Middle Willamette Agricultural Water Quality Management Area Plan

Developed by the

Middle Willamette Local Advisory Committee

with assistance from

The Benton and Polk Soil and Water Conservation Districts

and

The Oregon Department of Agriculture

2010 Review and Update

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Acronyms and Terms Used in This Document

Area Plan – Middle Willamette Agricultural Water Quality Management Area Plan

Area Rules – Middle Willamette Agricultural Water Quality Management Area Rules

Beneficial Use - Existing or desired use that requires a certain level of water quality. For example, water contact recreation, aquatic life, or livestock watering.

CAFO – Confined Animal Feeding Operation

CWA – Clean Water Act

DEQ - Oregon Department of Environmental Quality

EPA – Environmental Protection Agency

FSA - Farm Services Agency

GWMA – Ground Water Management Area

LAC - Local Advisory Committee

LMA - Local Management Agency

Management Area – Middle Willamette Agricultural Water Quality Management Area

NRCS - Natural Resources Conservation Service

OAR - Oregon Administrative Rule

ODA - Oregon Department of Agriculture

ORS - Oregon Revised Statute

OSU – Oregon State University

OSUES - Oregon State University Extension Service

OWEB - Oregon Watershed Enhancement Board

RUSLE – Revised Universal Soil Loss Equation

SWCD - Soil and Water Conservation District

303(d) List - The Clean Water Act, in Section 303(d), requires states to list waters that are "water quality limited."

TMDL – Total Maximum Daily Load

USDA - United States Department of Agriculture

WSC – Watershed Council

Foreword

This Agricultural Water Quality Management Area Plan provides guidance for addressing agricultural water quality issues in the Middle Willamette Agricultural Water Quality Management Area. The purpose of the Area Plan is to identify strategies to reduce water pollution from agricultural lands through a combination of outreach programs, suggested land treatments, management activities, and monitoring.

The provisions of the Area Plan do not establish legal requirements or prohibitions.

The Oregon Department of Agriculture (ODA) will exercise its enforcement authority for the prevention and control of water pollution from agricultural activities under Oregon Administrative Rules (OARs) for the Middle Willamette Agricultural Water Quality Management Area (OARs 603-095-2300 through 603-095-2360 and 603-090-0060 through 603-090-0120).

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1. Introduction

This Agricultural Water Quality Management Area Plan (Area Plan) was developed in response to the Agricultural Water Quality Management Act, passed in 1993 by the Oregon Legislature and codified at ORS 568.900—568.933. The Act authorizes the Oregon Department of Agriculture (ODA) to develop and carry out a plan to prevent and control water pollution from agriculture and soil erosion. The intent of the Act and the ODA Water Quality Program are to:

- Satisfy multiple federal and state water quality mandates;
- Encourage voluntary conservation;
- Promote water quality improvement through outreach and education;
- Allow flexibility in meeting local water quality standards;
- Provide enforcement provisions for landowners who refuse to work towards meeting water quality standards; and
- Involve local citizens and organizations in the development of water quality standards.

This Area Plan applies specifically to agricultural activities on all agricultural, rural, and forestlands within the Middle Willamette Agricultural Water Quality Management Area (Management Area) that are not owned by the federal government, are not part of an Indian Reservation, or are not Tribal Trust Lands. This Management Area consists of: (1) all lands within the Ash, Dixon, Frazier, Glenn, Luckiamute, Marys, Rickreall and Spring Valley watersheds and (2) all lands drained by other streams flowing directly into the Willamette River within the boundaries of the Management Area. It applies to all lands, regardless of size, in current agricultural use and those lying idle or on which management has been deferred. It also applies to agricultural operations within incorporated city boundaries. Activities subject to the Oregon Forest Practices Act are not included in this Plan. Activities regulated by Oregon Fill-Removal Laws are also not included in this Plan.

The Area Plan provides background information on the Management Area, discusses local water quality concerns, and describes goals, objectives, strategies, and targets to improve water quality. The Area Plan also references Area Rules, that describe conditions land users must meet on all agricultural lands they own, occupy, or manage, and describes procedures for handling complaints and enforcement actions. Finally, the Area Plan describes a process for evaluating Area Plan effectiveness and updating the Area Plan on a regular basis.

The Area Plan does not hold agriculture responsible for cleaning up water quality problems from other sources; its focus is on encouraging landowners to keep water as clean when it leaves their property as when it enters. The Area Plan is also not intended to tell anyone how to farm, ranch, or otherwise manage his or her natural resources. However, the Benton and Polk Soil and Water Conservation Districts (SWCDs), U.S. Department of Agriculture - Natural Resources Conservation Service (USDA-NRCS), the Oregon Department of Agriculture, Oregon State University Extension Service (OSUES) and other partners are available to provide technical, financial, and educational assistance to landowners in the Management Area to meet their conservation goals and local water quality standards.

A Local Advisory Committee (LAC) developed this Area Plan with assistance from the Benton and Polk Soil and Water Conservation Districts and the Oregon Department of Agriculture, and with input from members of the community. LAC members and alternates are:

LAC Member	**Area**	**Type of Operation**
Ralph Blanchard, Chair	Dallas	Timber, hay
Frank Bricker	Albany	Ryegrass, wheat
Michael Calef	Independence	Grass seed, vegetables, blueberries
Peter Cheeke	Corvallis	Beef cattle, hay
Mike Gamroth	Corvallis	Oregon State University
Madeline Hall	Monmouth	Sheep, eggs
Eric Horning, Vice Chair	Monroe	Row crops, grass seed, cattle
Paul Kovash	Monmouth	Hay, pasture, oats, beef cattle, timber
Jeff Mitchell	Philomath	Timber
Gylan Mulkey	Monmouth	Grass seed, mint
Frank Nusbaum	Monroe	Grass seed, Christmas trees, beef cattle, small woodland
Ron Quiring	Rickreall	Grass seed, legume seed, wheat
Don Schellenberg	Dallas	Prunes, grass seed, beef
Chris Vandenberg	Monmouth	Sheep, cattle, hay
Larry Venell	Corvallis	Grass seed, row crops

2. Background

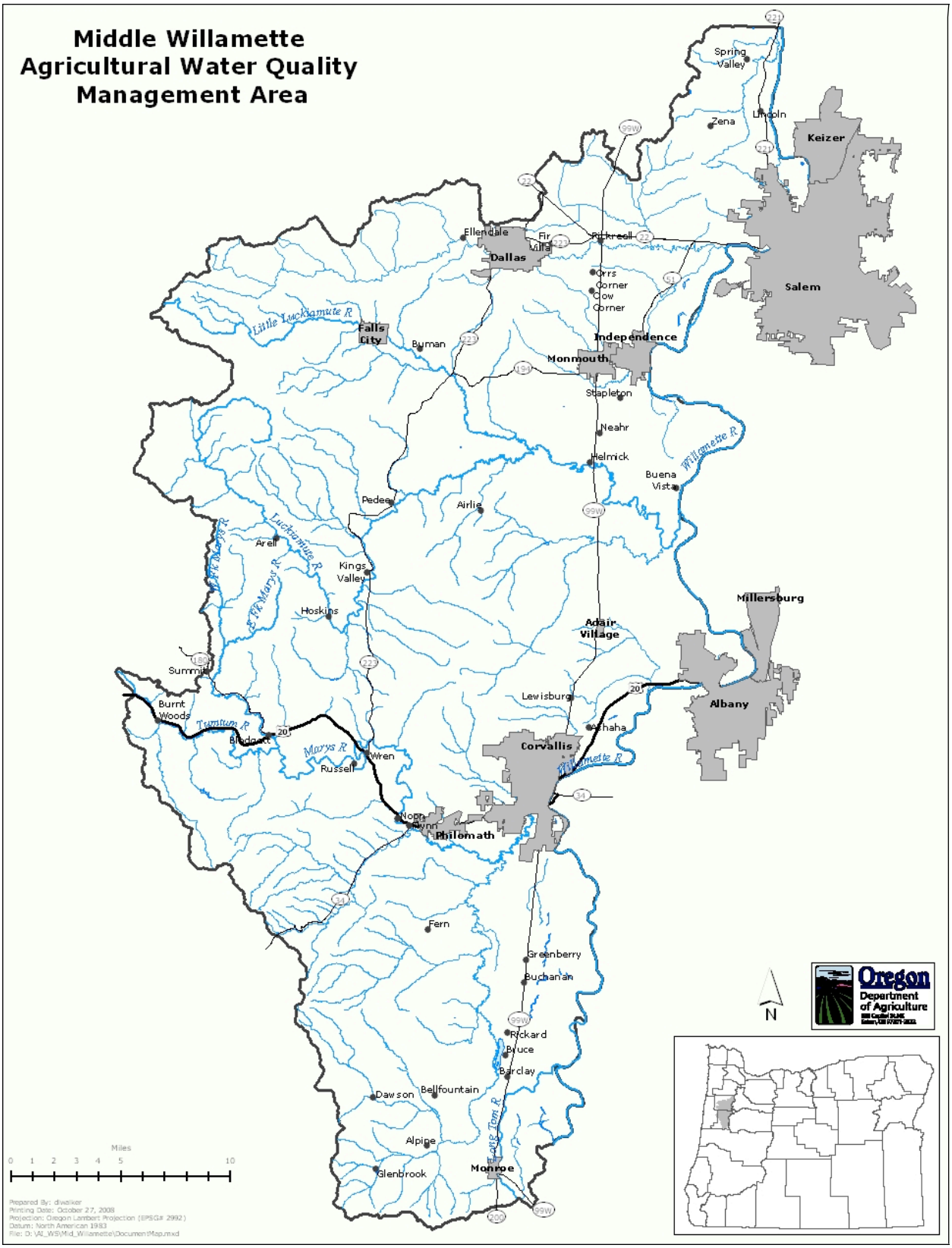
2.1. Geographical and Physical Setting

2.1.1 General Description

The Middle Willamette Agricultural Water Quality Management Area (Management Area) includes the Ash, Dixon, Frazier, Glenn, Luckiamute, Marys, Rickreall, and Spring Valley watersheds, as well as several small streams that drain directly into the Willamette River. A small part of the northern Long Tom watershed is also within the Management Area. The area includes much of Benton and Polk counties and a small portion of east Lincoln County. Included in the Management Area are the communities of Adair Village, Airlie, Blodgett, Corvallis, Dallas, Eola, Independence, Kings Valley, Monmouth, Monroe, north Albany, Philomath, Rickreall, and west Salem.

Boundaries of the Management Area are the crest of the Coast Range to the west, the Willamette River to the east, the Yamhill River watershed boundary to the north, and the Lane-Benton county line (approximately) to the south. Figure 1 shows the area in more detail.

Figure 1. Middle Willamette Agricultural Water Quality Management Area.



2.1.2. Physical Features

The Luckiamute River, Marys River, and Rickreall Creek are the largest drainages in the Management Area. Each stream's headwaters are in the Coast Range and are relatively fast flowing. These streams flow down steep gradients until they reach the Willamette Valley floor. The streams then meander slowly through agricultural, rural, and urban lands, eventually emptying into the Willamette River.

Marys River

The Marys River mainstem flows nearly twenty miles through the Coast Range and foothills before reaching the Willamette Valley floor near Philomath. It then passes through developed lands, including parks, industrial areas, agricultural areas, and downtown Corvallis, where it reaches its confluence with the Willamette River.

A major tributary, Muddy Creek, also originates in the Coast Range. Headwater streams flow for a few miles through mountain forestlands, then through rural residential areas, pasture lands, Christmas tree farms, and mixed coniferous and deciduous woodlands in the foothills. On the valley floor, Muddy Creek flows primarily through agricultural areas and Finley National Wildlife Refuge.

Luckiamute River

The Luckiamute River flows southeast through the Coast Range for approximately fifteen miles. Most of its headwater streams are deeply incised with narrow ridge-tops and floodplains (USDA, 1962). The river then flows northeast through Kings Valley, where its gradient flattens significantly, and passes through pastures, cropland and small woodlands. The river flows southeast after its intersection with Highway 99W, and after passing through more agricultural lands and wetlands, empties into the Willamette River north of Albany.

Major tributaries include the Little Luckiamute River and Soap Creek. The Little Luckiamute River flows down a steep gradient through the Coast Range. It then reaches Falls City and its gradient flattens as it flows through the Coast Range foothills. Its confluence with the Luckiamute River is southwest of Monmouth. Soap Creek drains much of McDonald and Dunn Forests, as well as Soap Creek Ranch, then flows through more agricultural lands and reaches the Luckiamute near its confluence with the Willamette River.

Long Tom River

Part of the lower Long Tom River watershed, approximately the area north of the Lane-Benton County line, is within the Management Area. This portion of the river has a very flat gradient and meanders across a broad floodplain. Two small tributaries, Miller Creek and Shafer Creek, join the mainstem in this area. This part of the watershed is mostly agricultural land.

Rickreall Creek

Rickreall Creek's headwaters are on Laurel Mountain in the Coast Range, 3600 feet above sea level. The Creek flows northeast, flattening just west of Dallas and meandering toward its confluence with the Willamette River. Most of the watershed west of Dallas is commercial timber, and much of the land east of Dallas is in agriculture. Baskett Slough Creek is a major tributary that flows through agricultural lands and a large wildlife refuge before reaching Rickreall Creek near its confluence with the Willamette River.

Small Willamette River Tributary Streams

Several smaller streams within the Management Area flow directly into the Willamette River, including Ash Creek, Glenn Creek, Frazier Creek, Dixon Creek, and Spring Valley Creek. Most of these streams drain agricultural, rural residential, and urban lands. The north, middle and south forks of Ash Creek flow just north and south of Monmouth. The mainstem flows through Independence and into the Willamette River. Glenn Creek and its tributary Gibson Creek drain West Salem and adjacent agricultural and rural residential areas. Frazier Creek drains part of the McDonald research forest, rural residential areas north of Corvallis, and agricultural bottomlands along the Willamette River. Dixon Creek is almost entirely an urban stream that drains most of north Corvallis.

Southern Willamette Valley Groundwater Management Area (GWMA)

A small portion of the GWMA is within the Management Area. Starting in the south, the GWMA includes land bounded on the west by Territorial Highway from Highway 36 north to Monroe, Highway 99W from Monroe to Corvallis, and Highway 20 from Corvallis to Albany. On the east the GWMA is bounded by I-5 from just south of Coburg north to the intersection of I-5 with Muddy Creek, and then follows Muddy Creek until it's confluence with the Willamette River near Corvallis. From the north the eastern boundary is the Willamette River until its intersection with Highway 20. The southern boundary of the GWMA also includes several surface roads south of Junction City. See Figure 2, page 20 for a map of the GWMA.

Tables 1 and 2 describe other characteristics and major tributaries of the watersheds in the Management Area.

Table 1. Acreages and major tributaries of watersheds in the Management Area (Benton and Polk County Geographic Information Systems Departments, 2001).

Watershed	Length (mi)	Area (acres)	Intermittent/ Perennial	Major tributaries
Marys River	40	191,360	Perennial	Newton Creek, Blakesley Creek, Oak/Squaw Creek, Tumtum River, Horton Creek, Wren Creek, Shotpouch Creek, Bark Creek, Laskey Creek, Mulkey Creek, LaBare Creek, Oleman Creek, Norton Creek, Greasy Creek, Woods Creek, and Muddy Creek (includes North Fork, Middle Fork, South Fork, Evergreen Creek, Bull Run Creek, Beaver Creek, Reese/Oliver Creek, Gray Creek, and Hammer Creek)
Luckiamute River	58	198,400	Perennial	Little Luckiamute River (includes Cooper Creek, Fern Creek and Teal Creek), Jont Creek, Dry Creek, McTimmonds Creek, Pedee Creek, Ritner Creek, Bump Creek, Berry Creek, Maxfield Creek, Price Creek, Plunkett Creek, Vincent Creek, Soap Creek
Rickreall Creek	32	64,230	Perennial	Baskett Slough Creek (includes Goodwin Branch, McNary Branch, Mud Slough), Hayden Slough (Includes Oak Point Creek)
Long Tom River	9	5,300	Perennial	Shafer Creek, Miller Creek
Ash Creek	8	34,110	Perennial	North Fork, Middle Fork, South Fork
Glenn Creek	7	7,620	Perennial	Gibson Creek
Spring Valley Creek	9	16,194	Perennial	Walker Creek, King Creek
Frazier Creek	7	24,140	Perennial	Bowers Slough, Jackson Creek
Dixon Creek	4	2,632	Perennial	
"North Albany" Streams	N/A	5,055	Intermittent	N/A

Table 2. Average Gradients of the Marys, Luckiamute, and Rickreall mainstems in the Coast Range, foothills, and Willamette Valley (Oregon Water Resources Board, 1963).

Water Body	Gradient Coast Range ft/mile	Gradient Foothills ft/mile	Gradient Willamette Valley ft/mile
Luckiamute River	340	56	5
Marys River	N/A	14	6
Rickreall Creek	490	55	11

2.1.3. Geology and Soils

Coast Range

The Coast Range was created by compression and uplift as the Juan de Fuca, Kula, and Farallon Plates subducted under the North American plate along the Pacific coast. The mountains are composed primarily of sedimentary rocks such as shale, sandstone, and siltstone, as well as some volcanic material.

Soils in the Coast Range Mountains formed primarily from sedimentary material as well as some volcanic material. They are relatively unstable and subject to puddling and active erosion. Soils in the Coast Range foothills formed from alluvial and colluvial deposits, which have been weathered extensively. They are less subject to slumping than soils in steeper areas.

Willamette Valley

Willamette Valley lowlands are composed of alluvial material deposited during the Missoula floods and by the rivers and their tributaries. The alluvial material is underlain by sedimentary and volcanic formations, deposited through erosion as uplift processes created the Coast Range. Depending on the composition of the deposited material, soils in bottomlands and terraces range from excessively drained loams and well-drained gravelly loams to poorly drained silty clay loams and silt loams (Knezevich 1975; Knezevich 1982).

2.1.4. Climate

Like most of Western Oregon, the climate of the Management Area is relatively mild throughout the year. Temperatures rarely fall below zero during the winter, and exceed 90° F for only a few days during the summer each year (Taylor and Hannan, 1999). Average summer temperatures range from the low 50s to low 80s, and average temperatures in the winter are generally between the low 30s to about 40° F. The mean growing season (the 32° F frost-free period) is 150 to 180 days on the Valley floor to 110 to 130 days in the foothills (Taylor and Hannan, 1999).

Precipitation in the Management Area ranges from approximately 40 to 45 inches on the Valley floor to 60 to 120 inches in the foothills and Coast Range. Approximately 70 percent of the precipitation falls during November through March. Less than five percent of the precipitation occurs from June through August (Knezevich 1975; Knezevich 1982). Most of the precipitation is in the form of rain on the Willamette Valley floor. The amount of snowfall increases with elevation.

2.1.5. Land Use/Land Ownership

Agriculture and Forestry

Forestry and agriculture are the predominant land uses in the area. Most of the approximately 277,500 acres of forestlands in the area are located in the Coast Range and foothills (Benton and Polk County Geographic Information Systems Departments, 2001). Major forest landowners

and managers include the Bureau of Land Management, the U.S. Forest Service, Weyerhaeuser, Starker Forests, Georgia Pacific, Forest Capital, and numerous individual private forest landowners.

Forest management on both federal and private lands has changed significantly in the past few decades. In federal forests, management objectives have diversified in recent years, and fish and wildlife habitat has increased in priority. While timber harvest still occurs, there is less emphasis on timber production. Private landowners, from industrial timber companies to small woodland owners, are not only regulated by the Forest Practices Act, but have also made voluntary efforts to manage forestlands for multiple objectives including water quality.

Agricultural lands are scattered throughout the foothills and cover much of the Valley floor. They account for approximately 227,000 acres in the Management Area (Benton and Polk County Geographic Information Systems Departments, 2001). A wide variety of commodities can be grown in the area's highly productive agricultural soils.

Major crops in the area include grass seed, small grains, fruit and nut orchards, row crops such as sweet corn, broccoli and snap beans, hay, cattle, sheep, nursery products, wine grapes, Christmas trees, and dairy products. Along the Marys River mainstem, most of the agricultural land is in pasture or hay land. Sheep, cattle, and horses are pastured on ranches and small hobby farms. In the Muddy Creek watershed, row crops, grass seed, Christmas trees, and orchards are some of the main crops. In the Luckiamute watershed, agricultural land in the Coast Range foothills is mostly pasture and hay land. From Kings Valley eastward, grass seed, Christmas trees, nursery crops, vineyards, meadowfoam, row crops, livestock, and hay are predominant. Above Dallas, agricultural land in the Rickreall Creek watershed is mostly pasture and hay land. Below Dallas, major crops include grass seed, row crops, orchards and vineyards, small grains, dairy, and nursery stock.

Industrial

Industrial sites, totaling approximately 1900 acres, are located throughout the Management Area, mostly near urban areas or in rural areas on the Willamette Valley floor (Benton and Polk County Geographic Information Systems Departments, 2001). Major industrial sites include lumber mills, waste disposal sites, food processing businesses, and high-tech equipment production facilities such as Hewlett-Packard. Many of these companies, including Georgia Pacific, Smurfit Newsprint, and Valley Landfills have permits for wastewater discharge in or near waterbodies.

Roads

There is an extensive network of roads throughout the Management Area, including highways, city and county roads, private residential, forest, and farm roads, and roads on federal and state lands. Major highways in the area include 99W, 221, 22, 51, 20, and 34.

Natural Areas

There are several wildlife areas in the Management Area. The Oregon Department of Fish and Wildlife manages E.E. Wilson Wildlife Area near Adair Village. The Wildlife Area provides recreational opportunities such as hunting, fishing, and wildlife viewing, and also provides habitat for migratory waterfowl, songbirds, reptiles, amphibians, and fish. The two U.S. Fish and Wildlife Service refuges in the area, Baskett Slough and William Finley, are located in agricultural areas near Dallas and Monroe, respectively. Besides the seasonal wetlands that host migratory waterfowl, habitats at the refuges include oak savannah, ash swales, and mixed oak and maple woodland.

Primary management objectives of the wildlife areas include the protection of dusky Canada geese and other waterfowl. Canada geese populations in the Willamette Valley are estimated to be five to ten times higher than historical levels (Budeau, 2001). The water quality impacts of these population increases are unknown; however, recent studies indicated that goose droppings contain high concentrations of fecal bacteria. The U.S. Department of Agriculture's Wildlife Research Center initiated a Canada Goose Disease Surveillance Study in 2006 that will evaluate goose droppings from sites throughout the United States, including two sites in Oregon.

Outside of designated wildlife areas, there are many other natural areas in the Management Area on public and private lands. Many private landowners in the area have maintained or restored riparian areas and seasonal wetlands on their property.

Urban

North Albany, Corvallis, and west Salem are the largest urban areas in the Management Area. There are also several smaller cities and rural communities, including Adair Village, Airlie, Alpine, Dallas, Philomath, Maple Grove, Monroe, Falls City, Monmouth, Rickreall, Independence, Kings Valley, Wren, Pedee, and Suver. The population of Polk and Benton counties is 152,805 (Center for Population Studies, 2007). Parts of these counties fall outside of the Management Area, but the bulk of the population from these counties falls within the Management Area.

Wastewater treatment plants exist for most incorporated cities within the area. Treatment plants for the cities of Falls City, Philomath, Monmouth, and Dallas discharge in or near the Little Luckiamute River, Marys River, Ash Creek, and Rickreall Creek, respectively.

Commercial

Most commercial lands within the Management Area are within urban areas. There are a few unincorporated commercial lands in Polk County along Highway 22 near Grand Ronde, Rickreall, and Eola.

Rural Residential

Rural residential lands in the area total approximately 27,930 acres (Benton and Polk County Geographic Information Systems Departments, 2001). Many rural residential lands are in transitional areas between farm and forestlands in the foothills of the Coast Range or in agricultural areas.

2.2. Water Resources

2.2.1. Water Availability

Like most streams with headwaters in the Coast Range, rainfall provides much of the surface water supply in Management Area watersheds. Seasonal fluctuations in stream flow are much more pronounced in the Luckiamute, Marys, and Rickreall Creek watersheds than in streams with headwaters in the Cascade Mountains because snowmelt supplies a relatively small portion of the stream flow. For example, flow in the Luckiamute River during the highest flow month is 54 times the flow during the lowest flow month, much "flashier" than the high-flow, low-flow difference of just five times in the McKenzie River. Table 3 lists minimum, maximum, and average flows for several waterbodies in the area.

Groundwater resources in much of the area are relatively meager because there are few porous, permeable geologic formations to absorb and transmit water, except on the valley floor near the Willamette River. Alluvial material along major streams and rivers is the most abundant source of groundwater; however, (on the east foothills of the coast range) yields are still relatively low because the material is of the same geologic origin as material throughout the Coast Range.

Table 3. Minimum, maximum, and average flow in several waterbodies in the Management Area. Flow is in cubic feet per second (cfs). Figures are derived from U.S. Geological Survey stream gage data, gathered from the year the gage was installed until the present (U.S. Geological Survey, 2001).

Water Body	Average Summer Flow (cfs)	Average Winter Flow (cfs)	Minimum Flow (cfs)	Maximum Flow (cfs)	Average Annual Flow (cfs)
Long Tom River @ Monroe	70	1842	7	19,300	760
Marys River @ Philomath	50	1121	4	13,600	467
Luckiamute River @ Suver	109	2154	.065	32,900	877
Rickreall Creek above Dallas	12	1042	0	5600	146

2.2.2. Water Use

Consumptive uses of water in the Management Area include irrigation, municipal use, and commercial use. Non-consumptive uses include recreation, power generation, and fish and wildlife habitat. Sources of appropriated water are reservoirs, surface water, and groundwater. Table 4 summarizes water allocations in the area. Allocations in cubic feet per second represent the maximum amount of water that may be withdrawn at any given time; allocations in acre-feet represent the total amount of water that may be withdrawn during a water year.

Several cities withdraw drinking water from Management Area streams. The City of Dallas withdraws drinking water from Mercer Reservoir on Rickreall Creek. Philomath receives its drinking water from the Marys River.

Table 4. Water allocations in several waterbodies in the Management Area. Allocations are in cubic feet per second (cfs) or acre-feet (af) (Oregon Water Resources Department, 1990).

Water Body	Irrigation	Fish and Wildlife	Agriculture	Industrial	Municipal
Ash Creek	11 cfs 15 af	2 cfs 15 af	.05 cfs 35 af	.01 cfs 0 af	4 cfs 0 af
Dixon Creek	2 cfs 2 af	0 cfs 0 af	0 cfs 0 af	.55 cfs 0 af	0 cfs 0 af
Glenn Creek	15 cfs 228 af	.2 cfs 3 af	.01 cfs 2 af	0 cfs 0 af	2 cfs 0 af
Frazier Creek	6 cfs 2 af	.03 cfs 17.3 af	0 cfs 0 af	0 cfs 0 af	0 cfs 0 af
Luckiamute River	171 cfs 1318 af	3 cfs 456 af	.45 cfs 165 af	6 cfs 61 af	8.5 cfs 0 af
Marys River	111 cfs 318 af	11 cfs 1008 af	.33 cfs 11 af	11 cfs 449 af	20 cfs 257 af
Rickreall Creek	101 cfs 2147 af	.88 cfs 1345 af	7 cfs 41 af	.45 cfs 74 af	15 cfs 2780 af

2.3. Water Quality

2.3.1. Clean Water Act

The federal Clean Water Act requires states to monitor water quality and identify waterbodies that do not meet water quality standards. In Oregon, these tasks are the responsibility of the Department of Environmental Quality (DEQ). Waterbodies that are identified as "water quality limited" are placed on the state "303(d)" list (named after the section of the Clean Water Act that requires the list be maintained).

DEQ has established state water quality standards for several water quality parameters, such as bacteria, temperature, dissolved oxygen, and nutrients. The standards protect "beneficial uses"

associated with waterbodies. Beneficial uses in Oregon include water contact recreation, drinking water, salmonid spawning, rearing, and migration, aesthetics, fish consumption, and livestock watering. A water body is placed on the 303(d) list for a particular parameter when water quality is no longer adequate to protect the most sensitive beneficial use.

Once 303(d) waterbodies are identified, DEQ is responsible for developing Total Maximum Daily Loads (TMDLs), which specify the amount of pollution a waterbody can receive without exceeding water quality standards. Sources of pollution, such as wastewater treatment plants, industrial plants, urban and rural storm water runoff, agricultural lands, and forestlands, are identified and each assigned loads for the necessary reductions under the TMDLs.

2.3.2. Water Quality and Total Maximum Daily Loads in the Management Area

The DEQ evaluated data from its own monitoring program, the Oregon Department of Fish and Wildlife, and the city of Corvallis to determine the listing status of stream segments in the Management Area. Several stream segments were determined to exceed state standards for temperature, bacteria, and dissolved oxygen. Beneficial uses impacted by these water quality concerns include aquatic life, water contact recreation, and fish consumption.

Water quality concerns occur seasonally throughout the Management Area. Temperature standard violations in Rickreall Creek, Marys River, and Long Tom River occur during the summer months. In addition, there are temperature violations year round on the following creeks; Little Luckiamute, Little Muddy Creek, Luckiamute River, Maxfield Creek, McTimmonds Creek, Oak Creek, Pedee Creek, Ritner Creek, and Soap Creek. Bacteria problems have been identified during the fall, winter, and spring, when storm-related runoff and discharges are most likely to occur from a variety of sources in Oak Creek and the Luckiamute, Marys, and Long Tom Rivers. Dissolved oxygen concerns occur in Glenn, Gibson, and Soap Creeks and in the Marys River. Mercury concern is a Willamette Basin-wide parameter because of potential bioaccumulation and human consumption of fish. Some seasonal variation in water quality likely occurred before European settlement of the area because of seasonal fluctuations in stream flow and other factors.

Based on the 303(d) listing for dissolved oxygen, a TMDL was established for dissolved oxygen in 1994 for Rickreall Creek. Dissolved oxygen levels were below state standards in Rickreall Creek, and did not protect beneficial uses for resident aquatic life or steelhead. In the TMDL, the city of Dallas Sewage Treatment Plant received a waste load allocation that, if met, would likely eliminate dissolved oxygen standard violations in Rickreall Creek. Other sources of pollution, such as agriculture and forestry, were also assigned a load allocation.

DEQ completed the Willamette Basin TMDLs for temperature, bacteria, and mercury, and the US Environmental Protection Agency (EPA) approved the TMDLs in September of 2006. These TMDLs include temperature, bacteria and mercury loads for the Willamette Basin.

Temperature
DEQ endeavored to set the TMDL for temperature to protect salmon spawning, rearing, and migration as the most sensitive beneficial uses in the Willamette Basin. DEQ has identified the existing nonpoint source pollution sources as solar heating of the Area's waterways due to a lack of riparian vegetation from forestry, agriculture, rural residential, and urban activities.

Bacteria
DEQ has set the bacteria TMDL to protect human water contact recreation, the most sensitive beneficial use. Urban stormwater discharge and agricultural run-off are two potential sources of bacteria.

Mercury
Human fish consumption is the most sensitive beneficial use for which DEQ has set the Mercury TMDL. Primary sources of mercury include air deposition from national and international sources, discharge from specific legacy mining sites, and erosion of soils containing mercury.

2.3.3. Southern Willamette Ground Water Management Area

In 2004, DEQ declared a Groundwater Management Area (GWMA) for the Southern Willamette Valley because monitoring data showed elevated nitrate levels in groundwater (Figure 2).

In December 2006, after significant debate and research, the GWMA stakeholder committee action plan for the GWMA was finalized and accepted. This action plan is not a regulatory document, but includes many recommendations and voluntary strategies to address the issue of excess nitrate in regional groundwater. Currently, 93 percent of the land area within the GWMA is in agricultural use. Although agricultural use makes up the vast portion of land area, there are also many non-agricultural potential sources of nitrate. To address this, the action plan provides recommendations and strategies to reduce nitrate inputs as related to four focus sectors: (1) agricultural, (2) residential, (3) commercial / industrial / municipal and (4) public water supplies. Some of the agricultural recommendations and strategies are already accomplished by or included in the Area Plan, and some will likely be incorporated and developed over time.

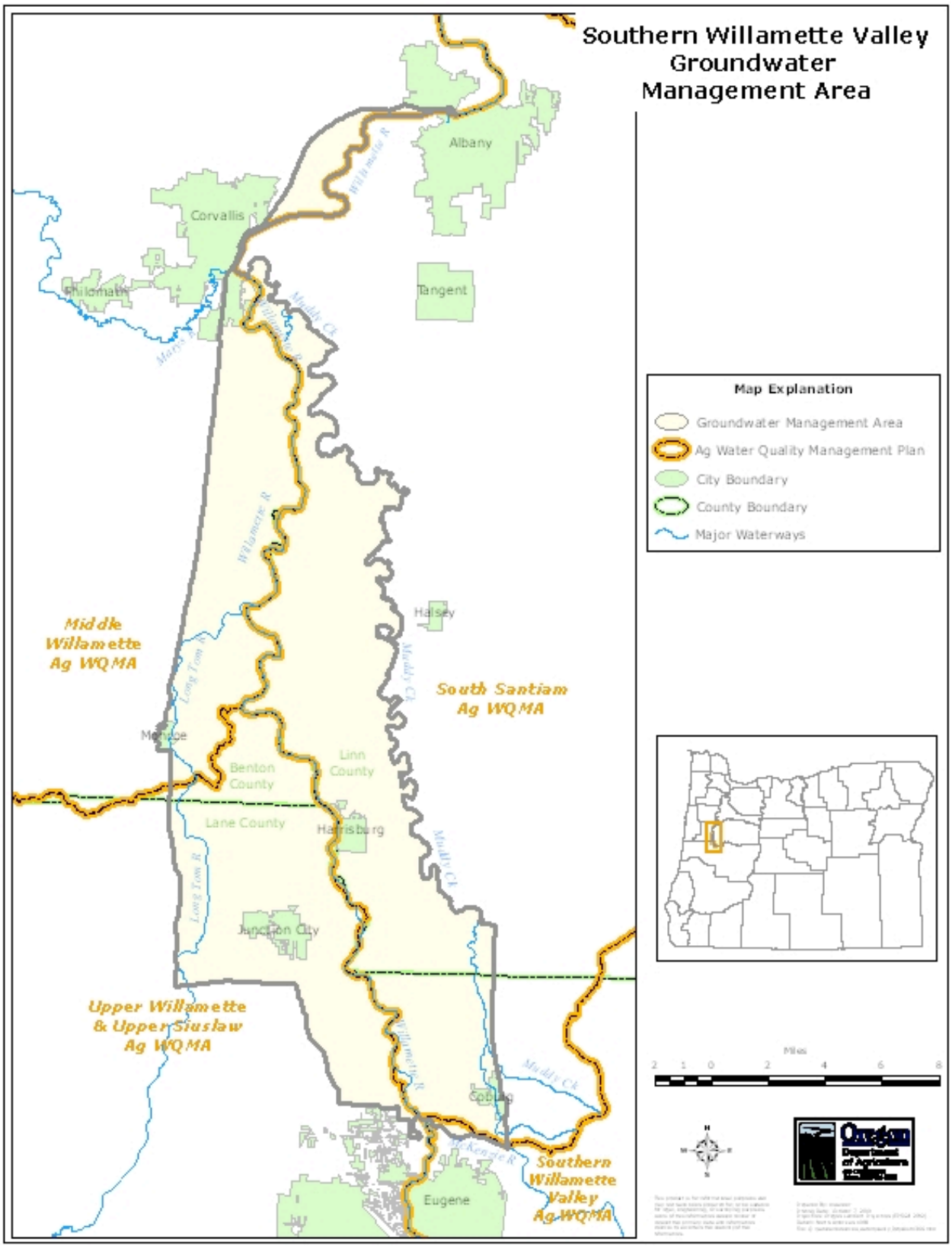
DEQ is currently conducting quarterly sampling of 38 groundwater-monitoring locations in the GWMA for nitrate. This program includes monitoring 24 shallow monitoring wells and 14 domestic wells. The domestic wells are generally installed deeper than the monitoring wells. As of October 2009, there appears to be some downward contamination trends, although there are some areas where nitrate levels are still increasing. In the spring of 2009, DEQ completed a Synoptic Sampling Event, where approximately 100 domestic wells in the GWMA were tested at the same time as the long-term monitoring wells. The mean nitrate concentration for the event was 5.5 mg/L, while the highest level of nitrate was close to 35 mg/L.

2.3.4. Factors Affecting Water Quality

There are many factors that may affect water quality in the Management Area. Sources impacting temperature include wastewater treatment plants, industrial operations, removal of riparian vegetation, seasonal reductions in stream flow, and stream channel and floodplain

alteration. Contributors to bacteria and nutrient concerns include wastewater treatment plant overflows during heavy rains or generalized leaching to groundwater, legal and illegal waste dumping sites, leaching septic systems, leaching of fertilizers to groundwater, runoff from urban and rural areas and roads, runoff from agricultural lands, and natural sources such as geese and other wildlife. Elevated stream temperatures, as well as nutrient levels, can contribute to low dissolved oxygen levels. Mercury can enter waterbodies from industrial and municipal wastewater discharges, erosion of soils that naturally contain mercury, runoff of atmospherically deposited mercury, and runoff from abandoned mines.

Figure 2: Southern Willamette Valley Groundwater Management Area



3. Goal, Objectives, Strategies, and Targets

3.1. Goal

The goal of the Area Plan is to ensure that water quality goals are met while promoting the flexibility and economic viability of agriculture.

Objective 1: Education

Create awareness among the agricultural community, rural landowners, and the public of conditions that cause water quality concerns or problems.

The LAC recommends that the Benton and Polk SWCDs coordinate the education efforts and work with partners such as ODA, NRCS, OSUES, watershed councils, agribusiness partners, and other interested parties to carry out these education strategies. The LAC recommends the following strategies be used to achieve this objective:

1. Encourage education programs to promote public awareness of water quality issues.

- Co-sponsor workshops and tours between the SWCDs, OSUES, other agencies, and agribusinesses (businesses directly related to the agriculture industry, such as fertilizer dealers or farm stores), or participate in events sponsored by agribusiness and other organizations to promote water quality issues.
- Develop demonstration projects showcasing successful management practices and systems.
- Organize demonstration project tours for agricultural managers and producers.
- Produce and distribute brochures about water quality issues.
- Include updates on the status of the Area Plan and water quality data in SWCD newsletters.
- Develop media articles, public service announcements, videos and other tools about successful resource management practices and make them available in local libraries and SWCD, NRCS and OSU Extension offices.
- Hold small acreage resource management workshops and give presentations on water quality issues to resource, recreation, and education groups.

2. Involve the agricultural community in conservation education.

- Create and maintain a list of experienced agricultural operators willing to share their conservation practices with other interested people through making presentations or providing site tours.
- Plan in-service days for teachers and the public.

3. Build partnerships with agribusiness and agencies to promote water quality.

- Share education materials with agribusiness field representatives and OSUES agents.
- Develop educational materials in conjunction with agribusinesses and commodity and volunteer organizations.
- Speak at industry and producer meetings.
- Coordinate with the Southern Willamette Valley GWMA committee and staff to ensure agricultural activities are being completed and the committee is updated regularly regarding the status of activities.

Objective 2: Resource Management

Promote awareness of conditions that result in improvement of water quality.

The LAC recommends the following strategies be used to achieve this objective:

1. Encourage agricultural producers to improve water quality.

- Promote the benefits of resource management practices.
- Showcase positive and effective practices through workshops and tours of demonstration projects.
- Promote Integrated Pest Management (see definition on page 51).
- Promote proper nutrient management and irrigation efficiencies to reduce nitrogen loss to groundwater.

2. Provide information so producers can initiate improvements.

- Provide technical assistance from the SWCDs, NRCS, and partner organizations.
- Develop and distribute a list of alternative management practices.
- Compile and make available ongoing research on effective practices, effective adaptive resource management, and practical knowledge from agricultural producers.

Resource Management Planning

Landowners and occupiers have flexibility in choosing management approaches and practices to address water quality issues on their lands. They may implement resource management systems on their own with or without an approved plan.

Alternative Management Practices

Alternative management practices are specific to individual farms and are selected by the landowner depending on the cropping system, livestock operation, topography, environmental, and economic conditions existing at a given site. As markets, technology, and cropping systems change, the alternative management practices which are most appropriate for a particular site may change as well. Producers should, therefore, view current practices as methods that are

likely to change over time to reflect new technologies and management strategies. For a list of some alternative management practices, please consult Appendix E.

The Benton and Polk SWCDs will offer technical assistance for resource management planning and will provide guidance to producers who wish to develop their own plans. In addition to the sound business practice of reviewing practices, resource management plans also qualify producers for a variety of funding programs. The United States Department of Agriculture's, Natural Resource Conservation Service and Farm Service Agency (USDA), and other organizations offer financial assistance for implementing alternative management practices included in resource management plans (Appendix D).

Objective 3: Funding

Secure adequate funding for administration and implementation of the program to achieve this plan's goal, objectives, and strategies.

The LAC recommends that the Benton and Polk SWCDs, ODA, and other partners use the following strategies to achieve this objective:

1. Obtain financial assistance for implementation of resource management practices, and funding for technical and/or resource management planning assistance, education, and water quality monitoring.

- Submit grants to the ODA, Oregon Watershed Enhancement Board (OWEB), the OWEB small grant program, USDA, U.S. Environmental Protection Agency, Oregon Department of Environmental Quality, and other agencies and private organizations.
- Seek funding for demonstration projects.
- Submit ongoing reports of successes to granting agencies.
- Form partnerships with the agribusiness sector for additional funding.
- Promote USDA incentive based cost share programs to assist producers who are interested in conservation plan implementation.
- Assist landowners in using the Pollution Abatement Tax Credit program.
- Encourage funding programs that provide sufficient incentives for widespread participation.
- Explore incentive programs designed to promote riparian enhancement on agricultural lands.
- Encourage long-term stability of incentive programs for riparian restoration and enhancement on agricultural lands.
- Provide education to landowners on current incentive programs for riparian enhancement and other activities that enhance water quality.
- Encourage streamlining of the signup process for the Conservation Reserve Enhancement Program and other incentive programs.
- Coordinate this plan with existing programs to minimize costs and conflicts.

2. Ensure adequate administration of the Middle Willamette Agricultural Water Quality Management Area Plan.

- Include implementation of the Middle Willamette Agricultural Water Quality Management Area Plan in the Benton and Polk SWCDs' annual and long range work plans.

The LAC recommends that Benton and Polk SWCDs seek funding to implement the Middle Willamette Agricultural Water Quality Management Area Plan. Funding is necessary in three main areas:

1. Education – to fund education programs such as workshops, tours, and development of educational materials.

2. Technical assistance – maintain adequate staffing to provide technical assistance to producers to implement resource management for water quality improvement.

3. Financial assistance – to assist landowners in obtaining cost-share dollars to address water quality goals or needs.

For sources of financial assistance, see Appendix D, Conservation Funding Programs.

Objective 4: Evaluation

Monitor and evaluate the effectiveness of the Plan and Rules.

The LAC recommends the following strategies be used by ODA, watershed councils, the Benton and Polk SWCDs, and other partners to achieve this objective:

- Work with watershed councils, DEQ, Southern Willamette Valley GWMA Committee, and other organizations to conduct and coordinate water quality monitoring programs, evaluate completeness of existing programs, and identify additional monitoring that needs to be conducted.
    - Use consistent protocols to gather baseline water quality data and potential sources of pollution in the Middle Willamette Agricultural Water Quality Management Area.

- Establish a plan for monitoring streams and surface water areas that will accurately reflect baseline water quality conditions and water quality trends.
    - Make monitoring results available to landowners and the public.

- Document successful practices implemented in the Management Area.

- Track increases in awareness of water quality issues.
    - Document participation in workshops and tours.

- Survey landowners affected by the Plan and Rules to determine awareness and concern for water quality issues, impact of the Area Rules on their operation, and ease of accessing resources to address water quality issues.
- Document the number of agribusiness partnerships produced.

- Monitor violations of prevention and control measures in the Middle Willamette Agricultural Water Quality Management Area.
  - Document the amount, subject, outcome and validity of complaints regarding potential violations of the prevention and control measures.
  - Review the Department's compliance assessment, which will be done prior to the Plan and Rules review and update.

- Monitor the availability of cost-share funds to implement resource management practices.

- Review and update the Area Plan if necessary.
  - Use a technical advisory committee to assist in evaluating plan success.
  - Prepare information for biennial reviews of the Mid Willamette Area Plan.
  - Prepare an Area Plan status report and if necessary provide Area Plan and Rule revisions for approval by the Board of Agriculture.

3.2. Targets

The following targets were developed based on the 2010-2011 and 2011-2012 scopes of work with the Benton and Polk SWCDs. The scopes of work are developed as an agreement between ODA and the SWCD with tasks related to implementation of the Area Plan. The targets are for the time period from July 2010 to July 2012 and are only for the SWCDs. Watershed councils and other groups make additional efforts that may fit within the goal and objectives of the Area Plan. The SWCDs are not obligated to these targets; they only serve as direction from the LAC as activities that they would like to see accomplished.

1) Education

- Co-sponsor two workshops or tours promoting water quality issues.
- Develop demonstration projects and give annual tours at the projects.
- Develop a Rural Living Handbook or other brochure that discusses water quality issues.
- Develop and publish eight newsletter or newspaper articles on water quality issues.
- Include an update of the Area Plan in the Benton and Polk SWCD newsletters.
- Host a minimum of four small acreage workshops highlighting topics such as mud and manure management or small acreage land stewardship.

2) Resource Management

- Provide information about the Area Plan to a minimum of 100 landowners.
- Provide technical assistance to a minimum of 40 landowners regarding BMPs for prevention of nutrients, sediment, and bacteria from entering waters of the state.
- Assist six landowners to plan and implement practices that improve the function of riparian vegetation.
- Showcase effective management practices at two workshops or tours.

- Work with three landowners within the Southern Willamette Valley GWMA to implement practices that reduce nitrogen loss to groundwater.

3) Funding

- Submit at least four grants for implementation of management practices, providing technical assistance, or for education and outreach.
- Assist at least six producers to enroll into the Conservation Reserve Enhancement Program.
- Provide information to at least 50 landowners regarding federal and local cost-share programs.
- Include implementation of the Area Plan into the Benton and Polk SWCD annual and long-range work plans.

4) Evaluation

- Work with partners to develop a monitoring plan for several agricultural streams in the Management Area.
- Provide documentation of workshops, tours, demonstration projects, presentations, and technical assistance during the biennial review of the Area Plan to the LAC.
- Provide a summary of violations of prevention and control measures to the LAC at the biennial review of the Area Plan.

4. Prevention and Control Measures

The focus of the Agricultural Water Quality Management Program is voluntary and cooperative efforts by landowners, SWCDs, ODA, and others to protect water quality. However, the Agricultural Water Quality Management Act also provides for a regulatory backstop to ensure prevention and control of water pollution from agricultural sources in cases where landowners or operators refuse to correct problem conditions. Agricultural Water Quality Management Area Rules (Area Rules) serve as this backstop while allowing landowners flexibility in how they protect water quality. Area Rules are goal-oriented and describe characteristics that should be achieved on agricultural lands, rather than practices that must be implemented.

In this section, there are five Prevention and Control Measures that describe water quality issues, relevant definitions, and water quality concerns affected. Area Rules are referenced in each Prevention and Control Measure. Each Area Rule has a border around it and appears in italics.

The Prevention and Control Measures and Area Rules relate directly to water quality concerns identified on the 303(d) list in the Management Area, for the dissolved oxygen TMDL for Rickreall Creek in 1994, and for the bacteria, mercury and temperature TMDLs that were established in September 2006 for the Willamette Basin. In addition, nitrate is discussed because of potential impacts to groundwater. Area Rules are not listed specific to mercury, dissolved oxygen, or nitrate, but prevention and control measures for erosion target these. Specific management practices are listed in Appendix E.

4.1. Prevention and Control Measure: Bacteria

Issue:

Animal and human wastes are a potential source for about 150 diseases (Terrell and Perfetti, 1989). The most commonly used indicator of animal or human waste pollution in a waterbody is the organism *Escherichia coli* (*E. coli*). It is a type of fecal coliform bacteria. These bacteria reside in the intestines of warm-blooded animals, including humans, livestock, and wild birds and mammals. The presence of *E. coli* alone does not confirm the contamination of waters by pathogens. It does, however, indicate contamination by sewage or animal manure and the potential for health risks.

Numerous factors influence the nature and amount of bacteria that reach waterways. Some of these factors are climate, topography, soil types, infiltration rates, animal species, and animal health. Typically, bacteria levels in streams are elevated after the first major storm event of the rainy season.

Bacteria also settle into sediments in a streambed and can live there for an extended period of time. If sediments are disturbed by increased stream turbulence following a runoff event, human or animal traffic, or other means, sediment-bound bacteria may be re-suspended into the water column (Sherer et al 1992). Sediment disturbance may account for erratic bacteria levels typically measured in water quality monitoring programs.

Oregon's water quality standard for bacteria was established to protect the most sensitive beneficial use affected by bacteria levels, water contact recreation. Appendix B includes detailed information about the bacteria standard. Within the Management Area, the Luckiamute River from mouth to Pedee Creek and the Marys River from mouth to Greasy Creek exceed water quality standards for bacteria during the fall, winter, and spring.

Livestock manure is a potential source of bacteria, nutrients, and oxygen-consuming material. If stored and applied at agronomic rates, manure can be a beneficial source of nitrogen and phosphorus, as well as organic matter (Mikkelsen and Gilliam, 1995). Nothing in this prevention and control measure is intended to discourage the use of manure or other amendments; rather, it seeks to ensure that they are applied correctly.

This prevention and control measure references Oregon Revised Statutes (ORS) 468B.025 and 468B.050. ORS 468B.025 is an existing statute developed to address water pollution from all sources. A Department of Justice Opinion dated September 12, 2000, clarifies that ORS 468B.025 applies to point and non-point source pollution as that term is commonly applied.

Senate Bill 502 was passed in 1995, authorizing ODA as the state agency responsible for direct regulation of farming activities for the purpose of protecting water quality. A Department of Justice opinion dated July 10, 1996, states '...ODA has the statutory responsibility for developing and implementing water quality programs and rules that directly regulate farming practices on Exclusive Farm Use and agricultural lands'. In addition this opinion states 'The program or rule must be designed to achieve and maintain Environmental Quality Commission's water quality standards.'

To implement Senate Bill 502, ODA incorporated ORS 468B.025 and 468B.050 into all of the Basin Agricultural Water Quality Management Administrative Rules in the state.

Area Rule

OAR 603-095-2340
(1)(a) Effective upon rule adoption, no person subject to these rules shall violate any provision of ORS 468B.025 or ORS 468B.050.

ORS 468B.025(1) states:
...no person shall:
(a) Cause pollution of any waters of the state or place or cause to be placed any wastes in a location where such wastes are likely to escape or be carried into the waters of the state by any means.
(b) Discharge any wastes into the waters of the state if the discharge reduces the quality of such waters below the water quality standards established by rule for such waters by the Environmental Quality Commission.

ORS 468B.050 identifies the conditions when a permit is required. In agriculture, under state rules, these are referred to as Confined Animal Feeding Operations (CAFO) and are operations that confine animals for more than 45 days per year or have a wastewater treatment facility.

Definitions

"Pollution" has the meaning given in ORS 468B.005(3) which states: such alteration of the physical, chemical or biological properties of any waters of the state, including change in temperature, taste, color, turbidity, silt or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive or other substance into any waters of the state, which will or tends to, either by itself or in connection with any other substance, create a public nuisance or which will or tends to render such waters harmful, detrimental or injurious to public health, safety or welfare, or to domestic, commercial, industrial, agricultural, recreational or other legitimate beneficial uses or to livestock, wildlife, fish or other aquatic life or the habitat thereof.

"Wastes" has the meaning given in ORS 468B.005(7) which states: sewage, industrial wastes, and all other liquid, gaseous, solid, radioactive or other substances which will or may cause pollution or tend to cause pollution of any waters of the state.

"Water" or "the waters of the state" include lakes, bays, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, estuaries, marshes, inlets, canals, the Pacific Ocean within the territorial limits of the State of Oregon and all other bodies of surface or underground waters, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters which do not combine or effect a junction with natural surface or underground waters), which are wholly or partially within or bordering the state or within its jurisdiction. [Formerly 449.075 and then 468.700; 2003 c.469 §1]

Other substances that will or may cause pollution include eroded sediment, commercial fertilizers, soil amendments, composts, animal wastes, and vegetative materials.

Parameters That May Be Affected by this Prevention and Control Measure:

Dissolved oxygen, bacteria, nutrients, toxics.

4.2. Prevention and Control Measure: Temperature

Issue

The importance and effect of stream temperatures on aquatic life, including salmonids, has been the subject of much debate in recent years. There is general agreement that salmonids and other coldwater aquatic organisms require cool water temperatures to survive. Dissolved oxygen levels, which are necessary to support fish and other aquatic life, have an inverse relationship with stream temperatures; as water temperature falls, dissolved oxygen levels rise. Elevated stream temperatures, in addition to affecting the metabolic processes of aquatic animals, cause further physical stress by lowering the dissolved oxygen available for respiration.

It is very difficult to determine exact temperature requirements of coldwater aquatic life in natural settings, where temperatures may vary several degrees in a stream reach. Oregon's temperature standard, which is described in detail in Appendix B, was set to protect coldwater aquatic life, the most sensitive beneficial use affected by stream temperature.

For many years, researchers have investigated factors that influence stream temperatures. Several authors emphasize the importance of water stored in the landscape and its importance in maintaining stream temperatures (Krueger et al, 1999; Moore and Miner, 1997; Naiman and Decamps, 1997). Clark (1998) explains that watershed conditions strongly influence riparian areas by affecting the infiltration of precipitation and the storage and release of water. Adequate ground cover in upland areas increases the likelihood of precipitation infiltrating the soil profile and decreases the possibility of overland flow, soil loss and resulting sediment delivery to streams. Many studies also highlight the significance of streamside shade in the maintenance of stream temperatures (Brown, 1969; Beschta, 1997). Other influences on stream temperature include stream channel width, stream depth, channel substrate, air temperature, and elevation (Bilby, 1984; Chen et al, 1998; Larson and Larson, 1996; Krueger et al, 1999; Ward, 1995). For a more complete list of factors that affect stream temperature, please consult Appendix H.

Area Rule

OAR 603-095-2340
(1)(b) By January 1, 2003, agricultural activities shall allow the growth and establishment of vegetation along perennial streams consistent with site capability to promote infiltration of overland flow, streambank stability and provide moderation of solar heating. Minimal breaks in shade vegetation for essential management activities are considered appropriate.

Definitions

Site Capability - The vegetation, ecological and functional status that an area is capable of producing/attaining given political, social, or economical constraints, which are often referred to as limiting factors. For more information, please see Appendix G.

Perennial stream – Natural channel in which water flows continuously and which is shown on a United States Geological Survey quadrangle map.

Parameters That May Be Affected by this Measure:

Temperature, dissolved oxygen, sediment, nutrients, turbidity, chlorophyll a.

4.3. Prevention and Control Measure: Mercury

Issue

Mercury is a metal, liquid at room temperature, commonly used in the recent past for thermometers. It continues to have many dental, medical, and industrial uses. In addition, it is found naturally in the soils of the Willamette Valley. It is also found in fossil fuels and is released into the air upon combustion. In the air, mercury can travel over continents and oceans to be deposited on land, added to naturally occurring mercury, and is carried by stormwater and erosion into Oregon's waterways. Fish consumption is the most common way humans are exposed to elevated levels of mercury (Oregon Department of Environmental Quality, 2007).

Mercury is also a severe poison. According to the DEQ (2007), small children and fetuses are most sensitive to mercury's toxic effects.

Mercury from point and non-point sources is bioaccumulating in fish tissue to levels that adversely affect public health. Mercury binds to particles; thus there are both higher levels of total suspended solids as well as higher mercury levels in the wet season. In setting the TMDL for mercury, DEQ has found that erosion of native soil makes up almost 48% of the mercury in the Willamette Basin. Some industrial facilities and domestic wastewater treatment facilities also discharge mercury, but at low levels.

The current DEQ mercury TMDL consists of interim targets and allocations. Sometime in 2011 DEQ plans to finalize these after additional data collection and public outreach (Oregon Department of Environmental Quality, 2007).

Refer to ORS 468B.025 and 468B.050 for the Administrative Rules and Statutes that apply to mercury, dissolved oxygen, and nitrate in this area.

4.4 Dissolved Oxygen

Dissolved oxygen refers to the amount of oxygen that is dissolved in water. Oregon's dissolved oxygen standards protect cool and coldwater aquatic life, which require relatively high levels of dissolved oxygen to breathe.

Dissolved oxygen levels can vary over the course of the day based on algal growth and decay. An increase in available nutrients may result in elevated algal production, eventually depleting dissolved oxygen when algae decay. Temperature and dissolved oxygen exhibit an inverse relationship; as water temperature falls, dissolved oxygen levels rise; as water temperature rises, dissolved oxygen levels fall. Elevated stream temperatures, in addition to affecting the metabolic processes of aquatic animals, cause further physical stress by lowering the dissolved oxygen available for respiration.

4.5 Nitrate

Nitrate is a form of nitrogen that is dissolved in water (mainly an issue in groundwater). Oregon does not have a standard for nitrate, but public drinking water systems must adhere to the EPA standard for nitrate of 10 mg/L, which was established due to health concerns. Individuals with household wells are not required to adhere to drinking water standards.

Nitrate is highly soluble in water, easily mobile in the soil, and can potentially leach through the soil and into the groundwater. Potential sources of nitrate pollution include fertilizer, animal waste, septic systems, and wastewater.

5. Administrative Roles and Responsibilities

5.1. Total Maximum Daily Loads

The Oregon Department of Environmental Quality, in accordance with the Federal Clean Water Act (CWA), is required to list polluted streams (section 303(d) of the CWA) and establish Total Maximum Daily Loads (TMDLs) for waterbodies on the 303(d) list. The 303(d) list consists of streams that violate state water quality standards. TMDLs identify the maximum amount (load) of each pollutant that a listed waterbody can receive and still meet state water quality standards. Once a Total Maximum Daily Load is established for a particular pollutant, each source of pollution in the area will be assigned a portion of that load (see also Section 2.3.1), and each source must develop or modify pollution control plans and programs designed to achieve their load.

DEQ approved the TMDLs for the Willamette in 2006. The Area Plan and Rules seek to satisfy agriculture's load in the TMDLs for these waterbodies. When TMDLs are completed for a management area, ODA and DEQ analyze the TMDLs and Area Plan and Rules to determine if any adjustments need to be made to the Area Plan and Rules to achieve agriculture's load allocations.

5.2. Designated Management Agency/Local Management Agency

The Oregon Department of Agriculture is the "Designated Management Agency" for addressing agricultural water quality issues in the Management Area. In turn, through Memoranda of Agreement, ODA designated the Benton and Polk SWCDs as Local Management Agencies to assist with the development and implementation of the Middle Willamette Agricultural Water Quality Management Area Plan.

SWCDs are legal, independent subdivisions of state government, and are led locally by an elected board of directors who serve four-year terms without pay. For several decades, SWCDs in Oregon have worked with landowners to promote the good stewardship of natural resources. Many SWCDs in Oregon choose to serve as Local Management Agencies for Area Plan development and implementation within their district boundaries.

During implementation of the Area Plan and Rules, the Benton and Polk SWCDs, the NRCS, and other partners conduct education and outreach programs, provide technical assistance to producers in evaluating and implementing resource management practices, and work to secure additional funds for plan implementation as resources allow. Implementation priorities will be established and reviewed regularly through annual work plans developed by the SWCDs and Memoranda of Agreement with ODA, with input from partner agencies.

ODA and the SWCDs will provide information to individual landowners and interested groups on an ongoing basis.

5.3. Resolution of Complaints and Enforcement Action

ODA will investigate complaints against landowners or occupiers who are reported to be out of compliance with OAR 603-095-2300 through 603-095-2360. The complaint must relate to a specific site and contain a thorough description of the problem. Department staff may also initiate an inspection if they directly observe violations of conditions or measures outlined in the Area Rules adopted to implement the Area Plan or if they are alerted to a violation by another agency.

ODA maintains records of complaints filed against landowners. A landowner can ask ODA to find out who filed a complaint against them.

Before conducting a complaint investigation, ODA shall make every attempt to establish contact with the operator to schedule a site visit.

ODA will use professional judgment to determine if a violation of a prevention and control measure exists. Based on this determination, appropriate action will be taken by the Department to assure that the violation is remedied.

ODA will use enforcement mechanisms where appropriate and necessary to gain compliance with the prevention and control measures. Any enforcement action will be pursued only when reasonable attempts at voluntary solutions have failed.

A landowner or operator shall be responsible for only those conditions caused by activities conducted on land managed by the landowner or operator. Criteria do not apply to conditions resulting from unusual weather events or other exceptional circumstances that could not have been reasonably anticipated, such as fire, natural disaster, or other extreme weather conditions. ODA recognizes that every farm and situation is different and will take into account each individual situation when enforcing the rules.

5.4. Plan Evaluation and Modification

ODA and as resources allow, the Benton and Polk SWCDs, will evaluate the effectiveness of the Area Plan in improving water quality and land conditions. Information considered in the evaluation will include, but not be limited to: water quality monitoring data collected by the Oregon Department of Environmental Quality, area watershed councils, and other agencies and organizations monitoring water quality in the Management Area; results of compliance sampling conducted by the ODA (this sampling is for information purposes only and does not result in enforcement); and results of random surveys of Management Area landowners to determine awareness of water quality issues. Results of effectiveness evaluations will be presented to the Local Advisory Committee (LAC) during the biennial reviews and as requested on an annual basis.

First Biennial Review, 2004

Two years after approval of the Area Plan and adoption of the Area Rules in 2002, the LAC met to review and update the Area Plan and Rules. The LAC added educational information to the Area Plan about new water quality parameters of concern and updated information about sources of technical and financial assistance. The LAC agreed that the existing Area Rules were adequate to address water quality concerns within the area.

Second Biennial Review, 2008

The LAC met on April 15, 2008, to review the progress and accomplishments of the Benton and Polk SWCDs and updates to the Area Plan and Rules since their last meeting in December of 2004. The LAC updated the narrative related to the GWMA in the Area Plan and added information related to the Willamette Basin TMDLs that were approved in 2006 for temperature, mercury, and bacteria. Prevention and control measures for mercury were also added and the 303(d) list in appendix A was updated. The LAC agreed that the existing Area Rules were adequate to address the Willamette Basin TMDLs and other water quality concerns within the area.

Third Biennial Review, 2010

The LAC met on February 25, 2010. The LAC updated information on dissolved oxygen and nitrate in the Area Plan. In addition, the LAC added targets to the Area Plan to assist with tracking progress of implementation of the objectives of the Area Plan. The LAC emphasized the need for water quality monitoring to evaluate trends, implementation, and effectiveness of the Area Plan. The LAC agreed that the existing Area Rules continue to be adequate to address water quality concerns within the Management Area.

The LAC will continue to meet every two years to review the Area Plan and Rules. Based on the results of the effectiveness evaluation of the Middle Willamette Area Plan and Rules, as well as any additional water quality concerns identified in the Middle Willamette; the LAC, ODA, and the Benton and Polk SWCDs will consider making appropriate modifications to the Middle Willamette Area Plan and Rules in consultation with the State Board of Agriculture.

6. Public Participation

ODA, the Benton and Polk SWCDs, LAC members, area watershed councils, and other partners began soliciting community participation before the development of the Middle Willamette Agricultural Water Quality Management Area Plan and Rules. The SWCDs prepared press releases and newsletter articles about the LAC recruitment, and also announced the process at meetings of local organizations such as watershed councils and agricultural groups.

During the Area Plan and Rules development process, interested members of the public received announcements of all committee meetings. Meetings were publicized in local newspapers and on local radio stations, and ODA and SWCD staff provided updates on the process to local watershed councils. Members of the public were encouraged to attend meetings and comment on the process during the public comment period.

When the draft Area Plan and Rules were complete, the Benton and Polk SWCDs, the LAC, and ODA presented the drafts to the public through newspaper articles, two public information meetings, direct mailings, and presentations to watershed councils, local governments, and other groups. The draft Plan and Rules were available on ODA's website, and were also mailed to interested parties throughout the Management Area.

In June and July 2002, ODA conducted a public comment period on the draft Area Plan and Rules, which included two public hearings in Corvallis and Dallas. After the public comment period, the LAC met again to discuss the comments with ODA and determine how to address the comments in the final Area Plan and Rules.

Since Area Plan and Rules adoption, the Benton and Polk SWCDs have continued outreach and education programs about the Area Plan and Rules. Ongoing outreach activities include newspaper articles, Polk SWCD's "First-Step" conservation planning workshops, Benton SWCD's quarterly newsletter, and presentations at agricultural group meetings.

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Appendices

A. 2004-2006 Water Quality Assessment List and Decision Matrix
B. Parameter List and Impacted Beneficial Uses
C. Educational and Technical Services for Natural Resources and Farm Management
D. Conservation Funding Programs
E. Resource Management Practices
F. References on Water Quality Improvement Practices for Agricultural Landowners
G. Site Capability
H. Factors that Affect Stream Temperature

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Appendix A: 2004-2006 Water Quality Assessment and Decision Matrix

Middle Willamette Agricultural Water Quality Management Area Water Quality Limited Waterbodies

"TMDL" means a TMDL has been established for the waterbody and approved by EPA, and is being implemented. TMDLs identify the maximum amount (load) of each pollutant that a listed waterbody can receive and still meet state water quality standards. The waterbody is considered water quality limited until it meets the water quality standard.

"303(d) List" means the waterbody exceeds listing criteria and is placed on the 303(d) List.

"Potential concern" means data indicate a waterbody may typically meet water quality standards except under unusual circumstances (e.g. unusual weather circumstances) or in situations where toxics exceed levels of concern but do not exceed definitions used for the 303(d) List. In these cases, the waterbodies are identified as being of potential concern and the Department of Environmental Quality will seek more data to verify the assessment.

Bacteria (Criteria: 30-day log mean > 126 organisms/100 mL based on at least 5 samples or single sample > 406 organisms/100 mL)

DEQ has set the bacteria TMDL to protect human water contact recreation, the most sensitive beneficial use. Urban stormwater discharge and agricultural run-off are two potential sources of bacteria. The bacteria TMDL addresses the entire area.

303(d) List, TMDL Approved September 2006	**Season**
Luckiamute River, Mouth to Pedee Creek	Fall-Winter-Spring
Marys River, Mouth to Greasy Creek	Fall-Winter-Spring
Glenn Creek, River Mile (RM) 0 to 7	Year Round
Long Tom River, RM 0 to 24.2	Fall-Winter-Spring
Oak Creek, RM 0 to 21.6	Fall-Winter-Spring

Temperature (Criteria: rearing and migration 64 F, spawning 55 F)

DEQ set the TMDL for temperature to protect salmon spawning, rearing, and passage as the most sensitive beneficial uses in the Middle Willamette Subbasin. DEQ has identified the existing nonpoint source pollution sources as solar heating of the Area's waterways due to a lack of riparian vegetation from forestry, agriculture, rural residential, and urban activities.

303(d) List	**Season**
Rickreall Creek, Mouth to Mercer Reservoir (was not addressed in the 2006 Temperature TMDL)	Temperature

303(d) List/TMDL Approved September 2006

Little Luckiamute, RM 0 to 26.4	Year Round
Little Muddy Creek, RM 0 to 12.2	Year Round
Long Tom River, RM 0 to 24.2	Summer
Luckiamute River, RM 0 to 60.1	Year Round
Marys River, RM 0 to 13.9	Summer
Maxfield Creek, RM 0 to 6.7	Year Round
McTimmonds Creek, RM 0 to 6	Year Round
Oak Creek, RM 0 to 21.6	Year Round
Pedee Creek, RM 0 to 2.9	Year Round
Rickreall Creek, RM 0 to 24.9	Summer
Ritner Creek, RM 0 to 7.4	Year Round
Soap Creek, RM 0 to 16.8	Year Round
South Fork Berry Creek, Mouth to RM 2.1	Summer

Mercury TMDL

Human fish consumption is the most sensitive beneficial use for which DEQ has set the Mercury TMDL. Primary sources of mercury include air deposition from national and international sources, discharge from specific legacy mining sites, and erosion of soils containing mercury. The Mercury TMDL has a basin wide strategy for mercury reduction.

Dissolved Oxygen (Criteria: DO < 8 mg/L for Cold Water Aquatic Life)

303(d) List	Season
Gibson Gulch, RM 0 to 2.8	Fall-Winter-Spring
Glenn Creek, RM 0 to 7	Year Round
Marys River, RM 0 to 41.1	Winter-Spring
Soap Creek, RM 0 to 16.8	Fall-Winter-Spring

TMDL Approved

Rickreall Creek, Mouth to City of Dallas WWTP (Approved in 1994)
Rickreall Creek, Dallas WWTP to Mercer Reservoir (Approved in 1994)

METALS

303(d) List	Season
Long Tom River, RM 0 to 57.3 (Iron, Manganese)	Year Round
Marys River, RM 0 to 41.1 (Iron, Manganese)	Year Round

Potential Concern

Rickreall Creek, RM 0 to 24.9 (Antimony, Chromium, Copper, Manganese, Nickel, & Zinc	Year Round

Additional Parameters of Potential Concern

ALKALINITY

Long Tom River, RM 0 to 57.3	Year Round
Marys River, RM 0 to 41.1	Year Round

PESTICIDES

Marys River, RM 0 to 13.9 (DDT)	Year Round

NUTRIENTS

Long Tom River, RM 0 to 57.3 (Phosphate)	Summer
Marys River, RM 0 to 41.1 (Phosphate)	Summer

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Appendix B: Parameter List and Impacted Beneficial Uses

The following is a list of parameters used by the DEQ in establishing the 303(d) List, developing TMDLs, and the beneficial uses of water impacted by these parameters. 303(d) listed parameters, which have approved TMDLs since September 2006, in the Middle Willamette Management Area are identified with an asterisk. This is an abbreviated summary and does not contain detailed descriptions of the standards. Specific information about these standards can be found in the Oregon Water Quality Assessment Database.

The 303(d) List and TMDLs can be obtained from the DEQ website at
http://www.deq.state.or.us/wq/assessment/rpt0406/search.asp
or by calling the Water Quality Division of the DEQ at (503) 229-5279.

Parameters

Aquatic Weeds or Algae

Standard – The development of fungi or other growths having a deleterious effect on stream bottoms, fish, or other aquatic life, or which are injurious to health, recreation, or industry shall not be allowed.

Beneficial Uses Affected - Water contact recreation, aesthetics, fishing, livestock watering, public and private domestic water supply, irrigation, industrial water supply.

Water Quality Limited Criteria – Macrophytes: Documented reports of an abundance of invasive, non-native macrophytes (those listed on the "A" or "B" Noxious Weed List maintained by the department of Agriculture) that dominate the lake assemblage of plants and significantly reduces the surface area available for lake usage; frequent herbicide treatments to control aquatic weeds; or other activities initiated to manage weed growth such as through a Coordinated Resources Management Plan in response to frequent complaints about weeds interfering with various uses. Periphyton (attached algae) or Phytoplankton (floating algae): Documented evidence that algae is causing other standard exceedences (e.g. pH or dissolved oxygen) or impairing a beneficial use.

Bacteria

Standard - Fecal bacteria levels shall not exceed a 30-day log mean of 126 E. Coli organisms per 100 ml, based on a minimum of 5 samples and no single sample shall exceed 406 E. Coli organisms per 100 ml. Bacterial pollution or other conditions deleterious to waters used for domestic purposes, livestock watering, irrigation, bathing, or shellfish propagation, or otherwise injurious to public health, shall not be allowed.

Beneficial Uses Affected - Water contact recreation, public and private domestic water supply, livestock watering.

Water Quality Limited Criteria – A 30-day log mean of 126 E coli organisms per 100 ml or more than 10 percent, and a minimum of at least two, exceedences are above 406 E coli organisms per 100 ml, or if E coli data is not available, the geometric mean of fecal coliform bacteria exceeds 200 per 100 milliliters or more than ten percent of the samples and a minimum of at least two exceedences are above 400 per 100 milliliters for the season of interest.

Chlorophyll a

Standard – The following average Chlorophyll a values shall be used to identify waterbodies where phytoplankton may impair the recognized beneficial uses:

1. Natural lakes that thermally stratify: 0.01 mg/l.
2. Natural lakes that do not thermally stratify, reservoirs, rivers, and estuaries: 0.015 mg/l.

Beneficial Uses Affected - Water contact recreation, aesthetics, fishing, water supply.

Water Quality Limited Criteria – Three-month average Chlorophyll a value exceeds standard. Data was screened for a greater than ten percent of seasonal values exceed standard based on multi-year data collections; if there were greater than ten percent exceedences, data was reviewed for the exceedence of the three-month average criteria that is identified in the rule.

Dissolved Oxygen

Standard - For waterbodies identified as salmonid spawning, dissolved oxygen must not be less than 11.0 mg/l. For waterbodies supporting cold water aquatic life, dissolved oxygen must not fall below 8 mg/l. For waterbodies supporting cool water aquatic life, dissolved oxygen must not fall below 6.5 mg/l. For waterbodies supporting warm water aquatic life, dissolved oxygen must not be less than 5.5 mg/l.

Beneficial Uses Affected - Resident fish and aquatic life, salmonid spawning, rearing, and migration.

Water Quality Limited Criteria – Greater than ten percent of the samples exceed the appropriate standard and a minimum of at least two exceedences of the standard for a season of interest.

Nutrients

Standard - see standards for aesthetics, pH, dissolved oxygen, chlorophyll a, and aquatic weeds or algae.

Beneficial Uses Affected - Aesthetics or use identified under related parameters.

Water Quality Limited Criteria – Greater than 10 percent of the samples exceed standard and a minimum of at least two exceedences of the standard or criteria used in draft TMDLs for a season of interest.

pH

Standard - pH shall not fall outside 6.5 to 8.5. The following exception applies: waters impounded by dams existing on January 1, 1996, which have pHs that exceed the criteria shall not be considered in violation of the standard if the DEQ determines that the exceedence would not occur without the impoundment and that all practicable measures have been taken to bring the pH in the impounded waters into compliance with the criteria.

Beneficial Uses Affected - Resident fish and aquatic life, water contact recreation, salmonid spawning, rearing, and migration.

Water Quality Limited Criteria – Greater than 10 percent of the samples exceed standard and a minimum of at least two exceedences of the standard for a season of interest.

Sedimentation

Standard – The formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, recreation, or industry shall not be allowed.

Beneficial Uses Affected - Resident fish and aquatic life, salmonid spawning, rearing, and migration.

Water Quality Limited Criteria – Documented that sedimentation is a significant limitation to fish and other aquatic life as indicated by the following information:
Beneficial uses are impaired. This documentation can consist of data on aquatic community status that shows aquatic communities (primarily macroinvertebrates) that are 60 percent or less of the expected reference community for both multi-metric scores and multivariate model scores are considered impaired. Streams with either multi-metric scores or multivariate scores between 61 percent and 75 percent of expected reference communities are considered as streams of concern. Streams greater than 75 percent of expected reference communities using either multi-metric or multivariate models are considered unimpaired.
-or-
Where monitoring methods determined a Biotic Condition Index, Index of Biotic Integrity, or similar metric rating of poor or a significant departure from reference conditions utilizing a suggested EPA bio-monitoring process or other technique acceptable to DEQ.
-or-
Fishery data on escapement, redd counts, population survey, etc. that show fish species have declined due to water quality conditions; and documentation through a watershed analysis or other published report which summarizes the data and utilizes standard protocols, criteria and benchmarks (e.g. those currently used and accepted by Oregon Fish and Wildlife or Federal agencies (PACFISH)). Sedimentation measurements include cobble embeddedness and percent fines. Documentation should indicate that there are conditions that are deleterious to fish or other aquatic life.

Temperature

Standard - 64°F for waterbodies with salmonid fish rearing and migration, and 55°F for waterbodies with salmonid fish spawning. Following a temperature TMDL, temperature water quality limited waters cannot be warmed more than 0.3° Celsius (0.5° - F) by sources of anthropogenic heating.

Beneficial Uses Affected - Resident fish and aquatic life, salmonid fish spawning, rearing, and migration.

Water Quality Limited Criteria – Rolling seven - day average of the daily maximum exceeds the appropriate standard listed above. In the cases where data were not collected in a manner to calculate the rolling -seven day average of the daily maximum, greater than 25 percent (and a minimum of at least two exceedences) of the samples exceed the appropriate standard based on multi-year monitoring programs that collect representative samples on separate days for the season of concern (typically summer) and time of day of concern (typically mid to late afternoon).

Total Dissolved Gas

Standard – The concentration of total dissolved gas relative to atmospheric pressure at the point of sample collection shall not exceed 110 percent of saturation, and the liberation of dissolved gases, such as carbon dioxide, hydrogen sulfide, or other gases, in sufficient quantities to cause objectionable odors or to be deleterious to fish or other aquatic life, navigation, recreation or other reasonable uses made of such waters shall not be allowed.

Beneficial Uses Affected - Resident fish and aquatic life, salmonid spawning, rearing and migration

Water Quality Limited Criteria – Greater than 10 percent of the samples exceed standard and a minimum of at least two exceedences of the standard or a survey that identified beneficial use impairment due to total dissolved gas such as assessment of fish condition.

Toxics

Standard - Toxic substances shall not be introduced above natural background levels in the waters of the state in amounts, concentrations, or combinations which may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bio-accumulate in aquatic life or wildlife to levels that adversely impact public health, safety, or welfare; aquatic life; wildlife; or other designated beneficial uses. Standards for specific toxic substances may be viewed on the Oregon Department of Environmental Quality website at http://www.deq.state.or.us/wq/rules/div041/table20.pdf

Beneficial Uses Affected - Resident fish and aquatic life, public, private and industrial water supply, livestock watering, fishing/fish consumption for human health, irrigation, water contact recreation.

Water Quality Limited Criteria – Water quality standards violations: The water quality standard listed in Table 20 (see OAR 340-41) for the chemical is violated more than ten percent of the time and for a minimum of two values. Other evidence of impairment of beneficial uses: A fish or shellfish consumption advisory or recommendation issued by the Health Division specifically refers to this chemical. The chemical has been found to cause a biological impairment via a field test of significance such as a bioassay. The field test must involve comparison to a reference condition.

Turbidity

Standard – No more than ten percent cumulative increase in natural stream turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity causing activities.

Beneficial Uses Affected - Resident fish and aquatic life, aesthetics.

Water Quality Limited Criteria – A systematic or persistent increase (of greater than ten percent) in turbidity due to an operational activity that occurs on a persistent basis (e.g. dam release or irrigation return, etc).

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Appendix C: Educational and Technical Services for Natural Resources and Farm Management

Soil and Water Conservation Districts (SWCDs)

Provide technical assistance in a wide variety of agricultural and natural resource areas and assists landowners in accessing federal and local funding programs.

Benton Soil and Water Conservation District (Benton SWCD)

400A SW 4th
Corvallis, OR 97339
(541) 753-7208

Polk Soil and Water Conservation District (Polk SWCD)

580 Main Street, Suite A
Dallas, OR 97338
(503) 623-9680

Farm Services Agency (FSA)

Maintains agricultural program records and administers federal cost-share programs. Maintains up-to-date aerial photographs and agricultural and forestlands slides.

Benton County

33630 McFarland Rd.
Tangent, OR 97389
(551) 967-5925

Polk County

580 Main Street, Suite A
Dallas, OR 97338
(503) 623-2396

Natural Resources Conservation Service (NRCS)

Provides information on soil types, soils mapping, and interpretation. Administers and provides assistance in developing conservation plans for federal programs such as the Conservation Reserve Program, Conservation Reserve Enhancement Program, the Environmental Quality Incentives Program, and the Wetlands Reserve Program. Makes technical determinations on wetlands and highly erodible lands.

Benton County

33630 McFarland Rd.
Tangent, OR 97389
(541) 967-5925

Polk County

580 Main Street, Suite A
Dallas, OR 97338
(503) 623-5534

Oregon Department of Agriculture (ODA)

635 Capitol St NE
Salem, OR 97301
(503) 986-4700 (Natural Resources Division)
(503) 986-4635 (Pesticides Division)

The Natural Resources Division is responsible for developing and implementing Management Area Plans and Rules across Oregon, the Confined Animal Feeding Operation Program, and for providing support to Oregon's Soil and Water Conservation Districts.

The Pesticides Division regulates the sale and use of pesticides; tests and licenses all users of restricted-use pesticides, is responsible for fertilizer registration, and investigates incidents of alleged pesticide misuse.

Oregon Department of Environmental Quality (DEQ)

750 Front St NE, #120
Salem, OR 97301-1039
(503) 378-8240
http://www.deq.state.or.us

Responsible for protecting Oregon's water and air quality, cleaning up spills and releases of hazardous materials, and managing the proper disposal of solid and hazardous wastes. Maintains a list of water quality limited streams and establishes Total Maximum Daily Loads for water quality limited waterbodies.

Oregon Department of Fish and Wildlife (ODFW)

7118 NE Vanderberg Avenue
Corvallis, OR 97330-9446
(541) 757-4186
http://www.dfw.state.or.us

Works with landowners to protect and enhance habitat for a variety of fish and wildlife species, manages recreational fishing and hunting programs, monitors fish and wildlife populations, conducts education and information programs, and administers wildlife habitat tax deferral program.

Oregon Department of Forestry (ODF)

825 Oak Villa Rd.
Dallas, OR 97338
(503) 623-8146
http://www.odf.state.or.us

Implements Oregon forest practices laws, administers Oregon forestry property tax programs, provides forest management technical assistance to landowners, and administers or assists with several federal and local cost-sharing programs.

Oregon Department of State Lands (DSL)

775 Summer Street NE Suite 100
Salem, OR 97301-1279
(503) 986-5200
http://oregon.gov/dsl

Administers Oregon fill and removal law and provides technical assistance to landowners.

Oregon State University Extension Service (OSUES)

Offers educational programs, seminars, classes, tours, publications, and individual assistance to guide landowners in meeting natural resource management goals.

Benton County

1849 NW 9th St.
Corvallis, OR 97330
(541) 766-6750

Linn County

4th and Lyons
P.O. Box 765
Albany, OR 97321
(541) 967-3871

Polk County

182 SW Academy, Suite 222
P.O. Box 640
Dallas, OR 97338
http://www.extension.oregonstate.edu/polk/
(503) 623-8395

Oregon Water Resources Department (WRD)

725 Summer St. NE, Suite A
Salem, OR 97301
(503) 986-0900
http://www.wrd.state.or.us

Provides information on streamflows and water rights, issues water rights, and monitors water use.

Oregon Watershed Enhancement Board (OWEB)

http://www.oweb.state.or.us
775 Summer St. NE, Suite 360
Salem, OR 97301-1290
(503) 986-0178

Provides funding for a variety of watershed enhancement, assessment, monitoring and educational activities. Provides support to watershed councils throughout Oregon.

Watershed Councils

Bring diverse interests together to cooperatively monitor and address local watershed conditions. Collect watershed condition data, conduct education programs, and train and involve volunteers.

Glenn/Gibson Watershed Council

580 Main Street, Suite A
Dallas, OR 97338
ggwc@hotmail.com
(503) 623-9680 ext. 112

Luckiamute Watershed Council

Western Oregon University
345 N Monmouth Ave
Monmouth, OR 97361
(503) 838-8804
lwc@wou.edu

Marys River Watershed Council

3640 NW Elmwood Dr.
Corvallis, OR 97309
(541)-758-7597
mrwc@peak.org

Rickreall Watershed Council

580 Main Street, Suite A
Dallas, OR 97338
(503) 623-9680 x 112
rickreallwc@hotmail.com

Appendix D: Conservation Funding Programs

The following is a list of some conservation funding programs available to landowners and organizations in Oregon. For more information, please refer to the contact agencies for each program. Additional programs may become available after the publication of this document. For more current information, please contact one of the organizations listed below.

Program	General Description	Contact
Conservation Reserve Enhancement Program (CREP)	Provides annual rent to landowners who enroll agricultural lands along streams. Also cost-shares conservation practices such as riparian tree planting, livestock watering facilities, and riparian fencing.	Natural Resources Conservation Service, Soil and Water Conservation Districts, Oregon Department of Forestry
Conservation Reserve Program (CRP)	Competitive CRP provides annual rent to landowners who enroll highly erodible lands. Continuous CRP provides annual rent to landowners who enroll agricultural lands along seasonal or perennial streams. Also cost-shares conservation practices such as riparian plantings.	Natural Resources Conservation Service, Soil and Water Conservation Districts.
Conservation Stewardship Program (CSP)	Provides cost-share and incentive payments to landowners who have attained a certain level of stewardship and are willing to implement additional conservation practices.	Natural Resources Conservation Service, Soil and Water Conservation Districts.
Emergency Watershed Protection Program (EWP)	Available through the USDA-Natural Resources Conservation Service. Provides federal funds for emergency protection measures to safeguard lives and property from floods and the products of erosion created by natural disasters that cause a sudden impairment to a watershed.	Natural Resources Conservation Service, Soil and Water Conservation Districts.

Program	General Description	Contact
Environmental Protection Agency Section 319 Grants	Fund projects that improve watershed functions and protect the quality of surface and groundwater, including restoration and education projects.	Oregon Department of Environmental Quality, Soil and Water Conservation Districts, Watershed Councils.
Environmental Quality Incentives Program (EQIP).	Cost-shares water quality and wildlife habitat improvement activities, including conservation tillage, nutrient and manure management, fish habitat improvements, and riparian plantings.	Natural Resources Conservation Service, Soil and Water Conservation Districts.
Farm and Ranchland Protection Program (FRPP)	Cost-shares purchases of agricultural conservation easements to protect agricultural land from development.	Natural Resources Conservation Service, Soil and Water Conservation Districts.
Federal Reforestation Tax Credit	Provides federal tax credit as incentive to plant trees.	Internal Revenue Service
Forest Resource Trust	State assistance up to 100 percent of the costs to convert non-stocked forestland to timber stands. Available to non-industrial private landowners.	Oregon Department of Forestry.
Grassland Reserve Program (GRP)	Provides incentives to landowners to protect and restore pastureland, rangeland, and certain other grasslands.	Natural Resources Conservation Service, Farm Service Agency, Soil and Water Conservation Districts.
Landowner Incentive Program (LIP)	Provides funds to enhance existing incentive programs for fish and wildlife habitat improvements.	U.S. Fish and Wildlife Service, Oregon Department of Fish and Wildlife.
Oregon Watershed Enhancement Board (OWEB)	Provides grants for a variety of restoration, assessment, monitoring, and education projects, as well as watershed council staff support. 25% local match requirement on all grants.	Soil and Water Conservation Districts, Watershed Councils, Oregon Watershed Enhancement Board.

Program	General Description	Contact
Oregon Watershed Enhancement Board Small Grant Program	Provides grants up to $10,000 for priority watershed enhancement projects identified by local focus group.	Soil and Water Conservation Districts, Watershed Councils, Oregon Watershed Enhancement Board.
Partners for Wildlife Program.	Provides financial and technical assistance to private and non-federal landowners to restore and improve wetlands, riparian areas, and upland habitats in partnership with the U.S. Fish and Wildlife Service and other cooperating groups.	U.S. Fish and Wildlife Service (503) 231-6179, Natural Resources Conservation Service, Soil and Water Conservation Districts.
Public Law 566 Watershed Program	Program available to state agencies and other eligible organizations for planning and implementing watershed improvement and management projects. Projects should reduce erosion, siltation, and flooding; provide for agricultural water management; or improve fish and wildlife resources.	Natural Resources Conservation Service, Soil and Water Conservation Districts.
Resource Conservation & Development (RC & D) Grants	Provides assistance to organizations within RC & D areas in accessing and managing grants.	Resource Conservation and Development, (541) 757-6709.
State Forestation Tax Credit	Provides for reforestation of under-productive forestland not covered under the Oregon Forest Practices Act. Situations include brush and pasture conversions, fire damage areas, and insect and disease areas.	Oregon Department of Forestry
State Tax Credit for Fish Habitat Improvements	Provides tax credit for part of the costs of voluntary fish habitat improvements and required fish screening devices.	Oregon Department of Fish and Wildlife

Program	General Description	Contact
Stewardship Incentive Program (SIP)	Cost-sharing program for landowners to protect and enhance forest resources. Eligible practices include tree planting, site preparation, pre-commercial thinning, and wildlife habitat improvements.	Natural Resources Conservation Service, Soil and Water Conservation Districts, Oregon Department of Forestry
Wetlands Reserve Program (WRP)	Provides cost-sharing to landowners who restore wetlands on agricultural lands.	Natural Resources Conservation Service, Soil and Water Conservation Districts
Wildlife Habitat Incentives Program	Provides cost-share for wildlife habitat enhancement activities.	Natural Resources Conservation Service, Soil and Water Conservation Districts.
Wildlife Habitat Tax Deferral Program	Maintains farm or forestry deferral for landowners who develop a wildlife management plan with the approval of the Oregon Department of Fish and Wildlife.	Oregon Department of Fish and Wildlife, Soil and Water Conservation Districts, Natural Resources Conservation Service

Appendix E: Resource Management Practices

The following is a list of possible resource management practices according to type of operation.

Field and Vegetable Crop Production

Possible practices to reduce erosion and sediment delivery from agricultural and rural land:

- Residue management
- Grassed waterways
- Cover cropping
- Crop rotations
- Conservation tillage
- Vegetative buffer strips
- Straw mulch
- Irrigation scheduling using soil moisture instrumentation
- Subsurface drainage – surface inlets and diversions

Possible practices to limit movement of nutrients and pesticides from agricultural lands to streams:

- Vegetative buffer strips
- Irrigation water management
- Nutrient management
- Equipment calibration and maintenance
- Integrated pest management
- Proper storage of pesticides, fertilizer, and fuel

Possible practices to manage and conserve irrigation water and prevent nitrate leaching into groundwater:

- Irrigation scheduling based on site-specific factors that influence crop production, such as:
  - Evapotranspirational demands (crop type, stage of growth, percent ground shade, weather conditions)
  - Soil conditions (percolation rate, water holding capacity)
  - Recent applications of crop nutrients or farm chemicals
- Properly maintain Irrigation system to ensure performance (uniformity, efficiency, and application rate)
- Irrigation scheduling using:
  - Soil probes
  - Evaporation pans
  - Neutron probes
  - Infrared guns
  - Tensiometers
  - Other soil monitoring devices

- Contour cropping
- Plant winter cover crops

Livestock

Possible practices to ensure proper animal waste storage and utilization or disposal:

- Vegetative buffer strips
- Manure management – clean water diversions, manure collection, storage and application; facilities operation and maintenance.
- Apply manure to cropland at rates that do not exceed agronomic needs for nitrogen and phosphorus based on soil and/or tissue tests for the crop to be grown.
- Pasture management/prescribed grazing.
- Establish animal heavy use areas during the winter away from waterways.
- Limit livestock access to pastures while soil is saturated.

Possible practices to manage livestock access to streams, wetlands, and riparian areas:

- Off-stream watering
- Seasonal grazing
- Exclusion – temporary or permanent

Nurseries

Possible practices to reduce erosion and sediment delivery from nurseries:

- Use ground cloth and/or gravel in container nurseries as a surface covering.
- Gravel or sod road surfaces and staging areas.
- Designed drainage systems to handle runoff from greenhouse and building roofs.
- Grass ditches, waterways, and buffer strips adjacent to streams and ponds.
- Land leveling
- Limit irrigation runoff from fields.
- Manage cultivation timing and methods.
- Subsurface tile drainage.

Possible practices to manage and conserve irrigation water:

- Recycle irrigation water in container nurseries.
- Monitor soil moisture to balance irrigation applications with crop needs.
- Monitor and record water use.
- Maintain irrigation delivery systems regularly for maximum efficiency.
- Use cultivation to conserve soil moisture in field operations.

Possible practices to limit movement of nutrients and pesticides from nurseries to streams:

- Apply fertilizer based on competent advice and nutrient levels determined by soil and tissue tests.
- Time fertilizer applications to promote optimum plant utilization and limit leaching.
- Protect water sources from contamination through use of backflow prevention devices where fertigation is practiced.
- Restrict irrigation water from leaving the property through irrigation management and water recycling.
- Make banded fertilizer application when feasible.
- Calibrate application machinery prior to use.
- Monitor and record application rates.
- Use timed release fertilizers.
- Maintain organic content of soil mixes and fields to hold nutrients for plant utilization.
- Use Integrated Pest Management Practices.
- Scout crops to determine presence of insects and disease.
- Trap to quantify pest populations.
- Establish economic thresholds for various crops.
- Use traps, pheromone disrupters, and beneficial insects as alternatives to chemicals.
- Rotate chemicals used in applications.
- Make application as per label instructions.
- Have trained applicators apply, or supervise the application of, pesticides.
- Calibrate equipment and use equipment suited for specific types of applications (i.e., ground, foliar, drench, etc.)

Possible practices for other nursery management issues:

- Recycle nursery wastes and byproducts to restrict their impact on the environment.
- Empty chemical containers.
- Plant tissue and residues (through composting)
- Paper products
- Plastic products – poly, pots & flats
- Metal, glass, wood, tires, and oils
- Cover cropping to reduce erosion, build soil organic matter, provide habitat for beneficial insects and wildlife, and control weeds.
- Install fish screens at pump intakes to protect small fish and other aquatic life.
- Control noxious weeds to prevent degradation of protective native vegetation near riparian areas.
- Set aside less productive land for conservation and wildlife habitat enhancement.

Streamside Areas

Possible practices to protect and/or restore ecological functions in riparian and wetland areas:

- Control of undesirable vegetation and preservation of desirable vegetation
- Planting native trees and shrubs.

- Allowing snags (dead trees) to remain standing unless safety factors indicate otherwise.
- Allowing fallen trees to remain on the ground or in the stream unless removal is essential for traffic, navigation, or serious flooding reasons.

Possible practices to reduce erosion and sedimentation, provide filtering, and moderate water heating:

- Buffer zones
- Grassed waterways
- Streambank protection
- Subsurface tile drainage
- Allow marginally productive or poorly drained lands in floodplains to revert to riparian or wetland status.

Vineyards, Berries, Christmas Trees, and Orchards

Possible practices to reduce erosion and sediment delivery:

- Annual and perennial cover crops
- Conservation tillage
- Deep ripping a field to improve water infiltration
- Subsurface drainage or tiling
- Strip cropping
- Straw mulch
- Catch basins
- Grassed waterways
- Vegetative filter strips
- Straw bales

Possible practices to limit over-application of pesticides and nutrients:

- Mechanical weed control.
- Apply herbicide under the vine row or spot treat weeds.
- Adopt methods to monitor disease and pest pressure.
- Make pesticide applications at label recommended rates.
- Rotate pest control methods to reduce development of resistance.
- Encourage an open canopy – reduces disease pressure, improves spray penetration and fruit quality.
- Encourage use of new, low impact products.
- Apply nutrients when there is a maximum uptake by the crop.
- Use organic nutrient sources.
- Conduct soil tests at least every seven years.
- Conduct tissue analyses at least every three years.
- Apply fertilizer based on competent advice and nutrient levels determined by soil and tissue tests.
- Recycle all organic matter.

Possible practices to manage and conserve irrigation water.

- Irrigate only young vineyards except where shallow soils or drought conditions exist.
- Use water sensing devices or physiological indicators to help schedule water applications.

Possible management practices to encourage botanical diversity within and around the borders of the vineyard and provide favorable habitat for beneficial insects:

- Alternate mowing (the oldest inter-row is mowed when the youngest inter-row begins flowering)
- Botanical diversity in cover

Other Management Areas – Roads, Staging Areas, and Farmsteads

There are other land uses associated with agriculture that do not fall under a specific type of operation, such as access roads and staging areas. Several practices may be applicable to these areas.

Example practices to minimize soil erosion from access roads:

- Encourage landowners to cooperate with county or state roads departments to implement roadside management practices.
- Plant and maintain grass cover where appropriate.
- Appropriate culvert construction and design.
- Water bars
- Grading roads
- Manage runoff and contaminants in the farmstead area.

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Appendix F: References on Water Quality Improvement Practices for Agricultural Landowners

Below is a list of some selected references with more specific information on water quality and natural resources improvement practices. Copies of many of these publications are available from the local Oregon State University Extension office or local Soil and Water Conservation District. Underlined publications are also available online on the publishing agency's website.

General Water Quality Protection

Adams, E.B. 1992. Farming practices for groundwater protection. Washington State University, Spokane, Washington.

Hermanson, R.E. 1994. Care and feeding of septic tanks. Washington State University, Spokane, Washington.

Hirschi, M. et al. 1994. 50 ways farmers can protect their groundwater. University of Illinois, Urbana, Illinois.

Hirschi, M., et al. 1997. 60 ways farmers can protect surface water. University of Illinois, Urbana, Illinois.

Ko, L. 1999. Tips on land and water management for small acreages in Oregon. Oregon Association of Conservation Districts, Portland, Oregon.

U.S. Department of Agriculture Natural Resources Conservation Service. 1998. National Handbook of Conservation Practices. U.S. Department of Agriculture Natural Resources Conservation Service, Portland, Oregon.

Riparian Areas and Streams

Adams, E.B. 1994. Riparian Grazing. Washington State University, Spokane, Washington.

Darris, D. and S.M. Lambert. 1993. Native willow varieties for the Pacific Northwest. U.S. Department of Agriculture Soil Conservation Service, Corvallis Plant Materials Center, Corvallis, Oregon.

Nash, E. and T. Mikalsen, eds. 1994. Guidelines for streambank restoration. Georgia Soil and Water Commission, Atlanta, Georgia.

South Santiam Watershed Council. 1998. Guide for using Willamette Valley native plants along your stream. Linn Soil and Water Conservation District, Tangent, Oregon.

Nutrient and Manure Management

Godwin, D. and J.A. Moore. 1997. Manure management in small farm livestock operations: protecting surface and groundwater. Oregon State University, Corvallis, Oregon.

Hart, J. 1995. How to take a soil sample...and why. Oregon State University, Corvallis, Oregon.

Hart, J. 1999. Analytical laboratories serving Oregon. Oregon State University, Corvallis, Oregon.

Marx, E.S., J. Hart, and R.G. Stevens. 1999. Soil Test Interpretation Guide. Oregon State University, Corvallis, Oregon.

Moore, J. and T. Willrich. 1993. Manure management practices to reduce water pollution. Oregon State University, Corvallis, Oregon.

Sattell, R. et al. 1999. Nitrogen scavenging: using cover crops to reduce nitrate leaching in western Oregon. Oregon State University, Corvallis, Oregon.

Grazing and Pasture Management

Ursander, D. et al. 1997. Pastures for Profit: a guide to rotational grazing. University of Wisconsin, Madison, Wisconsin.

Erosion and Sediment Control

Hansen, H. and W. Trimmer. 1997. Irrigation runoff control strategies. Oregon State University, Corvallis, Oregon.

Trimmer, W. and H. Hansen. 1994. Irrigation scheduling. Oregon State University, Corvallis, Oregon.

Pesticide Management and Integrated Pest Management

Kerle, E.A., J.J. Jenkins, and P.A. Vogue. 1996. Understanding pesticide persistence and mobility for groundwater and surface water protection. Oregon State University, Corvallis, Oregon.

Menzies, G., C.B. MacConnell, and D. Havens. 1994. Integrated pest management: effective options for farmers.

Appendix G: Site Capability

Streamside vegetation generally affects water quality. The primary water quality-related functions provided by streamside vegetation are shade, bank stability, filtration of sediment and nutrients, and infiltration of runoff water. Absent of human influence, different riparian sites have varying abilities to support these functions. This ability is referred to as **site potential**, or the highest ecological status an area can attain. The site potential is influenced by physical and biological factors such as elevation, aspect, geology, climate, and the current plant community. It is also influenced by disturbances found in riparian systems, such as flooding, and the complex variation of these disturbances.

Site conditions that affect the establishment and development of streamside vegetation are further modified by human infrastructure, such as roads, power and telephone lines, and irrigation and drainage systems. When infrastructure limits a site's ability to achieve or maintain its vegetative potential, the resulting condition is called the **site capability**. This capability determines what can be expected in terms of vegetation, such as the types of bank-stabilizing shrub species, and the functions the site can provide.

Example

Historically, Llama Creek meandered through a narrow coastal valley until it reached the Pacific Ocean. Historical vegetation along Llama Creek included a canopy of Douglas fir, western red cedar, big leaf maple and alder in the headwaters, and a combination of alder, willow, red osier dogwood, grasses, and sedges in the lower reaches (site potential). The vegetation provided many functions, including shade, bank stability, infiltration of runoff water, and filtration of sediment and nutrients.

In the upper reaches of Llama Creek, there are generally more of the younger age classes and less of the older age classes of vegetation than there were historically, but vegetation is still composed mostly of Douglas fir, western red cedar, big leaf maple and alder. Streamside sites in upper Llama Creek are still able to produce plant communities that were historically present, and those plant communities provide the water quality-related functions listed above.

Over the past few decades, the lower reaches of Llama Creek were channelized and straightened. As a result, streambanks eroded, lower Llama Creek became much wider and shallower, and the water table dropped. Presently, lower Llama Creek is capable of supporting those plant species that can establish and grow under the constraints of a lower water table and competitive pressure from invasive plant species. Depending on the site, the plant community will likely include blackberry, native shrubs, herbaceous species, and tree species capable of establishing and growing in these modified conditions. Some sites dominated by blackberry and other invasive vegetation do not provide riparian functions at the same level as the historic plant community, but at other sites the vegetation still promotes infiltration of runoff water, filters sediment and nutrients from runoff, provides shade, and provides for some bank stability.

How site capability applies in an Agricultural Water Quality Management Area

Site capability can be applied in several ways in an Agricultural Water Quality Management Area. It can be used in voluntary conservation and outreach projects to illustrate the vegetation landowners might expect given a management regime and the capability of a site. For example, it could predict the likelihood of success of "passive restoration, " which involves reducing management pressure on the existing plant community, versus more "active restoration," which involves reducing management pressure, planting desirable vegetation, and/or controlling undesirable vegetation. Site capability can also predict the consequences or benefits of planting desirable species in specific locations in a riparian area. It can also help provide a clearer picture of the functions a near-stream area can be reasonably expected to provide given natural limiting factors such as soil type and climate, and legacy conditions such as channel deepening or streambank erosion associated with natural events or past management activities.

Appendix H: Factors that Affect Stream Temperature

(Krueger et al, 1999)

Physical

Weather
Season
Year
Climate
Cloudiness
Wind
Position on the landscape
Microclimate
Time of day/angle of the sun
Sunlight, shade, reflection
Daytime/nighttime temperatures
Morning temperature
Elevation
Soil temperature
Air temperature
Latent heat
Time of exposure
Penetration of light (short vs. long waves)

Stream Structure

Morphology (differing potentials)
Flow
Gradient
Depth
Volume
Width
Sinuosity
Ponds, glides, riffles (mixing)

Local

Storage (dams)
Effluent (interflow)
Influent
Hyporrheic
Soil structure
Soil physics/geology
Streambed
Temperature at the source
Physical limits to heating
Roughness
Debris
Refugia (variation in stream)
Catastrophic events
Condition of uplands
Vegetation +/- (potentials)
Bank stability
Turbidity/pollution

Management

Land uses (roads, agriculture, forestry)
Water management (regulated flows)
Irrigation +/-