.49	6.28	3.55	25.88
1964	8.07	.70	3.15	1.02	.54	1.52	.20	.33	.15	1.48	5.73	14.94	37.83
1965	6.19	1.55	1.13	1.95	1.08	.36	.14	1.20	.04	1.13	5.25	4.17	24.19
1966	7.58	1.41	3.24	.30	.47	.62	.47	.03	.62	2.91	4.21	5.45	27.31
1967	5.99	1.77	2.59	1.45	.11	.26	.01	.00	.61	5.25	2.72	3.57	24.33
1968	3.78	6.91	1.62	.84	1.23	.15	.09	2.64	.80	4.14	6.94	7.09	36.23
1969	7.95	2.45	1.47	1.07	1.05	.92	.03	.07	.86	2.19	1.26	7.13	26.45
1970	12.94	3.52	1.45	1.93	.51	.33	.06	.00	.53	2.43	6.36	6.42	36.48
1971	5.89	2.60	5.96	1.20	.97	1.70	.03	.09	1.92	2.39	4.57	5.28	32.60
1972	8.41	3.30	4.45	2.19	1.24	.72	.06	.27	2.65	.46	4.01	7.48	35.24
1973	3.90	.74	1.12	.58	.63	.54	.02	.35	2.22	2.63	11.09	11.09	34.91
1974	7.31	4.34	3.39	2.89	1.27	.51	1.05	.08	.04	.72	4.57	6.23	32.40
1975	7.20	4.56	3.73	.94	.63	1.25	.26	1.17	.00	4.14	6.16	6.60	36.64
1976	.00	5.97	2.99	2.20	.92	.16	.12	1.12	.68	.82	.92	1.26	17.16
1977	.70	1.70	2.30	.14	1.43	.54	.07	1.98	1.74	2.00	7.08	11.24	30.92
1978	5.16	3.05	.78	2.23	.93	.19	.58	1.17	.55	.52	2.27	3.08	20.51
1979	1.88	6.16	2.44	1.32	.79	.06	.54	1.61	1.11	4.32	3.30	4.19	27.72
1980	8.38	4.88	1.54	2.81	.33	1.83	.03	.15	.68	.64	5.87	9.79	36.93
1981	1.97	4.63	1.02	1.72	1.20	2.72	.19	.00	2.61	1.92	3.77	10.47	32.22
1982	6.26	5.71	1.50	2.33	.25	.48	.15	.32	3.69	5.59	3.52	6.67	36.47
1983	6.04	7.23	5.70	.77	.41	.35	.90	1.34	1.19	.77	7.82	8.32	40.84
1984	2.58	2.93	3.03	1.75	2.16	.49	.00	.01	1.56	3.51	12.66	3.51	34.19
1985	.27	4.87	2.72	1.03	.48	2.03	.10	.56	2.91	2.42	3.28	2.26	22.93
1986	7.10	8.82	2.70	1.63	.38	.07	.17	.09	2.15	1.11	5.36	3.94	33.52
1987	6.56	3.73	3.06	1.06	.95	.22	1.17	.04	.06	.16	1.99	8.99	27.99
1988	5.03	1.07	3.71	1.99	.71	.96	.12	.00	.51	.01	10.80	2.31	27.22
1989	4.30	1.82	4.08	1.33	1.11	.46	.29	1.32	.30	1.24	2.15	2.50	20.90
1990	8.53	4.40	1.45	2.91	2.05	.76	.41	.31	.00	2.96	2.79	2.36	28.93
Mean	5.36	3.91	2.93	1.63	.95	.69	.25	.59	1.14	2.20	5.11	6.00	31.05
Maximum	12.94	9.96	5.96	2.91	2.62	2.72	1.17	2.64	3.69	5.59	12.66	14.94	40.84
Minimum	.27	.70	.78	.14	.11	.06	.00	.00	.00	.01	.92	1.26	20.51
StdDev	2.97	2.34	1.51	.77	.57	.66	.31	.70	.99	1.53	2.82	3.27	5.57

Dates of Spring and Fall Low Temperatures
Hood River, Oregon

	Last Date in Spring of Low Temperatures (°F)				First Date in Fall of Low Temperatures (°F)			
Year	24°	28°	32°	36°	24°	28°	32°	36°
1961	28-Jan	5-Apr	20-Apr	4-May	6-Nov	29-Oct	24-Sep	22-Sep
1962	12-Mar	28-Mar	5-May	16-May	24-Dec	24-Nov	5-Oct	9-Sep
1963	13-Mar	2-Apr	21-Apr	16-May	28-Nov	28-Nov	19-Oct	19-Oct
1964	27-Feb	14-May	25-May	28-Jun	14-Nov	18-Oct	3-Oct	9-Sep
1965	19-Mar	3-Apr	6-May	18-May	14-Dec	17-Sep	17-Sep	16-Sep
1966	4-Mar	19-Apr	1-Jun	1-Jun	***	18-Oct	9-Oct	3-Oct
1967	12-Mar	15-Apr	26-Apr	25-May	13-Dec	3-Nov	20-Oct	15-Oct
1968	15-Feb	13-Apr	27-Apr	8-May	19-Dec	15-Nov	2-Oct	2-Oct
1969	12-Mar	25-Mar	4-May	4-May	14-Oct	13-Oct	11-Oct	15-Sep
1970	11-Jan	19-Mar	11-May	14-May	22-Nov	7-Oct	13-Sep	9-Sep
1971	2-Mar	1-Apr	22-Apr	10-May	17-Oct	17-Oct	16-Oct	18-Sep
1972	5-Feb	22-Apr	1-May	25-May	4-Dec	30-Oct	25-Sep	25-Sep
1973	28-Jan	8-Apr	11-May	27-May	***	2-Nov	3-Oct	16-Sep
1974	8-Mar	21-Mar	17-May	31-May	23-Dec	6-Oct	6-Oct	27-Sep
1975	28-Mar	8-Apr	25-May	25-May	18-Nov	16-Nov	7-Nov	27-Oct
1976	6-Mar	2-Apr	3-Jun	26-Jun	27-Nov	18-Oct	12-Oct	4-Oct
1977	28-Jan	16-Mar	12-May	29-May	19-Nov	4-Nov	4-Oct	2-Oct
1978	12-Feb	15-Mar	5-May	30-May	26-Oct	22-Oct	13-Oct	18-Sep
1979	15-Feb	18-Mar	20-Apr	30-May	27-Nov	1-Nov	1-Nov	3-Oct
1980	16-Feb	22-Feb	11-Apr	3-Jun	9-Dec	22-Oct	9-Oct	29-Aug
1981	12-Feb	13-Apr	25-Apr	12-May	***	21-Oct	12-Oct	24-Sep
1982	11-Feb	20-Apr	5-May	19-May	15-Nov	19-Oct	5-Oct	13-Sep
1983	4-Jan	13-Apr	15-Apr	13-May	19-Dec	29-Sep	20-Sep	19-Sep
1984	21-Jan	5-Mar	4-May	1-Jun	6-Dec	5-Dec	24-Sep	24-Sep
1985	18-Feb	26-Mar	12-May	15-May	9-Oct	29-Sep	29-Sep	29-Sep
1986	10-Feb	24-Apr	6-May	22-May	***	10-Nov	12-Oct	14-Sep
1987	26-Feb	30-Mar	20-Apr	20-May	17-Nov	11-Oct	10-Oct	17-Sep
1988	5-Feb	17-Mar	10-Apr	7-May	15-Dec	27-Oct	27-Oct	18-Sep
1989	2-Mar	20-Mar	30-Mar	28-May	11-Dec	29-Oct	15-Oct	3-Oct
1990	19-Feb	25-Mar	27-Mar	8-May	19-Dec	11-Oct	7-Oct	6-Oct
Probabilities								
10%	27-Jan	15-Mar	10-Apr	7-May	21-Oct	5-Oct	23-Sep	9-Sep
20%	3-Feb	18-Mar	20-Apr	11-May	14-Nov	11-Oct	28-Sep	14-Sep
Median (50%)	17-Feb	1-Apr	4-May	21-May	27-Nov	22-Oct	8-Oct	23-Sep
80%	8-Mar	13-Apr	12-May	30-May	15-Dec	5-Nov	15-Oct	3-Oct
90%	12-Mar	20-Apr	25-May	1-Jun	19-Dec	16-Nov	20-Oct	6-Oct

*** Did not occur

Exhibit 8
Columbia River Gorge
Wine Growers Association
Member Rooster

Last Name	First Name, Husband	First Name, Wife	Vineyard or Winery	Phone	Email	Address	City	State	Zip	Grapes Grown	2001 Dues Paid
Bartlemay	Larry	Laurie	Wheatridge Vineyard	541/454-2585	wheatridge@honkernet.net	11102 Philippi Lane	Arlington	OR	97812	1 acre experimental	Yes-$50
Beeks	Dennis	Becky	Chukar Ridge Vineyard	509/767-1282		PO Box 555 or 185 Oak Creek Road	Dallesport	WA	98617	15 acres Sirrah & various	Yes-$50
Brehm	Peter	Faye	White Salmon Vineyard	509/493-4640 **510/527-3675**	peter@BrehmVineyards.com	932 Evelyn Avenue	Albany	CA	94706	4 acres Chardonnay; 3 acres Pinot Noir	Yes-$50
Brady	Joe	Vicki	Underwood Mountain Vineyard	425/462-6436	bradyjoe@worldnet.att.net	1432 108th Avenue SE	Bellevue	WA	98004	12 acres Pinot Noir and Pinot Gris	Yes-$50
Brady	Jack	Sally	Underwood Mountain Vineyard		jackbrady@gorge.net	442 Kramer Road	Underwood	WA	98651	12 acres Pinot Noir and Pinot Gris	(see above)
Castagnoli	Steve		OSU Extension Service	541/386-3343	steve.castagnoli@orst.edu	2990 Experiment Station Dr	Hood River	OR	97031		
Cowan	Jim	Dee	Mountainview Vineyard	509/493-4786	(no)	31 Memory Lane	Underwood	WA	98651	4 1/4 acres Riesling	
Dobson	Christopher	Robin	Columbia Gorge Winery	509/365-2900	(no)	6 Lyle-Snowden Road	Lyle	WA	98635		
Dowling	Kristin		English Estate	360/256-2469	kristindowling@home.com	17908 SE 1st Street	Vancouver	WA	98684	3-4 acres Pinot Noir	
Ensminger	Rick	Jody	Celilo Vineyards	509/493-2916	ricjodens@gorge.net	PO Box 43	Underwood	WA	98651	65 acres various Chard / Gerwurtz	Yes-$50
Gensler	Don	Kristi	Mont Elise Vineyard	541/352-6812	**gansita@gorge.net (BOUNCES; DON'T READ)**	4970 Alexander Road	Parkdale	OR	97041	Pinot Noir; Gewurztaminer	Yes-$50
Goodwillie	Joel	Kris	Wind River Cellars	509/493-2324	windriverwines@gorge.net	PO Box 215	Husum	WA	98623	12 acres various	Yes-$50
Haw	John		Maryhill Winery (Winemaker)	509/773-6951	**jpvino1@ibm.net (BOUNCES)**	PO Box 1104	Glendale	WA	98620		
Heany	Fred			509/493-4453	fheany@gorge.net						
Henderson	Charles	Della	Mont Elise Vineyard	509/493-1880	mev@gorge.net (mew@gorge.net?)	PO Box 394 or 133 Wnuk Road	White Salmon	WA	98672	Pinot Noir; Gewurztaminer	Yes-$50
Jacox	Norm	Karen	Crystal Pheasant Vineyard	503/778-0645 509/493-4997	kklug@pps.k12.or.us	19 Dorsey Rd- White Salmon or PO Box 1305	Vancouver	WA	98666	47 acres Pinot, Chard, Gris, Gerwurzt, Riesling	Yes-$50
Larsen	Don		Larsen's Cherries Inc	509/493-3318	dlarsen@gorge,net	5 Larsen Ranch Road; PO Box 865	White Salmon	WA	98672	5 acres Gerwurzt; 1/2 A Chardonnay	Yes-$50
Larkowski	Bob	Andrea Holin	Cascade Cliffs Winery								
Maionchi	Edward	Ruth		509/369-4415		1210 Highway 142	Lyle	WA	98635		Yes-$50
Mantone	James	Poppie	Syncline Wine Cellars	541/683-9643	morchwine@netscape.net	PO Box 761	Bingen	WA	98605	4 acres Cabernet Franc, Malbec, Petit Verdot	
Martz	Rick	Terri	MarBil Vineyards	541/386-5895	ramartz@aol.com	2130 Tucker Road	Hood River	OR	97031	4 acres Malbec, Petite Verdot, Cabernet Franc	Yes-$50
McDurmott	Don	Sarah			nod@gorge.net						
Myzkowski	Alex	Cathy		509/493-2702	**cathy.myzkowski@mail.sprint.com (BOUNCES)**	139 Cooke Road	White Salmon	WA	98672	12 acres Pinot Noir, Chard (growing to 25)	Yes-$50
Reed	Dick	Christie	Wy-East and Blue Chip	541/386-9233	reedfam@gorge.net	675 Highline	Hood River	OR	97031	5 acres Chard, Pinot Gris	Yes-$50
Sato	Gordy				gordysato@aol.com	5171 BaseLine Drive	Parkdale	OR	97041		

Last Name	First Name, Husband	First Name, Wife	Vineyard or Winery	Phone	Email	Address	City	State	Zip	Grapes Grown	2001 Dues Paid
Schechtel	Tim	Erin	Columbia Country Vineyards	541/386-6408	hoodcraft@gorge.net	1450 Tucker Road	Hood River	OR	97031	Works with Lonnie Wright	
Smasne		Judi	Maryhill Winery (Operations Manager)	509/773-6951	smasne@gorge.net	PO Box 1104	Glendale	WA	98620		
Stingl	Dan			509/493-2300 509/493-2375	ZionProperties@aol.com or HarryHoundstooth@aol.com	717 Highway 14	Lyle	WA	98635	Blvd. Bonita Springs, FL 34134 (941-498-3935)	Yes-$50
Swihart	Matthew	Mary			matts@fullsailbrewing.com						
Unknown	Ed				edm@gorge.net	Klickitat River					
Watts	Brian	Jeanie	WyEast Vineyard		bcjkwatts@aol.com	1152 Methodist Road	Hood River	OR	97031	18 acres Pinot Noir, Pinot Gris, Chardonnay	
Wharry	Mark	Melinda (Mindy)	Swift Water Vineyard	503/224-6020	mwharry@sjoeng.com or melinda_pyrch@mentorg.com	2300 SW Hoffman Avenue	Portland	OR	97201		Yes-$50
Woodward	Thomas	Marlene Farnum	Oak Ridge Vineyard	509/493-1862	twoodward@gorge.net	PO Box 218	Husum	WA	98623	5.5 acres Gerwurzt	Yes-$50
Ziegler	Clark	Helen	Gorge View Vineyard	509/493-1601	clarkz@gorge.net	10241 Cook-Underwood Road	Underwood	WA	98651	2 acres Pinot Gris	Yes-$50
Ziegler	Ken	Jackie	Ziegler Lane Vineyard	509/493-2620		493 Little Buck Creek Road	Underwood	WA	98651	4 acres Pinot Gris	

Exhibit 9
Columbia Gorge Appellation
Proposed Boundaries (Small Scale)

See USGS maps
2/4/04
MS

TTB Note: Due to their size, the USGS maps were not scanned. Contact TTB for more information.

2/15/02 → ADDITIONAL INFO

COLUMBIA RIVER GORGE WINE GROWERS ASSOCIATION

February 15, 2002

Lisa Geffer
Regulations Division - 5th Floor
Bureau of Alcohol, Tobacco, and Firearms
650 Massachusetts Avenue, NW
Washington DC 20226

Dear Lisa:

Per our telephone discussion several weeks ago, I am enclosing additional information in support of our petition for Rule Amendment to establish the **Columbia Gorge** Appellation American Viticultural Area. As we discussed, there were three issues to address:

1. Additional information regarding characterization of soils outside the proposed boundary.
2. Confirmation of the proposed name for the Appellation.
3. Additional information regarding the proposed boundary and any reevaluation (if necessary) to revise portions of the boundary to follow natural features.

This three issues are discussed in detail below. In addition, appropriate back-up materials have been attached.

Confirmation of Proposed Name for the Appellation

It appeared that there was some confusion as to whether the name should be the "Columbia Gorge" or the "Columbia River Gorge" Appellation. As the brochures and references illustrate, both terms are utilized. The shorter version "Columbia Gorge" is the more common usage while "Columbia River Gorge" appears usually as a more official title such as the "Columbia River Gorge National Scenic Area".

In reviewing historical references, it is used both ways in our application, but it is our position that the shorter term "Columbia Gorge" is the more common usage. We are therefore petitioning to use the more common term **Columbia Gorge Appellation** as the original title of our application stated.

Properties of Soils Outside the Proposed Appellation Boundary

As demonstrated in the original application, the predominant soil types in the appellation areas on both sides of the Columbia River are silty loams with relatively low permeability as outlined below.

Skamania County	Chemawa Loam Series (Soil Types 21, 22, 23, 24) Underwood Loam Series (Soil Types 144, 145, 146) McElroy Loam Series (Soil Type 69)
Klickitat County	Chemawa Loam Series (Soil Types 86A, 86B, 86C) McGowen Loam Series (Soil Type 77) Underwood Loam Series (Soil Types 76A, 76B, 76C)
Hood River County	Oak Grove Loam Series (Soil Types 16B, 16C, 16D) Parkdale Loam Series (Soil Types 17B, 17C, 17D) Van Horn Loam Series (Soil Types 23, 24) Wyest Silt Loam Series (Soil Types 28B, 28C)
Wasco County	Wamic Loam Series (Soil Type 49, 50, and 51) Van Horn Loam Series (Soil Type 45)

All of these loam soils are all similar in nature and consist of very deep and well drained soil deposits on terraces, foot slopes and back slopes. Permeability of these loams is slow to moderate and available water capacity is high. By contrast, the areas immediately surrounding the proposed appellation boundary are generally comprised of gravelly, higher permeability soils. Examples are outlined below.

Skamania County	Steeper McElroy Series (Soil Types 67 and 68) (west of proposed boundary on Washington side)
Klickitat County	No data available. (east of proposed boundary on Washington side)
Hood River County	Bins-Bindle Series (Soil Type 3E and 3F) Yallani Series (Soil Types 32E and 32F) (west of proposed boundary on Oregon side)
Wasco County	Hesslan-Skyline Series (Soil Types 27F, 28E, and 43F) (east of proposed boundary on ~~Washington~~ Oregon side)

These soils typically support sloped timber areas above 2,000' elevation. Further data on these surrounding area soil characteristics has been attached as Exhibit A. The information is presented from the County Soil Surveys compiled by the Natural Resource Conservation Service.

Examination of Proposed Boundary

We reviewed the proposed boundary per our last discussions. There are several criteria that were looked at in developing the proposed boundary.

1. Elevation
   A general elevation limit of 2,000 feet was considered. This does not mean that the 2,000' elevation is a hard and fast cut-off. The Columbia River moderates the temperature to some degree as the Gorge cuts through the Cascades. Consequently, there are some regions approaching or slightly exceeding 2,000' (particularly on the Washington side) that have been included in the proposed boundary because grape growing is viable. In addition, there are some lower elevation regions, to the extreme north and south ends of the proposed appellation, that have not been included because they experience too much cold weather and frost. In general, however, the proposed boundary tends to follow the 2,000 contour.

2. Soil Type
   As the valleys on both the Washington and Oregon side of the appellation slope up to the surrounding hills, the terrain becomes much steeper and the soil types change considerably (as shown in the attached evidence and discussed above).

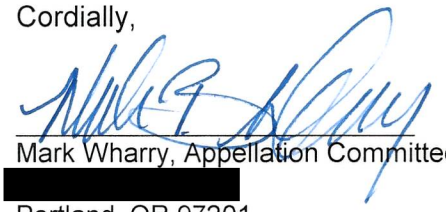
3. Established Grape Growing Areas
   The locations of established vineyards in the area were carefully reviewed. Existing vineyards are the best proof of grape growing ability and history.

In light of your review comments, we have made some minor revisions to the proposed boundary. In a few cases, the boundary was revised to follow the actual 2,000' contour. In other cases, we simply revised the boundary along section lines to more closely follow the above criteria. **The proposed boundary attempts to draw a general line that includes the lower, flatter, loamy soil, agricultural areas and excludes the higher elevation, steeper, gravelly soil, timber areas.**

A complete revised boundary description has been attached as Exhibit B. In addition, I have included the small map which shows the entire area as Exhibit C. The original boundary is shown in black and the proposed revisions are shown in red. In numerous areas, the 2,000 elevation has been shown in green for information. **Please note that this map is a metric map and that the 600 meter elevation was used to approximate the 2,000' contour.**

We appreciate your consideration of our petition. Please do not hesitate to contact me if there are questions or if further information is needed.

Cordially,



Mark Wharry, Appellation Committee
[redacted]
Portland, OR 97201
[redacted]

Exhibit A
Surrounding Region Soil Types
Columbia Gorge Appellation

vegetation is bunchgrasses, forbs, and shrubs. The average annual precipitation is 10 to 13 inches, the average annual air temperature is 49° to 54° F, and the frost-free period is 130 to 180 days at 32° and 180 to 200 days at 28°.

In a representative profile the surface layer is very dark grayish brown silt loam about 16 inches thick. The underlying material is very dark grayish brown and dark brown silt loam that extends to a depth of 60 inches or more. Depth to gravel and sand is 40 to 60 inches or more. The soil material throughout the profile is neutral to moderately alkaline.

Permeability is moderate, and the available water capacity is 7.5 to 12.5 inches. Water-supplying capacity is 8 to 13 inches. Effective rooting depth is 40 to 60 inches or more.

These soils are used for hay, pasture, small grain, range, and wildlife habitat.

Representative profile of a Hermiston silt loam in the SW¼SE¼NW¼ section 32, T. 2 N., R. 15 E.:

Ap—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; neutral; gradual wavy boundary.

A12—8 to 16 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak coarse prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; neutral; gradual wavy boundary.

AC—16 to 37 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak coarse prismatic structure; slightly hard, firm, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; moderately calcareous; moderately alkaline; gradual wavy boundary.

C1ca—37 to 48 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; moderately calcareous with mycelial lime; mildly alkaline; gradual wavy boundary.

C2—48 to 60 inches; dark brown (10YR 3/3) silt loam, grayish brown (10YR 5/2) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores; neutral; abrupt smooth boundary.

The A horizon is dark grayish brown or grayish brown when dry and very dark brown or very dark grayish brown when moist. It is silt loam or loam. The C horizon is grayish brown or brown when dry and very dark grayish brown or dark brown when moist. It is silt loam or loam and has stratified layers of sand and gravel.

26—Hermiston silt loam. A representative mapping unit is in the SW¼SE¼NW¼ section 32, T. 2 N., R. 15 E. This soil has slopes of 0 to 3 percent. It is adjacent to streams in long, narrow strips that average about 100 yards wide.

Included with this soil in mapping were areas of Tygh, Endersby, Pedigo, and noncalcareous silt loam soils. These soils make up about 10 percent of the unit.

Runoff is slow, and the hazard of erosion is slight. Capability unit IIe-3, nonirrigated and I-1, irrigated; Semi-Moist Bottom range site.

Hesslan Series

The Hesslan series consists of well drained soils formed in loess, volcanic ash, and colluvium weathered from sandstone on uplands. Slopes are 5 to 70 percent. Elevation is 500 to 3,500 feet. In uncultivated areas, the vegetation is bunchgrasses, forbs, shrubs, oak, and ponderosa pine. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 45° to 49° F, and the frost-free period is 110 to 140 days at 32° and 140 to 160 days at 28°.

In a representative profile the surface layer is very dark grayish brown stony loam about 9 inches thick. The upper 9 inches of the subsoil is dark brown loam, and the lower 5 inches is dark brown cobbly loam. Semiconsolidated sandstone is at a depth of about 23 inches. The soil material throughout the profile is neutral.

Permeability is moderate, and the available water capacity is 3 to 8 inches. Water-supplying capacity is 5 to 7 inches. Effective rooting depth is 20 to 40 inches.

These soils are used for range, timber, wildlife habitat, and water supply.

Representative profile of a Hesslan stony loam in an area of Skyline-Hesslan complex, 40 to 65 percent slopes, 500 feet north of the county road in the NW¼SW¼SE¼ section 1, T. 1 S., R. 12 E.:

A11—0 to 3 inches; very dark grayish brown (10YR 3/2) stony loam, grayish brown (10YR 5/2) dry; weak medium platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 5 percent pebbles, 5 percent cobbles, and 5 percent stones; neutral; abrupt smooth boundary.

A12—3 to 9 inches; very dark grayish brown (10YR 3/2) stony loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 5 percent pebbles, 5 percent cobbles, and 5 percent stones; neutral; abrupt smooth boundary.

B1—9 to 18 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 5 percent pebbles and 5 percent cobbles; neutral; clear smooth boundary.

B2—18 to 23 inches; dark brown (10YR 4/3) cobbly loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 10 percent pebbles and 10 percent cobbles; neutral; abrupt wavy boundary.

IIC—23 to 30 inches; semiconsolidated sandstone; extremely hard.

The A horizon is grayish brown, dark grayish brown, or brown when dry and very dark grayish brown, very dark brown, or dark brown when moist. It is stony loam or cobbly loam. The content of rock fragments 2 millimeters to 10 inches in size ranges from 5 to 20 percent. The content of surface stones is 5 to 20 percent. The B horizon is grayish brown, brown, or pale brown when dry and very dark grayish brown or dark brown when moist. It is 5 to 30 percent rock fragments 2 millimeters to 10 inches in size. It has weak or moderate medium and fine subangular blocky structure. Depth to rippable bedrock is 20 to 40 inches.

27F—Hesslan complex, 30 to 70 percent slopes.

A representative mapping unit is in the SW¼NW¼ NW¼ section 17, T. 1 S., R. 13 E. This complex is about 60 percent a Hesslan stony loam and 20 percent loam or cobbly loam soils that are 40 to 60 inches deep to bedrock. The Hesslan soil is on ridgetops and north-facing side slopes.

Included with this complex in mapping were areas of Wamic loam and Skyline very cobbly loam. These soils make up about 20 percent of the unit. Also included were outcroppings of sandstone.

Runoff is rapid, and the hazard of erosion is severe. This complex is used for timber, range, wildlife habitat, and water supply. Capability subclass VIIs; Oak Steep North range site.

28E—Hesslan-Skyline complex, 5 to 40 percent slopes. A representative mapping unit is in the SW¼ SW¼NW¼ section 5, T. 1 S., R. 12 E. This complex is about 30 to 60 percent a Hesslan stony loam and 20 to 50 percent a Skyline very cobbly loam. The Hesslan soil has north-facing slopes, and the Skyline soil has south-facing slopes.

Included with this complex in mapping were areas of Frailey loam and Wamic loam. These soils make up about 20 percent of the unit.

Runoff is medium to rapid, and the hazard of erosion is moderate. This complex is used for range, wildlife habitat, and water supply. Capability subclass VIIs; Oak Steep South range site.

Ketchly Series

The Ketchly series consists of well drained soils formed in loess, volcanic ash, and colluvium weathered from andesite on uplands. Slopes are 3 to 65 percent. Elevation is 2,000 to 3,600 feet. The vegetation includes Douglas-fir, ponderosa pine, Oregon white oak, bunchgrasses, forbs, and shrubs. The average annual precipitation is 25 to 30 inches, the average annual air temperature is 42° to 45° F, and the frost-free period is 70 to 120 days at 32° and 100 to 140 days at 28°.

In a representative profile the surface layer is very dark grayish brown or dark brown loam about 11 inches thick. The subsoil is brown heavy loam about 31 inches thick. The substratum is very cobbly clay loam about 3 inches thick. Andesite bedrock is at a depth of 45 inches.

Permeability is moderately slow, and the available water capacity is 6 to 11 inches. Water-supplying capacity is 10 to 15 inches. Effective rooting depth is 40 to 60 inches.

These soils are used for timber, water supply, and wildlife habitat.

Representative profile of Ketchly loam, 3 to 30 percent slopes, 175 feet south of road in the NE¼NE¼ NW¼ section 2, T. 1 N., R. 11 E.:

O1—1 inch to 0; fir needles and twigs, grass, and deciduous leaves.

A11—0 to 6 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; many very fine irregular pores; 15 percent pebbles ⅛ to ½ inch in diameter; neutral; gradual smooth boundary.

A12—6 to 11 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine and medium roots; many very fine tubular pores; 15 percent pebbles ⅛ to ½ inch in diameter; neutral; clear smooth boundary.

B1—11 to 18 inches; brown (7.5YR 4/4) heavy loam, pale brown (10YR 6/3) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many very fine tubular pores; 15 percent pebbles; neutral; gradual smooth boundary.

B21t—18 to 24 inches; brown (7.5YR 4/4) heavy loam, pale brown (10YR 6/3) dry; weak coarse subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; many fine roots; many very fine tubular pores; common thin clay films in pores; neutral; gradual smooth boundary.

B22t—24 to 42 inches; brown (7.5YR 4/4) heavy loam, light yellowish brown (10YR 6/4) dry; weak coarse subangular blocky structure; extremely hard, firm, sticky and plastic; few to common fine and medium roots; many very fine tubular pores; common thin clay films on peds and in pores; slightly acid; gradual wavy boundary.

IIC—42 to 45 inches; very cobbly clay loam; massive; extremely hard, very firm, sticky and plastic; common very fine pores.

IIIR—45 inches; andesite bedrock.

The B2t horizon is loam, heavy loam, or light clay loam and is 5 to 30 percent rock fragments. Depth to bedrock is 40 to 60 inches or more.

29E—Ketchly loam, 3 to 30 percent slopes. A representative mapping unit is in the NE¼NE¼NW¼ section 2, T. 1 N., R. 14 E. This soil is on broad ridgetops. It has the profile described as representative of the series.

Included with this soil in mapping were areas of Bins, Bindle, Frailey, Bald, and shallow stony loam soils. These soils make up as much as 15 percent of the unit.

Runoff is slow, and the hazard of erosion is moderate. Capability subclass VIe; woodland group 2o.

29F—Ketchly loam, 30 to 65 percent slopes. A representative mapping unit is in the NW¼NE¼ section 10, T. 1 N., R. 11 E. This soil has long and narrow slopes.

Included with this soil in mapping were areas of Bins, Bindle, and Bald soils. These soils make up as much as 15 percent of the unit.

Runoff is rapid, and the hazard of erosion is severe. Capability subclass VIIe; woodland group 2r.

Lickskillet Series

The Lickskillet series consists of well drained soils formed in shallow, stony colluvium consisting of a mixture of loess, rock fragments, and residuum weathered from the underlying basalt on uplands. Slopes are 15 to 70 percent. Elevation is 200 to 3,600 feet. The vegetation is bunchgrasses, forbs, and shrubs. The average annual precipitation is 10 to 13 inches, the average annual air temperature is 45° to 52° F, and the frost-free period is 100 to 150 days at 32° and 150 to 210 days at 28°.

In a representative profile (fig. 4) the surface layer is very dark grayish brown extremely stony loam about

Sherar soils that make up as much as 10 percent of the unit.

Runoff is rapid, and the hazard of erosion is severe. Capability subclass VIe; Droughty North Exposure range site.

42F—Sinamox silt loam, 45 to 70 percent slopes. A representative mapping unit is in the SW¼SW¼ SW¼ section 12, T. 4 S., R. 13 E. This soil is in long, narrow areas and has north-facing slopes. It has a profile described as representative of the series.

Included with this soil in mapping were areas of Sherar soils that make up as much as 15 percent of the unit.

Runoff is rapid, and the hazard of erosion is severe. Capability subclass VIIe; Steep North range site.

Skyline Series

The Skyline series consists of well drained soils formed in loess, volcanic ash, and colluvium over bedrock on uplands. Slopes are 5 to 70 percent. Elevation is 500 to 3,500 feet. The vegetation is bunchgrasses, forbs, and shrubs. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 47° to 49° F, and the frost-free period is 110 to 140 days at 32° and 140 to 160 days at 28°.

In a representative profile the surface layer is very dark grayish brown very cobbly loam and cobbly loam about 9 inches thick. The subsoil is dark brown gravelly loam about 5 inches thick. Sandstone bedrock is at a depth of about 16 inches. The soil material in the profile is neutral.

Permeability is moderate, and the available water capacity is 1 to 3 inches. Water-supplying capacity is 6 to 9 inches. Effective rooting depth is 12 to 20 inches.

These soils are used for range and wildlife habitat.

Representative profile of a Skyline very cobbly loam in an area of Skyline-Hesslan complex, 40 to 65 percent slopes, 1,000 feet north of the county road in the NE¼NE¼NW¼ section 26, T. 1 S., R. 12 E.:

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) very cobbly loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 20 percent fine and medium pebbles; 20 percent cobbles, and 10 percent stones; neutral; abrupt smooth boundary.

A3—2 to 9 inches; very dark grayish brown (10YR 3/2) cobbly loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 10 percent fine pebbles and 15 percent cobbles; neutral; clear smooth boundary.

B2—9 to 14 inches; dark brown (10YR 3/3) gravelly loam, brown (10YR 5/3) dry; weak medium subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; 15 percent pebbles and 10 percent cobbles; neutral; abrupt wavy boundary.

IIC—14 to 16 inches; semiconsolidated sandstone bedrock.

The A horizon is grayish brown, brown, or dark grayish brown when dry and very dark grayish brown or dark brown when moist. It is cobbly loam or very cobbly loam and is 20 to 40 percent rock fragments 2 millimeters to 10 inches in size. The content of surface stones is 5 to 20 percent. The B horizon is grayish brown or brown when dry and very dark grayish brown or dark brown when moist. It is cobbly loam to cobbly heavy loam and is 10 to 30 percent rock fragments 2 millimeters to 10 inches in size. It has weak to moderate, medium, subangular blocky structure. The soil is 12 to 20 inches deep to semiconsolidated sandstone bedrock.

43F—Skyline-Hesslan complex, 40 to 65 percent slopes. A representative mapping unit is in the NE¼ NE¼NW¼ section 26, T. 1 S., R. 12 E. This complex is about 50 to 70 percent a Skyline very cobbly loam and 10 to 30 percent a Hesslan stony loam. The Skyline soil has south-facing slopes, and the Hesslan soil has north-facing side slopes. The soils have the profiles described as representative of their respective series.

Included with this complex in mapping were areas of Frailey loam and Wamic loam. These soils make up about 20 percent of the unit.

Runoff is rapid, and the hazard of erosion is severe. This complex is used for range and wildlife habitat. Capability subclass VIIs; Oak Steep South range site.

Tygh Series

The Tygh series consists of somewhat poorly drained soils on bottom lands. They formed in alluvium derived from volcanic ash, loess, and weathered sedimentary rocks. Slopes are 0 to 3 percent. Elevation is 200 to 1,800 feet. In uncultivated areas, the vegetation is bunchgrasses, forbs, and shrubs. The average annual precipitation is 14 to 20 inches, the average annual air temperature is 48° to 52° F, and the frost-free period is 130 to 150 days at 32° and 150 to 180 days at 28°.

In a representative profile the surface layer is very dark brown fine sandy loam about 10 inches thick. The upper 20 inches of the underlying material is dark grayish brown fine sandy loam, the next 11 inches is dark gray sandy loam, the next 5 inches is gray and dark gray loamy sand, and below this is gray to dark gray very gravelly sand to a depth of 60 inches or more. The soil material throughout the profile is neutral.

Permeability is moderately rapid, and the available water capacity is 4 to 8 inches. These soils are subject to seasonal flooding. Effective rooting depth is 40 to 60 inches.

These soils are used for dryfarmed and irrigated small grain, hay, pasture, range, and wildlife habitat.

Representative profile of Tygh fine sandy loam, 200 feet north of Fifteen Mile Creek in the NE¼NW¼ SW¼ section 33, T. 1 S., R. 13 E.:

Ap—0 to 10 inches; very dark brown (10YR 2/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; slightly hard, friable, nonsticky and nonplastic; common very fine roots; many very fine irregular pores; 2 percent gravel; neutral; abrupt smooth boundary.

C1—10 to 17 inches; dark grayish brown (10YR 4/2) fine sandy loam, light brownish gray (10YR 4/2) dry; common prominent fine reddish brown (5YR 4/4) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; common very fine roots; many very fine tubular pores; 2 percent gravel; neutral; clear wavy boundary.

Hermiston: 26	0–37	Silt loam	ML	A–4	0	100	100	95–100	70–90	20–25	NP
	37–60	Silt loam, very fine sandy loam.	ML	A–4	0	100	100	95–100	70–90	20–25	NP
Hesslan:											
[1]27F	0–9	Stony loam	ML	A–4	5–20	85–95	80–95	70–90	50–70	20–25	NP–5
	9–23	Cobbly loam	ML	A–4	10–30	85–95	80–95	70–90	50–70	20–25	NP–5
	23	Weathered bedrock.			0						
[1]28E:											
Hesslan part	0–9	Stony loam	ML	A–4	5–20	85–95	80–95	70–90	50–70	20–25	NP–5
	9–23	Cobbly loam	ML	A–4	10–30	85–95	80–95	70–90	50–70	20–25	NP–5
	23	Weathered bedrock.			0						
Skyline part	0–9	Very cobbly loam	ML, GM, SM	A–2, A–4	15–50	60–85	50–80	40–75	30–60		NP
	9–14	Gravelly loam	ML, SM, GM	A–4, A–2	5–15	65–80	60–75	50–70	35–55		NP
	14	Weathered bedrock.									
Ketchly: 29E, 29F	0–11	Loam	ML, SM	A–4	0	75–95	70–95	60–90	40–70		NP
	11–42	Clay loam, loam	CL, GC	A–6	0	60–95	55–95	50–95	40–75	30–35	10–15
	42–45	Stony clay loam, very cobbly clay loam.	CL	A–6	30–50	90–95	85–90	75–90	60–70	30–35	10–15
Lickskillet: 30E, 31F	0–10	Extremely stony loam	GM–GC, CL–ML	A–4	10–50	60–90	60–85	50–80	35–65	25–30	5–10
	10–16	Very gravelly clay loam, very gravelly loam.	GC	A–2, A–6, A–7	15–35	40–65	25–50	20–50	15–40	35–45	15–20
	16	Unweathered bedrock.									
Maupin: 32A, 32B	0–31	Loam	ML	A–4	0	95–100	95–100	80–95	55–75	25–30	NP–5
	31–37	Indurated.									
	37	Unweathered bedrock.									
Maupin variant: 33	0–51	Loam	ML	A–4	0	95–100	95–100	80–95	55–75	25–30	NP–5
	51	Unweathered bedrock.									
Nansene: 34F	0–22	Silt loam	ML	A–4	0	95–100	95–100	90–100	85–90	20–25	NP–5
	22–62	Silt loam	ML	A–4	0	95–100	95–100	90–100	85–90	20–25	NP–5
	62	Unweathered bedrock.									
Pedigo: 35	0–49	Silt loam	ML	A–4	0	100	100	95–100	80–95	20–40	NP–10
Quincy: 36	0–60	Loamy fine sand	SM, SP–SM	A–2, A–1, A–3	0–15	85–100	80–100	40–75	5–30		NP
Riverwash: 37.											
Rock outcrop—Rubble land complex: 38.											
Rock outcrop—Xeropsamments complex:											
[1]39											
Rock outcrop part.											
Xeropsamments part	0–30	Loamy sand	SM, SP–SM	A–2, A–1, A–3	0	90–100	85–100	40–75	5–30		NP
	30	Unweathered bedrock.									
Sherar: 40E, 41F	0–3	Cobbly loam, very cobbly loam.	ML	A–4	15–40	80–90	75–90	65–85	50–70	30–35	5–10
	3–9	Clay loam	CL	A–6	5–20	80–95	75–95	70–95	50–75	35–40	15–20
	9–29	Clay, gravelly clay	CH	A–7	15–35	70–95	60–85	55–85	50–80	50–65	25–35
	29–35	Very gravelly clay	GC	A–2, A–7	15–30	35–45	25–40	25–40	25–40	50–65	25–35
	35	Weathered bedrock.									
Sinamox: 42B, 42C, 42D, 42E, 42F.	0–33	Silt loam	ML	A–4	0	95–100	95–100	85–100	70–90	30–35	5–10
	33–49	Gravelly clay loam, very gravelly clay loam.	GM, ML	A–2, A–6	0–15	45–70	35–70	35–70	30–55	35–40	10–15

TABLE 13. — *Engineering Properties and Classifications* — Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments >3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				*Pct*					*Pct*	
Sinamox: Cont.	49–59	Silty clay	CH	A–7	0–5	90–100	85–100	75–95	70–95	50–60	25–30
	59	Weathered bedrock.									
Skyline: [1]43F:											
Skyline part	0–9	Very cobbly loam	ML, GM, SM	A–2, A–4	15–50	60–85	50–80	40–75	30–60		NP
	9–14	Gravelly loam	ML, SM, GM	A–4, A–2	5–15	65–80	60–75	50–70	35–55		NP
	14	Weathered bedrock.									
Hesslan part	0–9	Stony loam	ML	A–4	5–20	85–95	80–95	70–90	50–70	20–25	NP–5
	9–23	Cobbly loam	ML	A–4	10–30	85–95	80–95	70–90	50–70	20–25	NP–5
	23	Weathered bedrock.			0						
Tygh: 44	0–30	Fine sandy loam	SM, ML	A–4	0	95–100	95–100	65–85	40–55		NP
	30–41	Sandy loam	SM	A–2, A–4	0	90–100	90–100	55–70	25–40		NP
	41–46	Loamy sand	SM	A–2	0	85–95	80–95	40–70	10–30		NP
	46–60	Very gravelly sand	GW, GP	A–1	0–5	15–30	10–25	5–20	0–5		NP
Van Horn: 45B, 45C, 45D, 45E.	0–21	Loam	ML, SM	A–4	0	100	100	80–90	40–60	20–25	NP–5
	21–49	Sandy clay loam, clay loam.	CL, SC	A–6	0	100	100	80–90	35–55	30–40	10–15
	49–60	Sandy loam, loam	SM	A–2, A–4	0	100	100	60–70	30–40		NP
Walla Walla: 46B, 46C, 46D, 47D, 47E, 48E, 48F.	0–13	Silt loam	ML	A–4	0	100	100	95–100	70–100	20–30	NP–5
	13–44	Silt loam	ML	A–4	0	100	100	95–100	80–100	20–35	NP–10
	44–82	Silt loam	ML	A–4	0	100	100	95–100	80–100	20–25	NP–5
Wamic:											
49B, 49C, 50C, 50D, 50E, 50F.	0–28	Loam	ML	A–4	0	95–100	95–100	90–95	55–75	20–25	NP–5
	28–44	Loam, clay loam	ML	A–4	0	95–100	95–100	90–95	55–75	30–35	5–10
	44	Unweathered bedrock.									
[1]51D:											
Wamic part	0–28	Loam	ML	A–4	0	95–100	95–100	90–95	55–75	20–25	NP–5
	28–44	Loam, clay loam	ML	A–4	0	95–100	95–100	90–95	55–75	30–35	5–10
	44	Unweathered bedrock.									
Skyline part	0–9	Very cobbly loam	ML, GM, SM	A–2, A–4	15–50	60–85	50–80	40–75	30–60		NP
	9–14	Gravelly loam	ML, SM, GM	A–4, A–2	5–15	65–80	60–75	50–70	35–55		NP
	14	Weathered bedrock.									
Wapinitia variant: 52B	0–12	Silt loam	ML	A–4	0	95–100	95–100	90–100	65–90	30–35	NP–5
	12–22	Silty clay loam	CL	A–6	0	95–100	95–100	90–100	80–95	35–40	10–15
	22–53	Clay	CH	A–7	0	95–100	95–100	85–100	70–95	50–65	25–35
	53–60	Unweathered bedrock.									
Warden: 53E	0–8	Silt loam	ML	A–4	0	95–100	95–100	85–100	70–90	25–30	NP–5
	8–21	Very fine sandy loam, silt loam.	ML	A–4	0	95–100	95–100	85–100	70–90	25–30	NP–5
	21–60	Silt loam, very fine sandy loam.	ML	A–4	0	95–100	95–100	85–100	70–90	25–30	NP–5
Watama: [1]54B, 54C, 54D, 54E:											
Watama part	0–10	Silt loam	ML	A–4	0	95–100	95–100	90–100	65–90	30–35	NP–5
	10–24	Loam	ML	A–4	0	95–100	95–100	80–95	55–75	30–35	NP–5
	24–34	Clay loam	ML	A–6	0–5	95–100	95–100	85–100	65–80	35–40	10–15
	34	Unweathered bedrock.									
Wapinitia part	0–19	Silt loam	ML	A–4	0	95–100	95–100	90–100	65–90	30–35	NP–5
	19–29	Silty clay loam	ML	A–6	0	95–100	95–100	90–100	80–95	35–40	10–15
	29–36	Fine sandy loam	SM, ML	A–4	0	95–100	95–100	65–85	40–55	20–25	NP–5

TABLE 14. — *Physical and Chemical Properties of Soils* — Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodibility group
							Uncoated steel	Concrete	K	T	
	In	*In/hr*	*In/hr*	*pH*	*Mmhoa/cm*						
Nansene: 34F	0–22	0.6–2.0	0.16–0.19	6.1–7.3	<2	Low	Moderate	Low	0.43	3	
	22–62	0.6–2.0	0.16–0.19	6.1–7.3	<2	Low	Moderate	Low	0.55		
	62										
Pedigo: 35	0–49	0.6–2.0	0.19–0.20	7.4–9.0	<4	Low	High	Low			5
Quincy: 36	0–60	0.6–2.0	0.05–0.10	6.1–7.3	<2	Low	Moderate	Low	0.20	5	2
Riverwash: 37.											
Rock outcrop—Rubble land complex: 38.											
Rock outcrop—Xeropsamments complex: [1]39.											
Rock outcrop part.											
Xeropsamments part	0–30	>6.0	0.05–0.10	6.1–7.3	<2	Low	Low	Low	0.32	3	2
	20										
Sherar: 40E, 41F	0–3	0.6–2.0	0.11–0.15	6.6–7.3	<2	Low	Low	Low	0.24	2	
	2–9	0.2–0.6	0.16–0.20	6.6–7.3	<2	Moderate	Moderate	Low	0.24		
	9–29	0.06–0.2	0.10–0.14	6.6–7.8	<2	High	High	Low	0.17		
	29–35	0.06–0.2	0.07–0.12	6.6–7.8	<2	High	High	Low	0.10		
	35										
Sinamox: 42B, 42C, 42D, 42E, 42F.	0–33	0.6–2.0	0.19–0.21	6.6–7.3	<2	Low	Moderate	Low	0.49	3	
	33–49	0.2–0.6	0.10–0.14	6.6–7.8	<2	Moderate	Moderate	Low	0.10		
	49–59	0.2–0.6	0.12–0.15	7.9–8.4	<2	High	High	Low	0.28		
	59										
Skyline: [1]43F:											
Skyline part	0–9	0.6–2.0	0.10–0.15	6.6–7.3	<2	Low	Low	Low	0.17	1	
	9–14	0.6–2.0	0.10–0.15	6.6–7.3	<2	Low	Low	Low	0.20		
	14										
Hesslan part	0–9	0.6–2.0	0.13–0.17	6.6–7.3	<2	Low	Low	Low		2	
	9–23	0.6–2.0	0.11–0.15	6.6–7.3	<2	Low	Low	Low	0.28		
	23								0.28		
Tygh: 44	0–30	2.0–6.0	0.13–0.15	6.6–7.3	<2	Low	Low	Low	0.20	3	
	30–41	2.0–6.0	0.11–0.13	6.6–7.3	<2	Low	Low	Low	0.20		
	41–46	6.0–20	0.06–0.08	6.6–7.3	<2	Low	Low	Low	0.10		
	46–60	>20	0.03–0.05	6.6–7.3	<2	Low	Low	Low	0.10		
Van Horn: 45B, 45C, 45D, 45E	0–21	2.0–6.0	0.14–0.16	6.1–6.5	<2	Low	Low	Low	0.24	5	
	21–49	0.6–2.0	0.14–0.18	6.1–6.5	<2	Moderate	Moderate	Low	0.20		
	49–60	6.0–20	0.11–0.16	6.1–6.5	<2	Low	Low	Low	0.20		
Walla Walla: 46B, 46C, 46D, 47D, 47E, 48E, 48F.	0–13	0.6–2.0	0.17–0.20	6.6–7.8	<2	Low	Low	Low	0.49	5	5
	13–44	0.6–2.0	0.17–0.20	6.6–7.8	<2	Low	Low	Low	0.55		
	44–88	0.6–2.0	0.16–0.19	7.9–9.0	<2	Low	High	Low	0.55		

Cherryhill: 14B, 14C, 14D, 14E, 14F, 15F	0–17	0.6–2.0	0.19–0.20	6.1–7.3	<2	Low	Low	Low	0.43	3	
	17–28	0.6–2.0	0.18–0.19	6.1–7.3	<2	Low	Low	Low	0.37		
	28–41	0.2–0.6	0.15–0.17	5.6–6.5	<2	Moderate	Moderate	Moderate	0.24		
	41										
[1]16D:											
Cherryhill part	0–17	0.6–2.0	0.19–0.20	6.1–7.3	<2	Low	Low	Low	0.43	3	
	17–28	0.6–2.0	0.18–0.19	6.1–7.3	<2	Low	Low	Low	0.37		
	28–41	0.2–0.6	0.15–0.17	5.6–6.5	<2	Moderate	Moderate	Moderate	0.24		
	41										
Rock outcrop part.											
Condon: 17B, 17C, 17D	0–27	0.6–2.0	0.20–0.25	6.1–7.3	<2	Moderate	Moderate	Low	0.43	2	
	27										
[1]18D:											
Condon part	0–27	0.6–2.0	0.20–0.25	6.1–7.3	<2	Moderate	Moderate	Low	0.43	2	
	27										
Bakeoven part	0–9	0.2–0.6	0.06–0.14	6.1–7.3	<2	Low	Moderate	Low	0.10	1	
	9										
Cumulic Haplaquolls: 19A	0–60										
Duart: 20B, 20C, 20D, 20E, [1]21E.	0–33	0.6–2.0	0.19–0.21	6.6–7.8	<2	Low	Moderate	Low	0.43	2	
	33										
Dufur: 22B, 22C, 22D, 22E	0–42	0.6–2.0	0.19–0.21	6.6–7.3	<2	Low	Moderate	Low	0.43	3	
	42–61	0.6–2.0	0.11–0.13	7.9–9.0	<2	Low	Moderate	Low	0.37		
	61										
Dune land: 23	0–60	76.0	0.04–0.08	5.6–7.3	<2	Low	Low	Low			1
Endersby: 24	0–53	2.0–6.0	0.16–0.18	6.6–7.8	<2	Low	Moderate	Low	0.32	3	
	53–60	>20	0.03–0.05	6.6–7.8	<2	Low	Moderate	Low	0.10		
Frailey: 25E, 25F	0–65	0.6–2.0	0.13–0.17	6.1–6.5	<2	Low	Low	Low	0.32	5	
	65										
Hermiston: 26	0–37	0.6–2.0	0.19–0.21	6.6–7.8	<2	Low	High	Low	0.37	5	5
	37–60	0.6–2.0	0.17–0.21	7.9–9.0	<2	Low	High	Low	0.49		
Hesslan:											
[1]27F	0–9	0.6–2.0	0.13–0.17	6.6–7.3	<2	Low	Low	Low	0.28	2	
	9–23	0.6–2.0	0.11–0.15	6.6–7.3	<2	Low	Low	Low	0.28		
	23										
[1]28E:											
Hesslan part	0–9	0.6–2.0	0.13–0.17	6.6–7.3	<2	Low	Low	Low	0.28	2	
	9–23	0.6–2.0	0.11–0.15	6.6–7.3	<2	Low	Low	Low	0.28		
	23										
Skyline part	0–9	0.6–2.0	0.10–0.15	6.6–7.3	<2	Low	Low	Low	0.17	1	
	9–14	0.6–2.0	0.10–0.15	6.6–713	<2	Low	Low	Low	0.20		
	14										
Ketchly: 29E, 29F	0–11	0.6–2.0	0.14–0.17	6.6–7.3	<2	Low	Low	Low	0.32	4	
	11–42	0.2–0.6	0.14–0.20	6.1–6.5	<2	Low	Moderate	Low	0.32		
	42–45	0.2–0.6	0.11–0.14	6.1–6.5	<2	Low	Moderate	Low	0.24		
Lickskillet: 30E, 31F	> 0–10	0.6–2.0	0.08–0.14	6.1–7.3	<2	Low	Moderate	Low	0.17	1	
	10–16	0.6–2.0	0.06–0.14	6.6–7.3	<2	Low	Moderate	Low	0.24		
	16										
Maupin: 32A, 32B	0–31	0.6–2.0	0.16–0.18	6.6–8.4	<2	Low	High	Low	0.37	2	
	31–37										
	37										
Maupin variant: 33	0–51	0.6–2.0	0.16–0.18	6.6–9.0	<2	Low	High	Low	0.37	4	
	51										

Map symbol	Mapping unit	Described on page	Capability unit Symbol	Page	Range site Name	Woodland group Symbol
15F	Cherryhill silt loam, 35 to 50 percent south slopes	17	VIe	47	Oak South Exposure	------
16D	Cherryhill-Rock outcrop complex, 3 to 25 percent slopes	17	VIe	47	----------	------
	Cherryhill part	--	------	--	Pine-Oak-Fescue	------
	Rock outcrop part	--	------	--	----------	------
17B	Condon silt loam, 1 to 7 percent slopes	18	IIIe-5	45	Rolling Hills	------
17C	Condon silt loam, 7 to 12 percent slopes	18	IIIe-5	45	Rolling Hills	------
17D	Condon silt loam, 12 to 25 percent slopes	18	VIe	47	Rolling Hills	------
18D	Condon-Bakeoven complex, 2 to 20 percent slopes	18	VIe	47	----------	------
	Condon part	--	------	--	Rolling Hills	------
	Bakeoven part	--	------	--	Scabland	------
19A	Cumulic Haplaquolls, nearly level*	18	IVw-1	47	----------	------
20B	Duart silt loam, 1 to 7 percent slopes	19	IIIe-5	45	Rolling Hills	------
20C	Duart silt loam, 7 to 12 percent slopes	19	IIIe-5	45	Rolling Hills	------
20D	Duart silt loam, 12 to 25 percent slopes	19	VIe	47	Rolling Hills	------
20E	Duart silt loam, 25 to 40 percent slopes	19	VIe	47	Droughty South Exposure	------
21E	Duart complex, 20 to 55 percent slopes*	19	VIe	47	Droughty South Exposure	------
22B	Dufur silt loam, 1 to 7 percent slopes	20	IIe-3	43	Rolling Hills	------
22C	Dufur silt loam, 7 to 12 percent slopes	20	IIIe-1	44	Rolling Hills	------
22D	Dufur silt loam, 12 to 25 percent slopes	20	IIIe-4	45	Droughty North Exposure	------
22E	Dufur silt loam, 25 to 40 percent slopes	20	IVe-2	47	North Exposure	------
23	Dune land*	20	VIIIe	48	----------	------
24	Endersby loam	21	IIe-3 non-irrigated	43	Semi-Moist Bottom	------
			I-1 irrigated	42		
25E	Frailey loam, 3 to 30 percent slopes*	21	VIe	47	Pine-Douglas Fir-Sedge	3o
25F	Frailey loam, 30 to 70 percent slopes*	21	VIIe	48	----------	3r
26	Hermiston silt loam	22	IIe-3 non-irrigated	43	Semi-Moist Bottom	------
			I-1 irrigated	42		
27F	Hesslan complex, 30 to 70 percent slopes*	22	VIIs	48	Oak Steep North	------
28E	Hesslan-Skyline complex, 5 to 40 percent slopes*	23	VIIs	48	Oak Steep South	------
29E	Ketchly loam, 3 to 30 percent slopes*	23	VIe	47	----------	2o
29F	Ketchly loam, 30 to 65 percent slopes*	23	VIIe	48	----------	2r
30E	Lickskillet very stony loam, 15 to 40 percent slopes*	24	VIIs	48	Droughty South Exposure	------
31F	Lickskillet extremely stony loam, 40 to 70 percent slopes*	24	VIIs	48	Droughty Steep South	------
32A	Maupin loam, 0 to 5 percent slopes	25	IIe-3 non-irrigated	43	Shrubby Rolling Hills	------
			IIe-2 irrigated			
32B	Maupin loam, 5 to 12 percent slopes	25	IIIe-5	45	Shrubby Rolling Hills	------
33	Maupin variant loam	26	IIe-3 non-irrigated	43	Shrubby Rolling Hills	------
			IIe-2 irrigated	43		
34F	Nansene silt loam, 35 to 70 percent slopes*	26	VIIe	48	Steep North	------
35	Pedigo silt loam	27	IIw-1	43	Alkaline Bottom	------
36	Quincy loamy fine sand, wet	27	IIIw-1	46	Semi-Moist Bottom	------
37	Riverwash*	27	VIIIw	48	----------	------
38	Rock outcrop-Rubble land complex*	27	VIIIs	48	----------	------

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit		Range site	Woodland group
			Symbol	Page	Name	Symbol
39	Rock outcrop-Xeropsamments complex*----------	28	VIIIs	48	----------	------
40E	Sherar cobbly loam, 5 to 45 percent slopes*--	29	VIe	47	Shrubby South Exposure	------
41F	Sherar very cobbly loam, 45 to 70 percent slopes*----------	29	VIIe	48	Droughty Steep South	------
42B	Sinamox silt loam, 1 to 7 percent slopes-----	29	IIIe-3	44	Shrubby Rolling Hills	------
42C	Sinamox silt loam, 7 to 12 percent slopes----	29	IIIe-5	45	Shrubby Rolling Hills	------
42D	Sinamox silt loam, 12 to 20 percent slopes---	29	IIIe-7	46	Shrubby Rolling Hills	------
42E	Sinamox silt loam, 20 to 45 percent slopes---	29	VIe	47	Droughty North Exposure	------
42F	Sinamox silt loam, 45 to 70 percent slopes---	30	VIIe	48	Steep North	------
43F	Skyline-Hesslan complex, 40 to 65 percent slopes*----------	30	VIIs	48	Oak Steep South	------
44	Tygh fine sandy loam----------	31	IIIw-1	46	Semi-Moist Bottom	------
45B	Van Horn loam, 0 to 8 percent slopes---------	32	IIe-1	42	Pine-Oak-Fescue	------
45C	Van Horn loam, 8 to 12 percent slopes--------	32	IIIe-2	44	Pine-Oak-Fescue	------
45D	Van Horn loam, 12 to 20 percent slopes-------	32	IIIe-2	44	Pine-Oak-Fescue	------
45E	Van Horn loam, 20 to 35 percent slopes-------	32	IVe-1	46	Pine-Oak-Fescue	------
46B	Walla Walla silt loam, 3 to 7 percent slopes-	33	IIe-3	43	Rolling Hills	------
46C	Walla Walla silt loam, 7 to 12 percent slopes	33	IIIe-1	44	Rolling Hills	------
46D	Walla Walla silt loam, 12 to 20 percent north slopes----------	33	IIIe-4	45	Droughty North Exposure	------
47D	Walla Walla silt loam, 12 to 20 percent south slopes----------	33	IIIe-4	45	Rolling Hills	------
47E	Walla Walla silt loam, 20 to 35 percent north slopes----------	33	IVe-3	47	North Exposure	------
48E	Walla Walla silt loam, 20 to 35 percent south slopes----------	33	IVe-2	47	Droughty South Exposure	------
48F	Walla Walla silt loam, 35 to 50 percent south slopes----------	33	VIe	47	Droughty South Exposure	------
49B	Wamic loam, 1 to 5 percent slopes----------	34	IIIe-1	44	Pine-Oak-Fescue	5o
49C	Wamic loam, 5 to 12 percent north slopes-----	34	IIIe-4	45	Pine-Oak-Fescue	5o
50C	Wamic loam, 5 to 12 percent south slopes-----	34	IIIe-5	45	Oak South Exposure	------
50D	Wamic loam, 12 to 20 percent slopes----------	34	IIIe-4	45	Pine-Oak-Fescue	5o
50E	Wamic loam, 20 to 40 percent slopes----------	34	VIe	47	Pine-Douglas Fir-Sedge	5r
50F	Wamic loam, 40 to 70 percent slopes*---------	34	VIIe	48	Pine-Douglas Fir-Sedge	5r
51D	Wamic-Skyline complex, 2 to 20 percent slopes*	34	VIe	47	----------	------
	Wamic part----------	--	------	--	Oak South Exposure	------
	Skyline part----------	--	------	--	Oak Steep South	------
52B	Wapinitia variant silt loam, 1 to 7 percent slopes----------	35	IIIe-5	45	Shrubby Rolling Hills	------
53E	Warden silt loam, 5 to 40 percent slopes*----	36	VIe	47	Silty Terrace	------
54B	Watama-Wapinitia silt loams, 0 to 5 percent slopes----------	36	IIe-3 non-irrigated IIe-2 irrigated	43 43	Shrubby Rolling Hills	------
54C	Watama-Wapinitia silt loams, 5 to 12 percent slopes----------	37	IIIe-4	45	Shrubby Rolling Hills	------

cent cobbles, and 0 to 5 percent stones. The structure is weak to moderate fine or medium subangular blocky. Depth to bedrock is 40 to 60 inches or more.

29E—Wyeth very gravelly loam, 5 to 45 percent slopes. This soil occurs as irregularly shaped areas and has north-facing slopes. It has a profile similar to the one described as representative of the series. A representative mapping unit is in the SE¼SW¼SW¼ sec. 32, T. 3 N., R. 11 E. Included in mapping were areas of Bald, Bodell, and Bindle soils that make up about 15 percent of the mapping unit.

Runoff is slow to rapid, and the hazard of erosion is slight to high. Capability subclass VIs; woodland suitability group 4f1; wildlife group 2.

29F—Wyeth very gravelly loam, 45 to 75 percent slopes. This soil occurs as long areas and has north-facing slopes. It has the profile described as representative of the series. A representative mapping unit is in the NE¼NE¼SE¼ sec. 31, T. 3 N., R. 11 E. Included in mapping were areas of Bald, Bodell, and Bindle soils that make up about 15 percent of the mapping unit.

Runoff is rapid, and the hazard of erosion is high. Capability subclass VIIs; woodland suitability group 4f2; wildlife group 2.

Xerofluvents

Xerofluvents are well drained to moderately well drained soils dissected by numerous small drainage channels. They formed in recently deposited alluvium from ashy and sandy outwash containing a large number of basalt cobbles and pebbles. Slopes are 0 to 3 percent. The surface is convex. The vegetation is trees and grasses, forbs, and shrubs. Average annual precipitation is 30 to 60 inches. The average annual air temperature is 42° to 52° F., and the frost-free period is 30 to 180 days.

These soils are stratified and are variable in texture. The surface layer, subsoil, and substratum are very cobbly sand, cobbly loamy sand, gravelly loamy sand, loamy sand, or sand.

Permeability is dominantly rapid, and available water capacity is low. These soils are occasionally flooded. They contain appreciable amounts of organic matter, which decreases irregularly with increasing depth. The content of coarse fragments is commonly high throughout the soil, but varies. Rooting depth is 60 inches or more.

Xerofluvents are used for grazing and wildlife habitat.

30A—Xerofluvents, nearly level. Mapped areas of these soils vary in size. A representative mapping unit is in the NW¼SE¼ sec. 33, T. 1 N., R. 10 E.

Xerofluvents, nearly level, are used for grazing, and provide wildlife habitat. Runoff is slow, and the erosion hazard is slight. Forage yields are low. Capability subclass VIIs; wildlife group 1.

Xerumbrepts

Xerumbrepts are well drained soils on north- and south-facing canyon slopes and ridges in the uplands. They formed in colluvium of variable origin. Slopes range from 40 to 70 percent. The vegetation is mostly bunchgrasses, forbs, shrubs, and trees. Elevation is 100 to 3,600 feet. Average annual precipitation is 30 to 60 inches. The average annual temperature is 42° to 51° F., and the frost-free period is 30 to 180 days.

The surface layer and subsoil are loam, silt loam, and clay loam that usually contain varying numbers of stones, boulders, cobbles, or pebbles, or combinations of these coarse fragments. The depth to rippable bedrock is 20 to 40 inches. Rock commonly crops out.

Xerumbrepts are associated with Hood, Parkdale, Van Horn, and Wind River soils. They are used for woodland, water supply, and wildlife habitat.

31F—Xerumbrepts, very steep. This mapping unit occurs as long narrow areas about 200 to 400 acres in size. It is not extensive. A representative unit is in the SW¼SW¼SW¼ sec. 13, T. 2 N., R. 10 E. Runoff is rapid, and the erosion hazard is high. Capability subclass VIIe; woodland suitability group 4r1; wildlife group 2.

Yallani Series

The Yallani series consists of well drained soils on uplands. These soils formed in volcanic ash and stony colluvium weathered from andesite and basalt. Slopes are 8 to 65 percent. Elevation is 1,800 to 3,000 feet on south-facing slopes and 1,500 to 2,400 on north-facing slopes. Vegetation is Douglas-fir, grand fir, western hemlock, bigleaf maple, forbs, and shrubs. The dominant understory plants are western fescue, mountain brome, thimbleberry, trailing blackberry, Cascade oregongrape, western hazel, vine maple, and Pacific serviceberry. Average annual precipitation is 40 to 60 inches, the average annual air temperature is 42° to 45° F., and the frost-free period is 30 to 60 days.

In a representative profile the surface layer is dark brown stony loam about 4 inches thick. The upper 9 inches of the subsoil is dark brown gravelly loam. The lower 26 inches is dark reddish brown and dark brown very gravelly loam. The substratum is dark brown very gravelly loam about 21 inches thick. The soil is mostly medium acid. The subsoil is slightly acid.

Permeability is moderately rapid. Available water capacity is 3 to 7 inches. Water-supplying capacity is 13 to 17 inches. Effective rooting depth is more than 60 inches.

Yallani soils are used for woodland, wildlife habitat, and water supply.

Representative profile of Yallani stony loam, 30 to 65 percent slopes, 20 feet north of a logging road in SE¼SE¼NW¼ sec. 21, T. 1 N., R. 9 E.

A1—0 to 4 inches; dark brown (7.5YR 3/2) stony loam, dark brown (7.5YR 4/4) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many fine irregular pores; 30 percent pebbles, 5 percent cobbles; about 0.1 percent of surface covered with stones; medium acid; clear wavy boundary.

B1—4 to 13 inches; dark brown (7.5YR 3/4) gravelly loam, dark brown (7.5YR 4/4) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular pores; 30 percent pebbles, 5 percent cobbles; slightly acid; gradual smooth boundary.

B21—13 to 28 inches; dark reddish brown (5YR 3/4) very gravelly loam, brown (7.5YR 5/4) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common

very fine roots; many very fine tubular pores; 20 percent cobbles, 40 percent pebbles, 5 percent stones; slightly acid; gradual smooth boundary.

B22—28 to 39 inches; dark brown (7.5YR 3/4) very gravelly loam, brown (7.5YR 5/4) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many very fine tubular pores; 40 percent pebbles, 20 percent cobbles, 5 percent stones; slightly acid; gradual smooth boundary.

C1—39 to 60 inches; dark brown (7.5YR 4/4) very gravelly loam, brown (7.5YR 5/4) dry; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; 30 percent cobbles, 40 percent pebbles, 5 percent stones; medium acid.

The A horizon is dark brown, dark grayish brown, or brown when dry and dark brown or very dark grayish brown when moist. It commonly is stony, cobbly, or gravelly loam that is 20 to 35 percent rock fragments. The B horizon is brown, dark yellowish brown, or yellowish brown when dry and dark brown, dark reddish brown, or dark yellowish brown when moist. It is gravelly or cobbly loam that is 35 to 65 percent rock fragments. The soil is 20 to 60 percent volcanic ash in the fine earth fraction.

32E—Yallani stony loam, 8 to 30 percent slopes. This soil occurs as broad, long, irregularly shaped areas. It has a profile similar to the one described as representative of the series. A representative mapping unit is in the SW¼SW¼SE¼ sec. 22, T. 1 N., R. 9 E. Included in mapping were areas of Bins, Divers, Hutson, Parkdale, and Bald soils that make up as much as 15 percent of the mapping unit.

Runoff is medium, and the hazard of erosion is moderate to high. Capability subclass VIs; woodland suitability group 3f1; wildlife group 3.

32F—Yallani stony loam, 30 to 65 percent slopes. This soil occurs as broad, irregularly shaped areas. It has the profile described as representative of the series. A representative mapping unit is in the SE¼SE¼NW¼ sec. 21, T. 1 N., R. 9 E. Included in mapping were areas of Bins, Divers, Hutson, Parkdale, and Bald soils and areas of Rock outcrop and Rubble land, all of which make up as much as 15 percent of the mapping unit.

Runoff is rapid, and the hazard of erosion is high. Capability subclass VIIs; woodland suitability group 3f2; wildlife group 3.

Use and Management of Soils [2]

Irrigated apple and pear orchards are the major crops in the Hood River County Area. They cover 18,000 acres, or 63 percent of the cropland. Few dryland crops are grown, other than the upland acreage of pasture and hay. Nearly all of the 9,000 acres of hay and pasture is irrigated.

Strawberries are occasionally interplanted in young orchards (fig. 8). Small acreages are planted to row crops, such as corn for silage, and to some specialty crops, such as mint and truck crops.

This part of the survey describes suitable crop management. It explains the capability grouping used by the Soil Conservation Service and suggests management suitable for the soils of each capability unit. Table 2 lists predicted average acre yields of the principal crops under high level management.

[2] JOHN DENISON, conservation agronomist, BEN MOUCHETT and JAMES CRANE, district conservationists, Soil Conservation Service, and W. M. MELLENTHIN, pomologist, Oregon Agricultural Experiment Station, helped prepare this section.

Crops

Different soils require different management, and the same soil may require variation in management from year to year and from crop to crop. Basic management needs are described in the following paragraphs.

Conserving moisture.—Most of the cultivated soils in the Hood River County Area are limited in productivity because of inadequate moisture. All moisture available from precipitation and irrigation, therefore, should be conserved and used efficiently.

Controlling erosion.—Many soils in the survey area have a surface layer no more than 10 inches thick. Further erosion will reduce the capacity of these soils to store moisture and supply plant nutrients. Tilling properly, maintaining the supply of organic matter (fig. 9), and preserving soil structure increase the water intake rate and help to control erosion.

Preserving soil structure.—Proper tillage and maintenance of organic-matter content are the two principal factors in building and preserving good soil structure.

Excessive tillage tends to reduce the organic-matter content and break up the soil aggregates. Thus, the soil is less permeable to water, air, and roots.

Maintaining organic matter.—Organic matter is the partially decomposed remains of plants and soil organisms. The organic-matter content of the soils in the Hood River County Area ranges from a high of 3 or 4 percent under native plant cover to a low of 1 percent after a long period of cultivation.

Organic matter binds the soil particles together in aggregates, and thus helps to preserve soil structure. It is the food source for soil organisms and nutrient for plants. The organic matter in the soil is continuously decomposing, and the supply must be renewed regularly. An adequate supply of organic matter can be maintained by—

1. Returning all crop residue to the soil. Crop residue is the main source of organic matter. Organic matter is lost if residue is removed or otherwise destroyed.
2. Spreading barnyard manure on the field. In areas where fruit is grown, the supply of manure may be limited.
3. Growing grasses and legumes in the rotation. Grasses and legumes provide a supply of organic material that decomposes readily and does not compete with the crop for available nutrients, mostly nitrogen.
4. Using commercial fertilizer. Fertilization increases yields and the amount of crop residue. The decomposition of organic matter high in carbon can reduce yields unless a supply of nitrogen is provided.

Crops grown on soils in the Hood River County Area respond favorably to fertilization. Amount and type of fertilizer applied should be determined by the fertility level of the soil and the crop needs. Leaf analysis and soil tests are useful guides. Crops on some soils respond favorably to fertilizers containing zinc, boron, or sul-

Ketchly:								
14E	4o1	Moderate	Slight	Slight	Moderate	Douglas-fir Ponderosa pine	100	Douglas-fir.
14F	4r1	Severe	Moderate	Slight	Moderate	Douglas-fir Ponderosa pine	100	Douglas-fir.
Oak Grove:								
16B, 16C, 16D, 16E	4o1	Moderate	Slight	Slight	Moderate	Douglas-fir Grand fir Ponderosa pine	120	Douglas-fir, grand fir, ponderosa pine.
16F	4r1	Severe	Moderate	Slight	Moderate	Douglas-fir Grand fir Ponderosa pine	120	Douglas-fir, grand fir, ponderosa pine.
Parkdale:								
17B, 17C, 17D	3o1	Slight	Slight	Slight	Moderate	Douglas-fir Ponderosa pine Bigleaf maple	130	Douglas-fir, ponderosa pine.
17E	3o1	Moderate	Moderate	Slight	Moderate	Douglas-fir Ponderosa pine Bigleaf maple	130	Douglas-fir, ponderosa pine.
Rock outcrop: [1]								
19E: Rock outcrop part. Bodell part. Bald part	4f5	Moderate	Moderate	Severe	Slight	Douglas-fir Ponderosa pine	65	Ponderosa pine, Douglas-fir.
Rockford: 21B, 21C, 22E	3x1	Slight	Severe	Moderate	Moderate	Ponderosa pine Douglas-fir	95 120	Ponderosa pine, Douglas-fir.
Wamic variant: 25D, 25E	5o1	Severe	Slight	Moderate	Severe	Ponderosa pine Oregon white oak Douglas-fir	70	Ponderosa pine.
Wyeth:								
29E	4f1	Moderate	Moderate	Moderate	Moderate	Douglas-fir Bigleaf maple	110	Douglas-fir.
29F	4f2	Severe	Moderate	Moderate	Moderate	Douglas-fir Bigleaf maple	110	Douglas-fir.
Xerumbrepts: 31F	4r1	Severe	Moderate	Slight	Moderate	Douglas-fir Grand fir	120	Douglas-fir, grand fir.
Yallani:								
32E	3f1	Moderate	Slight	Slight	Moderate	Douglas-fir Grand fir Bigleaf maple	130	Douglas-fir.
32F	3f2	Severe	Moderate	Slight	Moderate	Douglas-fir Grand fir Bigleaf maple	130	Douglas-fir.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 9.—*Engineering properties and classifications*—Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments >3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				*Pct*					*Pct*	
Wind River variant:											
27B, 27E	0–28	Gravelly sandy loam	SM	A–2	0	75–90	55–75	30–50	15–30		NP
	28–60	Very gravelly sand	SP	A–1	0	70–80	20–40	10–30	0–5		NP
Wyeast: 28B, 28C	0–28	Silt loam	ML	A–4	0	100	100	90–100	75–85		NP
	28–78	Silt loam	ML	A–4	0	100	100	95–100	85–95		NP
Wyeth: 29E, 29F	0–22	Very gravelly loam	GM	A–1, A–2	15–25	30–55	25–55	20–50	15–35	25–30	NP–5
	22–62	Very cobbly loam, very gravelly loam.	GM	A–1, A–2, A–4	25–65	25–70	20–65	15–60	15–45	25–30	NP–5
Xerofluvents: [2] 30A	0–60	Variable.									
Xerumbrepts: [2] 31F	0–30	Variable.									
	30	Weathered bedrock.									
Yallani: 32E, 32F	0–13	Stony loam	GM	A–2, A–4	15–30	55–70	50–65	40–60	30–50		NP
	13–60	Very cobbly loam, very gravelly loam.	GM	A–2, A–4	45–65	55–60	40–55	40–50	25–40		NP

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

[2] Properties too variable to estimate. Onsite investigation required.

TABLE 10.—*Physical and chemical properties of soils*—Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors	
							Uncoated steel	Concrete	K	T
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm*					
Bodell part	0–3	0.6–2.0	0.06–0.14	6.6–7.3	<2	Low	Low	Low	0.17	1
	3–17	0.6–2.0	0.06–0.11	6.6–7.3	<2	Low	Moderate	Low	0.17	
	17									
Bald part	0–6	0.6–2.0	0.06–0.11	6.1–7.3	<2	Low	Low	Low	0.24	2
	6–36	0.6–2.0	0.06–0.11	6.1–7.3	<2	Low	Low	Low	0.24	
	36									
[1] 20: Rock outcrop part. Rubble land part.										
Rockford: 21B, 21C	0–12	0.6–2.0	0.11–0.15	5.6–6.5	<2	Low	Moderate	Moderate	0.17	4
	12–60	0.2–0.6	0.06–0.11	5.6–6.5	<2	Low	Moderate	Moderate	0.15	
22E	0–12	0.6–2.0	0.06–0.11	5.6–6.5	<2	Low	Moderate	Moderate	0.10	4
	12–60	0.2–0.6	0.06–0.11	5.6–6.5	<2	Low	Moderate	Moderate	0.15	
Van Horn: 23B, 23C	0–22	2.0–6.0	0.14–0.16	6.1–6.5	<2	Low	Low	Low	0.24	5
	22–61	0.6–2.0	0.14–0.18	6.1–6.5	<2	Moderate	Moderate	Low	0.20	
	61–72	6.0–20	0.11–0.16	6.1–6.5	<2	Low	Low	Low	0.20	
Van Horn variant: 24B.	0–15	0.6–2.0	0.16–0.18	5.6–6.5	<2	Low	High	Moderate	0.32	3
	15–43	0.6–2.0	0.08–0.15	5.6–6.5	<2	Low	High	Moderate	0.28	
	43–60	0.6–2.0	0.06–0.11	5.6–6.5	<2	Low	High	Moderate	0.28	
Wamic variant: 25C, 25D, 25E.	0–10	0.6–2.0	0.19–0.22	6.6–7.3	<2	Low	Moderate	Low	0.43	
	10–45	0.2–0.6	0.13–0.15	6.6–7.3	<2	Low	Moderate	Low	0.37	
	45									
Wind River: 26B, 26C	0–39	2.0–6.0	0.13–0.15	6.1–7.3	<2	Low	Low	Low	0.15	5
	39–60	2.0–6.0	0.09–0.10	6.1–7.3	<2	Low	Low	Low	0.10	
Wind River variant: 27B, 27E	0–28	2.0–6.0	0.08–0.11	6.1–7.3		Low	Low	Low	0.10	5
	28–60	6.0–20	0.03–0.05	6.1–7.3		Low	Low	Low	0.10	
Wyeast: 28B, 28C	0–28	0.6–2.0	0.19–0.21	5.6–6.5		Low	High	Moderate	0.49	5
	28–52	0.06–0.2	0.10–0.16	6.1–7.3		Low	High	Low	0.55	
Wyeth: 29E, 29F	0–22	0.6–2.0	0.06–0.15	6.1–7.3		Low	Low	Low	0.20	5
	22–62	0.6–2.0	0.06–0.11	6.1–6.5		Low	Low	Low	0.20	
Xerofluvents: [2] 30A	0–60									
Xerumbrepts: [2] 31F	0–30									
	30									
Yallani: 32E, 32F	0–13	2.0–6.0	0.08–0.15	5.6–6.5		Low	Moderate	Moderate	0.24	5
	13–60	2.0–6.0	0.06–0.11	5.6–6.5		Low	Moderate	Moderate	0.24	

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

[2] Properties too variable to estimate. Onsite investigation required.

Bindle Series

The Bindle series consists of well drained soils on uplands. These soils formed in windlain silts, volcanic ash, and stony colluvium weathered from andesite and basalt. Slopes are 1 to 70 percent. Elevation is 2,500 to 3,500 feet. The vegetation is Douglas-fir, grand fir, bunchgrasses, forbs, and shrubs. The dominant understory plants are western fescue, mountain brome, white hawkweed, Cascade oregongrape, shinyleaf spirea, common snowberry, thimbleberry, creambush oceanspray, western hazel, and vine maple. Average annual precipitation is 30 to 40 inches, average annual air temperature is 42° to 45° F., and the frost-free period is 50 to 100 days.

In a representative profile the surface layer is dark brown gravelly loam about 6 inches thick. The upper 7 inches of the subsoil is dark brown gravelly loam. The lower 9 inches is dark brown very gravelly clay loam. The depth to highly fractured bedrock is 20 to 40 inches. The soil is neutral in the surface layer and slightly acid in the subsoil.

Permeability is moderate. Available water capacity is 2 to 5 inches. Water-supplying capacity is 13 to 20 inches. Effective rooting depth is 20 to 40 inches.

Bindle soils are used for woodland, wildlife habitat, and water supply.

The Bindle soils in the Hood River survey area are mapped only with Bins soils.

Representative profile of Bindle gravelly loam in an area of Bins-Bindle association, very steep, south of road in NE¼SW¼ sec. 23, T. 1 N., R. 10 E.

O1—1½ inches to 0; fir twigs and needles.
A1—0 to 6 inches; dark brown (7.5YR 3/2) gravelly loam, brown (7.5YR 5/3) dry; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; few medium roots; many very fine irregular pores; 20 percent pebbles, 5 percent cobbles; neutral; clear smooth boundary.
B21—6 to 13 inches; dark brown (7.5YR 3/3) gravelly loam, brown (7.5YR 5/4) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and few medium roots; many very fine tubular pores; 20 percent pebbles, 5 percent cobbles; slightly acid; gradual wavy boundary.
B22—13 to 22 inches; dark brown (7.5YR 4/3) very gravelly clay loam, brown (7.5YR 5/3) dry; weak fine subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine and medium roots; many very fine tubular pores; 45 percent pebbles, 10 percent cobbles; slightly acid; abrupt irregular boundary.
IIR—22 inches; highly fractured bedrock.

The A horizon is reddish brown or brown when dry and dark brown or dark reddish brown when moist. It is 20 to 40 percent fine pebbles and concretions ⅛ to ½ inch in diameter and up to 10 percent stones. The B horizon is reddish brown or brown when dry and dark reddish brown or dark brown when moist. It is 20 to 40 percent pebbles, 5 to 20 percent cobbles, and 5 to 10 percent stones. Depth to highly fractured bedrock is 20 to 40 inches.

Bins Series

The Bins series consists of well drained soils on uplands. These soils formed in windlain silts, volcanic ash, and stony, moderately fine textured colluvium weathered from andesite. Slopes are 1 to 70 percent. Elevation is 1,100 to 3,600 feet. The vegetation is Douglas-fir, grand fir, forbs, and shrubs. The dominant understory plants are western fescue, mountain brome, starflower, strawberry, Cascade oregongrape, shinyleaf spirea, common snowberry, western hazel, and vine maple. Average annual precipitation is 30 to 40 inches, average annual air temperature is 42° to 45° F., and the frost-free period is 50 to 100 days.

In a representative profile the surface layer is dark reddish brown gravelly loam about 13 inches thick. The subsoil is dark reddish brown loam and clay loam about 20 inches thick. The substratum is dark reddish brown heavy loam about 12 inches thick. Weathered andesite is at a depth of about 45 to 60 inches. The soil is slightly acid to medium acid in the surface layer, medium acid to strongly acid in the subsoil, and strongly acid in the substratum.

Permeability is moderately slow. Available water capacity is 7 to 12 inches. Water-supplying capacity is 17 to 20 inches. Effective rooting depth is 40 to 60 inches or more.

Bins soils are used for woodland, wildlife habitat, and water supply.

Representative profile of Bins gravelly loam in an area of Bins-Bindle association, steep, 1¾ miles from the Kingsley Ranch on Green Point Reservoir road, 50 feet southwest of road in SE¼SW¼ sec. 23, T. 2 N., R. 9 E.

O1—1 inch to 0; fir twigs, and needles.
A11—0 to 1 inches; dark reddish brown (5YR 2/2) gravelly loam, dark reddish gray (5YR 4/2) dry; weak medium granular structure; soft, very friable, nonsticky and nonplastic; many roots; many fine irregular pores; 25 percent fine pebbles; slightly acid; abrupt smooth boundary.
A12—1 to 13 inches; dark reddish brown (5YR 3/3) gravelly loam, reddish brown (5YR 4/3) dry; weak medium granular structure; soft, very friable, slightly sticky and slightly plastic; many roots; many fine irregular pores; 30 percent pebbles; medium acid; gradual smooth boundary.
B1—13 to 19 inches; dark reddish brown (5YR 3/4) loam, reddish brown (5YR 5/3) dry; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common roots; many very fine tubular pores; 3 percent pebbles and 2 percent cobbles; medium acid; gradual wavy boundary.
B2—19 to 33 inches; dark reddish brown (5YR 3/4) clay loam, reddish brown (5YR 5/3) dry; weak coarse subangular blocky structure; hard, firm, sticky and plastic; common roots; many very fine tubular pores; 5 percent pebbles and 5 percent cobbles; strongly acid; gradual wavy boundary.
IIC1—33 to 45 inches; dark reddish brown (2.5YR and 5YR 3/4) heavy loam, reddish brown (2.5YR 5/4) dry; massive; hard, firm, sticky and slightly plastic; common weathered andesitic fragments 2 to 15 inches in diameter; few roots; common very fine and fine pores; common white flecks; strongly acid; abrupt wavy boundary.
IIC2—45 to 60 inches; dark red (2.5YR 3/6) weathered andesite of loam texture.

The A horizon is dark reddish gray or reddish brown when dry. It is 15 to 25 percent fine pebbles ⅛ to ½ inch in diameter and 0 to 15 percent cobbes and stones. The B and C horizons are loam, heavy loam, or clay loam that is 0 to 15 percent pebbles and 0 to 20 percent cobbles. Depth to bedrock is 40 to 60 inches or more.

3E—Bins-Bindle association, steep. This mapping unit is about 55 percent a Bins gravelly loam, slopes of 1 to 30 percent, and 30 percent a Bindle gravelly loam,

slopes of 1 to 30 percent. Some areas at the east side of the survey area are up to 50 percent Bindle gravelly loam. The Bins soil occurs as irregularly shaped areas on broad ridgetops that are not capped by rock. The Bindle soil is on narrow ridges and the upper parts of slopes that are capped by rock. The Bins soil has the profile described as representative of the series. The Bindle soil has a profile similar to the one described as representative of the series, but has a gravelly loam surface layer. A representative mapping unit is in the SE¼SW¼ sec. 23, T. 2 N., R. 9 E.

Included with the soils in mapping were areas of very stony shallow soils, ashy soils, and Rock outcrop. These included areas make up as much as 15 percent of this mapping unit.

Runoff is slow, and the hazard of erosion is slight. Wildlife group 2. Bins soil in capability subclass VIe and woodland suitability group 4o1. Bindle soil in subclass VIs and woodland group 4f1.

3F—Bins-Bindle association, very steep. This mapping unit is about 45 percent a Bins gravelly loam, slopes of 30 to 70 percent, and 40 percent a Bindle cobbly loam, slopes of 30 to 70 percent. Some areas at the east side of the survey area are up to 50 percent the Bindle gravelly loam. The Bins soil is at mid slope and on the lower parts of slopes that are not capped by rock. The Bindle soil is on the tops and convex parts of slopes that are capped by rock. The Bins soil has a profile similar to the one described as representative of the series, but the percentage of rock fragments is higher. A representative mapping unit is in the SW¼ NW¼ sec. 19, T. 1 N., R. 11 E.

Included with this soil in mapping were areas of shallow very stony soils, Yallani and Wyeth soils, and Rock outcrop. These included soils make up as much as 15 percent of the mapping unit.

Runoff is rapid, and the hazard of erosion is high. Wildlife group 2. Bins soil in capability subclass VIIe and woodland suitability group 4r1. Bindle soil in subclass VIIs and woodland group 4f2.

Bodell Series

The Bodell series consists of well drained soils on uplands. These soils formed in mixed loess, volcanic ash, and colluvium weathered from basalt. Slopes are 5 to 75 percent. Elevation is 200 to 2,500 feet. The vegetation is bunchgrasses, forbs, shrubs, and scattered oak trees. The dominant understory plants are Idaho fescue, bluebunch wheatgrass, letterman needlegrass, Sandberg bluegrass, Oregon bluegrass, prairie junegrass, arrowleaf balsamroot, buckwheat, purple leptotaenia, bighead clover, and yarrow. Average annual precipitation is 25 to 40 inches, the average annual air temperature is 48° to 51° F., and the frost-free period is 100 to 140 days.

In a representative profile the surface layer is dark brown cobbly loam about 3 inches thick. The upper 6 inches of the subsoil is dark brown very cobbly loam. The lower 8 inches is dark brown very cobbly clay loam. Basalt is at a depth of 17 inches. The soil is neutral.

Permeability is moderate. Available water capacity is 1 to 2 inches. Water-supplying capacity is 4 to 7 inches. Effective rooting depth is 12 to 20 inches.

Bodell soils are used for wildlife habitat and water supply.

Representative profile of Bodell cobbly loam, 5 to 45 percent slopes, 10 feet north of road in SE¼SE¼ sec. 5, T. 2 N., R. 11 E.

A1—0 to 3 inches; dark brown (7.5YR 3/2) cobbly loam, brown (7.5YR 4/3) dry; weak fine granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine irregular pores; 20 percent pebbles, 20 percent cobbles; neutral; abrupt smooth boundary.

B21—3 to 9 inches; dark brown (7.5YR 3/2) very cobbly loam, brown (7.5YR 4/3) dry; weak medium and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; many very fine tubular and irregular pores; 10 percent pebbles, 40 percent cobbles; neutral; clear smooth boundary.

B22—9 to 17 inches; dark brown (7.5YR 3/3) very cobbly clay loam, brown (7.5YR 4/3) dry; weak fine subangular blocky structure; hard, firm, sticky and plastic; plentiful very fine roots; many very fine irregular and tubular pores; 60 percent cobbles; 10 percent stones; neutral; abrupt smooth boundary.

IIR—17 inches; basalt.

The A horizon is brown, grayish brown, or dark grayish brown when dry and dark brown or very dark grayish brown when moist. It is 10 to 30 percent pebbles and 20 to 30 percent cobbles. The B2 horizon is brown or dark yellowish brown when moist. The texture is very cobbly loam to very cobbly clay loam that is 18 to 30 percent clay. The B2 horizon is 50 to 70 percent rock fragments, mostly cobbles. Depth to bedrock is 12 to 20 inches.

4E—Bodell cobbly loam, 5 to 45 percent slopes. This soil occurs as irregularly shaped areas and has south-facing slopes. It has the profile described as representative of the series. A representative mapping unit is in the SE¼SE¼ sec. 31, T. 2 N., R. 11 E. Included in mapping were areas of Bald, Ketchly, and Wamic soils that make up as much as 15 percent of the mapping unit.

Runoff is slow to rapid, and the hazard of erosion is slight to high. Capability subclass VIs; wildlife group 2.

5F—Bodell very cobbly loam, 45 to 75 percent slopes. This very steep soil occurs as long, narrow areas and has south-facing slopes. It has a profile similar to that described as representative of the series, but the surface layer is more than 50 percent rock fragments. A representative mapping unit is in the SW¼SW¼ sec. 5, T. 2 N., R. 11 E. Included in mapping were areas of Bald, Ketchly, and Wamic soils that make up as much as 15 percent of the mapping unit.

Runoff is rapid, and the hazard of erosion is high. Capability subclass VIIs; wildlife group 2.

Culbertson Series

The Culbertson series consists of well drained soils on uplands. These soils formed in volcanic ash mixed with loess and stony moderately fine textured colluvium. Slopes are 0 to 50 percent. Elevation is 400 to 1,800 feet. The vegetation is Douglas-fir, chinquapin, maple, willow, and bunchgrasses. The dominant understory plants are mountain brome, blue wildrye, tall oregongrape, trailing blackberry, common snowberry, deerbrush, and western hazel. Average annual precipitation is 35 to 40 inches, the average annual air tem-

TABLE 3.—*Woodland management and productivity*

[Only the soils suitable for production of commercial trees are listed in this table. Absence of an entry in a column means the information was not available.]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Important trees	Site index	
Bald:								
1E	4f5	Moderate	Moderate	Severe	Slight	Douglas-fir Ponderosa pine	65	Ponderosa pine, Douglas-fir.
2F	4f6	Severe	Moderate	Severe	Slight	Douglas-fir Ponderosa pine	65	Ponderosa pine, Douglas-fir.
Bins:								
[1] 3E:								
Bins part	4o1	Moderate	Slight	Slight	Moderate	Douglas-fir	110	Douglas-fir, grand fir.
Bindle part	4f1	Moderate	Slight	Moderate	Moderate	Douglas-fir	100	Douglas-fir, ponderosa pine, grand fir.
[1] 3F:								
Bins part	4r1	Severe	Moderate	Slight	Moderate	Douglas-fir	110	Douglas-fir, grand fir.
Bindle part	4f2	Severe	Moderate	Moderate	Moderate	Douglas-fir	110	Douglas-fir, ponderosa pine, grand fir.
Culbertson:								
6B, 6C, 6D, 6E	4o1	Slight	Slight	Slight	Moderate	Douglas-fir	120	Douglas-fir.
6F	4r1	Severe	Moderate	Slight	Moderate	Douglas-fir	120	Douglas-fir.
Divers:								
10E	4f3	Moderate	Slight	Slight	Slight	Douglas-fir Western hemlock Noble fir Grand fir Western white pine	100	Douglas-fir.
10F	4f4	Severe	Moderate	Slight	Slight	Douglas-fir Western hemlock Noble fir Grand fir Western white pine	100	Douglas-fir.
Frailey: 11F	4r1	Severe	Moderate	Slight	Moderate	Douglas-fir	105	Douglas-fir, ponderosa pine.
Hutson:								
13E	4o2	Moderate	Slight	Slight	Slight	Douglas-fir Grand fir Western white pine	120	Douglas-fir.
13F	4r2	Severe	Moderate	Slight	Slight	Douglas-fir Grand fir Western white pine	120	Douglas-fir.

TABLE 9.—*Engineering properties and classifications*

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments >3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				*Pct*					*Pct*	
Bald:											
1E	0–6	Cobbly loam	ML, SM	A–4	15–30	75–95	70–90	60–85	40–70		NP
	6–36	Very cobbly loam, very gravelly loam.	GM	A–2, A–4	30–60	50–60	40–50	35–50	25–40	30–35	5–10
	36	Unweathered bedrock.									
2F	0–6	Very cobbly loam	GM, ML	A–2, A–4	50–60	50–90	40–85	35–80	25–65		NP
	6–36	Very cobbly loam, very gravelly loam.	GM	A–2, A–4	30–60	50–60	40–50	35–50	25–40	30–35	5–10
	36	Unweathered bedrock.									
Bins:											
[1]3E, [1]3F:											
Bins part	0–19	Gravelly loam	GM	A–2, A–4	0–20	55–75	50–70	40–65	30–50	25–30	NP–5
	19–45	Clay loam, loam, cobbly loam.	ML, CL	A–4, A–6	0–30	85–100	75–100	65–100	50–80	30–35	5–15
	45	Weathered bedrock.									
Bindle part	0–13	Gravelly loam	ML, GM, SM	A–2, A–4	5–20	60–85	55–80	40–80	30–65	25–30	NP–5
	13–22	Very gravelly loam, very gravelly clay loam.	GM	A–2, A–4	15–40	50–60	40–55	35–50	25–40	25–40	NP–10
	22	Unweathered bedrock.									
Bodell:											
4E	0–3	Cobbly loam	GM, ML	A–2, A–4	30–45	55–85	45–80	40–75	25–60	25–30	NP–5
	3–17	Very cobbly loam, very cobbly clay loam.	GM	A–4	45–70	55–65	50–60	45–55	35–50	25–35	NP–10
	17	Unweathered bedrock.									
5F	0–3	Very cobbly loam	GM, ML	A–2, A–4	30–45	55–85	45–80	40–75	25–60	25–30	NP–5
	3–17	Very cobbly loam, very cobbly clay loam.	GM	A–4	45–70	55–65	50–60	45–55	35–50	25–35	NP–10
	17	Unweathered bedrock.									
Culbertson:											
6B, 6C, 6D, 6E, 6F	0–22	Loam	ML	A–4	0	75–100	70–95	60–90	50–70	20–25	NP–5
	22–60	Clay loam, loam	ML	A–4, A–6	0–5	95–100	85–100	75–100	60–80	35–40	5–15
Cumulic Haplaquolls:											
[2]7A	0–60	Variable.									
Cumulic Haploxerolls:											
[2]8A	0–60	Variable.									
Dee: 9B, 9C	0–8	Silt loam	ML	A–4	0	100	100	90–100	70–90		NP
	8–45	Loam	ML	A–4	0	90–100	85–95	70–90	50–70		NP
	45–72	Sandy loam	SM	A–2	0	75–100	70–95	40–65	20–35		NP
Divers: 10E, 10F	0–46	Gravelly loam	GM	A–2, A–4	15–45	35–65	30–60	25–55	20–45		NP
	46–60	Very cobbly loam	GM	A–1	60–75	25–40	25–40	20–35	15–25		NP
Frailey: 11F	0–60	Loam	SM, ML	A–4	0–20	70–90	65–85	55–80	40–65	20–25	NP–5

TABLE 10.—*Physical and chemical properties of soils*

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion		Erosion factors	
							Uncoated steel	Concrete	K	T
	In	*In/hr*	*In/in*	*pH*	*Mmhos/cm*					
Bald: 1E, 2F	0–6	0.6–2.0	0.11–0.15	6.1–7.3		Low	Low	Low	0.24	2
	6–36	0.6–2.0	0.06–0.11	6.1–7.3		Low	Low	Low	0.24	
	36									
Bins: [1] 3E, [1] 3F:										
Bins part	0–19	0.6–2.0	0.14–0.17	5.6–6.5		Low	Low	Low	0.28	3
	19–45	0.2–0.6	0.18–0.21	5.1–5.5		Low	Moderate	Moderate	0.24	
	45									
Bindle part	0–13	0.6–2.0	0.10–0.14	6.1–7.3		Low	Low	Low	0.20	3
	13–22	0.6–2.0	0.06–0.11	6.1–6.5		Low	Low	Low	0.15	
	22									
Bodell: 4E, 5F	0–3	0.6–2.0	0.06–0.14	6.6–7.3		Low	Low	Low	0.17	1
	3–17	0.6–2.0	0.06–0.11	6.6–7.3		Low	Moderate	Low	0.17	
	17									
Culbertson:										
6B, 6C, 6D, 6E, 6F	0–22	0.6–2.0	0.14–0.17	5.6–6.5		Low	Moderate	Moderate	0.24	5
	22–60	0.2–0.6	0.18–0.21	5.6–6.5		Low	Moderate	Moderate	0.37	
Cumulic Haplaquolls: [2] 7A	0–60									
Cumulic Haploxerolls: [2] 8A	0–60									
Dee: 9B, 9C	0–8	0.6–2.0	0.25–0.28	6.1–6.5		Low	High	Low	0.49	5
	8–45	0.6–2.0	0.25–0.28	5.6–6.5		Low	High	Moderate	0.49	
	45–72	2.0–6.0	0.25–0.28	5.6–6.0		Low	High	Moderate	0.37	
Divers: 10E, 10F	0–46	2.0–6.0	0.12–0.20	5.1–6.5		Low	Moderate	Moderate	0.10	3
	46–60	>6.0	0.04–0.08	5.1–6.5		Low	Moderate	Moderate	0.10	
Frailey: 11F	0–60	0.6–2.0	0.13–0.17	6.1–6.5		Low	Low	Low	0.32	5
Hood: 12A, 12B, 12C, 12D, 12E	0–6	0.6–2.0	0.19–0.21	5.6–6.5		Low	Low	Low	0.43	5
	6–98	0.6–2.0	0.19–0.21	5.6–6.5		Low	Low	Low	0.55	
Hutson: 13E, 13F	0–29	2.0–6.0	0.20–0.25	6.1–6.5	<2	Low	Moderate	Low	0.20	5
	29–45	2.0–6.0	0.20–0.25	6.1–6.5	<2	Low	Moderate	Low	0.20	
	45–62	2.0–6.0	0.12–0.20	5.6–6.5	<2	Low	Moderate	Low	0.37	
Ketchly: 14E, 14F	0–12	0.6–2.0	0.14–0.17	6.6–7.3	<2	Low	Low	Low	0.32	4
	12–45	0.2–0.6	0.14–0.20	6.1–6.5	<2	Low	Moderate	Low	0.32	
	45–48	0.2–0.6	0.11–0.14	6.1–6.5	<2	Low	Moderate	Low	0.24	
Lava flows: 15.										
Oak Grove:										
16B, 16C, 16D, 16E, 16F.	0–34	0.6–2.0	0.16–0.18	5.1–6.0	<2	Low	Moderate	Moderate	0.32	5
	34–78	0.2–0.6	0.14–0.16	5.6–6.0	<2	High	High	Moderate	0.28	
Parkdale:	0–10	0.6–2.0	0.25–0.28	6.1–7.3	<2	Low	High	Low	0.43	5
17B, 17C, 17D, 17E.	10–75	0.6–2.0	0.25–0.28	6.1–7.3	<2	Low	High	Low	0.55	
Riverwash: [2] 18.										
Rock outcrop: [1] 19E:										
Rock outcrop part.										

The main limitation for harvesting timber is seasonal soil wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and damages the roots of trees. Unsurfaced roads and skid trails are soft and slippery and can be impassable when wet. Logging roads require suitable surfacing for year-round use. Rock for road construction is readily available in this unit. Occasional snowpack hinders the use of equipment and limits access in winter. Disturbance of the protective layer of duff can be reduced with the careful use of wheeled and tracked equipment.

Seedling establishment and mortality are the main concerns in the production of timber. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine and grand fir occurs periodically. Droughtiness of the surface layer reduces seedling survival, especially on south- and southwest-facing slopes. If the canopy is opened, brush invades and can delay establishment of Douglas fir seedlings unless controlled.

Among the common forest understory plants are creambush oceanspray, vine maple, western hazel, Pacific dogwood, thimbleberry, Oregongrape, dwarf rose, common snowberry, and common yarrow.

This unit is well suited to use as hayland and pastureland. It has few limitations. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Mowing at least twice a year helps to maintain uniform growth and discourages selective grazing. In some years, supplemental irrigation is also needed.

The main limitation of this unit for use as homesites is the steepness of slope. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants.

This map unit is in capability subclass IIIe.

67—McElroy gravelly loam, 15 to 30 percent slopes. This very deep, well drained soil is on back slopes of mountains. It formed in colluvium derived dominantly from basalt with a mantle of volcanic ash. The native vegetation is mainly mixed conifers and shrubs. Elevation is 400 to 2,300 feet. The average annual precipitation is about 55 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is 105 to 125 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 2 inches thick. The surface layer is dark brown gravelly loam 10 inches thick. The subsoil to a depth of 60 inches or more is dark brown very gravelly loam and very cobbly loam.

Included in this unit are small areas of Chemawa, Timberhead, Underwood, and Undusk soils. Also included are small areas of Hood soils on dissected terraces and McElroy soils that have slopes of less than 15 percent. Included areas make up about 10 percent of the total acreage.

Permeability of this McElroy soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is medium, and the hazard of water erosion is moderate.

Most areas of this unit are used for woodland, pastureland, hayland, wildlife habitat, recreation, and watershed. A few areas are used as homesites.

Douglas fir, ponderosa pine, and grand fir are the main woodland species on this unit. On the basis of a 100-year site curve, the mean site index is 134 for Douglas fir, and on the basis of a 50-year site curve, the mean site index is 100. The culmination of the mean annual increment (CMAI) for Douglas fir is 134 cubic feet per acre per year at age 70. Estimates of the site index or CMAI for ponderosa pine and grand fir have not been made. Among the trees of limited extent are Oregon white oak and bigleaf maple.

The main limitation for harvesting timber is seasonal soil wetness. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and damages the roots of trees. Unsurfaced roads and skid trails are soft and slippery and can be impassable when wet. Logging roads require suitable surfacing for year-round use. Rock for road construction is readily available in this unit. Occasional snowpack hinders the use of equipment and limits access in winter. Disturbance of the protective layer of duff can be reduced with the careful use of wheeled and tracked equipment.

Seedling establishment and mortality are the main concerns in the production of timber. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine and grand fir occurs periodically. Droughtiness of the surface layer reduces seedling survival, especially on south- and southwest-facing slopes. If the canopy is opened, brush invades and can delay establishment of Douglas fir seedlings.

Among the common forest understory plants are creambush oceanspray, vine maple, western hazel, Pacific dogwood, thimbleberry, Oregongrape, dwarf rose, common snowberry, and common yarrow.

This unit is well suited to use as hayland and pastureland. The main limitations are steepness of slope and the hazard of erosion. Erosion can be controlled by growing pasture. The use of equipment is limited by steepness of slope. Proper stocking rates, pasture rotation, and restricted grazing during wet periods help to keep the pasture in good condition and to protect the soil from erosion. Mowing at least twice a year helps to maintain uniform growth and discourages selective grazing.

The main limitation of this unit for use as homesites is the steepness of slope. Erosion is a hazard in the steeper areas. Only the part of the site that is used for construction should be disturbed. Preserving the existing plant cover during construction helps to control erosion. Plant cover can be established and maintained through proper fertilizing, seeding, mulching, and shaping of the slopes. Removal of pebbles and cobbles in disturbed areas is needed for best results when landscaping, particularly in areas used for lawns. Mulch, fertilizer, and irrigation are needed to establish lawn grasses and other small-seeded plants. Restricted permeability and steepness of slope increase the possibility of failure of septic tank absorption fields. Access roads should be designed to provide adequate cut-slope grade, and drains are needed to control surface runoff and keep soil losses to a minimum.

This map unit is in capability subclass IVe.

68—McElroy gravelly loam, 30 to 65 percent slopes. This very deep, well drained soil is on back slopes of mountains. It formed in colluvium derived dominantly from basalt with a mantle of volcanic ash. The native vegetation is mainly mixed conifers and shrubs. Elevation is 400 to 2,300 feet. The average annual precipitation is about 55 inches, the average annual air temperature is about 46 degrees F, and the average frost-free period is 105 to 125 days.

Typically, the surface is covered with a mat of decomposed needles, leaves, and twigs 2 inches thick. The surface layer is dark brown gravelly loam 10 inches thick. The subsoil to a depth of 60 inches or more is dark brown very gravelly loam and very cobbly loam.

Included in this unit are small areas of Chemawa, Timberhead, Underwood, and Undusk soils. Also included are small areas of McElroy soils that have slopes of less than 30 percent. Included areas make up about 10 percent of the total acreage.

Permeability of this McElroy soil is moderate. Available water capacity is moderate. Effective rooting depth is 60 inches or more. Runoff is rapid, and the hazard of water erosion is severe.

This unit is used for woodland, wildlife habitat, recreation, and watershed.

Douglas fir, ponderosa pine, and grand fir are the main woodland species on this unit. On the basis of a 100-year site curve, the mean site index is 133 for Douglas fir, and on the basis of a 50-year site curve, the mean site index is 100. The culmination of the mean annual increment (CMAI) for Douglas fir is 134 cubic feet per acre per year at age 70. Estimates of the site index or CMAI for ponderosa pine and grand fir have not been made. Among the trees of limited extent are Oregon white oak and bigleaf maple.

The main limitation for harvesting timber is steepness of slope, which restricts the use of wheeled and tracked equipment in skidding. Cable yarding systems generally are safer and disturb the soil less. Use of wheeled and tracked equipment when the soil is moist produces ruts, compacts the soil, and damages the roots of trees. Unsurfaced roads and skid trails are soft and slippery and can be impassable when wet. Logging roads require suitable surfacing for year-round use. Rock for road construction is readily available in this unit. Occasional snowpack hinders the use of equipment and limits access in winter. Establishing plant cover on steeper slopes that have been cut or filled reduces erosion. Steep yarding paths, skid trails, and firebreaks are subject to rilling and gullying unless plant cover is maintained or adequate water bars are provided.

Seedling establishment and mortality are the main concerns in the production of timber. Reforestation can be accomplished by planting Douglas fir seedlings. If seed trees are present, natural reforestation of cutover areas by ponderosa pine and grand fir occurs periodically. Droughtiness of the surface layer reduces seedling survival, especially on south- and southwest-facing slopes. If the canopy is opened, brush invades and can delay establishment of Douglas fir seedlings.

Among the common forest understory plants are creambush oceanspray, vine maple, western hazel, Pacific dogwood, thimbleberry, Oregongrape, dwarf rose, common snowberry, and common yarrow.

This map unit is in capability subclass VIe.

69—McElroy very stony loam, 5 to 15 percent slopes. This very deep, well drained soil is on foot slopes of mountains. It formed in colluvium derived dominantly from basalt with a mantle of volcanic ash. The native vegetation is mainly mixed conifers and

TABLE 13A.--ENGINEERING INDEX PROPERTIES (PREERUPTION)--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
64---------- McBee	0-13	Silt loam--------	CL-ML	A-4	0	100	100	90-100	70-90	25-35	5-10
	13-43	Silt loam, clay loam, silty clay loam.	CL	A-6	0	100	100	95-100	75-90	30-40	15-25
	43-60	Silt loam, clay loam, loam.	CL-ML	A-4	0	100	100	90-100	70-90	25-35	5-10
65---------- McDoug	0-12	Silt loam--------	CL-ML	A-4	0	100	100	95-100	75-90	20-30	5-10
	12-38	Clay loam, loam, sandy clay loam.	CL	A-6	0	100	90-100	85-95	55-75	25-40	10-20
	38-60	Clay loam, sandy clay loam, gravelly sandy loam.	CL, SM-SC, SC	A-6, A-4	0-5	80-100	60-100	50-85	40-60	20-35	5-15
66, 67, 68------- McElroy	0-10	Gravelly loam----	ML, SM, GM	A-4	0-5	60-80	55-70	50-70	35-55	25-30	NP-5
	10-60	Very gravelly loam, very cobbly loam, extremely gravelly loam.	GM	A-2, A-1	20-40	30-60	20-50	15-40	10-35	25-35	NP-5
69---------- McElroy	0-10	Very stony loam	SM	A-4	10-25	70-80	60-75	50-70	35-50	20-25	NP-5
	10-60	Very gravelly loam, very cobbly loam, extremely gravelly loam.	GM	A-2, A-1	20-35	45-65	30-50	25-45	20-35	25-30	NP-5
70, 71, 72------- Minniepeak	0-3	Cindery sandy loam.	SM	A-1, A-2	0	80-90	65-75	40-50	20-30	30-40	NP-5
	3-8	Loamy sand, sandy loam.	SM	A-1, A-2	0	100	85-100	45-75	15-30	30-40	NP-5
	8-60	Very cindery sandy loam, extremely cindery sand, extremely cindery coarse sand.	SP	A-1	0-5	75-85	10-45	5-30	0-5	---	NP
73, 74---------- Mossyrock	0-27	Silt loam--------	OH, MH, ML, OL	A-5, A-7	0	100	100	90-100	70-85	45-65	5-20
	27-60	Silt loam--------	ML, MH	A-5, A-7	0	100	100	90-100	70-85	40-60	5-20
75, 76, 77------- Mountzion	0-17	Clay loam--------	ML	A-7	0	100	75-90	70-80	60-75	40-50	10-15
	17-60	Silty clay loam, clay loam, gravelly clay loam.	ML	A-7	0	95-100	70-90	65-90	55-85	40-50	10-15

See footnote at end of table.

TABLE 14A.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS (PREERUPTION)--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
						K	T	
	In	In/hr	In/in	pH				Pct
53----------	0-13	0.6-2.0	0.30-0.40	5.1-5.5	Low----------	0.00	5	40-70
Histic	13-21	6.0-20.0	0.06-0.10	5.6-6.0	Low----------	0.17		
Cryaquepts	21-31	2.0-6.0	0.08-0.12	5.6-6.0	Low----------	0.15		
	31-35	0.6-2.0	0.30-0.40	5.1-5.5	Low----------	0.00		
	35-60	>20	0.02-0.06	5.6-6.0	Low----------	0.05		
54, 55----------	0-4	0.6-2.0	0.05-0.09	5.6-6.5	Low----------	0.10	3	1-5
Hoffstadt	4-36	0.6-2.0	0.05-0.09	5.6-6.5	Low----------	0.10		
	36-55	0.6-2.0	0.03-0.05	5.6-6.5	Low----------	0.05		
	55	---	---	---	----------	---		
56----------	0-8	0.6-2.0	0.19-0.21	5.6-6.5	Low----------	0.43	5	2-5
Hood	8-60	0.6-2.0	0.19-0.21	5.6-6.5	Low----------	0.55		
57, 58, 59-------	0-12	0.6-2.0	0.16-0.18	5.1-6.5	Low----------	0.37	5	4-8
Kinney	12-28	0.6-2.0	0.16-0.21	4.5-5.5	Low----------	0.24		
	28-60	0.6-2.0	0.15-0.18	4.5-5.5	Low----------	0.24		
60----------	0-2	2.0-6.0	0.09-0.13	5.6-6.0	Low----------	0.17	1	5-10
Lithic Umbric	2-6	6.0-20	0.02-0.06	5.6-6.0	Low----------	0.10		
Vitrandepts	6	---	---	---	----------	---		
61, 62, 63-------	0-7	0.6-2.0	0.13-0.18	5.6-6.5	Low----------	0.15	5	6-8
Lonestar	7-14	0.6-2.0	0.11-0.15	5.6-6.5	Low----------	0.15		
	14-28	2.0-6.0	0.08-0.12	6.1-7.3	Low----------	0.15		
	28-51	0.6-2.0	0.11-0.18	5.6-6.5	Low----------	0.32		
	51-60	0.6-2.0	0.16-0.21	5.1-5.5	Low----------	0.32		
64----------	0-13	0.6-2.0	0.19-0.21	5.6-6.5	Low----------	0.43	5	3-4
McBee	13-43	0.6-2.0	0.16-0.21	5.6-6.5	Moderate-----	0.43		
	43-60	0.6-2.0	0.19-0.21	5.6-6.5	Low----------	0.43		
65----------	0-12	0.6-2.0	0.19-0.21	5.6-6.5	Low----------	0.43	5	3-4
McDoug	12-38	0.6-2.0	0.15-0.20	5.6-6.5	Moderate-----	0.37		
	38-60	0.6-2.0	0.10-0.18	5.6-6.5	Moderate-----	0.32		
66, 67, 68-------	0-10	0.6-2.0	0.12-0.14	5.6-6.5	Low----------	0.20	5	2-3
McElroy	10-60	0.6-2.0	0.05-0.10	5.6-6.5	Low----------	0.10		
69----------	0-10	0.6-2.0	0.09-0.12	5.6-6.5	Low----------	0.15	5	1-2
McElroy	10-60	0.6-2.0	0.03-0.05	5.6-6.0	Low----------	0.15		
70, 71, 72-------	0-3	2.0-6.0	0.09-0.13	5.6-6.5	Low----------	0.15	5	1-2
Minniepeak	3-8	2.0-6.0	0.08-0.11	5.6-6.5	Low----------	0.20		
	8-60	6.0-20	0.04-0.06	5.6-6.5	Low----------	0.10		
73, 74----------	0-27	0.6-2.0	0.21-0.25	5.6-6.5	Low----------	0.28	5	5-15
Mossyrock	27-60	0.6-2.0	0.18-0.22	5.1-7.3	Low----------	0.32		
75, 76, 77-------	0-17	0.6-2.0	0.19-0.21	5.1-6.0	Moderate-----	0.28	5	1-2
Mountzion	17-60	0.6-2.0	0.17-0.21	4.5-5.5	Moderate-----	0.24		
78, 79, 80-------	0-7	2.0-6.0	0.11-0.15	5.6-6.5	Low----------	0.20	5	1-3
Pelee	7-32	>20	0.04-0.07	5.6-6.5	Low----------	0.02		
	32-60	2.0-6.0	0.11-0.15	5.6-6.5	Low----------	0.20		
81*:								
Pelee----------	0-7	2.0-6.0	0.11-0.15	5.6-6.5	Low----------	0.20	5	1-3
	7-32	>20	0.04-0.07	5.6-6.5	Low----------	0.02		
	32-60	2.0-6.0	0.11-0.15	5.6-6.5	Low----------	0.20		

See footnote at end of table.

Exhibit B
Revised Boundary Description
Columbia Gorge Appellation

Revised Proposed Appellation Boundary

The proposed Columbia Gorge viticultural area is located in Hood River and Wasco Counties, Oregon and Skamania and Klickitat Counties, Washington.

1. Point of Beginning:	West side of Section 30, R10E, T3N, on the vertical boundary between Range 9E and Range 10E near Tunnel 4 on Highway 14 at the centerline of the Columbia River.
2. Proceed North:	Proceed north on the vertical boundary between Range 9E and Range 10E approximately ~~1.5~~ 2 miles to the NW corner of Section 19, R10E, T3N.
3. Proceed East:	Turn and proceed east approximately 2 miles to the NE corner of Section 20, R10E, T3N.
4. Proceed North:	Turn and proceed north approximately 4 miles to the NW corner of Section 33, R10E, T4N.
5. Proceed East:	Turn and proceed east approximately 1 mile to the NE corner of Section 33, R10E, T4N.
6. Proceed North:	Turn and proceed north approximately 1 mile to the NW corner of Section 27, R10E, T4N.
7. Proceed East:	Turn and proceed east approximately 1 mile to the NE corner of Section 27, R10E, TN.
8. Proceed North:	Turn and proceed north approximately 4 miles to the NE corner of Section 2, R10E, T4N.
9. Proceed East:	Turn and proceed east on the horizontal boundary between Township 4N and Township 5N approximately 4 miles to the NE corner of Section 5, R11E, T4N.
10. Proceed South:	Turn and proceed south approximately 2 miles to the NE corner of Section 17, R11E, T4N.
11. Proceed East:	Turn and proceed east approximately 2 miles to the NE corner of Section 15, R11E, T4N.
12. Proceed South:	Turn and proceed south approximately 3 miles to the NE corner of Section 34, R11E, T4N.

13. Proceed East:	Turn and proceed east approximately 2 miles to the NE corner of Section 36, R11E, T4N.
14. Proceed South:	Turn and proceed south on the vertical boundary between Range 11E and Range 12E approximately 1.25 miles to 2000' contour line elevation just south of the NW corner of Section 1, R11E, T3N.
15. Proceed Southeast:	Follow the 2000' contour line southerly and then easterly through Sections 1, 12, 7, 8, 9, 10, and 3 until the 2000' contour line intersects the line between Sections 2 and 3, approximately 0.75 mile south of the NE corner of Section 3, R12E, T3N.
16. Proceed South:	Turn and proceed south approximately 5.25 miles along the east boundary of Sections 3, 10, 15, 22, 27, and 34 to the centerline of the Klickitat River.
17. Proceed Southwest:	Following the centerline of the Klickitat River, proceed generally southwest approximately 0.5 miles to the centerlines of the confluence of the Klickitat River and Columbia River.
18. Proceed Southeast:	Following the centerline of the Columbia River, proceed generally southeast approximately 2 miles to the intersection of the Columbia River centerline and the vertical boundary of Range 12E and Range 13E on the Oregon side of the Columbia River.
19. Proceed South:	Turn and proceed south on the vertical boundary between Range 12E and Range 13E approximately 11.25 miles to the SE corner of Section 36, R12E, T1N.
20. Proceed West:	Turn and proceed west along the horizontal boundary between Township 1N and Township 1S (BASELINE) approximately 6 miles to the SW corner of Section 31, R12E, T1N.
21. Proceed North:	Turn and proceed north on the vertical boundary between Range 11E and Range 12E approximately 6 miles to the NW corner of Section 6, R12E, T1N.
22. Proceed West:	Turn and proceed west on the horizontal boundary between Township 1N and Township 2N approximately 6 miles to the SW corner of Section 31, R11E, T2N.

23. Proceed South:	Turn and proceed south on the vertical boundary between Range 10E and Range 11E east approximately 2 miles to the 2000' contour elevation line just north of the SE corner of Section 12, R10E, T1N.
24. Proceed Southwest:	Follow the 2000' contour line southwesterly through Sections 12, 13, 14, 23, 22, 27, 34, and 4 until the 2000' contour line intersects the horizontal line between Sections 4 and 9 approximately 0.50 mile west of the SE corner of Section 4, R10E, T1S.
25. Proceed West:	Turn and proceed west approximately 2.50 miles along the south border of Sections 4, 5, and 6 to the SW corner of Section 6, R10E, T1S.
26. Proceed North:	Turn and proceed north along the vertical boundary between Range 9E and Range 10E approximately 1 mile to the northwest corner of Section 6, R10E, T1S.
27. Proceed West:	Turn and proceed west along the horizontal boundary between Township 1N and Township 1S (BASELINE) approximately 1.25 miles to the SW corner of Section 31, R10E, T1N.
28. Proceed North:	Turn and proceed north along the vertical boundary between Range 9E and Range 10E approximately 3 miles to the SE corner of Section 13, R9E, T1N.
29. Proceed West:	Turn and proceed west approximately 2 miles along the south borders of Sections 13 and 14 to the SW corner of Section 14, R9E, T1N.
30. Proceed North:	Turn and proceed north approximately 1 mile to the NW corner of Section 14, R9E, T1N.
31. Proceed East:	Turn and proceed east approximately 1 mile NE corner of Section 14, R9E, T1N.
32. Proceed North:	Turn and proceed north approximately 2 miles along the west border of Sections 12 and 1 to the NW corner of Section 1, R9E, T1N.
33. Proceed East:	Turn and proceed east approximately 1 mile to the NE corner of Section 1, R9E, T1N.

34. Proceed North:	Turn and proceed north along the vertical boundary between Range 9E and Range 10E approximately 7 miles to the northwest corner of Section 31, R10E, T3N and the centerline of the Columbia River.
35. Proceed Northeast:	Following the centerline of the Columbia River, turn and proceed northeast approximately 1 mile to the Point of Beginning.

4/26/02 → ADDITIONAL INFO

COLUMBIA RIVER GORGE WINE GROWERS ASSOCIATION

April 26, 2002

Bernard Kipp
Regulations Division
Bureau of Alcohol, Tobacco, and Firearms
9828 E. Burnside, Suite 210
Portland, OR 97216

Dear Mr. Kipp:

Per our meeting discussion several weeks ago, I am enclosing additional information in support of our petition for Rule Amendment to establish the **Columbia Gorge** Appellation American Viticultural Area. As we discussed, there were three main issues to address regarding the development of a comparison demonstrating that the proposed appellation area is unique:

1. Comparison of types of grapes grown inside and outside of the proposed appellation boundary.
2. Comparison of temperature and climatic data inside and outside of the proposed boundary.
3. Clarification regarding location of classified soils inside and outside of the proposed appellation boundary.

This three issues are discussed in detail below. In addition, appropriate back-up materials have been attached.

Comparison of Types of Grapes Grown Inside and Outside of the Proposed Appellation Boundary

A comparison of the differences in grape production between the neighboring Columbia Valley Appellation to the east and the proposed Columbia Gorge Appellation has been developed. The grape acreage tally for the Columbia Gorge Appellation was developed from the Columbia Gorge Wine Growers Association.

In general, grapes grown in the proposed Columbia Gorge Appellation region are early varietals. The top three varietals grown in the region are Pinot Noir, Chardonnay, and Gewurtztraminer. These three varietals make up 66% of the total acreage of grapes planted (Columbia Gorge Wine Growers Association).

By contrast, the Columbia Valley Appellation is able to grow much later varieties. According to the attached 1999 Washington Wine Grape Acreage Summary, the top three varietals for the Columbia Valley Appellation are Merlot, Cabernet Sauvignon, and Chardonnay. These three varietals constitute 71% of total acreage of grapes planted.

Comparison of Temperature and Climatic Data Inside and Outside of the Proposed Boundary.

A complete collection of climatic data compiled from the Western Regional Climate Center has been compiled and is enclosed with this letter as documentation. A comparison of temperature and rainfall has been summarized below

OREGON	Bonneville	Hood River	The Dalles	Arlington
Precipitation				
Average 3-Month Total Precipitation (June, July, August)	5.14	1.38	0.91	0.84
Average 12-Month Total Precipitation	77.54	30.21	14.52	9.08
Temperature				
Average 3-Month Mean Temperature (June, July, August)	65.67	65.13	71.60	73.27
Number Growing Degree Days (Base Temperature = 60°F)	767	666	1447	1596

WASHINGTON	Skamania	Wind River	Appleton	Yakima
Precipitation				
Average 3-Month Total Precipitation (June, July, August)	7.25	4.35	1.59	1.21
Average 12-Month Total Precipitation	85.49	99.71	33.23	8.21
Temperature				
Average 3-Month Mean Temperature (June, July, August)	61.23	62.07	61.97	67.80
Number Growing Degree Days (Base Temperature = 60°F)	364	420	454	921

On the Washington side, there were no weather data stations within the proposed appellation area. Wind River and Appleton are immediately to the west and east of the proposed appellation respectively and were used to demonstrate the extreme precipitation gradient.

In general, the proposed Columbia Gorge Appellation area is characterized by rainfall of approximately 20-40 inches annually. As can be seen in the data above, annual rainfall amounts to the east in the Columbia Valley Appellation area are in the 8-14 range while annual rainfall in the western areas of Bonneville and Skamania sour to 75-85 inches. The data also demonstrates that average growing temperatures are higher and there are more growing degree days in the eastern locations that comprise the Columbia Valley Appellation.

Clarification Regarding Location of Classified Soils Inside and Outside of the Proposed Appellation Boundary

The soils data presented in earlier correspondence has been re-summarized below for clarification. In general, the soil types within the proposed appellation boundary are silty loams while those outside the area are steeper and more gravelly. This soils data has been developed from County Soil Survey reports published by the Soil Conservation Service. A colored map has also been included to demonstrate roughly where these soil profiles occur. The proposed boundary attempts to draw a general line that includes the lower, flatter, loamy soil agricultural areas and excludes the higher elevation, steeper, gravelly soil, timber areas.

County	Soil Types Within Proposed Columbia Gorge Appellation	Soil Types Outside Proposed Columbia Gorge Appellation
Skamania	Chemawa Series (Soil Types 21, 22, 23, 24) Underwood Loam Series (Soil Types 144, 145, 146) McElroy Series (Soil Type 69)	Steeper McElroy Series (Soil Types 67, 68) Undusk Gravelly Loam Series (Soil Types 147, 148)
Klickitat	Chemawa Series (Soil Types 86A, 86B, 86C) McGowen Series (Soil Type 77) Underwood Loam Series (Soil Types 76A, 76B, 76C)	Husum Gravelly Loam (Soil Type 92) Rock Outcrop (Soil Type 721)
Hood River	Oak Grove Loam Series (Soil Types 16B, 16C, 16D) Parkdale Loam Series (Soil Types 17B, 17C, 17D) Van Horn Loam Series (Soil Types 23, 24) Wyest Silt Loam Series (Soil Types 28B, 28C)	Bins-Bindle Series (Soil Types 3E, 3F) Yallani Series (Soil Types 32E, 32F)
Wasco	Wamic Loam Series (Soil Types 49, 50, 51) Van Horn Loam Series (Soil Types 45)	Hesslan-Skyline Series (Soil Types 27F, 28E, 43F)

We appreciate your consideration of our petition. Please do not hesitate to contact me if there are questions or if further information is needed.

Cordially,

Mark Wharry, Appellation Committee
[redacted]
Portland, OR 97201
[redacted]

PROPOSED COLUMBIA GORGE VITICULTURAL AREA
WINE GRAPE ACREAGE SUMMARY

Source: Columbia Gorge Wine Growers Association

	Total	Chardonnay	Pinot Gris	Riesling	Gewurztraminer	Pinot Noir	Others
Washington							
Celilo Vineyards	71	31	3		30	2	5
Brehm Vineyards	7	4				3	
Mountainview Vineyard	4			4			
Wind River Cellars	6			6			
Gensler Vineyard	12				4	8	
Cyrstal Pheasant Vineyard	43	10	10	1	1	18	3
Oak Ridge Vineyard	5				5		
Ziegler Lane Vineyard	4		4				
Gorge View Vineyard	2		2				
Myzkowski Vineyard	12	4		4		4	
Swift Water Vineyard	4		4				
Huber Vineyard	15	3	3			6	3
Larson Vineyard	5				5		
Underwood Mtn. Vineyards	12		6			6	
Oregon							
Blue Chip Farm	6		3			3	
Phelps Creek Vineyard	9	4				5	
Hood River Vineyard 30	20	5		5		5	5
Flerchinger Vineyard	6			3			3
Bickford Vineyard	5					5	
Wy'East Vineyard	18		9			9	
Maribel Vineyard	5						5
Pine Grove Vineyard	5			5			
County Club Vineyard	8				8		
Acre Totals	284	61	44	28	53	74	24
		(21%)	(15%)	(10%)	(19%)	(26%)	(8%)

PROPOSED COLUMBIA GORGE VITICULTURAL AREA
CLIMATE DATA COMPARISON SUMMARY

Source: Western Regional Climate Center
www.wrcc.dri.edu/cgi-bin

OREGON

	Bonneville	Hood River	The Dalles	Arlington
Precipitation				
Average 3-Month Total Precipitation (June, July, August)	5.14	1.38	0.91	0.84
Average 12-Month Total Precipitation	77.54	30.21	14.52	9.08
Temperature				
Average 3-Month Mean Temperature (June, July, August)	65.67	65.13	71.60	73.27
Number Growing Degree Days (Base Temperature = 60°F)	767	666	1447	1596

WASHINGTON

	Skamania	Wind River	Appleton	Yakima
Precipitation				
Average 3-Month Total Precipitation (June, July, August)	7.25	4.35	1.59	1.21
Average 12-Month Total Precipitation	85.49	99.71	33.23	8.21
Temperature				
Average 3-Month Mean Temperature (June, July, August)	61.23	62.07	61.97	67.80
Number Growing Degree Days (Base Temperature = 60°F)	364	420	454	921

1999 WASHINGTON WINE GRAPE ACREAGE SURVEY

COMPILED BY:

WASHINGTON AGRICULTURAL STATISTICS SERVICE

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OFFICE STAFF

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	Cheryl Ito	Kim Ritchie	Paula Quartano	

Washington State Department of Agriculture
Jim Jesernig, Director

U.S. Department of Agriculture
National Agricultural Statistics Service
R. Ronald Bosecker, Administrator
Joseph T. Reilly, Deputy Administrator
for Field Operations

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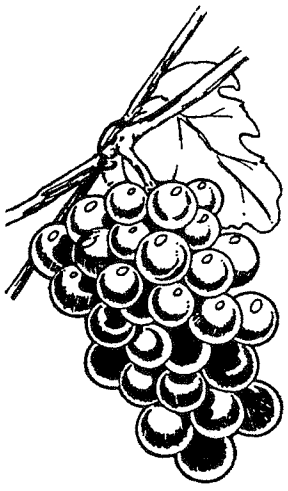

United States
Department
of Agriculture
National Agricultural
Statistics Service
NASS

Washington Agricultural Statistics Service

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www.nass.usda.gov

Acknowledgment

Information presented in this report are the estimates from the Wine Grape Acreage Survey conducted during the winter of 1999 and relate to the acreage as of July 1, 1999. These survey data are comparable with data collected for January 1, 1993 in the Washington Fruit Survey. Comparisons can be made to interpret trends at the state level. Data collected for the Wine Grape Acreage Survey are the same format as the January 1, 1993 survey, except the earlier estimates were for state level only and the current report presents data at the appellation level and regions within the Columbia Valley Appellation.

The Washington Wine Commission recognized the need for accurate, current information about the wine grape industry and contacted the Washington Agricultural Statistics Service (WASS) to conduct the survey. Support for this survey was very strong and cooperation was excellent. The Wine Commission publicized the need for data and asked for cooperation of the producers along with the wineries and other industry people. Funding to complete this survey was provided by the Washington Wine Commission.

The Washington wine grape acreage, on July 1, 1999, totaled 24,000 acres. Survey results have been posted to our homepage (www.nass.usda.gov/wa). Oregon conducted a similar survey and published their results on their homepage (www.nass.usda.gov/or) showing 9,800 acres of wine grapes. Other reports are presented on both homepages that relate to production and price of wine grapes and other commodities.

The additional workload for this survey fell largely on Joe Ross, our fruit statistician and Rita Walker, who prepared final copy to print and post on the Internet. Their efforts go beyond the normal workload and are appreciated.

Doug Hasslen

Douglas A. Hasslen
State Statistician

Washington Wine Grape Acreage, July 1, 1999

The total wine grape acreage in Washington is estimated at 24,000 acres as of July 1, 1999, more than double the acreage estimated on January 1, 1993. Red varieties more than tripled during this period, going from 4,000 acres in 1993 to 13,500 acres in 1999. The total bearing acreage of wine grapes (based on bearing the third year) totaled 17,000 acres compared with 10,200 acres six years ago.

The ratio of bearing acres to total acres shows the rapid increase in acreage that has occurred over the last two years, with red varieties advancing to a higher degree than whites. The percent of white varieties that are bearing is 86% and red varieties are at 59% for a combined total of 71% bearing. Comparison of the 1993 data shows white varieties were 96% bearing age and red varieties were 85% for a total of 92% bearing.

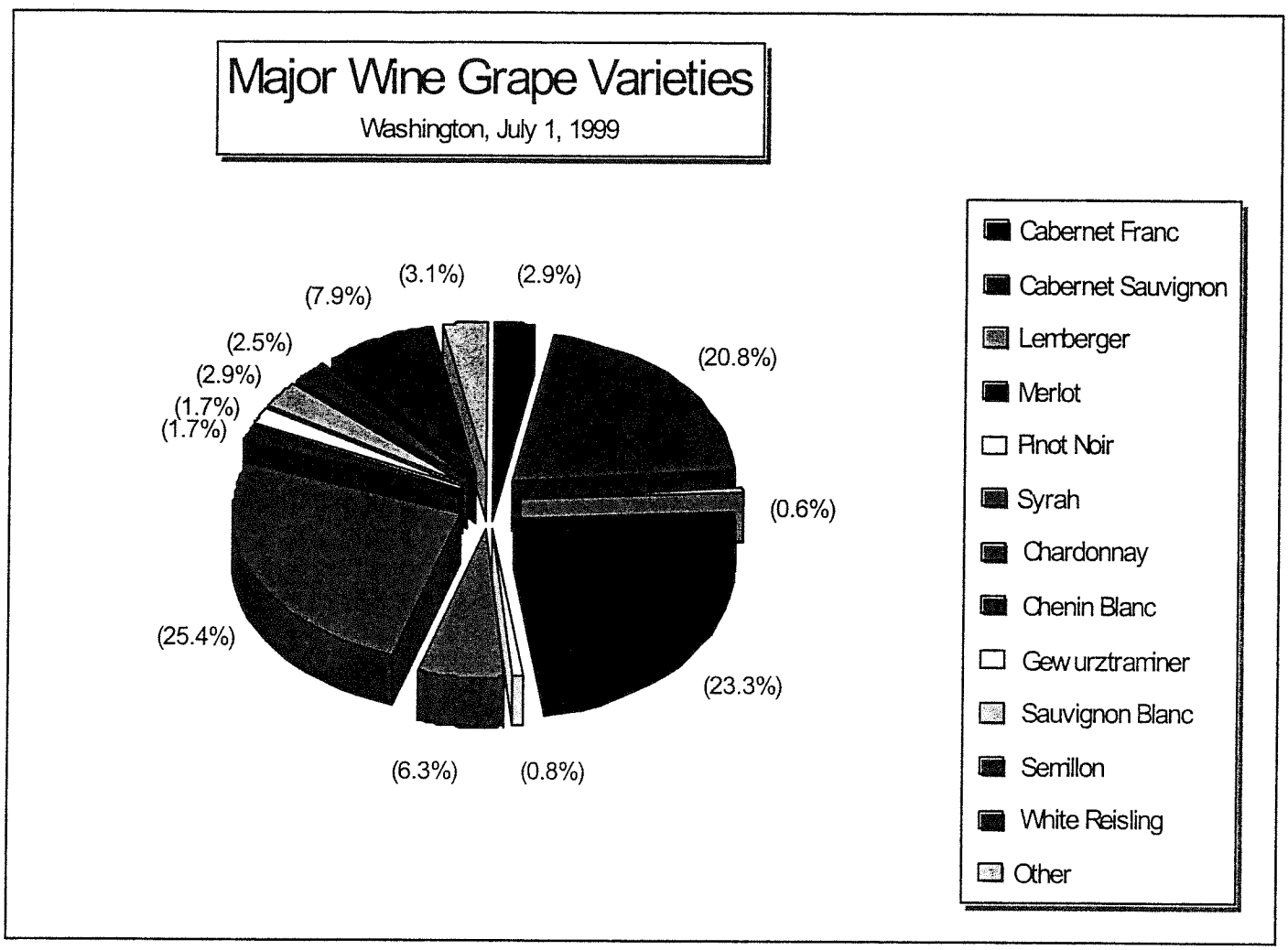
Chardonnay still retains its status as the most popular variety with the largest bearing acreage. Merlot and Cabernet Sauvigon are the second and third leading varieties. These three varieties account for 69% of the total acreage, both total and bearing. In 1993, White Reisling and Merlot held the second and third places, respectively, in terms of total acreage.

WINE GRAPE ACREAGE, TOTAL, AND BEARING ACRES, 1993 & 1999, WASHINGTON

Variety	January 1, 1993		July 1, 1999		Percent 1999/1993	
	Total	Bearing	Total	Bearing	Total	Bearing
White Varieties:						
Chardonnay	2,600	2,350	6,100	5,030	235%	214%
Chenin Blanc	600	600	400	400	67%	67%
Gewurztraminer	300	300	400	310	133%	103%
Sauvignon Blanc	800	800	700	600	88%	75%
Semillon	700	700	600	590	86%	84%
White Reisling	2,000	1,950	1,900	1,780	95%	91%
Muscat Canelli	-	-	110	110	-	-
Pinot Gris	-	-	150	80	-	-
Viognier	-	-	60	20	-	-
Other White 1/	100	100	80	80	-	-
Total White	7,100	6,800	10,500	9,000	148%	132%
Red Varieties:						
Cabernet Franc	150	100	700	510	467%	510%
Cabernet Sauvignon	1,400	1,350	5,000	2,690	357%	199%
Lemberger	150	150	150	110	100%	73%
Merlot	1,800	1,350	5,600	4,040	311%	299%
Pinot Noir	250	200	200	200	80%	100%
Malbec	-	-	50	10	-	-
Sangiovese	-	-	100	40	-	-
Syrah	-	-	1,500	290	-	-
Zinfandel	-	-	50	10	-	-
Other Red 1/	250	250	150	100	-	-
Total Red	**4,000**	**3,400**	**13,500**	**8,000**	**338%**	**235%**
TOTAL ALL VARIETIES	**11,100**	**10,200**	**24,000**	**17,000**	**216%**	**167%**

* *The Columbia Valley and Walla Walla Valley AVA's extend into Oregon. The Oregon acreage in these two AVA's is 806 acres bringing the Washington State and contiguous Oregon acreage to 24,806 total acres of wine grapes, with 17,653 bearing acres.*

1/ "Other" includes varieties not published due to disclosure of individual operations. See page 17 for further information.



Acreage by American Viticultural Areas

An American Viticultural Area (AVA) is an area that is "recognized" and "defined" by the U.S. Treasury Department, Bureau of Alcohol, Tobacco and Firearms. An AVA has unique climate, soil, physical features, etc. which distinguish it from surrounding areas. Washington has four AVA's which are Puget Sound, Yakima Valley, Columbia Valley and Walla Walla Valley. Two of Washington's AVA's, the Columbia Valley and the Walla Walla Valley, extend into the state of Oregon. Acreage in this report for these two AVA's includes only the Washington portion of the acreage unless stated otherwise.

The Yakima Valley and the Columbia Valley AVA's have 97% of the State's total and bearing acreage. Chardonnay is the variety with the largest acreage in the Yakima Valley AVA, at 2,910 acres, followed by Merlot with 1,850 acres and Cabernet Sauvignon with 1,450 acres. The combined acreage of these three varieties is 6,210 acres or 68% of the Yakima Valley AVA total. The Columbia Valley AVA shows Merlot as the leading variety with 3,630 acres, followed by Cabernet Sauvignon with 3,390 acres and Chardonnay with 3,090 acres. This three variety total for the Columbia Valley is 10,110 acres or 71% of the Columbia Valley AVA total.

Washington Wine Grape Acreage, July 1, 1999 - by AVA's

Variety	Puget Sound		Yakima		Walla Walla 1/		Columbia Valley 1/		Other		State Total	
	Total	Bearing	Total	Bearing	Total	Bearing	Total	Bearing	Total	Bearing	Total	Bearing
White Varieties:												
Chardonnay	0	0	2,910	2,320	80	70	3,090	2,620	20	20	6,100	5,030
Chenin Blanc	0	0	180	180	0	0	220	220	0	0	400	400
Gewurztraminer	0	0	290	220	10	10	90	70	10	10	400	310
Sauvignon Blanc	0	0	250	180	0	0	450	420	0	0	700	600
Semillon	0	0	190	190	0	0	410	400	0	0	600	590
White Reisling	0	0	760	680	0	0	1,130	1,090	10	10	1,900	1,780
Muscat	0	0	30	30	0	0	80	80	0	0	110	110
Pinot Gris	0	0	120	60	0	0	10	0	20	20	150	80
Voignier	0	0	30	10	0	0	30	10	0	0	60	20
Other White	40	40	10	10	0	0	20	20	10	10	80	80
Total White	**40**	**40**	**4,770**	**3,880**	**90**	**80**	**5,530**	**4,930**	**70**	**70**	**10,500**	**9,000**
Red Varieties:												
Cabernet Franc	0	0	230	180	20	20	450	310	0	0	700	510
Cabernet Sauvignon	0	0	1,450	830	150	70	3,390	1,780	10	10	5,000	2,690
Lemberger	0	0	120	90	0	0	30	20	0	0	150	110
Malbec	0	0	10	0	10	0	30	10	0	0	50	10
Merlot	0	0	1,850	1,390	110	40	3,630	2,600	10	10	5,600	4,040
Pinot Noir	10	10	110	110	0	0	40	40	40	40	200	200
Sangiovese	0	0	30	20	10	10	60	10	0	0	100	40
Syrah	0	0	510	150	50	20	940	120	0	0	1,500	290
Zinfandel	0	0	0	0	0	0	50	10	0	0	50	10
Other Red	10	10	20	10	10	0	100	70	10	10	150	100
Total Red Varieties	**20**	**20**	**4,330**	**2,780**	**360**	**160**	**8,720**	**4,970**	**70**	**70**	**13,500**	**8,000**
TOTAL ALL	**60**	**60**	**9,100**	**6,660**	**450**	**240**	**14,250**	**9,900**	**140**	**140**	**24,000**	**17,000**

1/ The Oregon acreage in the Columbia Valley AVA is 527 and in the Walla Walla Valley AVA is 279. This brings the Columbia Valley AVA total to 14,777 acres and the Walla Walla Valley AVA total to 729 acres.

Columbia Valley AVA Wine Grape Acreage

The Columbia Valley AVA is 1,152,000 acres in size and extends across the state line into the Oregon counties of Gilliam, Morrow, Sherman, Umatilla and Wasco. Nearly 60 percent of the state's wine grape acreage is located in this region. The Columbia Valley accounts for 65 percent of the state's acreage of red varieties and 53 percent of the state's acreage of white varieties.

The Columbia Valley AVA was subdivided into the following regions: Wahluke Slope, Royal Slope, TriCities, Alderdale Ridge and Other. The Wahluke Slope and Alderdale Ridge regions each account for nearly 38 percent of the Columbia Valley's total wine grape acreage. The Alderdale Ridge region has the largest acreage of white varieties at 2,360 acres or 43 percent of the AVA total followed by Wahluke Slope at 1,690 acres or 31 percent of the AVA total. The most prominent white variety produced in the Alderdale Ridge region is Chardonnay, at 990 acres. Chardonnay is also the most common white variety produced in the Wahluke Slope region at 1,070 acres. The Wahluke slope region has the largest acreage of red varieties in the Columbia Valley, at 3,730 acres or 43 percent of the AVA total, followed by Alderdale Ridge at 3,040 acres or 35 percent of the total. The most prominent red variety produced in the Wahluke slope region is Merlot, at 1,640 acres followed by Cabernet Sauvignon, at 1,550 acres. The red variety with the largest acreage in the Alderdale Ridge region is Cabernet Sauvignon, at 1,260 acres followed by Merlot, at 1,100 acres.

Columbia Valley AVA Total Wine Grape Acreage, July 1, 1999 - by Region

Variety	Wahluke Slope	Royal Slope	TriCities	Alderdale Ridge	Other	Columbia Valley Total
White Varieties:						
Chardonnay	1,070	120	680	990	230	3,090
Chenin Blanc	0	0	30	190	0	220
Gewurztraminer	40	0	10	40	0	90
Sauvignon Blanc	70	0	130	250	0	450
Semillon	100	0	20	290	0	410
White Reisling	350	0	210	540	30	1,130
Muscat	50	0	0	30	0	80
Pinot Gris	0	0	10	0	0	10
Voignier	10	0	10	10	0	30
Other White	0	0	0	20	0	20
Total White	**1,690**	**120**	**1,100**	**2,360**	**260**	**5,530**
Red Varieties:						
Cabernet Franc	170	0	70	140	70	450
Cabernet Sauvignon	1,550	100	380	1,260	100	3,390
Lemberger	0	0	0	30	0	30
Malbec	10	0	20	0	0	30
Merlot	1,640	130	490	1,100	270	3,630
Pinot Noir	0	0	30	0	10	40
Sangiovese	10	0	20	30	0	60
Syrah	320	30	180	390	20	940
Zinfandel	20	0	10	20	0	50
Other Red	10	0	20	70	0	100
Total Red	**3,730**	**260**	**1,220**	**3,040**	**470**	**8,720**
TOTAL ALL	**5,420**	**380**	**2,320**	**5,400**	**730**	**14,250**

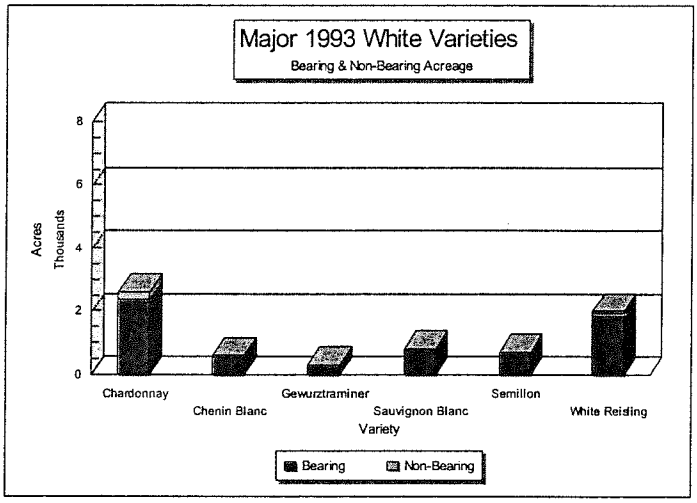
Washington State Wine Grape Acreage by AVA and Year Planted

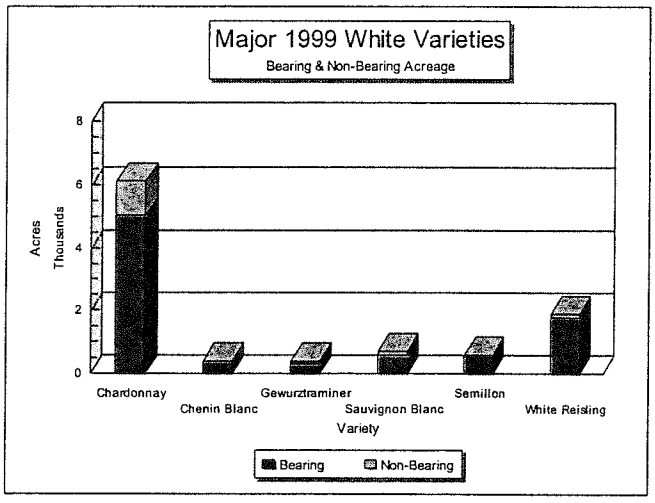
Data at the state level indicate that wine grape acreage is rapidly increasing with 7,000 new acres of wine grapes coming into production during the next two years (one or two years old as of July 1, 1999). Grower intentions also show that very little established acreage will be removed during the next year. The Columbia Valley has 600 acres of non-bearing white varieties compared with 3,750 acres of non-bearing red varieties which illustrates the increasing popularity of red varieties. Red varieties are also increasing in the Yakima Valley. Non-bearing red varieties total 1,550 acres compared with 890 non-bearing acres of white varieties.

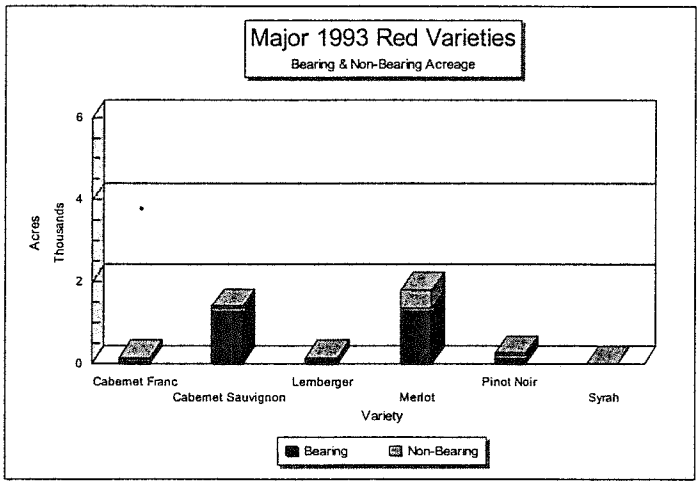
In addition to being the most common variety in the state, Chardonnay is also the most common white variety in the Columbia, Yakima and Walla Walla Valleys. Merlot's status as the most common red variety in the state also holds for the Columbia and Yakima Valleys.

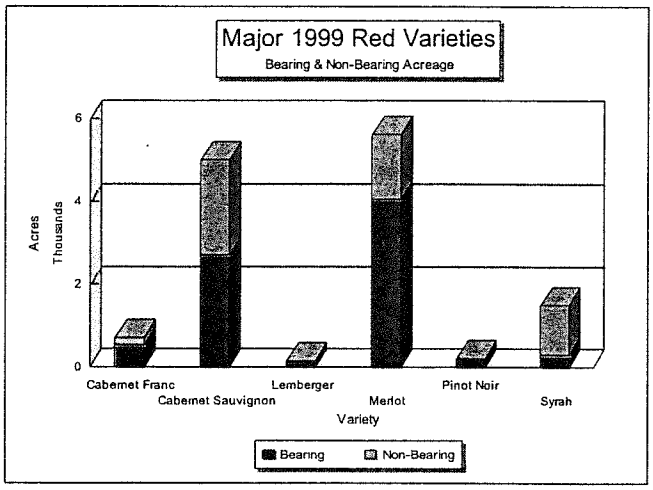
The white variety with the largest non-bearing acreage in the state is Chardonnay, at 1,070 out of a total of 6,100 acres. At the AVA level, the Yakima Valley has the largest non-bearing Chardonnay acreage, at 590. The red variety with the largest non-bearing acreage in the state is Cabernet Sauvignon, at 2,310 acres. At the AVA level, the Columbia Valley has the largest number of non-bearing Cabernet Sauvignon acres, at 1,610.

The variety that will most likely have the largest percentage increase in bearing acreage within two years at the state level is Syrah. The non-bearing acreage for this variety totals 1,210 acres of the total of 1,500 acres or 81 percent. At the AVA level, the Columbia Valley has the largest acreage of Syrah, at 940 acres of which 820 acres are non-bearing. The Yakima Valley has the next largest acreage of Syrah, at 510 acres of which 360 acres are non-bearing.









Washington State Wine Grape Acreage, July 1, 1999 - by Year Planted

Variety	Prior to 1980	1980-1989	1990-1994	1995	1996	1997	1998	1999	Washington Total	
									Total	Bearing
White Varieties:										
Chardonnay	300	1,910	1,100	120	510	1,090	760	310	6,100	5,030
Chenin Blanc	160	220	20	0	0	0	0	0	400	400
Gewurztraminer	130	130	0	0	10	40	20	70	400	310
Sauvignon Blanc	260	300	10	10	0	20	40	60	700	600
Semillon	150	400	20	0	0	20	10	0	600	590
White Reisling	620	1,090	60	0	10	0	0	120	1,900	1,780
Muscat	20	70	20	0	0	0	0	0	110	110
Pinot Gris	0	0	10	10	20	40	50	20	150	80
Voignier	0	0	10	0	0	10	20	20	60	20
Other White	0	50	10	0	0	20	0	0	80	80
Total White	**1,640**	**4,170**	**1,260**	**140**	**550**	**1,240**	**900**	**600**	**10,500**	**9,000**
Red Varieties:										
Cabernet Franc	0	30	140	60	90	190	160	30	700	510
Cabernet Sauvignon	330	910	700	90	270	390	960	1,350	5,000	2,690
Lemberger	0	90	10	0	10	0	10	30	150	110
Malbec	0	0	10	0	0	0	30	10	50	10
Merlot	130	950	1,580	100	350	930	880	680	5,600	4,040
Pinot Noir	60	120	10	0	10	0	0	0	200	200
Sangiovese	0	0	20	10	10	0	20	40	100	40
Syrah	0	30	90	30	70	70	370	840	1,500	290
Zinfandel	0	0	10	0	0	0	20	20	50	10
Other Red	60	10	20	10	0	0	10	40	150	100
Total Red	**580**	**2,140**	**2,590**	**300**	**810**	**1,580**	**2,460**	**3,040**	**13,500**	**8,000**
TOTAL ALL	**2,220**	**6,310**	**3,850**	**440**	**1,360**	**2,820**	**3,360**	**3,640**	**24,000**	**17,000**

Yakima Valley AVA Wine Grape Acreage, July 1, 1999 - by Year Planted

Variety	Prior to 1980	1980-1989	1990-1994	1995	1996	1997	1998	1999	Yakima Valley Total	
									Total	Bearing
White Varieties:										
Chardonnay	60	970	380	70	370	470	410	180	2,910	2,320
Chenin Blanc	40	120	20	0	0	0	0	0	180	180
Gewurztraminer	80	90	0	0	10	40	0	70	290	220
Sauvignon Blanc	50	120	0	0	0	10	30	40	250	180
Semillon	30	150	10	0	0	0	0	0	190	190
White Reisling	200	430	40	0	10	0	0	80	760	680
Muscat	0	20	10	0	0	0	0	0	30	30
Pinot Gris	0	0	0	10	10	40	50	10	120	60
Voignier	0	0	10	0	0	0	10	10	30	10
Other White	0	0	0	0	0	10	0	0	10	10
Total White	**460**	**1,900**	**470**	**80**	**400**	**570**	**500**	**390**	**4,770**	**3,880**
Red Varieties:										
Cabernet Franc	0	10	90	10	30	40	50	0	230	180
Cabernet Sauvignon	40	320	320	50	70	30	190	430	1,450	830
Lemberger	0	70	10	0	10	0	10	20	120	90
Malbec	0	0	0	0	0	0	10	0	10	0
Merlot	80	380	650	30	90	160	170	290	1,850	1,390
Pinot Noir	30	70	10	0	0	0	0	0	110	110
Sangiovese	0	0	10	10	0	0	0	10	30	20
Syrah	0	10	50	30	30	30	110	250	510	150
Zinfandel	0	0	0	0	0	0	0	0	0	0
Other Red	0	0	10	0	0	0	10	0	20	10
Total Red	**150**	**860**	**1,150**	**130**	**230**	**260**	**550**	**1,000**	**4,330**	**2,780**
TOTAL ALL	**610**	**2,760**	**1,620**	**210**	**630**	**830**	**1,050**	**1,390**	**9,100**	**6,660**

Columbia Valley AVA Wine Grape Acreage, July 1, 1999 - by Year Planted

Variety	Prior to 1980	1980-1989	1990-1994	1995	1996	1997	1998	1999	Columbia Valley Total	
									Total	Bearing
White Varieties:										
Chardonnay	220	870	720	50	140	620	340	130	3,090	2,620
Chenin Blanc	120	100	0	0	0	0	0	0	220	220
Gewurztraminer	50	20	0	0	0	0	20	0	90	70
Sauvignon Blanc	210	180	10	10	0	10	10	20	450	420
Semillon	120	250	10	0	0	20	10	0	410	400
White Reisling	420	650	20	0	0	0	0	40	1,130	1,090
Muscat	20	50	10	0	0	0	0	0	80	80
Pinot Gris	0	0	0	0	0	0	0	10	10	0
Voignier	0	0	0	0	0	10	10	10	30	10
Other White	0	20	0	0	0	0	0	0	20	20
Total White	**1,160**	**2,170**	**780**	**60**	**150**	**660**	**390**	**210**	**5,530**	**4,930**
Red Varieties:										
Cabernet Franc	0	10	50	50	60	140	110	30	450	310
Cabernet Sauvignon	290	570	370	40	170	340	770	840	3,390	1,780
Lemberger	0	20	0	0	0	0	0	10	30	20
Malbec	0	0	10	0	0	0	20	0	30	10
Merlot	50	570	910	70	240	760	710	320	3,630	2,600
Pinot Noir	30	10	0	0	0	0	0	0	40	40
Sangiovese	0	0	0	0	10	0	20	30	60	10
Syrah	0	20	30	0	30	40	250	570	940	120
Zinfandel	0	0	10	0	0	0	20	20	50	10
Other Red	50	10	0	10	0	0	0	30	100	70
Total Red	**420**	**1,210**	**1,380**	**170**	**510**	**1,280**	**1,900**	**1,850**	**8,720**	**4,970**
TOTAL ALL	**1,580**	**3,350**	**2,150**	**230**	**650**	**1,940**	**2,290**	**2,060**	**14,250**	**9,900**

Walla Walla Valley AVA Wine Grape Acreage, July 1, 1999 - by Year Planted

Variety	Prior to 1980	1980-1989	1990-1994	1995	1996	1997	1998	1999	Walla Walla Valley Total	
									Total	Bearing
White Varieties:										
Chardonnay	10	60	0	0	0	0	10	0	80	70
Chenin Blanc	0	0	0	0	0	0	0	0	0	0
Gewurztraminer	0	10	0	0	0	0	0	0	10	10
Sauvignon Blanc	0	0	0	0	0	0	0	0	0	0
Semillon	0	0	0	0	0	0	0	0	0	0
White Reisling	0	0	0	0	0	0	0	0	0	0
Muscat	0	0	0	0	0	0	0	0	0	0
Pinot Gris	0	0	0	0	0	0	0	0	0	0
Voignier	0	0	0	0	0	0	0	0	0	0
Other White	0	0	0	0	0	0	0	0	0	0
Total White	**10**	**70**	**0**	**0**	**0**	**0**	**10**	**0**	**90**	**80**
Red Varieties:										
Cabernet Franc	0	10	0	0	0	10	0	0	20	20
Cabernet Sauvignon	0	10	10	0	30	20	0	80	150	70
Lemberger	0	0	0	0	0	0	0	0	0	0
Malbec	0	0	0	0	0	0	0	10	10	0
Merlot	0	0	10	0	20	10	0	70	110	40
Pinot Noir	0	0	0	0	0	0	0	0	0	0
Sangiovese	0	0	10	0	0	0	0	0	10	10
Syrah	0	0	10	0	10	0	10	20	50	20
Zinfandel	0	0	0	0	0	0	0	0	0	0
Other Red	0	0	0	0	0	0	0	10	10	0
Total Red	**0**	**20**	**40**	**0**	**60**	**40**	**10**	**190**	**360**	**160**
TOTAL ALL	**10**	**90**	**40**	**0**	**60**	**40**	**20**	**190**	**450**	**240**

Puget Sound AVA Wine Grape Acreage, July 1, 1999 - by Year Planted

Variety	Prior to 1980	1980-1989	1990-1994	1995	1996	1997	1998	1999	Puget Sound Total	
									Total	Bearing
White Varieties:										
Chardonnay	0	0	0	0	0	0	0	0	0	0
Chenin Blanc	0	0	0	0	0	0	0	0	0	0
Gewurztraminer	0	0	0	0	0	0	0	0	0	0
Sauvignon Blanc	0	0	0	0	0	0	0	0	0	0
Semillon	0	0	0	0	0	0	0	0	0	0
White Reisling	0	0	0	0	0	0	0	0	0	0
Muscat	0	0	0	0	0	0	0	0	0	0
Pinot Gris	0	0	0	0	0	0	0	0	0	0
Voignier	0	0	0	0	0	0	0	0	0	0
Other White	0	20	10	0	0	10	0	0	40	40
Total White	**0**	**20**	**10**	**0**	**0**	**10**	**0**	**0**	**40**	**40**
Red Varieties:										
Cabernet Franc	0	0	0	0	0	0	0	0	0	0
Cabernet Sauvignon	0	0	0	0	0	0	0	0	0	0
Lemberger	0	0	0	0	0	0	0	0	0	0
Malbec	0	0	0	0	0	0	0	0	0	0
Merlot	0	0	0	0	0	0	0	0	0	0
Pinot Noir	0	10	0	0	0	0	0	0	10	10
Sangiovese	0	0	0	0	0	0	0	0	0	0
Syrah	0	0	0	0	0	0	0	0	0	0
Zinfandel	0	0	0	0	0	0	0	0	0	0
Other Red	10	0	0	0	0	0	0	0	10	10
Total Red	**10**	**10**	**0**	**0**	**0**	**0**	**0**	**0**	**20**	**20**
TOTAL ALL	**10**	**30**	**10**	**0**	**0**	**10**	**0**	**0**	**60**	**60**

Other Area Wine Grape Acreage, July 1, 1999 - by Year Planted

Variety	Prior to 1980	1980-1989	1990-1994	1995	1996	1997	1998	1999	Other Total	
									Total	Bearing
White Varieties:										
Chardonnay	10	10	0	0	0	0	0	0	20	20
Chenin Blanc	0	0	0	0	0	0	0	0	0	0
Gewurztraminer	0	10	0	0	0	0	0	0	10	10
Sauvignon Blanc	0	0	0	0	0	0	0	0	0	0
Semillon	0	0	0	0	0	0	0	0	0	0
White Reisling	0	10	0	0	0	0	0	0	10	10
Muscat	0	0	0	0	0	0	0	0	0	0
Pinot Gris	0	0	10	0	10	0	0	0	20	20
Voignier	0	0	0	0	0	0	0	0	0	0
Other White	0	10	0	0	0	0	0	0	10	10
Total White	**10**	**40**	**10**	**0**	**10**	**0**	**0**	**0**	**70**	**70**
Red Varieties:										
Cabernet Franc	0	0	0	0	0	0	0	0	0	0
Cabernet Sauvignon	0	10	0	0	0	0	0	0	10	10
Lemberger	0	0	0	0	0	0	0	0	0	0
Malbec	0	0	0	0	0	0	0	0	0	0
Merlot	0	0	10	0	0	0	0	0	10	10
Pinot Noir	0	30	0	0	10	0	0	0	40	40
Sangiovese	0	0	0	0	0	0	0	0	0	0
Syrah	0	0	0	0	0	0	0	0	0	0
Zinfandel	0	0	0	0	0	0	0	0	0	0
Other Red	0	0	10	0	0	0	0	0	10	10
Total Red	**0**	**40**	**20**	**0**	**10**	**0**	**0**	**0**	**70**	**70**
TOTAL ALL	**10**	**80**	**30**	**0**	**20**	**0**	**0**	**0**	**140**	**140**

Grower Intentions to Remove or Plant Acreage

Two questions were included in the survey for white and red varieties:

1. How many acres of wine grapes did you or do you plan to remove between July 1, 1999 to June 30, 2000?
   - A. White Varieties ____ 770
   - B. Red Varieties ____ 780

2. How many acres of wine grapes did you or do you plan to plant between July 1, 1999 to June 30, 2000?
   - A. White Varieties ____ 870
   - B. Red Varieties ____ 880

The results of the survey show 90 acres of white varieties will be removed and 550 acres will be planted for a net change of 460 acres more white varieties by July 1, 2000. The response for red varieties was also positive, but more sharply so, with 60 acres being removed and 1,950 acres being planted for a net change of 1,890 acres more red varieties.

Selected Characteristics of Operations Producing Wine Grapes in Washington

Of the 715 producers surveyed for wine grapes, 631 had wine grapes, concord grapes or acreages of both. Producers having wine grapes totaled 209 with 52 having acreages of both wine and concord grapes. Producers of concord grapes totaled 474 of which 422 produced concords only and had no wine grape acreage.

The wine industry is complex and the producers are very diverse. The entire operation was inventoried for fruit acreage by type to get a measure of this diversity. The following question layout was used to inventory the fruit acreage on individual operations:

INSTRUCTIONS

Please report the total acreage of each fruit and the total acreage in your entire operation. This information will be used to update our records plus provide information to describe the diversity of wine grape producers. The information you report should relate to July 1, 1999. This will provide a clear break of acreage by age for estimating the bearing acreage of wine grapes.

Summary of Fruit Acreage for Operation on Label - July 1, 1999

Fruit	Total Acres (Tenths)		Fruit	Total Acres (Tenths)
Apples	100 ___		Peaches	105 ___
Pears	101 ___		Nectarines	106 ___
Sweet Cherries	102 ___		Plums/Prunes	107 ___
Tart Cherries	103 ___		Wine Grapes	108 ___
Apricots	104 ___		Other Grapes	109 ___
Total Fruit Acreage				110 ___
Total Acres in Operation (Include roads, wasteland, other crops,etc.)				120 ___

The results of the inventory of fruit acreage for wine producers is presented in the following table:

Fruit Crops Produced by Washington Wine Grape Growers		
Fruit	Number of Reports	Acreage of Fruit
Apples	76	10,500
Pears	20	650
Sweet Cherries	38	1,500
Tart Cherries	0	0
Apricots	6	80
Peaches	9	150
Nectarines	5	30
Plums/Prunes	8	40
Wine Grapes	209	24,000
Other Grapes	52	4,400

Of the 209 operations reporting wine grapes, 86 of these operations had other tree fruit. Of these 86 operations, 76 had apples, 20 had pears, 38 had sweet cherries, 6 had apricots, 9 had peaches, 5 had nectarines and 8 had prunes. Some wine grape producers also had relatively large acreages of a particular tree fruit. Of the 76 wine grape producers with apple tree acreage, 67 had 50 or more acres of apples. Twenty wine grape producers had pear acreage with 12 having 50 or more acres of pears. Thirty-eight wine grape producers were also sweet cherry growers of which 33 had 50 or more acres of sweet cherries.

Survey Procedures

The Wine Grape Acreage survey was designed as a mail survey with phone follow-up. The total number of wine grape producers is relatively small so a complete enumeration of all known producers was possible. WASS maintains a list of producers in the state with the associated control data for each agricultural commodity produced. A questionnaire was mailed to all known grape producers, regardless of type produced, to ensure that all known producers were surveyed. Coverage of the list was considered very good and industry contacts helped to supplement the list with their knowledge of current conditions.

The initial mailing was made on October 5, 1999 to 715 grape producers. The mail response was very good as the Wine Commission and wineries supported the survey and encouraged response. About 60 % of the response was by mail and 30% by phone. Some producers were personally interviewed as the Wine Grape Acreage survey overlapped with other ongoing surveys conducted by WASS. Of the 715 producers surveyed, 631 (88%) had grapes. There were 55 producers (8%) who were farming but did not have grapes. Twenty-two operations (3%) were out-of-business, and 6 names were duplicated within the list and one producer had acreage in Oregon only.

Questionnaires received from growers were reviewed for completeness and key entered in code-data format. Microsoft Visual FoxPro was used for editing and summarizing the reported data. Growers provided wine grape acreage information by variety, appellation, and year of planting. A reference date for the survey of July 1, 1999 was used in order to provide a clear break for estimating acreage by age.

Operations not responding to the survey were estimated using control data for wine grape acreage maintained by NASS for sampling purposes, if available, or industry knowledge if no NASS data was available. The total raw data sum was adjusted for this non-response and estimates by variety and year planted were made proportional to reported data by AVA. The non-response adjustment to the total survey data was approximately 8 percent.

Acreage estimates were rounded to the nearest 1,000 acres at the state total level. The total acreage for white and red varieties were estimated to the nearest 500 acres. Estimates for each variety by year planted were made at 10 acre intervals. This procedure produces state estimates more accurately than the estimates at the appellation level.

Minor varieties were not published if they represented a disclosure problem as defined by NASS. Some producers were contacted in the Walla Walla AVA for written permission to publish varietal data for this appellation. Minor varieties were combined into "Other White" with 80 total and bearing acres, and "Other Red" with 150 total acres of which 100 were bearing age.

> There were 11 Other White minor varieties: Mueller-Thurgau, Siegerrebe, Madeline, Angevine, Madeline Sylvaner, Marsanne, Orange Muscat, Rousanne, Muscat of Alexandria, Okanagan Reisling, Golden Muscat, and Chasselas.
>
> There were 21 Other Red minor varieties: Petit Verdot, Gamay, Grenache, Cambell Early, Royalty, Marechal Foch, Nebbiolo, Touriga, Souzao, Tinto Cao, White Zinfandel, Leon Milot, Joffre, Cascade, Cinsaut, Carmenere, Dolcetto, Cournoise, New York Muscat, Barbera, and Mouverdre.

The data published from this survey were delivered to the Wine Commission in two reports, a press release format and a final report. The date of publication was determined by the Wine Commission as they had sponsored the survey. The press release and final report were published on the NASS home page www/nass.usda.gov/wa on the date of publication and a press release was mailed to each producer who requested a copy of the survey results. Data presented in the press release are primarily for state level information while the final report show data at the AVA, variety and year planted level. Twenty-five copies of the final report were delivered to the Wine Commission.

United States
Department
of Agriculture
National Agricultural
Statistics Service
NASS

Washington Agricultural Statistics Service

PO Box 609 Olympia, WA 98507-0609 (360)902-1940 FAX (360)902-2091
www.nass.usda.gov

Dear Grape Grower:

Our agency has agreed to conduct a Wine Grape Acreage Survey. The Washington Wine Commission is sponsoring this survey and our goal is to publish a report in early January 2000. This survey is designed as a mail survey. We are allowing adequate time for you to complete the enclosed questionnaire, and we will follow-up by phone interview in three to four weeks if we have not received your response.

We are mailing this questionnaire to all grape producers as many people are switching to wine grapes. This will provide the most accurate coverage, especially for new producers. If you do not have wine grapes, complete the face page for all fruit and skip to the back page to indicate if you intend to plant wine grapes.

Information is being requested by block, by county, by appellation or region (refer to the enclosed map). If the variety or year planted changes, use a separate line. All individual reports will be kept confidential and only summarized data published. Comments entered on the back page will be relayed to the Wine Commission without identifying who provided the comment.

Joe Ross or Steve Hoel can answer any questions you have about the survey. They can be reached at either (360)902-1940 or 1(800)435-5883.

Sincerely,

Doug Hasslen

Doug Hasslen
State Statistician

United States Department of Agriculture
National Agricultural Statistics Service
NASS

WINE GRAPE ACREAGE SURVEY
JULY 1, 1999

P.O. Box 609
Olympia, WA 98507
Form Approved
O.M.B. #0535-0039
Expires: 12/31/02
Project Code 412

Dear Reporter:

The Washington Wine Commission has contracted with our agency to conduct a survey of wine grapes in Washington. The data requested is the acreage of each wine variety and the year planted.

Your voluntary response is needed for accurate estimates. All reports will be kept confidential and only summary data will be presented in a published report.

Sincerely,

Douglas A. Hasslen
State Statistician

Please make correction in name, address, and zip code, if necessary.

INSTRUCTIONS

Please report the total acreage of each fruit and the total acreage in your entire operation. This information will be used to update our records plus provide information to describe the diversity of wine grape producers. The information you report should relate to July 1, 1999. This will provide a clear break of acreage by age for estimating the bearing acreage of wine grapes.

Summary of Fruit Acreage for Operation on Label - July 1, 1999

Fruit	Total Acres (Tenths)		Fruit	Total Acres (Tenths)
Apples	100 .___		Peaches	105 .___
Pears	101 .___		Nectarines	106 .___
Sweet Cherries	102 .___		Plums/Prunes	107 .___
Tart Cherries	103 .___		Wine Grapes	108 .___
Apricots	104 .___		Other Grapes	109 .___
Total Fruit Acreage				110 .___
Total Acres in Operation (Include roads, wasteland, other crops,etc.)				120 .___

Reported by:_____ Telephone:_____

County where grown:_____ Date:_____

According to the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The time required to complete this information collection is estimated to average 8 minutes per response.

MAJOR WINE GRAPE VARIETIES

Red Wine Varieties	White Wine Varieties
Cabernet Franc	Chardonnay
Cabernet Sauvignon	Chenin blanc
Lemberger	Gewurztraminer
Malbec	Muscat Canelli
Merlot	Pinot blanc
Pinot noir	Pinot gris
Sangiovese	White Reisling
Syrah	Sauvignon blanc
Zinfandel	Semillon
	Viognier
Other red (specify)_____	Other white (specify)_____

NOTE: If you do not have wine grapes, skip to the back page, question 2.

Wine Grape Acreage by Block for Operation on Label - July 1, 1999

(Note: Use a separate line if there is a change in variety or year planted.)

County	Appellation Region or Subregion	Block Name or Number	Wine Grape Variety	Office Use Only	Acres in Vines (tenths)	Year Planted (19__ __)
200	300		500		600 .___	700 __ __
201	301		501		601 .___	701 __ __
202	302		502		602 .___	702 __ __
203	303		503		603 .___	703 __ __
204	304		504		604 .___	704 __ __
205	305		505		605 .___	705 __ __
206	306		506		606 .___	706 __ __
207	307		507		607 .___	707 __ __
208	308		508		608 .___	708 __ __
209	309		509		609 .___	709 __ __
210	310		510		610 .___	710 __ __

If more lines are needed to report all of your information, please continue on the next page. Refer to the enclosed maps defining appellations and regions. If you don't know the appellation or region the block is located in, check with your winery or the Washington Wine Commission.

Wine Grape Acreage by Block for Operation on Label - July 1, 1999 (continued)

(Note: Use a separate line if there is a change in variety or year planted.)

County	Appellation Region or Subregion	Block Name or Number	Wine Grape Variety	Office Use Only	Acres in Vines (tenths)	Year Planted (19__)
211	311		511		611 .___	711 ___
212	312		512		612 .___	712 ___
213	313		513		613 .___	713 ___
214	314		514		614 .___	714 ___
215	315		515		615 .___	715 ___
216	316		516		616 .___	716 ___
217	317		517		617 .___	717 ___
218	318		518		618 .___	718 ___
219	319		519		619 .___	719 ___
220	320		520		620 .___	720 ___
221	321		521		621 .___	721 ___
222	322		522		622 .___	722 ___
223	323		523		623 .___	723 ___
224	324		524		624 .___	724 ___
225	325		525		625 .___	725 ___
226	326		526		626 .___	726 ___
227	327		527		627 .___	727 ___
228	328		528		628 .___	728 ___
229	329		529		629 .___	729 ___
230	330		530		630 .___	730 ___
231	331		531		631 .___	731 ___
				Total acreage for all blocks	400 .___	

Note: Verify that the sum of acres for wine grapes equals the acreage reported in the summary table on the face page of this questionnaire. If the information does not agree, please review and make corrections.

1. How many acres of wine grapes did you or do you plan to remove between July 1, 1999 to June 30, 2000?
   A. White Varieties ____ 770
   B. Red Varieties ____ 780

2. How many acres of wine grapes did you or do you plan to plant between July 1, 1999 to June 30, 2000?
   A. White Varieties ____ 870
   B. Red Varieties ____ 880

Comments about unusual situations that would be helpful in understanding your operation would be appreciated.
(These comments are confidential.)

_____

_____

_____

_____

_____

_____

Comments to be included in report to Wine Commission:

_____

_____

_____

_____

_____

Are the day to day decisions for this operation made by partners?

( ) No - Continue.

( ) Yes - To help us eliminate possible duplication, please identify other partners in the operation.

Name Address Phone

_____

_____

If you would like to receive a copy of the survey results, please check here. ☐ 111
If additional help is needed, please call (360)902-1940 or 1-800-435-5883.

WESTERN REGIONAL CLIMATE CENTER

CLIMATE DATA

FOR THE FOLLOWING LOCATIONS:

OREGON	WASHINGTON
BONNEVILLE	SKAMANIA
HOOD RIVER	WIND RIVER
THE DALLES	APPLETON
ARLINGTON	YAKIMA

SOURCE: Western Regional Climate Center
2215 Raggio Parkway
Reno, Nevada 89512
Phone: 775-674-7010
FAX: 775-674-7016
www.wwrc.dri.edu

DATE: MARCH 21, 2002

TTB Note: For the complete text of this document, contact TTB.