Upper Willamette and Upper Siuslaw Agricultural Water Quality Management Area Plan

Developed by the:

Upper Willamette and Upper Siuslaw Local Advisory Committee

Oregon Department of Agriculture

With support from the:

Upper Willamette Soil and Water Conservation District

Date: December 2, 2015

ODA and SWCD Contact Information

Oregon Department of Agriculture
Water Quality Program
635 Capitol Street NE
Salem, Oregon 97301
Phone: (503) 986-4700
http://www.oregon.gov/ODA/Pages/default.aspx

Upper Willamette SWCD
780 Bailey Hill Road, Suite 5
Eugene, OR 97402
Phone: (541) 465-6436, ext. 102
http://www.uwswcd.org

Table of Contents

Acronyms and Terms Used in this Document ii

Foreword 2

Required Elements of Area Plans 2

Plan Content 2

Chapter 1: Agricultural Water Quality Management Program Purpose and Background 4

1.1 Purpose of Agricultural Water Quality Management Program and Applicability of Area Plans 4

1.2 History of the Ag Water Quality Program 4

1.3 Roles and Responsibilities 5

1.3.1 Oregon Department of Agriculture (ODA) 5

1.3.2 Local Management Agency 8

1.3.3 Local Advisory Committee (LAC) 8

1.3.4 Agriculture's Role 8

1.3.5 Public Participation 9

1.4 Agricultural Water Quality 9

1.4.1 Point and Nonpoint Sources of Water Pollution 9

1.4.2 Beneficial Uses and Parameters of Concern 9

1.4.3 Impaired Water Bodies and Total Maximum Daily Loads (TMDLs) 10

1.4.4 Water Pollution Control Law – ORS 468B.025 and ORS 468B.050 10

1.4.5 Streamside Vegetation and Agricultural Water Quality 11

1.5 Other Water Quality Programs 12

1.5.1 Confined Animal Feeding Operation (CAFO) 12

1.5.2 Groundwater Management Areas 13

1.5.3 The Oregon Plan for Salmon and Watersheds 13

1.5.4 Pesticide Management and Stewardship 13

1.5.5 Drinking Water Source Protection 14

1.5.6 Oregon's Coastal Management Program and the Coastal Zone Management Act Reauthorization Amendments of 1990 14

1.6 Partner Agencies and Organizations 14

1.6.1 Oregon Department of Environmental Quality (DEQ) 14

1.6.2 Other Partners 15

1.7 Measuring Progress 15

1.7.1 Measurable Objectives 15

1.7.2 Land Condition and Water Quality 16

1.7.3 Focused Implementation in Small Geographic Areas 16

1.8 Implementation, Monitoring, Evaluation, and Adaptive Management 17

1.8.1 Statewide Aerial Photo Monitoring of Streamside Vegetation 17

1.8.2 Agricultural Ambient Water Quality Monitoring Assessment 17

1.8.3 Biennial Reviews and Adaptive Management 18

Chapter 2: Local Background 20

2.1 Local Roles and Responsibilities 20

2.1.1 Local Advisory Committee (LAC) 20

2.1.2 Local Management Agency 20
2.2 Area Plan and Regulations: Development and History 20
2.3 Geographical and Physical Setting 21
2.3.1 Location, Water Resources, Land Use, Land Ownership, Agriculture 21
2.3.2 Geographic and Programmatic Scope 25
2.3.3 Map of the Management Area 26
2.4 Agricultural Water Quality in the Management Area 27
2.4.1 Local Issues of Concern 27
2.4.2 303(d) List of Impaired Water Bodies 27
2.4.3 Basin TMDLs and Agricultural Load Allocations 27
2.4.4 Beneficial Uses and Parameters of Concern 28
2.4.5 Sources of Impairment 29
2.5 Prevention and Control Measures 33
2.5.1 Nutrients and Manure Management 34
2.5.2 Streamside Area Management 37
2.5.3 Soil Erosion Prevention and Control 39
2.5.4 Pesticides 42
2.5.5 Optional Issues: Upland Management, Irrigation Management, Livestock Management 43

Chapter 3: Goals, Objectives, and Strategies 46
Goal 46
3.1 Measurable Objectives 46
3.2 Strategic Initiatives 46
3.2.1 Focus Area 46
3.2.2 Pesticide Stewardship Partnership 47
3.3 Strategies and Activities 49
3.3.1 Community and Landowner Outreach 49
3.3.2 Conservation Planning and Conservation Activities 51
3.3.3 Funding 52
3.4 Monitoring and Evaluation 53

Chapter 4: Implementation, Monitoring, and Adaptive Management 54
4.1 Progress Toward Measurable Objectives 54
4.2 Progress on Strategic Initiatives 54
4.2.1 Focus Area 54
4.2.2 Pesticide Stewardship Partnership 54
4.3 Activities and Accomplishments 55
4.4 Water Quality Monitoring—Status and Trends 60
4.4.1 DEQ Monitoring Update 60
4.4.2 ODA Aerial Photo Monitoring 64
4.4.3 Siuslaw Watershed Council Water Quality Monitoring 65
4.4.4 Southern Willamette Groundwater Management Area 65
4.5 Biennial Reviews and Adaptive Management 66

References 68

Appendix A: 2010 303(d) List for Upper Willamette and Upper Siuslaw 74

Appendix B: Common Agricultural Water Quality Parameters of Concern 76

Appendix C: Conservation Funding Programs 78

Appendix D: Sources of Information and Technical Assistance **80**
Appendix E: Site Capability **84**

Acronyms and Terms Used in this Document

Ag Water Quality Program – Agricultural Water Quality Management Program
Area Plan – Agricultural Water Quality Management Area Plan
Area Rules – Agricultural Water Quality Management Area Rules
CAFO – Confined Animal Feeding Operation
CNPCP – Coastal Nonpoint Pollution Control Program
CWA – Clean Water Act
CZARA – Coastal Zone Act Reauthorization Amendments
DEQ – Oregon Department of Environmental Quality
GWMA – Groundwater Management Area
HUC – Hydrologic Unit Code
LAC – Local Advisory Committee
Management Area – Agricultural Water Quality Management Area
MOA – Memorandum of Agreement
NPDES – National Pollution Discharge Elimination System
NRCS – Natural Resources Conservation Service
OAR – Oregon Administrative Rules
ODA – Oregon Department of Agriculture
ODFW – Oregon Department of Fish and Wildlife
OHA – Oregon Health Authority
ORS – Oregon Revised Statute
OWEB – Oregon Watershed Enhancement Board
PMP – Pesticides Management Plan
PSP – Pesticides Stewardship Partnership
Regulations – Agricultural Water Quality Management Area Regulations
RUSLE – Revised Universal Soil Loss Equation
SWCD – Soil and Water Conservation District
T – Soil Loss Tolerance Factor
TMDL – Total Maximum Daily Load
USDA – United States Department of Agriculture
US EPA – United States Environmental Protection Agency
WQPMT – Water Quality Pesticides Management Team

Foreword

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

The Area Plan is neither regulatory nor enforceable (Oregon Revised Statute (ORS) 568.912(1)). It references associated Agricultural Water Quality Management Area Rules (Area Rules), which are Oregon Administrative Rules (OARs) that are enforced by the Oregon Department of Agriculture (ODA).

Required Elements of Area Plans

Area Plans must describe a program to achieve the water quality goals and standards necessary to protect designated beneficial uses related to water quality as required by state and federal law (OAR 603-090-0030(1)). At a minimum, an Area Plan must:

- Describe the geographical area and physical setting of the Management Area.
- List water quality issues of concern.
- List impaired beneficial uses.
- State that the goal of the Area Plan is to prevent and control water pollution from agricultural activities and soil erosion and to achieve applicable water quality standards.
- Include water quality objectives.
- Describe pollution prevention and control measures deemed necessary by ODA to achieve the goal.
- Include an implementation schedule for measures needed to meet applicable dates established by law.
- Include guidelines for public participation.
- Describe a strategy for ensuring that the necessary measures are implemented.

Plan Content

Chapter 1: Agricultural Water Quality Management Program Purpose and Background. The purpose is to have consistent and accurate information about the Ag Water Quality Program.

Chapter 2: Local Background. Provides the local geographic, water quality, and agricultural context for the Management Area. Describes the water quality issues, Agricultural Water Quality Management Area Rules (Area Rules), and available or effective practices to address water quality issues.

Chapter 3: Local Goals, Objectives, and Implementation Strategies. Presents goal(s), measurable objectives, and timelines, along with strategies to achieve these goal(s) and objectives.

Chapter 4: Local Implementation, Monitoring, and Adaptive Management. Summarizes land condition and water quality status and trends to assess progress toward the goals and objectives in Chapter 3.

Chapter 1: Agricultural Water Quality Management Program Purpose and Background

1.1 Purpose of Agricultural Water Quality Management Program and Applicability of Area Plans

As part of Oregon's Agricultural Water Quality Management Program (Ag Water Quality Program), the Area Plan guides landowners and partners such as Soil and Water Conservation Districts (SWCDs) in addressing water quality issues due to agricultural activities. The purpose of the Area Plan is to identify strategies to prevent and control water pollution from agricultural activities and soil erosion (ORS 568.909(2)) on agricultural and rural lands for the area within the boundaries of this Management Area (OAR 603-090-0000(3)) and to achieve and maintain water quality standards (ORS 561.191(2)). The Area Plan has been developed and revised by ODA and the Agricultural Water Quality Management Area Local Advisory Committee (LAC), with support and input from the SWCD and the Oregon Department of Environmental Quality (DEQ). The public was invited to participate in the original development and approval of the Area Plans and is invited to participate in the biennial review process. The Area Plan is implemented using a combination of outreach, conservation and management activities, compliance with Area Rules developed to implement the Area Plan, monitoring, evaluation, and adaptive management.

The provisions of the Area Plan do not establish legal requirements or prohibitions (ORS 568.912(1)). Each Area Plan is accompanied by Area Rules that describe local agricultural water quality regulatory requirements. ODA will exercise its regulatory authority for the prevention and control of water pollution from agricultural activities under the Ag Water Quality Program's general regulations (OAR 603-090-0000 to 603-090-0120) and under the Area Rules for this Management Area (OAR 603-095-095-2600 to 603-095-2660. The Ag Water Quality Program's general rules guide the Ag Water Quality Program, and the Area Rules for the Management Area are the regulations that landowners are required to follow.

The Area Plan and its associated regulations apply to all agricultural activities on non-federal and non-Tribal Trust land within this Management Area, including:

- Farms and ranches.
- Rural properties grazing a few animals or raising crops.
- Agricultural lands that lay idle or on which management has been deferred.
- Agricultural activities in urban areas.
- Agricultural activities on land subject to the Forest Practices Act (ORS 527.610).

1.2 History of the Ag Water Quality Program

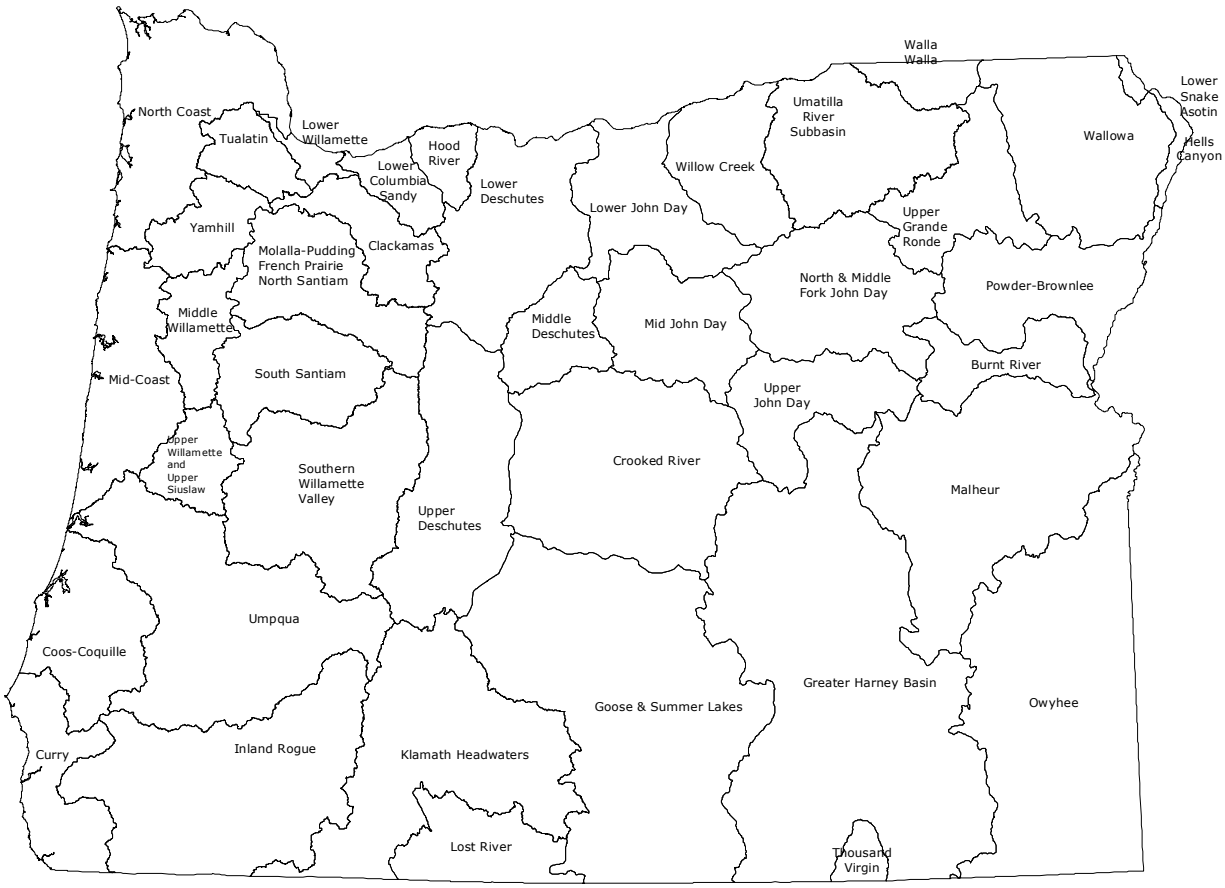
In 1993, the Oregon Legislature passed the Agricultural Water Quality Management Act (formerly known as "Senate Bill 1010") directing ODA to develop plans to prevent and control water pollution from agricultural activities, soil erosion, and to achieve water quality standards (ORS 568.900 through ORS 568.933). Senate Bill 502 was passed in 1995 to clarify that ODA regulates agriculture with respect to water quality (ORS 561.191). The Area Plan and its associated Area Rules were developed and subsequently revised pursuant to these statutes.

Between 1997 and 2004, ODA worked with LACs and SWCDs to develop Area Plans and associated Area Rules in 38 watershed-based Management Areas across Oregon (Figure 1). Since 2004, ODA, LACs, SWCDs, and other partners have focused on implementation including:

- Providing education, outreach, and technical assistance to landowners.
- Implementing projects to improve agricultural water quality.

- Investigating complaints of potential violations of Area Rules.
- Conducting biennial reviews of Area Plans and associated Area Rules.
- Monitoring, evaluation, and adaptive management.
- Developing partnerships with SWCDs, state and federal agencies, tribes, watershed councils, and others.

Figure 1: Map of 38 Agricultural Water Quality Management Areas



1.3 Roles and Responsibilities

1.3.1 Oregon Department of Agriculture (ODA)

The Oregon Department of Agriculture is the agency responsible for implementing the Ag Water Quality Program (ORS 568.900 to 568.933, ORS 561.191, OAR 603-090, and OAR 603-095). The Ag Water Quality Program was established to develop and carry out a water quality management plan for the prevention and control of water pollution from agricultural activities and soil erosion. State and federal laws that are drivers for establishing an Ag Water Quality Management Plan include:

- State water quality standards.
- Load allocations for agricultural nonpoint source pollution assigned under Total Maximum Daily Loads (TMDLs) issued pursuant to the Clean Water Act (CWA), Section 303(d).
- Approved management measures for Coastal Zone Act Reauthorization Amendments (CZARA).

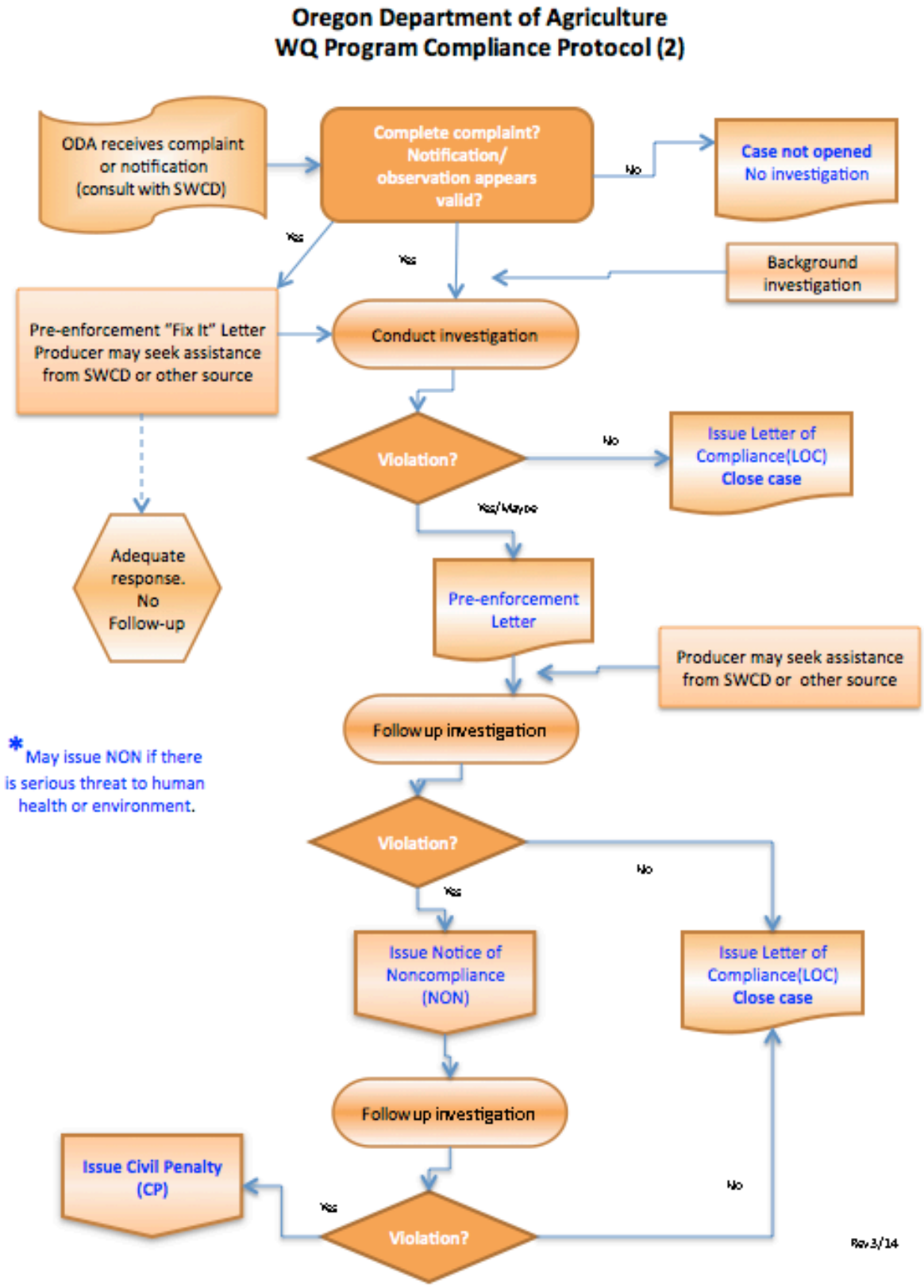
- Agricultural activities detailed in a Groundwater Management Area (GWMA) Action Plan (if a GWMA has been established and an Action Plan developed).

The Oregon Department of Agriculture has the legal authority to develop and implement Area Plans and associated Area Rules for the prevention and control of water pollution from agricultural activities and soil erosion, where such plans are required by state or federal law (ORS 568.909 and ORS 568.912). ODA bases Area Plans and Area Rules on scientific information (ORS 568.909). ODA works in partnership with SWCDs, LACs, DEQ, and other partners to implement, evaluate, and update the Area Plans and Area Rules. ODA has responsibility for any actions related to enforcement or determination of noncompliance with rules (OAR 603-090-0080 through OAR 603-090-0120). ORS 568.912(1) and ORS 568.912(2) give ODA the authority to adopt rules that require landowners to perform actions necessary to prevent and control pollution from agricultural activities and soil erosion.

The emphasis of the Area Plan is on voluntary action by landowners or operators to control the factors affecting water quality in the Management Area. The Area Rules are outlined as a set of minimum standards that landowners and operators must be meet on all agricultural or rural lands.

ODA will use enforcement where appropriate and necessary to gain compliance with agricultural water quality rules. Figure 2 outlines ODA's compliance process. Any enforcement action will be pursued only when reasonable attempts at voluntary solutions have failed (OAR 603-090-0000(5)(e)). If a violation is documented, ODA may issue a pre-enforcement notification or an Order such as a Notice of Noncompliance. If a Notice of Noncompliance is issued, ODA will direct the landowner or operator to remedy the condition through required corrective actions (RCAs) under the provisions of the enforcement procedures outlined in OAR 603-090-060 through OAR 603-090-120. If a landowner does not implement the RCAs, civil penalties may be assessed for continued violation of the rules. See the Compliance Flow Chart for a diagram of the compliance process. If and when other governmental policies, programs, or rules conflict with the Area Plan or associated Area Rules, ODA will consult with the appropriate agency to resolve the conflict in a reasonable manner.

Figure 2: Compliance Flow Chart



1.3.2 Local Management Agency

A Local Management Agency (LMA) is an organization that ODA designated to implement an Area Plan (OAR 603-090-0010). The Oregon legislature's intent is for SWCDs to be LMAs, to the fullest extent practical, consistent with the timely and effective implementation of Area Plans (ORS 568.906). SWCDs have a long history of effectively assisting landowners to voluntarily address natural resource concerns. Currently, all LMAs in Oregon are SWCDs.

The day-to-day implementation of the Area Plan is accomplished through an intergovernmental agreement between ODA and each SWCD. Each SWCD implements the Area Plan by providing outreach and technical assistance to landowners. SWCDs also work with ODA and the LAC to establish implementation priorities, evaluate progress toward meeting Area Plan goals and objectives, and revise the Area Plan and associated regulations as needed.

1.3.3 Local Advisory Committee (LAC)

For each Management Area, the director of ODA appoints an LAC (OAR 603-090-0020) with as many as 12 members to assist with the development and subsequent biennial reviews of the local Area Plan and associated Area Rules. The LAC serves in an advisory role to the director of ODA and to the Board of Agriculture. LACs are composed primarily of agricultural landowners in the Management Area and must reflect a balance of affected persons.

The LAC may meet as frequently as necessary to carry out their responsibilities, which include but are not limited to:

- Participate in the development and ongoing revisions of the Area Plan.
- Participate in the development and revisions of the Area Rules.
- Recommend strategies necessary to achieve the goals and objectives in the Area Plan.
- Participate in biennial reviews of the progress of implementation of the Area Plan and Area Rules.
- Submit written biennial reports to the Board of Agriculture and the ODA director.

1.3.4 Agriculture's Role

Each individual landowner or operator in the Management Area is required to comply with the Area Rules, which set minimum standards. However, the rules alone may not be enough in every Management Area. Each landowner and operator in the Management Area is required to comply with the Area Rules. Landowners also are encouraged to engage in restoration activities to achieve the goals and objectives of the Area Plan. Each landowner and operator's actions will contribute toward achievement of the water quality standards.

Technical and financial assistance is available to landowners who want to work with SWCDs (or other local partners) to achieve land conditions that contribute to good water quality. Landowners also may choose to improve their land conditions without assistance.

Under the Area Plan and associated Area Rules, agricultural landowners and operators are not responsible for mitigating or addressing factors that do not result from agricultural activities, such as:

- Conditions resulting from unusual weather events.
- Hot springs, glacial melt water, extreme or unforeseen weather events, and climate change.
- Septic systems and other sources of human waste.
- Public roadways, culverts, roadside ditches and shoulders.

- Dams, dam removal, hydroelectric plants, and non-agricultural impoundments.
- Housing and other development in agricultural areas.
- Other circumstances not within the reasonable control of the landowner or operator.

However, agricultural landowners or operators may be responsible for some of these impacts under other legal authorities.

1.3.5 Public Participation

The public was encouraged to participate when ODA, LACs, and SWCDs initially developed the Area Plans and Area Rules. In each Management Area, ODA and the LAC held public information meetings, a formal public comment period, and a formal public hearing. ODA and the LACs modified the Area Plans and Area Rules, as needed, to address comments received. The director of ODA adopted the Area Plans and Area Rules in consultation with the Board of Agriculture.

The Oregon Department of Agriculture, LACs, and SWCDs conduct biennial reviews of the Area Plans and Area Rules. Partners, stakeholders, and the general public are invited to participate in the process. Any future revisions to the Area Rules will include a formal public comment period and a formal public hearing.

1.4 Agricultural Water Quality

1.4.1 Point and Nonpoint Sources of Water Pollution

There are two types of water pollution. Point source water pollution emanates from clearly identifiable discharge points or pipes. Significant point sources are required to obtain permits that specify their pollutant limits. Agricultural operations regulated as point sources include permitted CAFOs, and many are regulated under ODA's CAFO Program. Pesticide applications in, over, or within three feet of water also are regulated as point sources. Irrigation water discharges from agricultural fields may be at a defined discharge point but they do not currently require a permit.

Nonpoint water pollution originates from the general landscape and is difficult to trace to a single source. Nonpoint water pollution sources include runoff from agricultural and forest lands, urban and suburban areas, roads, and natural sources. In addition, groundwater can be impacted from nonpoint sources including agricultural amendments (fertilizers and manure).

1.4.2 Beneficial Uses and Parameters of Concern

Beneficial uses related to water quality are defined by DEQ in OARs for each basin. They may include: public and private domestic water supply, industrial water supply, irrigation, livestock watering, fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation, aesthetic quality, hydropower, and commercial navigation and transportation. The most sensitive beneficial uses usually are fish and aquatic life, water contact recreation, and public and private domestic water supply. These uses generally are the first to be impaired because they are affected at lower levels of pollution. While there may not be severe impacts on water quality from a single source or sector, the combined effects from all sources can contribute to the impairment of beneficial uses in the Management Area. Beneficial uses that have the potential to be impacted in this Management Area are summarized in Chapter 2.

Many water bodies throughout Oregon do not meet state water quality standards. Many of these water bodies have established water quality management plans that document needed pollutant reductions. The most common water quality concerns related to agricultural activities are temperature, bacteria, biological

criteria, sediment and turbidity, phosphorous, algae, pH, dissolved oxygen, harmful algal blooms, nitrates, pesticides, and mercury. These parameters vary by Management Area and are summarized in Chapter 2.

1.4.3 Impaired Water Bodies and Total Maximum Daily Loads (TMDLs)

Every two years, the DEQ is required by the federal Clean Water Act (CWA) to assess water quality in Oregon. CWA Section 303(d) requires DEQ to identify a list of waters that do not meet water quality standards. The resulting list is commonly referred to as the 303(d) list. DEQ, in accordance with the CWA, is required to establish TMDLs for pollutants on the 303(d) list.

A TMDL includes an assessment of water quality data and current conditions and describes a plan to restore polluted waterways to conditions that meet water quality standards. TMDLs specify the daily amount of pollution that a water body can receive and still meet water quality standards. Through the TMDL, point sources are assigned pollution limits as "waste load allocations" in permits, while nonpoint sources (agriculture, forestry, and urban) are assigned pollution limits as "load allocations." TMDLs are legal orders issued by the DEQ, so parties assigned waste or load allocations are legally required to meet them. The agricultural sector is responsible for meeting the pollution limit (load allocation) assigned to agriculture specifically, or to nonpoint sources in general, as applicable.

Total Maximum Daily Loads generally apply to an entire basin or subbasin, and not just to an individual water body on the 303(d) list. Once a TMDL is developed for a basin, the basin's impaired water bodies are removed from the 303(d) list, but they remain on the list of impaired water bodies. When data show that water quality standards have been achieved, water bodies will be identified on the list of water bodies that are attaining water quality standards.

As part of the TMDL process, DEQ identifies the Designated Management Agency or parties responsible for submitting TMDL implementation plans. TMDLs designate that the local Area Plan is the implementation plan for the agricultural component of the TMDLs that apply to this Management Area. Biennial reviews and revisions to the Area Plan and regulations must address agricultural or nonpoint source load allocations from TMDLs.

The list of impaired water bodies (303(d) list), the TMDLs, and the agricultural load allocations for the TMDLs that apply to this Management Area are summarized in Chapter 2.

1.4.4 Water Pollution Control Law – ORS 468B.025 and ORS 468B.050

In 1995, the Oregon Legislature passed ORS 561.191. This statute states that any program or rules adopted by ODA "shall be designed to assure achievement and maintenance of water quality standards adopted by the Environmental Quality Commission."

To implement the intent of ORS 561.191, ODA incorporated ORS 468B into all of the Area Rules.

ORS 468B.025 states that:

> "(1) ...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.

(2) No person shall violate the conditions of any waste discharge permit issued under ORS 468B.050."

The aspects of ORS 468B.050 that apply to the Ag Water Quality Program, state that:

"(1) Except as provided in ORS 468B.053 or 468B.215, without holding a permit from the Director of the Department of Environmental Quality or the State Department of Agriculture, which permit shall specify applicable effluent limitations, a person may not:

(a) Discharge any wastes into the waters of the state from any industrial or commercial establishment or activity or any disposal system."

Definitions used in ORS 468B.025 and 468B.050:

"Wastes" means 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. Additionally, OAR 603-095-0010(53) includes but is not limited to commercial fertilizers, soil amendments, composts, animal wastes, vegetative materials, or any other wastes.

"Pollution or water pollution" means 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.

"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 affect a junction with natural surface or underground waters), which are wholly or partially within or bordering the state or within its jurisdiction.

1.4.5 Streamside Vegetation and Agricultural Water Quality

Across Oregon, the Ag Water Quality Program emphasizes streamside vegetation protection and enhancement to prevent and control water pollution from agriculture activities and to prevent and control soil erosion. Streamside vegetation can provide three primary water quality functions: shade for cooler stream temperatures, streambank stability, and filtration of pollutants. Other water quality functions from streamside vegetation include: water storage for cooler and later season flows, sediment trapping that can build streambanks and floodplains, narrowing and deepening of channels, and biological uptake of sediment, organic material, nutrients, and pesticides.

Additional reasons for the Ag Water Quality Program's emphasis on streamside vegetation include:

- Streamside vegetation improves water quality related to multiple pollutants, including: temperature (heat), sediment, bacteria, nutrients, toxics, and pesticides.

- Streamside vegetation provides fish and wildlife habitat.
- Landowners can improve streamside vegetation in ways that are compatible with their operation. Streamside conditions may be improved without the removal of the agricultural activity, such as with managed grazing.
- Streamside vegetation condition is measureable and can be used to track progress in achieving desired site conditions.

Site-Capable Vegetation

The Ag Water Quality Program uses the concept of "site-capable vegetation" to describe the vegetation that agricultural streams can provide to protect water quality. Site-capable vegetation is the vegetation that can be expected to grow at a particular site, given natural site factors (e.g., elevation, soils, climate, hydrology, wildlife, fire, floods), and historical and current human influences (e.g., channelization, roads, modified flows, previous land management). Site-capable vegetation can be determined for a specific site based on: current streamside vegetation at the site, streamside vegetation at nearby reference sites with similar natural characteristics, Natural Resources Conservation Service (NRCS) soil surveys and ecological site descriptions, and local or regional scientific research. ODA does not consider invasive, non-native plants such as introduced varieties of reed canary grass and blackberry to be site-capable vegetation.

The goal for Oregon's agricultural landowners is to provide the water quality functions (e.g., shade, streambank stability, and filtration of pollutants) produced by site-capable vegetation along all streams flowing through agricultural lands. The agricultural water quality regulations for each Management Area require that agricultural activities provide the water quality functions equivalent to what site-capable vegetation would provide.

In some cases, for narrow streams, mature site-capable vegetation such as tall trees may not be needed. For example, shrubs and grass may provide shade, protect streambanks, and filter pollutants. However, on larger streams, mature site-capable vegetation is needed to provide the water quality functions.

1.5 Other Water Quality Programs

The following programs complement the Ag Water Quality Management Program and are described here to recognize their link to agricultral lands.

1.5.1 Confined Animal Feeding Operation (CAFO)

Oregon Department of Agriculture is the lead state agency for the CAFO Program. The CAFO Program was developed to ensure that operators do not contaminate ground or surface water with animal manure. Since the early 1980s, CAFOs in Oregon have been registered to a general Water Pollution Control Facility permit designed to protect water quality, while allowing the operators and producers to remain economically viable. A properly maintained CAFO does not pollute ground or surface water. To assure continued protection of ground and surface water, the 2001 Oregon State Legislature directed ODA to convert the CAFO Program from a Water Pollution Control Facility permit program to a federal National Pollutant Discharge Elimination System (NPDES) program. Oregon Department of Agriculture and DEQ jointly issue the NPDES CAFO Permit, which complies with all CWA requirements for CAFOs. This permit does allow discharge in certain circumstances as long as the discharge does not violate water quality standards.

Oregon NPDES CAFO permits require the registrant to operate according to a site-specific, ODA-approved, Animal Waste Management Plan that is incorporated into the NPDES CAFO permit by reference.

1.5.2 Groundwater Management Areas

Groundwater Management Areas are designated by DEQ where groundwater has elevated contaminant concentrations resulting, at least in part, from nonpoint sources. After the GWMA is declared, a local groundwater management committee comprised of affected and interested parties is formed. The committee works with and advises the state agencies that are required to develop an action plan that will reduce groundwater contamination in the area.

Oregon has designated three GWMAs because of elevated nitrate concentrations in groundwater: the Lower Umatilla Basin GWMA, the Northern Malheur County GWMA, and the Southern Willamette Valley GWMA. Each GWMA has a voluntary action plan to reduce nitrate concentrations in groundwater. After a scheduled evaluation period, if DEQ determines that the voluntary approach is not effective, then mandatory requirements may become necessary.

1.5.3 The Oregon Plan for Salmon and Watersheds

In 1997, Oregonians began implementing the Oregon Plan for Salmon and Watersheds, referred to as the Oregon Plan (www.oregon-plan.org). The Oregon Plan seeks to restore native fish populations, improve watershed health, and support communities throughout Oregon. The Oregon Plan has a strong focus on salmonids because of their great cultural, economic, and recreational importance to Oregonians and because they are important indicators of watershed health. ODA's commitment to the Oregon Plan is to develop and implement Area Plans and associated Area Rules throughout Oregon.

1.5.4 Pesticide Management and Stewardship

The ODA Pesticides Program holds the primary responsibility for registering pesticides and regulating their use in Oregon under the Federal Insecticide Fungicide Rodenticide Act. ODA's Pesticide Program administers regulations relating to pesticide sales, use, and distribution, including pesticide operator and applicator licensing as well as proper application of pesticides, pesticide labeling, and registration.

In 2007, the interagency Water Quality Pesticide Management Team (WQPMT) was formed to expand efforts to improve water quality in Oregon related to pesticide use. The WQPMT includes representation from ODA, Oregon Department of Forestry (ODF), DEQ, and Oregon Health Authority (OHA). The WQPMT facilitates and coordinates activities such as monitoring, analysis and interpretation of data, effective response measures, and management solutions. The WQPMT relies on monitoring data from the Pesticides Stewardship Partnership (PSP) program and other monitoring programs to assess the possible impact of pesticides on Oregon's water quality. Pesticide detections in Oregon's streams can be addressed through multiple programs and partners, including the PSP program.

Through the PSP, state agencies and local partners work together to monitor pesticides in streams and to improve water quality (www.deq.state.or.us/wq/pesticide/pesticide.htm). ODA, Department of Environmental Quality, and Oregon State University Extension Service work with landowners, SWCDs, watershed councils, and other local partners to voluntarily reduce pesticide levels while improving water quality and crop management. Since 2000, the PSPs have made noteworthy progress in reducing pesticide concentrations and detections.

Oregon Department of Agriculture led the development and implementation of a Pesticides Management Plan (PMP) for the state of Oregon (www.oregon.gov/ODA/programs/Pesticides/water/pages/AboutWaterPesticides.aspx). The PMP, completed in 2011, strives to protect drinking water supplies and the environment from pesticide contamination, while recognizing the important role that pesticides have in maintaining a strong state

economy, managing natural resources, and preventing human disease. By managing the pesticides that are approved for use by the United States Environmental Protection Agency (US EPA) and Oregon in agricultural and non-agricultural settings, the PMP sets forth a process for preventing and responding to pesticide detections in Oregon's ground and surface water resources.

1.5.5 Drinking Water Source Protection

Oregon implements its drinking water protection program through a partnership between DEQ and OHA. The program provides individuals and communities with information on how to protect the quality of Oregon's drinking water. Department of Environmental Quality and OHA encourage preventive management strategies to ensure that all public drinking water resources are kept safe from current and future contamination. For more information, see: www.deq.state.or.us/wq/dwp/dwp.htm.

1.5.6 Oregon's Coastal Management Program and the Coastal Zone Management Act Reauthorization Amendments of 1990

The mission of the Oregon Coastal Management Program is to work in partnership with coastal local governments, state and federal agencies, and other partners and stakeholders to ensure that Oregon's coastal and ocean resources are managed, conserved, and developed consistent with statewide planning goals. Oregon's Coastal Nonpoint Pollution Control Program (CNPCP) has been developed in compliance with requirements of Section 6217 of the federal CZARA. The US EPA and the National Oceanic and Atmospheric Administration (NOAA) administer CZARA at the federal level. The federal requirements are designed to restore and protect coastal waters from nonpoint source pollution and require coastal states to implement a set of management measures based on guidance published by the US EPA. The guidance contains measures for agricultural activities, forestry activities, urban areas, marinas, hydro-modification activities, and wetlands. In Oregon, the Department of Land Conservation and Development and DEQ coordinate the program. The geographical boundaries for the CNPCP include the North Coast, Mid-Coast, South Coast, Rogue, and Umpqua basins. Oregon has identified the ODA coastal Area Plans and associated regulations as the state's strategy to address agricultural measures. The Area Plan and associated regulations are designed to meet the requirements of CZARA and to implement agriculture's part of Oregon's CNPCP.

Additional information about CZARA and Oregon's CNPCP can be found at:
www.oregon.gov/LCD/OCMP/pages/watqual_intro.aspx

1.6 Partner Agencies and Organizations

1.6.1 Oregon Department of Environmental Quality (DEQ)

The US EPA delegated authority to Oregon to implement the federal CWA in our state. DEQ is the lead state agency with overall authority to implement the CWA in Oregon. DEQ coordinates with other state agencies, including ODA and ODF, to meet the requirements of the CWA. The Department of Environmental Quality set water quality standards and develops TMDLs for impaired waterbodies, which ultimately are approved or disapproved by the EPA. In addition, DEQ develops and coordinates programs to address water quality including NPDES permits for point sources, the CWA Section 319 grant program, Source Water Protection, the CWA Section 401 Water Quality Certification, and GWMAs. DEQ also coordinates with ODA to help ensure successful implementation of Area Plans.

A Memorandum of Agreement (MOA) between DEQ and ODA recognizes that ODA is the state agency responsible for implementing the Ag Water Quality Program. ODA and DEQ updated the MOA in 2012.

The MOA includes the following commitments:

- ODA will develop and implement a monitoring strategy, as resources allow, in consultation with DEQ.
- ODA will evaluate the effectiveness of Area Plans and associated Area Rules in collaboration with DEQ.
    - ODA will determine the percentage of lands achieving compliance with Management Area Rules.
    - ODA will determine whether the target percentages of lands meeting the desired land conditions, as outlined in the goals and objectives of the Area Plans, are being achieved.
- ODA and DEQ will review and evaluate existing information to determine:
    - Whether additional data are needed to conduct an adequate evaluation.
    - Whether existing strategies have been effective in achieving the goals and objectives of the Area Plans.
    - Whether the rate of progress is adequate to achieve the goals of the Area Plans.

The Environmental Quality Commission, which serves as DEQ's policy and rulemaking board, may petition ODA for a review of part or all of any Area Plan or its associated Area Rules. The petition must allege, with reasonable specificity, that the Area Plan or Area Rules are not adequate to achieve applicable state and federal water quality standards (ORS 568.930(3)(a)).

1.6.2 Other Partners

Oregon Department of Agriculture and SWCDs work in close partnership with local, state, and federal agencies and organizations, including: DEQ (as indicated above), the United States Department of Agriculture (USDA) NRCS and Farm Service Agency, watershed councils, Oregon State University Agricultural Experiment Stations and Extension Service, tribes, livestock, and commodity organizations, conservation organizations, and local businesses. As resources allow, SWCDs and local partners provide technical, financial, and educational assistance to individual landowners for the design, installation, and maintenance of effective management strategies to prevent and control agricultural water pollution.

1.7 Measuring Progress

Agricultural landowners and operators have been implementing effective conservation projects and management activities throughout Oregon to improve water quality for many years. However, it has been challenging for ODA, SWCDs, and LACs to measure progress. ODA is working with SWCDs, LACs, and other partners to develop and implement strategies that will produce measurable outcomes. ODA also is working with partners to develop monitoring methods to document progress.

1.7.1 Measurable Objectives

A measurable objective is a numeric long-term desired outcome to achieve by a specified date. Milestones are the interim steps needed to make progress toward the measurable objective and consist of numeric short-term targets to reach by specific dates. Together, the milestones define the timeline needed to achieve the measurable objective.

After ODA, the LAC, and the LMA establish measurable objectives and associated milestones, they will evaluate progress toward the milestones at each biennial review of the Area Plan. Using adaptive management, the biennial review will evaluate progress toward the most recent milestone(s) and why they were or were not achieved. ODA, the LAC, and LMA will evaluate whether changes are needed to keep on track for achieving the longer-term measurable objective(s), and will revise strategies to address obstacles and challenges.

Measurable objectives allow the Ag Water Quality Program to better evaluate progress toward meeting water quality standards. Many of these measurable objectives relate to land conditions and primarily are implemented through focused work in small geographic areas (section 1.7.3), with a long-term goal of developing measurable objectives and monitoring methods at the Management Area scale. The measurable objectives and associated milestones for the Area Plan are in Chapter 3 and progress toward achieving the measurable objectives and milestones is summarized in Chapter 4.

1.7.2 Land Condition and Water Quality

Land conditions can serve as useful surrogates (indicators) for water quality parameters. For example, streamside vegetation generally is used as a surrogate for water temperature, because shade blocks solar radiation from warming the stream. In addition, sediment can be used as a surrogate for pesticides and nutrients, because many pesticides and nutrients adhere to sediment particles.

The Ag Water Quality Program focuses on land conditions, in addition to water quality data, for several reasons:

- Landowners can see land conditions and have direct control over them.
- It can be difficult to separate agriculture's influence on water quality from other land uses.
- Extensive monitoring of water quality is needed to evaluate progress, which is expensive and may fail to demonstrate improvements in the short term.
- Improved land conditions can be documented immediately, but there may be significant lag time before water quality improves or water quality impacts may be due to other sources.
- Reductions in water quality from agricultural activities are primarily through changes in land conditions and management activities.

Water quality monitoring data may help ODA and partners to measure progress or identify problem areas in implementing Area Plans. However, as described above, water quality monitoring may be less likely to document the short-term effects of changing land conditions on water quality parameters such as temperature, bacteria, nutrients, sediment, and pesticides.

1.7.3 Focused Implementation in Small Geographic Areas

Focus Areas

A Focus Area is a small watershed with water quality or concerns associated with agriculture. Through the Focus Area process, the SWCD delivers systematic, concentrated outreach and technical assistance in small geographic area. A key component of this approach is measuring land conditions before and after implementation, to document the progress made with available resources. The Focus Area approach is consistent with other agencies' and organizations' efforts to work proactively in small geographic areas, and is supported by a large body of scientific research (e.g., Council for Agricultural Science and Technology, 2012).

Systematic implementation in Focus Areas provides the following advantages:

- Measuring progress is easier in a small watershed than across an entire Management Area.
- Water quality improvement may be faster since small watersheds generally respond more rapidly.
- A proactive approach can address the most significant water quality concerns.
- Partners can coordinate and align technical and financial resources.
- Partners can coordinate and identify appropriate conservation practices and demonstrate their effectiveness.
- A higher density of projects allows neighbors to learn from neighbors.
- A higher density of projects leads to opportunities for increasing the connectivity of projects.

- Limited resources can be used more effectively and efficiently.
- Work in one Focus Area, followed by other Focus Areas, will eventually cover the entire Management Area.

Soil and Water Conservation Districts select a Focus Area in cooperation with ODA and other partners. In some cases, a Focus Area is selected because of efforts already underway or landowner relationships already established. The scale of the Focus Area matches the SWCD's capacity to deliver concentrated outreach and technical assistance, and to complete (or initiate) projects over a biennium. The current Focus Area for this Management Area is described in Chapter 3.

Working within a Focus Area is not intended to prevent implementation within the remainder of the Management Area. The SWCD will also continue to provide outreach and technical assistance to the entire Management Area.

Strategic Implementation Areas
Strategic Implementation Areas (SIAs) are small watersheds selected by ODA, in cooperation with partners based on a statewide review of water quality data and other available information. ODA conducts an evaluation of likely compliance with agricultural water quality regulations, and contacts landowners with the results and next steps. Landowners have the option of working with the SWCD or other partners to voluntarily address water quality concerns. ODA follows up, as needed, to enforce agricultural water quality regulations. Finally, ODA completes a post-assessment to document progress made in the watershed. Chapter 3 describes any SIAs that are underway in this Management Area.

1.8 Implementation, Monitoring, Evaluation, and Adaptive Management

ODA, the LAC and the LMA will assess the effectiveness of the Area Plan and associated Area Rules by evaluating the status and trends in agricultural land conditions and water quality data. This assessment will include an evaluation of progress toward measurable objectives on agricultural lands across the entire Management Area and within the Focus Area. ODA will utilize other agencies' and organizations' local monitoring data when available. The Area Plan summarizes the results and findings in Chapter 4 for each biennial review. ODA, DEQ, SWCDs, and LACs will examine these results during the biennial review and will revise the goal(s), measurable objectives, and strategies in Chapter 3, as needed.

1.8.1 Statewide Aerial Photo Monitoring of Streamside Vegetation

Starting in 2003, ODA began evaluating streamside vegetation conditions using aerial photos. Stream segments representing 10 to 15 percent of the agricultural lands in each Management Area were randomly selected for long-term aerial photo monitoring. Stream segments are generally 3-5 miles long. ODA evaluates streamside vegetation at specific points within 30-, 60-, and 90-foot bands along both sides of stream segments from the aerial photos and assigns each segment a score based on streamside vegetation. The score can range from 70 (all trees) to 0 (all bare ground). The same stream segments are re-photographed and re-scored every five years to evaluate changes in streamside vegetation conditions over time. Because site capable vegetation varies across the state, there is no single "correct" streamside vegetation index score. The purpose of this monitoring is to measure positive or negative change. The results for this Management Area are summarized in Chapter 4.

1.8.2 Agricultural Ambient Water Quality Monitoring Assessment

The Oregon Department of Agriculture evaluates water quality data from DEQ's long-term monitoring sites to determine trends in water quality at agricultural sites statewide. Results from monitoring sites in this Management Area, along with local water quality monitoring data, are described in Chapter 4.

1.8.3 Biennial Reviews and Adaptive Management

This and all Area Plans and associated Area Rules around the state undergo biennial reviews by ODA and the LAC. As part of each biennial review, ODA, DEQ, SWCDs, and the LAC discuss and evaluate the progress on implementation of the Area Plan and Area Rules. This evaluation includes discussion of enforcement actions, land condition and water quality monitoring, and outreach efforts over the past biennium. ODA and partners evaluate progress toward achieving measurable objectives, and revise implementation strategies as needed. The LAC submits a report to the Board of Agriculture and the Director of ODA describing progress and impediments to implementation, and recommendations for modifications to the Area Plan or associated Area Plans necessary to achieve the goal of the Area Plan. ODA and partners will use the results of this evaluation to update the measurable objectives and implementation strategies in Chapter 3.

Chapter 2: Local Background

2.1 Local Roles and Responsibilities

2.1.1 Local Advisory Committee (LAC)

This Area Plan was developed with the assistance of a LAC. The LAC was formed in 2001 to assist with the development of the Area Plan and regulations and with subsequent biennial reviews. Current LAC members are:

Name	Location	Description
Jerry Marguth, Chair	Junction City/Long Tom	Grass seed, vegetables, mint
Robin Pfeiffer, Vice-Chair	Junction City/ Long Tom	Wine grapes, timber
Rick Allison	Noti/Long Tom	Pasture, livestock, timber
Cleve Dumdi	Junction City/Long Tom	Pasture, livestock
Brian Parker	Junction City/Long Tom	Grass seed, flower, vegetable seed
Scott Gibson	Monroe/Long Tom	Grass seed, vegetables, mint, dairy
Tom Hunton	Junction City/Long Tom	Grass seed, mint
Barbara May	Eugene/Long Tom	Small acreage
Jan Nelson	Crow/Long Tom	Farm, forest
Jeff Levy	Lorane/Upper Siuslaw	Nursery
John Reerslev	Junction City/Long Tom	Grass seed, mint, sugar beet seed
Paul Reed, Alternate	Eugene/Long Tom	Rural resident

2.1.2 Local Management Agency

The implementation of this Area Plan is accomplished through an Intergovernmental Agreement between ODA and the Upper Willamette SWCD. This Intergovernmental Agreement defines the SWCD as the Local Management Agency for implementation of the Area Plan. The SWCD was also involved in development of the Area Plan and associated regulations.

2.2 Area Plan and Regulations: Development and History

The Director of ODA approved the Area Plan and regulations in 2003.

Since approval, the LAC met in 2003, 2007, 2009, 2011, 2013, and 2015 to review the Area Plan and regulations. The review process included assessment of the progress of Area Plan implementation toward achievement of plan goals and objectives.

When the draft for the initial Area Plan and Rules were complete, the Area Plan and Rules were presented to the public at two information sessions in December 2002, at a Long Tom Watershed Council meeting in January 2003, and in several local newspaper articles. ODA conducted a formal public comment period in January and February 2003, including two public hearings where members of the public could comment on the drafts. After the comment period, the LAC and ODA reviewed the comments and as appropriate made changes to the final plan and rules.

For the draft of the 2007 version of the Area Plan and Rules, notices of the review were provided to those on the Interested Parties List and to the Lane County Commissioners.

ODA, the Upper Willamette SWCD, and other partners continue to conduct outreach and education to the public and especially to agricultural producers. For more information on outreach and education efforts to take place after Area Plan and Rules completion, please consult Chapters 3 and 4 of the Area Plan.

During the 2015 biennial review, the Area Plan format was updated to be consistent with a format being used statewide, Upper Siuslaw Focus Area measurable objectives were added, Southern Willamette Valley Ground Water Management Area information was updated and information about the Coastal Zone Act Reauthorization Amendments (CZARA) was added.

2.3 Geographical and Physical Setting

2.3.1 Location, Water Resources, Land Use, Land Ownership, Agriculture

The Management Area is located in the southernmost part of the Willamette Valley west of the Willamette River. The Management Area includes most of the Long Tom watershed and the Upper Siuslaw watershed, as well as several small streams that drain directly into the Willamette River, including Spring Creek and Flat Creek. The area includes central Lane County and a small portion of Benton County; the cities of Eugene, Junction City, Monroe, and Veneta; and the rural communities of Crow, Elmira, Lorane, and Noti. The total size of the area is approximately 495,000 acres.

Long Tom River

The Long Tom River's headwaters are on the east side of the Coast Range near Noti. The river flows southeast for several miles through forestlands, rural residential areas, and small acreage farms until it reaches the Willamette Valley floor near Veneta. The river then flows northward through rural residential areas and small farms and empties into Fern Ridge Reservoir. Below Fern Ridge Dam, the river meanders northeast, mostly through large-scale commercial farms, and empties into the Willamette River at Norwood Island and Sam Daws Bend.

Coyote Creek, a major tributary to the Long Tom River, begins near Lorane and flows northwest through forest and small acreage agricultural lands before emptying into Fern Ridge Reservoir near Highway 126. Amazon Creek also supplies some of the water to Fern Ridge Reservoir. Much of the upper Amazon Creek watershed is within the city of Eugene.

Above Fern Ridge Reservoir, other major tributaries include Noti Creek and Elk Creek. Both of these watersheds are mostly forested with a few rural residential properties and mid-sized family farms.

Below Fern Ridge Dam, Ferguson and Bear creeks are major tributaries of the Long Tom. The headwaters for both streams are found in the Coast Range and much of the land in these watersheds is forested. These creeks also flow through agricultural and rural residential lands before emptying into the Long Tom River west of Junction City.

Spring Creek and Flat Creek

Spring and Flat creeks both begin near Santa Clara and flow north through industrial and agricultural lands before their confluence with the Willamette River. Flat Creek flows parallel to Amazon Creek and may mix with Amazon Creek and the Long Tom River during high-flow events (Thieman, 2000).

Table 1 lists major tributaries of the Long Tom and Siuslaw watersheds within the Management Area.

Table 1. Acreages and major tributaries of watersheds in the Management Area. (Thieman, 2000; Oregon Geospatial Data Clearinghouse, 2002)

Watershed	Area (acres)	Major tributaries
Long Tom River	257,584	Amazon Creek, Bear Creek, Coyote Creek, Elk Creek, Ferguson Creek, Spencer Creek
Upper Siuslaw River	200,554	Camp Creek, Douglas Creek, Letz Creek, South Fork, Walker Creek, Wildcat Creek, Wolf Creek

Upper Siuslaw River

The Siuslaw River also begins east of the Coast Range, but it flows west to the Pacific Ocean. The Upper Siuslaw is included as part of this Management Area, instead of the Mid Coast Management Area along with the Lower Siuslaw, because the agricultural land uses are more similar to those in the Upper Willamette.

From the confluence of the North and South forks west of Lorane, the Siuslaw River flows northwest until about Walton, loops around Bailey Ridge and Bald Mountain, then flows southwest until it reaches the ocean.

Except for an agricultural area around Lorane, most of the Upper Siuslaw watershed is forested. Agricultural lands in the Lorane Valley include family livestock and hay operations, vineyards, nurseries, and rural residential properties.

Major tributaries of the Siuslaw River within the Management Area include Wolf, Wildcat and Chickahominy creeks. There are also many small tributaries that flow directly into the Siuslaw from steep Coast Range slopes.

Southern Willamette Valley Groundwater Management Area (GWMA)

A small portion of the GWMA is within the Upper Willamette/Upper Siuslaw Agricultural Water Quality 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. From 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 its 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. Section 2.4.5 provides additional information about the GWMA and a map.

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 (Patching et al, 1987).

Soils in the Coast Range Mountains are 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 (Patching et al, 1987).

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 (Patching, 1987). 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 number of days between 32° F temperatures) is 150 to 180 days on the valley floor to 110 to 130 days in the foothills (Patching, 1987).

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. Most of the precipitation is in the form of rain on the Willamette Valley floor. The amount of snowfall increases with elevation.

Biological Resources

A variety of species depend on the Management Area's aquatic and upland habitats. In foothill and Coast Range forests, vegetation includes Douglas fir, western hemlock, grand fir, western red cedar, bigleaf maple, and Oregon white oak (Pojar and MacKinnon, 1994). Forest wildlife species include Roosevelt elk, blacktail deer, black bear, porcupine, voles, and a variety of resident and Neotropical migratory songbirds and raptors (Csuti et al, 1997). Much of the lowland areas were historically wet prairie or oak savannah and remnants of these areas are scattered throughout the lower Long Tom watershed and Lorane Valley. Vegetation in these habitats includes Oregon white oak, California black oak, red alder, Oregon ash, and a variety of grasses, rushes and sedges, and wildflowers. Wildlife species include the acorn woodpecker, western bluebird, sharptail and ringneck snakes, and several species of shrew. Lowland riparian and wetland vegetation in the Management Area includes Oregon ash, willow, red osier dogwood, black cottonwood, snowberry, serviceberry, Pacific ninebark, and wild rose (Guard, 1995). Aquatic and riparian-obligate species in the Management Area include beaver, western pond turtle, northern red-legged frog, Pacific tree frog, Oregon chub (Long Tom watershed, historically present), steelhead (Siuslaw watershed), cutthroat trout, coho (Siuslaw watershed), Pacific and brook lamprey, and other resident fish species. Migratory waterfowl, shorebirds, raptors, and songbirds are seasonally abundant throughout the area as well.

Land Use/Land Ownership

Agriculture and Forestry

Forestry and agriculture are the predominant land uses in the area. There are approximately 324,310 acres of forestlands in the area (Oregon Geospatial Data Clearinghouse, 2002). Most of the forestlands

are in the Coast Range and foothills. Major forest landowners and managers include the Bureau of Land Management, U.S. Forest Service, and many large and small private 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 is now a greater 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 Oregon Forest Practices Act, but have also made voluntary efforts to manage forestlands for multiple objectives including water quality.

Agricultural lands account for approximately 121,000 acres, or 25 percent of the Management Area (Oregon Geospatial Data Clearinghouse, 2002). Agriculture in the area includes grass seed, row crops, sheep, cattle, horses, and other livestock, hay, Christmas trees, vineyards, orchards, and nurseries. Farm sizes range from five acres with pasture and horses to diverse farms of several thousand acres.

Limited Use Areas

There are several large natural areas in the Management Area. In the Upper Siuslaw watershed, the Bureau of Land Management manages several large tracts of forestland. Between Eugene and Veneta, federal and local agencies, nonprofit organizations, and private landowners manage several thousand acres of natural and constructed wetlands, native prairie remnants, oak savannah, and other habitats. This area includes Fern Ridge Reservoir and associated wildlife areas, the West Eugene Wetlands, and the Willow Creek Preserve.

Urban

Eugene is the largest urban area in the Management Area. There are also several smaller cities and rural communities, including Crow, Elmira, Junction City, Lorane, Monroe, Noti, and Veneta. The total population of the incorporated communities in the Management Area in 2006 was estimated to exceed 219,000 (Population Research Center, 2007).

Water Resources

Water Availability

As with 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 Long Tom and Siuslaw watersheds than in streams with headwaters in the Cascade Mountains because snowmelt supplies a relatively small portion of the stream flow. Flow in the Siuslaw River during its highest flow month is 35 times the flow during the lowest flow month, while the high flow month low flow month ratio for the Long Tom River is 116 times, much “flashier” than the high flow low flow difference of just five times in the McKenzie River (Bastasch, 1998). Table 2 lists minimum, maximum, and average flows for several waterbodies in the area.

Groundwater resources in much of the Coast Range and foothills are relatively meager because there are few porous, permeable geologic formations to absorb and transmit water. Alluvial materials along major streams and rivers are the most abundant source of groundwater, with some of these wells capable of providing over 300 gallons per minute.

Water Use

Consumptive uses of water in the Management Area include irrigation, private and public drinking water, 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 3 summarizes surface water allocations in the area. Allocations in cubic feet per second (cfs) represent the maximum amount of water that may be withdrawn at any given time; allocations in acre-feet (af) represent the total amount of water that may be withdrawn during a water year. In this table, "agriculture" appropriations are for agricultural uses other than irrigation, such as livestock watering.

Table 2. Minimum, maximum, and average flow in several waterbodies in the Management Area. Flow is in cfs. Figures are derived from either U.S. Geological Survey stream gage data, gathered from the year the gage was installed until the present, or from Oregon Water Resources Department projections of stream flow based on water availability (U.S. Geological Survey, 2001, Oregon Water Resources Department, 1990).

Waterbody	Average Summer Flow (cfs)	Average Winter Flow (cfs)	Minimum Flow (cfs)	Maximum Flow (cfs)	Average Annual Flow (cfs)
Long Tom @Noti	38	542	.04	6,990	233
Long Tom @ Alvadore (just below Fern Ridge reservoir)	63	1,211	2	11,500	520
Long Tom River @ Monroe	70	1,842	7	19,300	760
Coyote Creek @ Crow	7	468	Not available	Not available	177

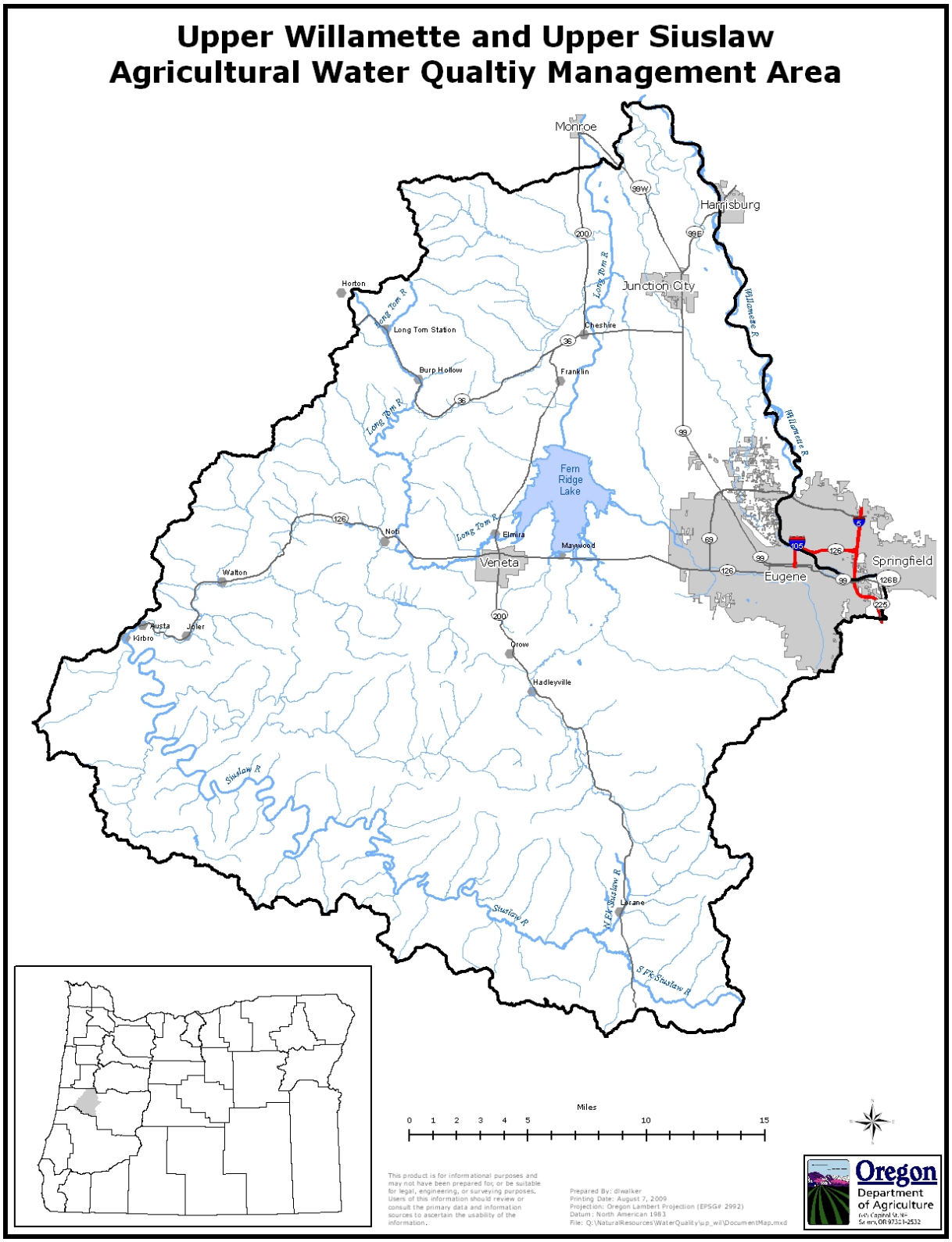
Table 3. Water allocations in several waterbodies in the Management Area. Allocations are in cubic feet per second (cfs) or acre-feet (af) (Oregon Water Resources Department, 2003).

Waterbody	Irrigation	Agriculture	Domestic	Industrial	Municipal	Fish and Wildlife/ Other
Flat Creek	52 cfs 230 af	.08 cfs 0 af	.05 cfs 0 af	2 cfs 0 af	8 cfs 0 af	0 cfs 2 af
Long Tom	355 cfs 8,000 af	.2 cfs 285 af	.6 cfs 3 af	34 cfs 370 af	4 cfs 0 af	6 cfs 644 af
Upper Siuslaw	14 cfs 17 af	1 cfs 34 af	.4 cfs 0 af	1 cfs 0 af	0 cfs 0 af	245 cfs 154 af

2.3.2 Geographic and Programmatic Scope

The Upper Willamette and Upper Siuslaw Agricultural Water Quality Management Area includes the drainage area of the Long Tom River, Upper Siuslaw River, and several smaller streams that drain directly to the Willamette River. The physical boundaries of the Management Area are indicated on the map in Section 2.3.2. Operational boundaries for the land base include all lands in agricultural use, agricultural and rural lands that are lying idle or on which management has been deferred, and forest lands with agricultural activities, with the exception of public lands managed by federal agencies.

2.3.3 Map of the Management Area



2.4 Agricultural Water Quality in the Management Area

2.4.1 Local Issues of Concern

The DEQ evaluated data from its own monitoring program, the Lane Council of Governments, the U.S. Geological Survey, and data collected in other local studies to determine the listing status of stream segments in the Management Area. Several stream segments exceed state standards for temperature, bacteria, dissolved oxygen, and turbidity. Beneficial uses impaired by these water quality concerns include fish and aquatic life and water contact recreation. Appendix A shows the 303(d) list and Decision Matrix for Management Area waterbodies.

Many water quality concerns occur seasonally throughout the Management Area. Temperature and dissolved oxygen violations occur during the summer months. Bacteria problems mainly occur during the fall, winter, and spring, when storm-related runoff and discharges are most likely to occur from a variety of sources.

Many factors may affect water quality in the Management Area. Wastewater treatment plants, industrial operations, removal of riparian vegetation, seasonal reductions in stream flow, and stream channel and floodplain alteration may increase water temperature. Contributors to bacteria and nutrient levels include wastewater treatment plants, applications of municipal wastewater, legal and illegal waste dumping sites, leaching septic systems, runoff from residential areas, runoff from agricultural lands, and background sources such as geese and elk.

2.4.2 303(d) List of Impaired Water Bodies

The 303(d) list is provided in Appendix A.

2.4.3 Basin TMDLs and Agricultural Load Allocations

DEQ has 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 specific to the Upper Willamette Subbasin. In addition, DEQ defined two additional TMDLs: dissolved oxygen for Amazon Diversion Channel and Coyote Creek, and turbidity for Fern Ridge Reservoir.

Table 4. Agricultural load allocations that apply to the Management Area.

Geographic Scope in Management Area	TMDL	Load Allocation for Agriculture
Parameter: Temperature		
Mainstem Willamette	Willamette TMDL (2006), Chapter 4	All nonpoint sources collectively (agriculture's allocation is not specified): 0.05°C of the 0.3°C human use allocation (with a surrogate of effective shade)
	Willamette TMDL (2006), Chapter 9	All nonpoint sources collectively (agriculture's allocation is not specified): 0.05°C of the 0.3°C human use allocation (with a surrogate of effective shade)

Coyote Creek	Willamette TMDL (2006), Chapter 10	All nonpoint sources collectively (agriculture's allocation is not specified): 0.05°C of the 0.3°C human use allocation (with a surrogate of effective shade) 25% increase in effective shade.
Parameter: Bacteria		
Mainstem Willamette	Willamette TMDL (2006), Chapter 4	66% to 83% reduction from agricultural areas compared to average loads in 2006
Lower Long Tom Watershed (below Fern Ridge Reservoir)	Willamette TMDL (2006), Chapter 10	47% reduction compared to average loads in 2006
Upper Long Tom Watershed (above Fern Ridge Reservoir)	Willamette TMDL (2006), Chapter 10	77% reduction compared to average loads in 2006
Coyote Creek Watershed	Willamette TMDL (2006), Chapter 10	66% reduction compared to average loads in 2006
Upper Amazon	Willamette TMDL (2006), Chapter 10	58% reduction compared to average loads in 2006
A-3 Drain	Willamette TMDL (2006), Chapter 10	33% reduction compared to average loads in 2006
Fern Ridge Reservoir Watershed	Willamette TMDL (2006), Chapter 10	64% reduction compared to average loads in 2006
Parameter: Dissolved Oxygen		
Amazon Creek	Willamette TMDL (2006), Chapter 10	40% reduction in loads of BOD, nutrients, and volatile suspended solids
Coyote Creek	Willamette TMDL (2006), Chapter 10	20% reduction in loads of BOD, nutrients (including ammonia), and volatile suspended solids
Parameter: Mercury		
Entire Management Area	Willamette TMDL (2006), Chapter 3	Agriculture: 27% reduction compared to average loads in 2006

2.4.4 Beneficial Uses and Parameters of Concern

Temperature
DEQ endeavored to set the TMDL for temperature to protect salmon spawning, rearing, and passage as the most sensitive beneficial uses in the Upper Willamette Subbasin. On agricultural lands, absence of streamside vegetation, water withdrawals, and land management that leads to widened stream channels contribute to elevated stream temperatures. 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 (risk of infection and disease to people who come in contact with fresh water while fishing, swimming, or boating) as the most sensitive beneficial use. On agricultural lands, *E. coli* generally comes from livestock waste, either deposited directly into waterways or carried to waterways via runoff and soil erosion. Runoff and soil

erosion from agricultural lands may also carry bacteria from other sources. There are numerous sources of bacteria in streams, including humans (from recreation or failing septic systems) and wildlife.

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. If mercury is contributed on agricultural lands, it is through eroded soils.

Dissolved Oxygen
Salmon and trout rearing, resident fish and aquatic life, and fishing are the most sensitive beneficial uses in the Amazon Diversion Channel and Coyote Creek that DEQ attempts to protect with this TMDL. An interaction of high water temperatures and nutrient levels interact to create low dissolved oxygen levels that threaten fish survival. DEQ has identified multiple sources of pollutants, including storm water discharges, agricultural run-off, and insufficient riparian vegetation.

Turbidity
In setting the TMDL for turbidity in the Fern Ridge Reservoir, DEQ looked at trout rearing, resident fish and aquatic life, and fishing as the most sensitive beneficial uses to defend. For potential sources of turbidity, DEQ has identified urban storm water discharge, urban and agricultural run-off, and bank erosion from areas where the riparian vegetation has been removed.

2.4.5 Sources of Impairment

Several researchers have studied agriculture and water quality issues within the Management Area. The Long Tom Watershed Council completed a two-year baseline water quality monitoring study in 2001. The resulting evaluation of water quality for several Long Tom sub-watersheds is in Table 5. The council also conducted an agricultural surface runoff pilot study during 2000-01 to assess water quality of surface runoff from agricultural fields and the quality of recipient stream water. First-year results indicated mostly low levels of total suspended solids in runoff from agricultural fields, and potentially problematic nitrate and phosphorus levels in runoff from some sites (Thieman, 2001). Researchers from Oregon State University (OSU) and other agencies conducted several research and education programs in the area related to groundwater and irrigation, nutrient and pesticides management on mint and other field crops. While pesticides in groundwater were detected at levels well below safe drinking water standards (Gatchell, 1996), nitrate levels were a concern in some areas (Petit, 1988; Penhallegon, 1994; Shelby, 1995). Researchers presented the results of their work through several educational forums, prompting many growers to alter their nutrient and irrigation application schedules (Smesrud and Selker, 1998).

In April 2007, the Long Tom Watershed Council updated its baseline water quality monitoring efforts with the publishing of its summary report for 1999-2006. A summary of the major issues and findings includes:

- High water temperature and low dissolved oxygen levels in most mid-elevation and lowland stream reaches pose threats to native fish populations
    - Stream vegetation, stream flow levels, and in-stream impoundments all are factors in high water temperatures
- There are high bacteria concentrations in parts of the watershed
- Nitrate and phosphorus levels appear to be highest in urban and agricultural areas
- Bear Creek, Elk Creek, Ferguson Creek, Upper Amazon Creek, and Upper Long Tom River Dissolved Oxygen levels show a downward trend

- Worsening bacteria levels are evident in the Lower Amazon, while the Bear Creek, Ferguson Creek, and Upper Amazon Creek remain impaired and have shown no improvement
- The following waterways show increasing levels of nitrate-nitrogen: Elk, Ferguson, Lower Amazon, Lower Long Tom, Upper Amazon, and Upper Long Tom
- No waterways showed an overall improvement in water quality

Table 5 summarizes the updated water quality status of Long Tom subwatershed.

Table 5. Long Tom Subbasins Water Quality Evaluation 1999-2001.
From the Long Tom Water Quality Monitoring Final Report for 1999-2001 (Thieman, 2001).
"Impaired" means water quality met the state standard for less than 50 percent of samples.
"Moderate" means water quality met the state standard for 50-85 percent of the samples.
"OK" means water quality met the state standard for more than 85 percent of the samples.

Subbasin	Water Temp	Turbidity	Dissolved Oxygen	*E. coli*	pH	Nitrate-nitrite
Bear Creek	Impaired	OK	OK	Impaired	OK	OK
Coyote Creek	Impaired	OK	Moderate	Moderate	OK	OK
Elk Creek	Impaired	OK	OK	Moderate	OK	OK
Ferguson Creek	Impaired	OK	OK	Impaired	OK	OK
Lower Amazon	Impaired	OK	Moderate	OK	OK	OK
Lower Long Tom	Impaired	OK	Moderate	OK	OK	OK
Spencer Creek	Impaired	OK	Moderate	Moderate	OK	OK
Upper Amazon	Impaired	OK	Moderate	Impaired	OK	OK
Upper Long Tom	Impaired	OK	OK	Moderate	OK	OK

Table 6. Long Tom Subbasins Water Quality Evaluation 1999-2006.
From the Long Tom Water Quality Monitoring Final Report for 1999-2006 (Temperature map on page 16, Appendix F using the most downstream monitoring site) (Thieman, 2007).
"Impaired" means water quality met the state standard for less than 50 percent of samples.
"Moderate" means water quality met the state standard for 50-85 percent of the samples.
"OK" means water quality met the state standard for more than 85 percent of the samples.

Subbasin	Water Temp	Turbidity	Dissolved Oxygen	*E. coli* (ave)	pH	Nitrate-nitrite
Bear Creek	Impaired	OK	Moderate	Impaired	OK	OK
Coyote Creek	Impaired	OK	Moderate	Moderate	OK	OK
Elk Creek	Impaired	OK	Moderate	Moderate	OK	Moderate
Ferguson Creek	Impaired	OK	Moderate	Impaired	OK	Moderate
Lower Amazon	Impaired	OK	Moderate	Moderate[a]	OK	Impaired
Lower Long Tom	Impaired	Moderate	Moderate	OK	OK	Impaired
Spencer Creek	Impaired	OK	Moderate	Moderate	OK	OK
Upper Amazon	Impaired	OK	Impaired	Impaired	OK	Moderate
Upper Long Tom	Impaired	OK	Moderate	Moderate	OK	Moderate

Notes: a/ Based on the single sample standard of >406 cells/mL

A watershed assessment has been completed for the Siuslaw watershed (Siuslaw Basin Council and Ecotrust, 2002). In addition to summarizing existing data on the watershed, the assessment included some

ground truthing of water quality and habitat conditions. One concern identified in the assessment was stream temperature. The authors listed several contributors to stream temperatures above state water quality criteria, including a relatively warm summer climate compared with more northern coastal watersheds, lack of riparian cover, and the amount of exposed bedrock, which heats much more rapidly than gravel or sand, in and adjacent to stream channels.

Southern Willamette Groundwater Management Area

In accordance with state water quality rules OAR 340-40, DEQ declared a GWMA for the Southern Willamette Valley in 2004 because monitoring data showed elevated nitrate levels in groundwater (Figure 3). 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 from four focus sectors: (1) agricultural, (2) residential, (3) commercial / industrial / municipal, and (4) public water supplies.

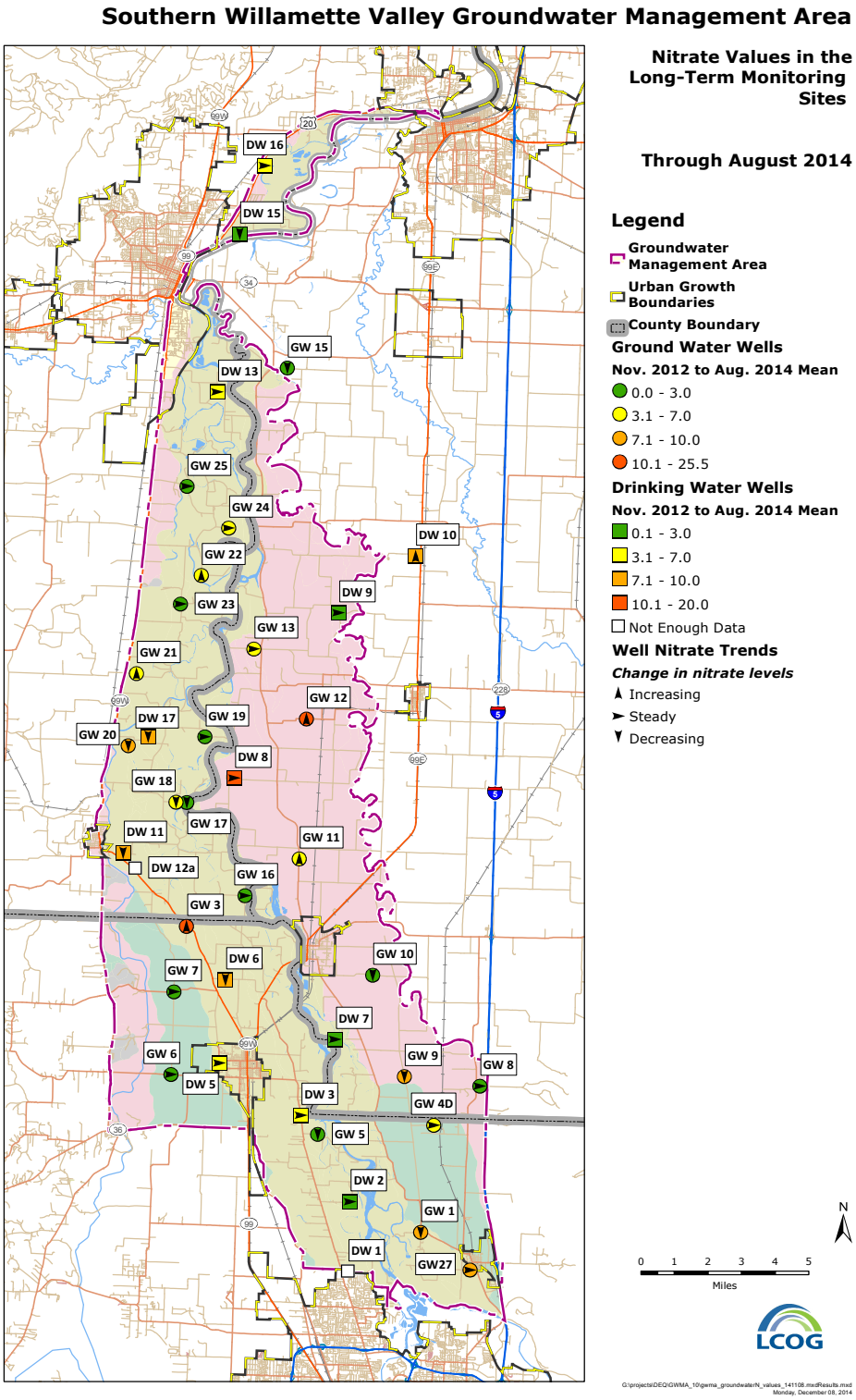
DEQ is currently conducting quarterly sampling of 12 groundwater-monitoring locations and conducting annual sampling of 33 additional groundwater- and surfacewater- monitoring locations in the GWMA for nitrate. Some locations are also sampled for chloride and phosphorous. This program includes monitoring 23 shallow monitoring wells, 16 domestic wells, and six surfacewater sites. The domestic wells are generally installed deeper than the monitoring wells. While nitrate contamination trends appear to be decreasing at some monitoring locations, there are some areas in the GWMA where nitrate levels continue to increase and other areas where no change in nitrate concentration is evident. 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; the threshold for drinking water is 10mg/L, as measured by nitrogen (NO_3-N).

In early 2010, an evaluation of the accomplishments in regards to the Action Plan was completed. This evaluation included reporting of agricultural accomplishments by the ODA's Water Quality and CAFO programs, the NRCS, and the Linn, Benton, and Upper Willamette SWCDs. This evaluation found that 65 percent of the agricultural measures of implementation had been completed. Based on the Action Plan evaluation, it was determined that an update to the Action Plan was needed.

On October 26, 2011, an agriculture workgroup met to review and update the agricultural section of the GWMA Action Plan. The agriculture workgroup consisted of ODA staff, SWCD staff, NRCS staff, and seven local agricultural producers. The purpose of the agriculture workgroup meeting was to review updates to the Action Plan and review research needs. The workgroup asked that information on precision agricultural practices that producers are implementing be included in the Action Plan. The goals of the Action Plan were updated to be consistent with the statutes related to the ODA's Agricultural Water Quality Program and statutes related to the GWMA. Research needs that were identified include: additional research to understand what is happening below the root zone of crop plants and the effects of various recommended management practices on leaching of nutrients from the soil. The updates to the GWMA Action Plan should be completed in early 2017.

The GWMA Action Plan can be found at http://gwma.oregonstate.edu.

Figure 3. Map of the Southern Willamette Valley GWMA



2.5 Prevention and Control Measures

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 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, instead of practices that must be implemented.

This LAC developed Area Rules to protect water quality and prevent and control water pollution from agriculture. While developing the Area Rules that were adopted for the first time in 2003, the LAC also considered the time and expense that would be involved for area landowners to meet the rules. As a result, each Rule has an implementation date the LAC believed would be acceptable to area landowners. These implementation dates are now passed and all landowners are expected to be in compliance with these Area Rules.

This Area Plan serves as a guidance document and, as stated in the Foreword, does not establish provisions for enforcement. The Area Rules developed with input from the LAC (OAR 603-095-2600 to 603-095-2660) are enforceable and are included in this document only as a reference for landowners.

Each Area Rule relates directly to water quality concerns identified on the 303(d) list in the Management Area, and addresses the Upper Willamette TMDLs as required under the federal Clean Water Act. The concerns addressed in the Area Rules are described below.

Area Rules

Landowners in the Management Area are required to achieve the conditions outlined in the Area Rules below. Each Rule has a box around it and appears in italics. Relevant definitions are included after each Rule. The applicable rule is provided within each section below.

> ***OAR 603-095-2640***
>
> *(1) All landowners or operators conducting activities on lands in agricultural use shall comply with the following criteria. A landowner shall be responsible for only those conditions caused by activities conducted on land controlled by the landowner. A landowner is not responsible for violations of the Prevention and Control Measures resulting from actions by another landowner. Conditions resulting from unusual weather events (equaling or exceeding a 25-year, 24-hour storm event) or other exceptional circumstances are not the responsibility of the landowner. Limited duration activities may be exempted from these conditions subject to prior written approval by the department.*

The following preferred management tables are intended as recommendations for landowners to meet Area Rules and generally maintain and enhance natural resources on their property. The practices below benefit a variety of water quality parameters, not just those parameters of concern within the Management Area. The tables provide some idea of the water quality benefits of each practice as well as potential costs and benefits to landowners. The tables are organized by resource, such as nutrients and manure.

Landowners who want more information on any of the following practices, or who are looking for other ideas for water quality improvement and conservation on their lands, may contact several agencies and organizations that provide technical assistance (Appendix D) or read some of the publications cited on the

next page. Also, please consult Appendix C for a list of cost-sharing programs that cover many of these practices.

2.5.1 Nutrients and Manure Management

Bacteria

The most commonly used indicator of fecal 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, wild birds, and mammals. Not all *E. coli* are pathogenic; however, the presence of *E. coli* indicates 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. 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.

Nitrate

Nitrate is a form of nitrogen that is dissolved in water (usually an issue in groundwater, but can impact surface water as well). Oregon public drinking water systems must adhere to the EPA standard for nitrate of 10 mg/L, which was established because of health concerns. There are no established drinking water standards for household drinking water, nor any requirements to test those wells unless the property is transferred. The standard for declaring a GWMA based on nitrate is the area-wide presence of wells with nitrate levels greater than 7 mg/L.

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.

Waste, Nutrients, and Other Pollutants Rule

OAR 603-095-2640(1)

(b) Effective upon rule adoption, no person subject to these rules shall violate any provision of ORS 468B.025 or 468B.050.
(c) Corralled or enclosed livestock areas will be managed to control runoff of sediment and animal waste. Application and storage of manure will be done in a manner that minimizes the introduction of nutrients and bacteria to waterways.

Wastes has the meaning given in ORS 468B.005(7): 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.

Waters of the state has the meaning given in ORS 468B.005(8): 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.

Nutrient and Manure Management

Practice	Resource Concerns Addressed	Benefits to Producer	Costs to Producer
a. Apply nutrients according to soil test results (Hart, Pirelli, and Cannon, 1995; Marx, Hart, and Stevens, 1999; Natural Resources Conservation Service, 1997i; Sullivan, 1998; Waskom, 1994).	Helps prevent nutrient runoff into waters of the state and leaching into groundwater.	May help reduce fertilizer costs; ensures that plants receive needed nutrients for growth; makes plants more competitive against weeds. Practice may be eligible for cost-sharing programs.	Costs of soil testing; time associated with taking soil samples. Practice may be eligible for cost-sharing programs.
b. Store manure under a tarp or roof; preferably on an impervious surface such as concrete or plastic (Gamroth and Moore, 1996; Godwin and Moore, 1997; Moore and Wilrich, 1993).	Helps prevent nutrient and bacteria runoff into waters of the state and leaching into groundwater.	Prevents nutrient leaching so manure applied on crops or pasture has higher nutrient content; may save some fertilizer costs; producers may be eligible for cost-sharing programs.	Cost of constructing manure storage facilities. Practice may be eligible for cost-sharing programs.
c. Establish animal heavy-use areas where animals are confined during the winter to protect other pastures from trampling and compaction. Limit livestock access to pastures when soils are saturated; cover heavy-use areas with rock, hogged fuel, and/or geotextile. Clean manure regularly from	Helps prevent sediment, nutrient and bacteria runoff into waters of the state and leaching into groundwater. Helps protect streamside areas.	Protects pastures from compaction during the winter, improving growth. May improve animal health by covering heavy-use areas with material so animals are not wading in mud. Practice may be eligible for cost-sharing programs.	Cost of fencing heavy-use area; cost of feeding hay during the winter; cost of materials for protecting heavy-use area. Practice may be eligible for cost-sharing programs.

Practice	Resource Concerns Addressed	Benefits to Producer	Costs to Producer
heavy-use area (Natural Resources Conservation Service, 1997d).			
d. Site barns and heavy-use areas away from streams (Godwin and Moore, 1997).	Helps prevent sediment, nutrient, and bacteria runoff into waters of the state. Helps protect streamside areas.	Helps prevent flooding in barns and heavy-use areas. Practice may be eligible for cost-sharing programs.	Need either off-stream watering facility or other source of water for livestock. Practice may be eligible for cost-sharing programs.
e. Prevent silage leaching and/or store and manage leachate from silage and other vegetative materials (Bruneau, Hodges, and Lucas, 1995; Feise, Adams, and LaSpina, 1993).	Helps prevent nutrient runoff into waters of the state and leaching into groundwater.	Preventing leaching maintains higher nutrient content of ensiled feed material. Practice may be eligible for cost-sharing programs.	May require cost of facility development and purchase of moisture-absorbing materials. Practice may be eligible for cost-sharing programs.
f. Installing gutters and downspouts in areas with high livestock use. Connect downspout water to drainage system or, if possible, route clean downspout to a location where it can soak into the ground (Natural Resources Conservation Service, 1997f).	Helps prevent sediment, nutrient and bacteria runoff into waters of the state. Helps protect streamside areas.	May improve animal health by lessening mud during the winter, so animals are not wading in mud. Practice may be eligible for cost-sharing programs.	Cost of installation and maintenance of gutters and downspouts. Practice may be eligible for cost-sharing programs.
g. Cover heavily used animal walkways with sand, rock, and/or geotextile (Natural Resources Conservation Service, 1997c).	Helps prevent sediment, nutrient and bacteria runoff into waters of the state. Helps protect streamside areas.	Can improve animal health because animals are not wading in mud. Can help prevent animal health problems such as scratches, hoof or foot rot, and worms. Practice may be eligible for cost-sharing programs.	Cost of sand, rock or other materials. Owners should be aware that feeding equine species on sand may result in sand colic. Practice may be eligible for cost-sharing programs.

2.5.2 Streamside Area Management

Temperature

Oregon's temperature standard 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. Many studies highlight the significance of streamside shade in the maintenance of stream temperatures (Brown, 1969; Beschta, 1997). Several authors emphasize that the capture of precipitation in the soil profile and the eventual flow of groundwater into streams is key to maintaining stream temperatures (Krueger et al, 1999; Moore and Miner, 1997; Naiman and Decamps, 1997). Clark (1998) explains that upland and riparian conditions strongly influence stream temperatures 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 into the soil profile and decreases the possibility of overland flow, soil loss and resulting sediment delivery to streams. Other influences on stream temperature include stream channel width, stream depth, channel substrate, air temperature, and elevation (Bilby, 1984; Chen et al, 1998; Ward, 1995).

Across Oregon, the Ag Water Quality Program emphasizes streamside vegetation protection and enhancement to prevent and control agricultural water pollution. Streamside vegetation provides three primary water quality functions: shade for cooler stream temperatures, streambank stability, and filtration of pollutants. Other water quality functions include: water storage for cooler and later season flows, sediment trapping that builds streambanks and floodplains, narrowing and deepening of channels, and biological uptake of sediment, organic material, nutrients, and pesticides.

Additional reasons for the Ag Water Quality Program's emphasis on streamside vegetation include:

- Streamside vegetation improves water quality related to multiple pollutants, including: temperature (heat), sediment, bacteria, nutrients, toxics, and pesticides.
- Streamside vegetation provides fish and wildlife habitat.
- Landowners can improve streamside vegetation in ways that are compatible with their operation.
- Streamside vegetation condition can be monitored readily to track the status and trends of agriculture's progress in addressing water quality concerns.

Site Capable Vegetation

The Ag Water Quality Program uses the concept of "site-capable vegetation" to describe the vegetation that agricultural streams can provide to protect water quality. Site-capable vegetation is the vegetation that can be expected to grow at a particular site, given natural site factors (e.g., elevation, soils, climate, hydrology, wildlife, fire, floods) and historical and current human influences (e.g., channelization, roads, modified flows, past land management). Site-capable vegetation can be determined for a specific site based on: current streamside vegetation at the site, streamside vegetation at nearby reference sites with similar natural characteristics, Natural Resources Conservation Service (NRCS) soil surveys and ecological site descriptions, and local or regional scientific research. ODA does not consider invasive, non-native plants such as introduced varieties of reed canary grass and blackberry to be site-capable vegetation.

The goal for Oregon's agricultural landowners is to provide the water quality functions (e.g., shade, streambank stability, and filtration of pollutants) produced by site-capable vegetation along all streams flowing through agricultural lands. The agricultural water quality regulations for each Management Area require that agricultural activities provide the water quality functions equivalent to what site-capable vegetation would provide.

In some cases, for narrow streams, mature site-capable vegetation such as tall trees may not be needed. For example, shrubs and grass may provide shade, protect streambanks, and filter pollutants. However, on larger streams, mature site-capable vegetation is needed to provide the water quality functions.

Riparian Areas Rule

> ***OAR 603-095-2640(1)***
>
> *(a) Effective upon rule adoption, agricultural activities shall allow the establishment and development of riparian vegetation along perennial and intermittent streams for streambank stability, shading, and proper riparian function, consistent with site capability.*
> *(A) Legally constructed drainage and irrigation ditches are exempt from OAR 603-095-2640(1)(a).*

Riparian vegetation means plant communities consisting of plants dependent upon or tolerant of the presence of water near the ground surface for at least part of the year (OAR 603-095-0010(36)).

Site capability means the ability of a site to provide for the development of potential structural and functional properties. Structural properties include, among other things, vegetation and soil characteristics. Functional properties include processes such as energy and nutrient flow. Capabilities to produce and sustain these properties are site-specific. More information is included in Appendix E.

Riparian Areas and Streams

Practice	Resource Concerns Addressed	Potential Benefits of Practice to Producer	Potential Costs of Practice to Producer
a. Light rotational grazing in riparian area; timed when growth is palatable to animals and when riparian areas are not saturated (Adams, 1994; Chaney, Elmore and Platts, 1003; Rogers and Stephenson, 1998).	Helps establish desirable riparian vegetation, promotes streambank integrity; helps filter nutrients and sediment from runoff; helps reduce stream temperatures by providing shade.	May lessen streambank erosion and loss of pastures; allows limited use of riparian area for grazing, improves wildlife habitat, and may control weeds. Practice may be eligible for cost-sharing programs.	May require time and financial investment for livestock control and off-stream watering facilities. Practice may be eligible for cost-sharing programs.
b. Livestock exclusion from riparian area; establish off-stream watering facilities (Natural Resources Conservation Service, 1997g and 1997h).	Helps promote desirable riparian vegetation; promotes streambank integrity; helps filter nutrients and sediment from runoff; may help narrow channel and reduce erosion in channel.	May lessen streambank erosion and loss of pastures; less time involved in managing livestock grazing in riparian area, improves wildlife habitat. Practice may be eligible for cost-sharing programs.	May require higher weed control costs than seasonal riparian grazing. May require financial investment for livestock control and off-stream watering facilities. Practice may be eligible for cost-sharing programs.
c. Plant perennial vegetation in riparian area. Recommend	Helps establish perennial riparian vegetation rapidly; promotes	May lessen streambank erosion and loss of pastures. If livestock are	Costs of vegetation and weed control. May require financial

Practice	Resource Concerns Addressed	Potential Benefits of Practice to Producer	Potential Costs of Practice to Producer
using native vegetation, or if using non-native vegetation, avoid using invasives (Guard, 1995; Pojar and MacKinnon, 1994).	streambank integrity; may help narrow channel and reduce erosion in channel.	excluded from riparian area, area may be eligible for federal cost-share programs. Some alternative perennial agricultural products may be harvested from riparian areas.	investment for riparian fencing and off-stream watering facilities while vegetation establishes. Practice may be eligible for cost-sharing programs.

2.5.3 Soil Erosion Prevention and Control

Mercury

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. 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 are carried by storm water 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 bio-accumulating in fish tissue to levels that adversely affect public health. Mercury binds to particles; thus there are 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 percent 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. DEQ plans to finalize these after additional data collection and public outreach (Oregon Department of Environmental Quality, 2007).

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.

Turbidity

Turbidity refers to the clarity of a waterbody. It includes the amount of suspended solids in the water column. Sediment, algae, and other particles contribute to turbidity.

Oregon's turbidity standard was established to protect fish and aquatic life. High turbidity levels can negatively affect aquatic life by consuming dissolved oxygen, clogging gills and other respiratory organs, reducing water infiltration through stream substrate (harming incubating fish eggs) and reducing animals' ability to see predators and prey.

Erosion and Sediment Control Rules

> ***OAR 603-095-2640(1)***
> *(d) Effective January 1, 2004, agricultural activities will not cause the following visual indicators of erosion where erosion may cause sediment runoff into waters of the state:*
> *(A) Sheet erosion; noted by scoured surfaces or pedestals of soil at the base of plants on sparsely vegetated or bare ground;*
> *(B) Visible active gullies;*
> *(C) Multiple rills, which have the form of gullies, but are smaller in cross-sectional area than one foot.*
> *(D) This prevention and control measure applies to farm roads and staging areas, pastures, cropland, and other areas where agricultural activities occur.*

Erosion, sheet means the removal of a fairly uniform layer of soil from the land surface by runoff water (OAR 603-095-0010(15)).

> *(e) Construction, maintenance, and use of surface drainage field ditches or surface irrigation field ditches shall cause no pollutant delivery to waters of the state from soil erosion induced by excessive channel slope, unstable channel cross section or placement of disposed spoils.*
> *(f) Agricultural activities shall not cause pollution from active channel erosion or other means of sediment delivery from intermittent streams and drainage ways.*

Active channel erosion means gullies or channels which at the largest dimension have a cross-sectional area of at least one square foot and which occur at the same location for two or more consecutive years (OAR 603-095-0010(1)).

> *(g) Roadways, staging areas, and heavy-use areas shall be constructed and maintained to prevent sediment or runoff contaminants from adversely affecting waters of the state.*
> *(A) Exemptions: Public roads and roads subject to the Oregon Forest Practices Act.*

Erosion and Sediment Control

Practice	Resource Concerns Addressed	Benefits to Producer	Costs to Producer
a. Grazing management: graze pasture plants to appropriate heights, rotate animals between several pastures; provide access to water in each pasture	Helps prevent sediment, nutrient, and bacteria runoff into waters of the state. Helps protect streamside areas.	May improve pasture production; easy access to water may increase livestock production as well. May improve composition of pasture	Cost of installing fencing, watering facilities for rotational grazing system; time involved in moving animals through

(Ko, 1999; Lundin, 1996; Hirschi, 1997).		plants and help prevent weed problems. Practice may be eligible for cost-sharing programs.	pastures. Practice may be eligible for cost-sharing programs.
b. Farm road construction: construct fords appropriately, install water bars or rolling dips to divert runoff to roadside ditches (Binn, 1998; U.S. Forest Service, 1998).	Helps prevent sediment runoff to waters of the state.	May help prevent water damage on farm roads. Practice may be eligible for cost-sharing programs.	Cost of installation and maintenance. Practice may be eligible for cost-sharing programs.
c. Plant appropriate vegetation along drainage ditches; seed ditches following construction (Natural Resources Conservation Service, 1997a).	Helps prevent sediment runoff into waters of the state.	May help prevent ditch bank erosion and slumping. Practice may be eligible for cost-sharing programs.	Costs of establishing vegetation. Practice may be eligible for cost-sharing programs.
d. Plant cover crops on erosion-sensitive areas (Natural Resources Conservation Service, 1997b; Hirschi, 1997).	Helps prevent sediment runoff into waters of the state; filters nutrients and slows runoff.	May reduce weed problems; prevents loss of applied nutrients. Practice may be eligible for cost-sharing programs.	Costs of establishing cover crops; cover crops may compromise primary crop. Practice may be eligible for cost-sharing programs.
e. Irrigate pasture or crops according to soil moisture and plant water needs (Hansen and Trimmer, 1997; Trimmer and Hansen, 1994).	Helps prevent irrigation return flow and associated nutrients and sediment to waters of the state.	May reduce costs of irrigation; may help crop or pasture production. Practice may be eligible for cost-sharing programs.	Installation/ maintenance cost. Monitoring time. Practice may be eligible for cost-sharing programs.
f. Install/maintain diversions or French drains to prevent unwanted drainage into barnyards and heavy-use areas (Natural Resources Conservation Service, 1997e).	Helps prevent nutrient runoff into waters of the state.	Decreases muddiness and shortens saturation period in protected areas. Practice may be eligible for cost-sharing programs.	Cost of installation. Practice may be eligible for cost-sharing programs.
g. In areas where gullies repeatedly appear, install underground outlet or grassed waterway to capture and convey water (Natural Resources Conservation Service, 1997j and 1997k; Hirschi, 1997).	Prevents gully erosion and sediment runoff to waters of the state.	Prevents loss of soil and fertilizers, lessens inconvenience of driving equipment over gullies. Practice may be eligible for cost-sharing programs.	For underground outlet, costs of installing inlets and plastic pipe; for grassed waterways, costs of installation, seeding, weed control, and any land put out of production. Practice may be eligible for cost-sharing programs.
f. Install and manage field borders/filter strips	Controls sediment and nutrient	Prevents loss of soil and fertilizers, lessens	Cost of installation. Cost of management.

along field boundaries (Natural Resources Conservation Service, 2001)	movement to waters of the state. Erosion control during high water events.	inconvenience of driving equipment in wet areas. Practice may be eligible for cost-sharing programs.	Practice may be eligible for cost-sharing programs.

2.5.4 Pesticides

Oregon has strict laws and regulations related to pesticide use, storage, and reporting, and that improper application and storage may lead to surface or groundwater quality problems. All pesticide users are required to apply and store pesticides according to the label (ORS 634.372). Users of restricted-use pesticides are required to obtain certification from ODA's Pesticides Division.

Pest Management

Practice	Resource Concerns Addressed	Benefits to Producer	Costs to Producer
a. Apply pesticides and herbicides according to the label. Use the correct rate and timing. Comply with label restrictions and precautions.	Reduces risk of pesticide runoff to streams or other water resources.	Compliance with federal and Oregon law; reduces health risks to applicator, may decrease costs.	N/A
b. Triple rinse pesticide application equipment; apply rinsates to sites; dispose of or recycle clean containers according to Oregon law	Reduces risk of pesticide runoff to streams.	Dilutes pesticide residues; correct disposal or rinsate ensures compliance with federal and Oregon law; eliminates disposal costs of collected rinsates identified as hazardous waste.	Triple rinsing creates more volume that must be disposed of.
c. Calibrate, maintain, and correctly operate application equipment.	Reduces risk of pesticide runoff to streams.	May reduce use and therefore cost of pesticides; reduces health risks to applicator.	
d. Integrated pest management practices such as pheromone traps, beneficial insect release, and field monitoring.	Reduces risk of pesticide runoff to streams, may reduce loss of non-target species.	May improve effectiveness of pest control system. Practice may be eligible for cost-sharing programs.	Time involved to scout fields is usually offset by reduced or more effective pesticide use.
e. Store and mix pesticides on leak-proof facilities.	Reduces risk of pesticide runoff to streams.	Helps protect drinking water; reduces health risks to applicator.	Cost of installation and maintenance.
Store petroleum products such as fuel and oil in leak proof containers and	Reduces risk of runoff of petroleum products to streams or soil contamination.	Helps protect drinking water, reduces health risks to landowner or operator.	

Practice	Resource Concerns Addressed	Benefits to Producer	Costs to Producer
facilities; clean up spills of petroleum products properly.			

Hirschi, 1994 and 1997

2.5.5 Optional Issues: Upland Management, Irrigation Management, Livestock Management

Role of Upland Vegetation to Prevent and Control Pollution

Upland areas are the rangelands, forests, and croplands located upslope from streamside areas. Upland areas extend to the ridge-tops of watersheds. With a protective cover of crops and crop residue, grass (herbs), shrubs, or trees, these areas will capture, store, and safely release precipitation, thereby reducing the potential of excessive soil erosion or delivery of soil or pollutants to the receiving stream or other body of water.

Healthy upland areas provide several important ecological functions, including:

- Capture, storage, and moderate release of precipitation reflective of natural conditions.
- Plant health and diversity that support cover and forage for wildlife and livestock.
- Filtration of sediment.
- Filtration of polluted runoff.
- Plant growth that increases root mass, utilizes nutrients, and stabilizes soil to prevent erosion.

Nutrient and Irrigation Efficiencies

Practice	**Resource Concerns Addressed**	**Benefits to Producer**	**Costs to Producer**
Apply fertilizer at the correct rate and time applications for crop uptake.	Reduces the risk of excess nitrogen in the soil at the end of the growth season.	Precise application saves the producer money in fertilizer costs.	Time related to precision application.
Sample soil prior to fertilizer application to know existing nutrients.	Prevents the application of excess nutrients.	Precise application saves the producer money in fertilizer costs.	Cost of soil sampling and analysis.
Plant winter cover crops to take up excess nitrogen left over after crops are harvested.	Takes up extra nitrogen and limits potential for leaching into ground water.	Stores extra nitrogen in plant matter for later release when cover crop is incorporated into the soil.	Cost of seed and fuel to plant cover crop.
Properly maintain irrigation systems to prevent over-irrigation.	Prevents leaching of excess nitrogen past the root zone.	Uniform irrigation application and save producer money on nitrogen costs.	Replacement nozzles at least every four years is recommended.
Monitor soil water content and adjust irrigation schedules to maintain soil water content in an appropriate range in the root zone.	Prevents over-irrigation and leaching of excess nitrogen past the root zone.	Allows accurate irrigation application and keeps nutrients available to crops.	Soil monitoring equipment and time to evaluate soil water content.

Practice	Resource Concerns Addressed	Benefits to Producer	Costs to Producer
Schedule irrigation applications based on expected evapotranspiration rates.	Prevents over-irrigation and leaching of excess nitrogen past the root zone.	Allows accurate irrigation application and keeps nutrients available to crops.	Time to evaluate expected evapotranspiration rates.

Selker et al, 2004

Chapter 3: Goals, Objectives, and Strategies

Mission

The mission of the LAC is to advise ODA on development of methods to improve water quality directly related to agricultural practices in the Management Area.

Goal

Prevent and control water pollution from agricultural activities and soil erosion, and to achieve applicable water quality standards.

3.1 Measurable Objectives

A measurable objective is a numeric long-term outcome with a date by which we want to achieve it. Milestones are the interim steps needed to achieve the measurable objective, and usually consist of numeric short-term targets to reach by specific dates. Together, the milestones define the timeline needed to achieve the measurable objective.

Once ODA, the LAC, and the LMA establish measurable objectives and the associated milestones, we will work to evaluate progress on the milestones at each biennial review of the Area Plan. In a process of adaptive management, the biennial review will consider the success of the more recent milestone(s) and why they were or were not accomplished. We will evaluate if changes are needed to meet the milestone(s) to keep on track for achieving the longer-term measurable objective(s), and revise strategies to address obstacles and challenges.

The Upper Willamette SWCD selected the South Fork Siuslaw River as a Focus Area and a pre-assessment, using ODA's Streamside Vegetation Assessment tool, began in early 2015. Measurable objectives will be determined when the pre-assessment has been completed. A summary of the South Fork Siuslaw River Focus Area is provided in 3.2 below.

3.2 Strategic Initiatives

3.2.1 Focus Area

The current Focus Area for this Management Area is the South Fork Siuslaw. The Upper Willamette SWCD developed an Action Plan for the current biennium, approved by ODA, that outlines the key components of the Focus Area process. The SWCD will use ODA's Streamside Vegetation Assessment to determine: (1) the Management / Focus Area's likely site-capable streamside vegetation, (2) the likely level of water quality functions (shade, bank stability, filtration of pollutants) from the site-capable vegetation, and (3) whether the vegetation measured via pre- and post-assessments is likely providing these functions. Steps include:

- Conduct a pre-assessment of current land conditions.
- Identify areas of concern.
- Conduct outreach to landowners.
- Offer technical assistance to landowners and financial assistance, if needed and available.
- Conduct a post-assessment after project implementation to document change.

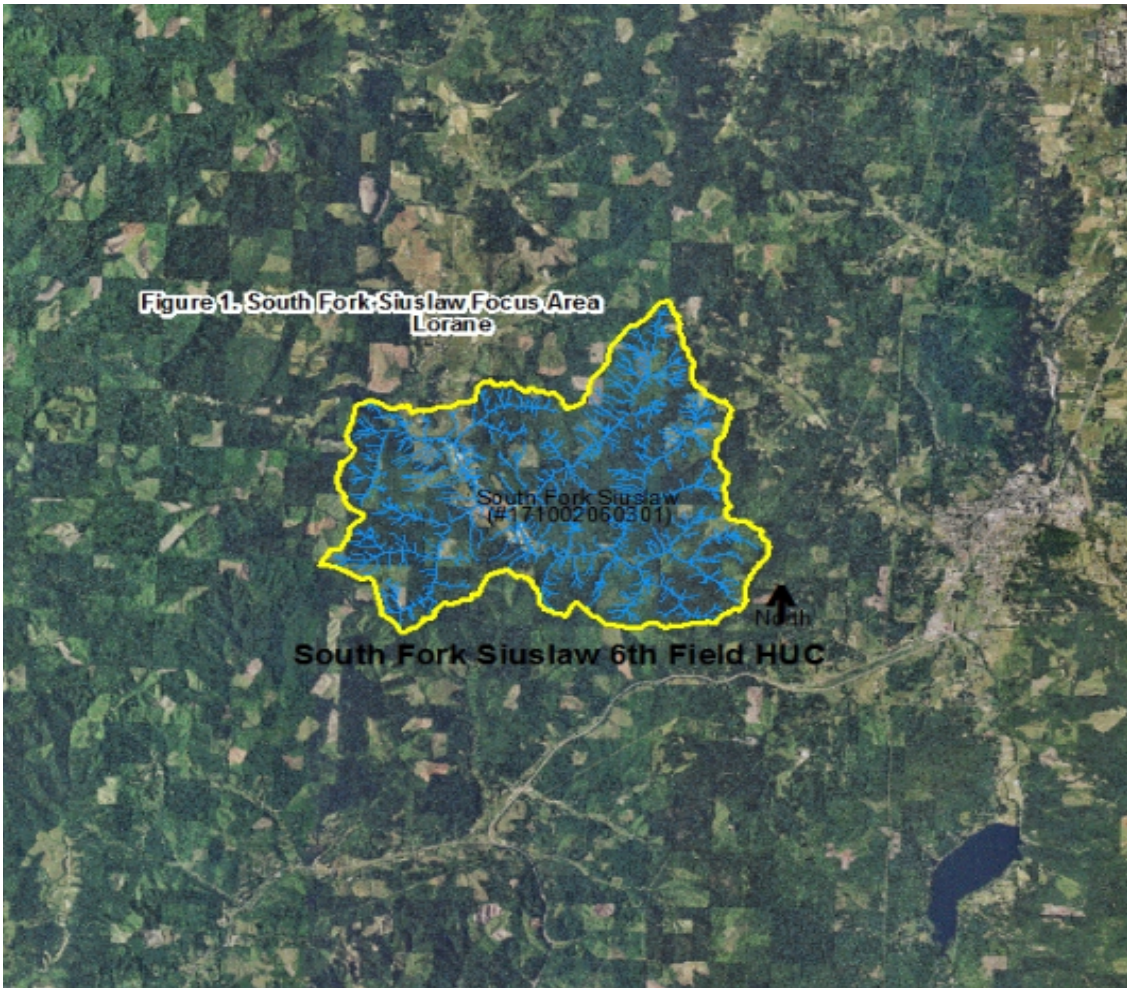
Current Conditions (From Pre-Assessment) in 2015:

Bare Ag + Grass + Grass Ag = 15. 68 acres
Shrub Ag + Shrub + Tree = 48.356 acres

Focus Area Milestone for 2015-2017

By June 30, 2017: Bare Ag + Grass + Grass Ag = 12.68 acres
By June 30, 2017: Shrub Ag + Shrub + Tree = 51.365 acres

The Upper Willamette SWCD will report the results to ODA at the end of each fiscal biennium via the Action Plan. As part of the next Biennial Review, ODA will summarize the results in Chapter 4, discuss and evaluate progress with the LAC, and use adaptive management to adjust implementation strategies if needed.



3.2.2 Pesticide Stewardship Partnership

The PSP uses water quality monitoring data to inform and focus voluntary, collaborative actions to reduce pesticides in Oregon waters. The Amazon project was initiated in 2011, with DEQ, Long Tom Watershed Council, OSU Extension, ODA, Sure-Crop, Rexius, and the local SWCD as the principal partners. The monitoring network for the Amazon PSP includes five sites throughout the sub-basin, including locations

along Amazon Creek or the A-1 Channel (tributary) that represent residential, commercial, industrial, and agricultural land uses. The watershed begins in the urban area in Eugene and drains into agricultural land north of Eugene.

The general approach initiated by the Long Tom Watershed Council to address pesticides in Amazon Creek is to work with local growers, commercial and industrial property, and business owners, and commercial landscape maintenance professionals to set up reduction goals, implement best management practices, and track success over time. For the agricultural area of the watershed, the short-term plan is to provide agricultural pesticide applicator and calibration trainings in partnership with OSU Extension, and to identify a filter strip demonstration project between Bond Road and High Pass Road. Sure-Crop, Inc. has been a key partner in facilitating outreach to local growers in the watershed.

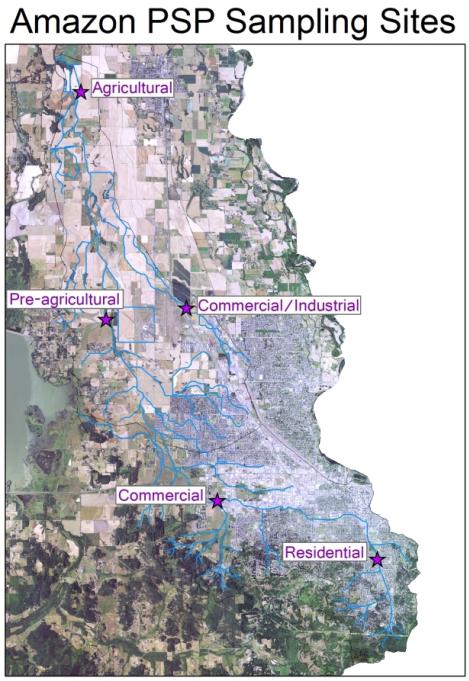
For city residents and commercial and industrial property owners (and their contractors) the following actions have been recommended to reduce pesticides from reaching local waterways:

(a) Reduce or eliminate the use of chemicals and pesticides on the landscape,
(b) Replace turf and traditional landscapes with a variety of native plants that require less fertilizers, and are more pest resistant than other plants,
(c) Ensure irrigation is efficient; overspray and overwatering can saturate a landscape and carry runoff to storm drains and local waterways,
(d) Where and when possible, reduce runoff from leaving your property by installing swales, rain gardens, green roofs, or planter boxes. Urban pesticides in Amazon Creek can travel into the agricultural areas because of the nature of the Creek's drainage.

Within the Management Area, Amazon Creek is currently a PSP and being monitoring for pesticide concentrations. There are five pesticide sampling locations with the Amazon Creek watershed:

- A1 Channel at Aubrey Lane
- Amazon Creek at 29th Street Gaging Station
- Amazon Creek at Beltline Road
- Amazon Creek at Bond Road
- Amazon Creek, tributary to Long Tom River, at High Pass Road

A summary of current findings is provided in Chapter 4.



3.3 Strategies and Activities

The LAC developed the following work plan with outreach and funding strategies for improving water quality. The objectives and strategies below are high priority and may be implemented by the Local Management Agency (Upper Willamette SWCD), with guidance and resources from ODA, and other partners as funding allows. The LAC recognizes that this list is not all-inclusive, that other strategies may also be effective in improving water quality, and that resources may not always permit these recommended strategies to be completed before the next biennial review.

- Prevent runoff of agricultural wastes: agricultural activities will not discharge any wastes or place waste where it is likely to run off into waters of the state.
- Prevent and control upland and cropland soil erosion using practical and available methods.
- Control active channel erosion to protect against sediment delivery to streams.
- Prevent bare areas due to livestock overgrazing near streams.
- Allow streamside vegetation along streams on agricultural properties to establish and grow, to provide streambank stability, filtration of overland flow, and moderation of solar heating.

3.3.1 Community and Landowner Outreach

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

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

- Co-sponsor workshops and tours between the SWCDs, OSU Extension (OSUE), 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.

Target: Four workshops, tours, and/or agribusiness events, but at least two workshops (see Objective 2, Strategy 1).

- Develop demonstration projects showcasing successful management practices and systems.

  Target: Two demonstration projects (see Objective 2, Strategy 1).

- Organize demonstration project tours for agricultural managers and producers.

  Target: One tour of each demonstration project.

- Include updates on the status of the Area Plan and water quality data in SWCD newsletters.

  Target: Provide update in Annual Work Plan report and accompanying newsletter.

- Develop media articles, public service announcements, videos and other tools about the state's agricultural water quality program and successful resource management practices. Submit these information resources to local media for publication.

  Target: Eight articles and/or public service announcements delivered to local media. As other information resources are developed, share these with the media.

  Target: Distribute agricultural water quality technical and planning information to 2,000 Upper Willamette SWCD residents through targeted mailings of Eugene Watershed Enhancement Board, Farm Services Agency, OSU/OSUE, and others as available.

- Sponsor or attend small acreage resource management workshops and give presentations on water quality issues to resource, recreation, and education groups.

  Target: Sponsor and/or attend four small acreage workshops or meetings.

Strategy 2. Build partnerships with agribusiness and agencies to promote water quality.

- Coordinate with ODA to update staff at local watershed councils, NRCS and OSUE offices to on the status and activities of this Area Plan.

  Target: Once per biennium to NRCS (Tangent office), Lane County OSUE, Long Tom Watershed Council, and two agribusinesses.

  Coordinate with the Southern Willamette Valley GWMA committee and staff to ensure that agricultural activities are being completed and the committee is updated regularly of the status of activities.

- Develop educational materials in conjunction with agribusinesses and commodity and volunteer organizations.

  Target: Determine interest by at least three local agribusinesses to help sponsor agricultural water quality educational materials.

- Speak at industry and producer meetings or conferences.

  Target: Give presentations at two events.

3.3.2 Conservation Planning and Conservation Activities

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

Strategy 1. Encourage agricultural producers to improve water quality.

- Promote the operational economic efficiency and water quality benefits of resource management practices by showcasing positive and effective practices through workshops and tours of demonstration projects.

  Target: Two workshops and two demonstrations projects (see also Objective 1, Strategy 1)

- Promote Integrated Pest Management (IPM).

  Target: Write one article (newsletter, newspaper, mass mailing, etc.) discussing the management and economic considerations of IPM for a priority crop.

  Target: Integrate the article into one workshop or presentation.

- Promote proper nutrient management and irrigation efficiencies to reduce nitrogen loss to groundwater.

  Target: Work with eight producers to implement best management practices and one demonstration project.

Strategy 2. Provide information so producers can initiate improvements.

- Provide technical assistance from the SWCDs, NRCS, and partner organizations.

  Target: Provide technical assistance to 150 landowners, 50 of these within the Southern Willamette GWMA.

- Compile and make available ongoing research on effective practices, effective adaptive resource management, and practical knowledge from agricultural producers.

  Target: Obtain a research article (authored by OSU/OSUE, NRCS, etc.) or develop one that summarizes practical resource management for water quality.

  Target: Integrate the article into one workshop or presentation.

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.

3.3.3 Funding

Secure adequate funding for administration and implementation to achieve the mission, goal, objectives, and strategies of the Area Plan.

The LAC recommends that Upper Willamette SWCD seek funding to implement the Upper Willamette and Upper Siuslaw 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.

The LAC recommends that the Upper Willamette SWCD, ODA, and other partners use the following strategies to achieve this objective:

Strategy 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 OWEB, the OWEB Small Grant Program, USDA, U.S. EPA, Oregon DEQ, and other agencies and private organizations.

  Target: Write and implement ten OWEB Small Grant Program awards to improve agricultural water quality.

- Form partnerships with the agribusiness sector for additional funding.

  Target: Join with an agribusiness to obtain one large grant to address a priority agricultural water quality issue.

- Promote USDA incentive-based cost-share programs to assist producers who are interested in conservation plan implementation.

  Target: Develop and implement two USDA NRCS conservation program plans that include federal cost-share (state and/or other costs-share may be integrated into these plans as well).

  Target: Write and implement ten agricultural water quality plans.

- Assist landowners in using the Pollution Abatement Tax Credit program.

  Target: Integrate this program into two conservation plans.

- Explore incentive programs designed to promote riparian enhancement on agricultural lands.

  Target: Develop and implement four riparian enhancement project grants (can be large or small grants).

- Provide education to landowners on current incentive programs for riparian enhancement and other activities that enhance water quality.

  Target: Summarize this information in four presentations and four articles.

Strategy 2. Ensure adequate administration of the Upper Willamette and Upper Siuslaw Agricultural Water Quality Management Area Plan.

- Include implementation of the UW and US Agricultural Water Quality Management Area Plan in the Upper Willamette SWCD annual and long-range work plans.

  Target: Implementation of the UW and US Agricultural Water Quality Management Area Plan is included in the Upper Willamette SWCD's annual and long-range work plans.

3.4 Monitoring and Evaluation

Monitor and evaluate the effectiveness of the Area Plan and Area Rules.

- Work with watershed councils, DEQ, Southern Willamette Valley GWMA, and other organizations conducting water quality monitoring to coordinate monitoring programs, evaluate completeness of existing programs, and identify additional monitoring that needs to be conducted.

  Target: Provide results in the Biennial Report.

- Document successful practices implemented in the Management Area.

  Target: Develop a research and documentation plan to evaluate best management practice implementation. Provide this review in the Biennial Report.

- Track increases in awareness of water quality issues.
  - Document participation in workshops, tours, demonstration projects, presentations, etc.
  - Document the number of agribusiness partnerships produced.

  Target: Provide this review in the Biennial Report.

- Monitor violations of prevention and control measures in the Upper Willamette and Upper Siuslaw 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 ODA's compliance assessment, which will be done before the plan and rules review and update.

  Target: Provide this review in the Biennial Report and in the biennial review LAC meeting.

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

  Target: Compare changes in cost-share available and obtained between biennial reviews; provide this information in the Biennial Report.

Chapter 4: Implementation, Monitoring, and Adaptive Management

4.1 Progress Toward Measurable Objectives

Progress toward meeting the Upper Siuslaw Focus Area measurable objectives are provided in 4.2.1 below. Additional objectives may be considered by the LAC at their next meeting.

4.2 Progress on Strategic Initiatives

4.2.1 Focus Area

The Upper Siuslaw Focus Area is in the initial stages of development. A pre-assessment of streamside conditions has been completed and the SWCD has identified milestones to achieve by the 2017 biennial review. Outreach to landowners within the focus area has begun. Results will be provided in the Area Plan for the LAC's next biennial review.

4.2.2 Pesticide Stewardship Partnership

In 2009, the LAC recommended adding a long-term monitoring station between Eugene and Monroe, possibly Amazon Creek at High Pass Road. In response, ODA facilitated the addition of a new ambient monitoring site on Amazon Creek at High Pass Road. This site has been sampled every other month since October 2011. Based on the results of the monitoring, ODA had concerns and contracted with DEQ to do a synoptic sampling at three other locations between the Eugene city limits and High Pass Road. The purpose of the synoptic sampling was to further differentiate the urban contribution to water quality observed at the High Pass Road site. Based on results of this synoptic event, ODA worked with the Long Tom Watershed Council about on further monitoring of the A-1 Canal, where monitoring showed the most pronounced impairments. The results of this monitoring showed that high concentrations of total phosphorus and *E. coli* bacteria were coming from industrial developments and eventually flowing into Amazon Creek upstream of the High Pass Road monitoring station.

2014 data show that there were two herbicides that exceeded the lowest benchmark 100% of the time on a given date:

- A1 Channel at Aubrey Lane (upstream of agricultural influence)- MCPA, (2-methyl-4-chlorophenoxyacetic acid) is a powerful, selective, widely used phenoxy herbicide. The pure compound is a brown-colored powder. MCPA is used as an herbicide, generally as its salt or esterified forms. Used thus, it controls broadleaf weeds, including thistle and dock, in cereal crops and pasture. (Oct 2014)

- Amazon Creek at 29th Street Gaging Station (upstream of agricultural influence) - Mirex, an organochloride that was an insecticide and later banned because of its impact on the environment by the United States Environmental Protection Agency prohibited its use in 1976. This white crystalline odorless solid was popularized to control fire ants and was recognized as a bioaccumulative pollutant. July (2014)

Besides these exceedances, the other three monitoring stations had many detections of various pesticides during the 16 sampling events in 2014. Amazon Creek at Beltline Road had a total of 48 detections, Amazon Creek at Bond Road had 90, and Amazon Creek at High Pass Road had 108 detections. Pesticides were detected in every sampling event, though none were detected at the Bond Road site during the September 15, 2014 event.

4.3 Activities and Accomplishments

Many conservation activities and implementation monitoring tracks have been implemented to benefit water quality. The SWCD and NRCS track activities that have been implemented through quarterly reports to ODA and through a NRCS database, respectively. Projects that have received funding from the OWEB are tracked in OWEB's restoration database. In addition, partner agencies can submit reports of projects and activities in the Management Area that improve water quality.

Implementation monitoring tracks the conservation practices that have been implemented to benefit water quality. The local SWCDs and NRCS track practices that have been implemented through quarterly reports to ODA and through an NRCS database. In addition, projects that have received funding from the Oregon Watershed Enhancement Board are tracked in OWEB's restoration database. In addition, partner agencies can submit reports of projects and practices installed in the management area that impact water quality. The biennial report from the LAC has an attachment with details regarding the implemented projects.

Local Management Agency - Upper Willamette District: July 1, 2013 - June 30, 2015

Strategy 1. Encourage education programs to promote Public awareness of water quality issues.	2013- Provided presentation regarding Agricultural water quality program to students at Junction City High School ag class. Discussed plan/rules. (25 students) 2013- Provided presentation to small farms group annual meeting. Provided plan/rules for attendees. (16 attendees) 2013- continued distribution of District handbook (distributed 2500 copies) 2014- Distributed water quality information at Veneta Earth Day event. 2014- Distributed information regarding water quality plan/rules at Local Food Connection Conference. (300 attendees) 2014- Provided water quality information to landowners regarding plan/rules at Pesticide Reduction Conference. (35 attendees) 2014- Provided Presentation to Ag producers regarding UWUS Plan/Rules at FSA producer meeting in Junction City. (10 attendees) 2014- Provided water quality information at landowner meeting for OSU Extension in Monroe. (28 attendees) 2014- Provided presentation regarding water quality issues within the UWUS Ag WQ management area to students at LCC Conservation class. Provided examples of Ag Plan/Rules and implementation strategies to assist landowners. (22 attendees) 2014- Provided presentation to Siuslaw Watershed Council meeting regarding area Plan/Rules. Discussed selection of South Fork Siuslaw as priority area for UWUS management area. 2015- Developed Curriculum for Water Wonders summer camp for low-income youth in UWUS management area. This week long camp will teach kids about water quality and issues that affect water quality. 2015- Provided water quality information presentation for landowners in UWUS management area at FSA Ag producer meeting held in Junction City. Provided Plan/Rules and priority area information. (16 attendees). 2015- Provided table information regarding water quality issues for the Local Food Connection Conference at LCC. Information distributed included UWUS Plan/Rules summary, Project information for Ag producers. (300+ attendees)
Strategy 2. Build partnerships with agribusiness and agencies to promote water quality.	2015- Provided information booth at West Eugene Community Event. Provided information to rural residential attendees regarding water quality issues, UWUS Plan/Rules Summary, Ag activities that affect water quality and implementation measures available to correct issues. (500 attendees) 2015- provided information table at Confluence Event held at Green Island. Provided information regarding water quality issues that affect landowners conducting agricultural activities, UWUS Plan/Rules summary. (150 attendees) 2013-15 The Upper Willamette SWCD continues to partner with Sure Crop Farm Services in providing a soil testing service for agricultural landowners within the Upper Willamette/Upper Siuslaw management area. During the biennium, the district provided soil analysis for 150 area landowners. These analyses provide nutrient input information to ensure landowners are applying correct amounts of nutrient to the various crops grown.

	2013-14 District staff continued it's partnership with the City of Eugene to conduct 7 rain garden workshops in Eugene, Veneta, and Junction City for residents interested in installing a rain garden. 2013-15 The District continues to partner with DEQ, ODA, Linn and Benton SWCD, NRCS, WRD, LTWSC, Cities of Junction City, Monroe, Eugene, Harrisburg, and the appointed committee for the Groundwater Management Area. The UWSWCD sits on the PINE committee designated to address agricultural contributions to high nitrates in groundwater and provides continuing input regarding lysimeter testing being conducted in the UWUS management area. 2015- The District is a member of the Willamette River Wains group that addresses invasive aquatic species in the Willamette River and its tributaries. 2015- The District is partnering with Lane County Public Works, BLM, Siuslaw WSC, and seven agricultural landowners to conduct a project to restore flow and habitat in Crow Creek located near Lorane.
Objective 2. Resource Management	
Strategy 1. Encourage agricultural producers to improve water quality.	2013-2015 District staff provided presentations at landowner meetings in Veneta, (2) Lorane, (2) Junction City (2), and Monroe (1) regarding water quality topics. Staff received over 150 phone calls from the Upper Willamette/Upper Siuslaw management area landowners regarding water quality issues and provided technical assistance covering various topics such as manure management, livestock exclusion, grass waterways, nutrient management, riparian enhancement, pasture management/enhancement. Staff also conducted two landowner tours within the management area, visiting project sites that had implement practices to improve water quality. Staff has distributed over 300 pieces of information to landowner regarding water quality; focused on the Ag water quality program it's Plan and Rules. 2013-2015 District Staff conducted 50 individual landowner site visits within the management area. From those visits, 12 projects were developed. Three are still in progress. Practices installed to address water quality concerns include sub-surface and surface drainage implementing grass waterways, or underground outlet, riparian buffer establishment, exclusion fence, rotational grazing, manure management, heavy use protection, off-stream watering and nutrient management through soil testing. The District and ODA is nearly completed the UWUS pre-assessment phase for the South Fork Siuslaw Focus area, blanket mailings and workshops meetings are upcoming. Staff is currently working with 7 landowners who received individual visits to discuss their agricultural operations in relation to restoring and enhancing nearly 2 miles of stream on Crow Creek east of Lorane.
Strategy 2. Provide information so producers can initiate improvements.	

Objective 3. Funding	
Strategy 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.	2013-2015 During this biennium the primary source of funding obtained for implementation of management practices for projects within the management area was provided by the OWEB small grant and regular grant programs. Staff also utilized RAC funds to be used for project planning assistance/Practice implementation and education. Over the 2-year period, $110,000.00 was obtained for project implementation through the district.
Strategy 2. Ensure adequate administration of the Area Plan.	Staff works closely with ODA to complete duties associated with carrying out the goals and strategies of the Area Plan which includes education/outreach, implementation of best management practices, compliance and monitoring of the practices to ensure water quality issues associated with agricultural activities are addressed. District staff also completed coordination of area biennial meeting to include, planning meeting with committee chair and vice chair, member contacts, member recruitment, committee meeting coordination, meeting minutes, and distribution.
Objective 4. Evaluation	
Strategy 1. *Monitor and evaluate effectiveness of the Area Plan and Rules*	During the biennium, the district conducted extensive outreach to agricultural producers within the management area. Through increased awareness of the Plan and Rules the District has received an increase in landowner technical assistance services as well as site visit evaluations. With the implementation of the focus area within the management area, many smaller Ag operations are understanding that their activities effect water quality to the same degree that a large operation does and that they have a part in protecting water quality as well. One compliance visit was conducted by ODA and the District with agreement by the landowner to change management practices to address water quality concerns. Monitoring of a previous compliance visit has been completed using public viewpoints to confirm compliance has been maintained.

The Natural Resource Conservation Service (NRCS) is recognized as an important partner in the effort to provide technical and financial assistance to agricultural producers to help obtain or maintain compliance with the Management Area Rules.

During the last biennium, NRCS staff has assisted over 20 individual producers within the Management Area in Lane County. During that time, over **$500,700** in federal cost/share funding assistance was allocated through federal cost/share programs. In addition, another **$130,000** of state funded assistance has been allotted to individual landowners within the Management Area administered by the District. The following table illustrates the amount of conservation practices that have been applied in the Management Area.

NRCS Applied Practices in the Upper Willamette Management Area 2013-15:

Conservation Practices	Units	2013	2014	2015	Totals
Access Road	FT	450	160	0	810
Composting Facility	NO	5	3	3	11
Comprehensive nutrient Mgmt. Plan	NO	1	5	3	8
Cover Crop	AC	84	81	3	168
Conservation Crop Rotation	AC	122	130	115	367
Fence	FT	66,736	10,884	15,873	93,493
Field Border	FT	330	0	0	330
Filter Strip	AC	7	2	0	9
Grass Waterway	AC	5	2	0	7
Heavy Use Protection	NO	5	17	1	23
Irrigation Water Management	AC	1,594	804	866	3264
Irrigation System Sprinkler/micro	AC	12	122	0	134
Irrigation Water Conveyance (underground)	FT	18,348	1620	649	20,617
Manure Transfer	NO	N/A	N/A	N/A	N/A
Nutrient Management	AC	1,729	821	502	3199
Pest management	AC	506	59	96	661
Prescribed Grazing	AC	761	449	409	1619
Conservation Tillage (no-till, Strip till, mulch till)	AC	76	555	153	784
Riparian Buffer	AC	161	38	4	203
Stream bank Protection	FT	120	0	90	210
Tree/Shrub Est.	AC	101	42	22	165
Use Exclusion	AC	152	65	31	248
Waste Storage Facility	NO	1	3	1	5
Waste Utilization	AC	81	0	0	81

4.4 Water Quality Monitoring—Status and Trends

4.4.1 DEQ Monitoring Update

The Oregon DEQ monitors and evaluates water quality in a given area and statewide through a variety of programs, including: Ambient Monitoring and Oregon Water Quality Index (OWQI), Statewide Toxics Monitoring, Statewide Biomonitoring, Volunteer Water Quality Monitoring, Drinking Water Protection, Groundwater Monitoring as well as a geographic specific water quality assessment projects. Each of these efforts relies on specific funding sources and is designed to provide information to stakeholders and decisionmakers at certain spatial or temporal scales, including the Oregon Water Quality Assessment and list of impaired waterbodies (i.e., 303(d) list). The WQ Assessment information is accessed via the following: http://www.deq.state.or.us/wq/assessment/assessment.htm.

Ambient Water Quality (and OWQI):
DEQ calculates and revises (as necessary) the OWQI for each Basin based on new data at least biennially (http://www.deq.state.or.us/lab/wqm/wqimain.htm). There are three ambient stations in the Management Area. For the Willamette the OWQI represents a single ambient station relatively low in each of the mainstem segments. The 2015 OWQI shows the following status:

- Long Tom River at Stow Pit Road - Fair
- Amazon Creek at High Pass Road—Very poor
- Willamette River at HWY 99 E (Harrisburg) - Excellent

Based on the most recent OWQI, all of these stations showed "No Trend" (condition not improving or declining). The WQ "sub-indices" for specific pollutants are used to evaluate trends in the overall index.

Long term ambient temperature data indicate that the Willamette River at HWY 99E (Harrisburg) failed to meet spawning (22 times) and non spawning criteria; failed to meet pH (of 8.5) in the past but only once since 1975; has failed to meet DO 22 times since 1975; failed E. Coli criteria several times until 1995, and since then *E. Coli* is decreasing.

Toxic chemicals: DEQ's Statewide Water Quality Toxics Monitoring Program collected and analyzed water samples between 2008 and 2013 in order to establish baseline data on the types and prevalence of toxic chemicals in waters of the state. DEQ tested for more than 500 different chemicals in Oregon rivers and estuaries. Under the program, DEQ collected samples from 177 sites within 15 water basins throughout the state. Of those sites, samples were collected between April 2008 and May 2010 at 10 locations in the Upper Willamette subbasins (which includes Coast Fork, Willamette McKenzie , Middle Fork Willamette, South Santiam and Upper Willamette sub-basins. Samples from two sites, Long Tom River and Calapooia River, in the Upper Willamette area contained the greatest numbers of unique chemicals.

Chemicals detected in the Upper Willamette plan area included:

- Consumer product constituents were detected in the McKenzie, Middle fork, and Coast Fork, but not at the Long Tom monitoring site. Sulfamethoxazole was found out the Willamette River Harrisburg site).
- Current-use herbicides was the most common group of chemicals with 11 compound detected. Samples collected at the Long Tom River site accounted for a majority of these detections including Diuron and pentachlorphenol. One detection, pentachlorophenal at the Long Tom River site exceeded its Oregon DEQ criterion for human health during the spring sampling event.

- Current use pesticides detected at the Long Tom River site included 2,4,D, Atrazine, Dicamba, 417Diuron, Metolachlor, Metribuzin, Oxamyl, Propiconazole, and Simazine. Diuron was detected in the Willamette at Harrisburg
- Metals, included arsenic, barium, iron, cobalt, copper, lead, manganese, nickel, zinc, and chromium were detected. Human health criteria were exceeded for Copper (Willamette River at Harrisburg), lead (Long Tom at Stow Pit) as well as iron and chromium at other sites in the Upper Willamette subbasins.
- Legacy pesticides – not sampled
- Plant and animal sterols—Cholesterol and Coprostanol (detected at Long Tom and Harrisburg sites)
- Combustion byproducts (not sampled)
- Flame retardants (classified as PBDEs)—low level methods were not available at this time

DEQ's review thus far shows that the Upper Willamette & Upper Siuslaw Agricultural Water Quality Management Area Plan:

- Long Tom River, Amazon Creek and Willamette River (at Harrisburg) exceed water quality criteria for copper, lead and zinc.
- Samples collected in 2008-2010 (prior to the Mid-Coast Basin) did not include low-level analyses for legacy pesticides, PCBs, flame retardants or dioxins and furans. Analysis did not include speciation of inorganic arsenic.
- While some combustion by-products were included, new methods allowing low-level analysis were not. Nutrient measurements including analysis for ammonia were also not included.
- Future toxics monitoring work in the Willamette Basin will include these analyses. . Additional sampling may help identify any potential trends

DEQ has not identified the source(s) of most of these chemicals. General sources include:

- Increased rates of soil erosion and land disturbance exacerbate the delivery of arsenic, mercury and other metals naturally occurring in soils and underlying geologic formations.
- Consumer product constituents and animal sterols are indicative of domestic wastewater sources. Animal sterols suggest livestock and wildlife sources.
- Atrazine is labeled for use in forestry and for agricultural crops.

Biomonitoring Program:

Based on results from Oregon's Statewide Biomonitoring Program from 1997-2007 & 2012, and subsequent comparison to reference site conditions, a number of sites were identified as "impaired" in the MidCoast and placed on Oregon's 303(d) list in the 2010 Assessment cycle by U.S.EPA. Additional sites are proposed for placement on the 303(d) list in 2012.

Volunteer Water Quality Monitoring:

No recent data has been entered into database.

TMDL Effectiveness Monitoring Baseline Data:

DEQ collected data 2011-2013 to establish baseline water quality in small streams on agricultural and

urban lands. Subsequent monitoring will determine if water quality is improving on these lands after the jurisdictions (counties, cities, and agriculture) have implemented their TMDL and Agricultural Water Quality Plans for 5 or 10 years. Data were analyzed to determine if state standards for water quality were met; if water quality differed between up and downstream sites (agriculture vs. urban); and for storm sampling (to determine the quality of surface runoff in the fall after soil was saturated).

Flat Creek (Four sampling sites):
There are four collection sites associated with the Junction City DMA. Two of these sites are located along a small stormwater collection ditch that runs through the eastern side of Junction City and eventually joins with Flat Creek north of town.The upstream site (JCTR1UP) is located just south E 1st Ave and the downstream site (JCTR1DW) is located just north of town along W. 18th Avenue. The other two sites are located along a creek that appears to be a branch of Flat Creek that also collects stormwater as it travels through the central and more westerly portion of Junction City. The upstream site (JCTR2UP) is located just south of town at a small footbridge to the east of Hwy 99 and south of an RV dealership and the downstream site (JCTR2DW) is located at a culvert on W. 18th just north of town. Streams were ephemeral during the two year study which limited sampling to spring and summer months.

Tributary 1 is a small ephemeral stream that originates in farm land south of Junction City and collects storm runoff as it travels through the eastern side of town and eventually connects with Flat Creek to the north. Overall, State Standards and DEQ Benchmarks were met for all parameters except temperature at both the up and downstream sites. State Standards: In particular, State Standards for temperature were not met at either the upstream or downstream sites on Tributary 1 although those for *E. coli* were always met.

Analysis on the data collected from Tributary 1 indicated statistically significant differences between the upstream and downstream results for turbidity and total suspended solids. The monitoring site upstream of Junction City had higher values for turbidity and suspended solids than the downstream sites, indicating that turbidity and suspended sediment are higher as the stream enters Junction City than when it exits downstream. This suggests that the farmlands are a greater source of turbidity upstream of town and/or the sediment drops out on its way through town.

Storm sampling results from Tributary 1 indicated State Standards for E. coli were not met at either the up nor downstream sites in the second year. Again, the results indicated more degraded water quality at the upstream rather than downstream site for this event.

Tributary 2 is a small ephemeral stream (a branch of Flat Creek) that collects storm runoff as it travels through Junction City on its way to reconnecting with Flat Creek to the north. Overall, State Standards and DEQ Benchmarks were met for all parameters except dissolved oxygen at the upstream site and all parameters except temperature at the downstream sites. State Standards for temperature were not met downstream of Junction City once. Standards for E. coli were always met at both up and downstream sites. Dissolved oxygen was sampled only before stream flow dropped for the season.

Comparison of the upstream and downstream results from Tributary 2 showed a significant difference for turbidity ($p = 0.0301$), a somewhat significant difference for total suspended solids ($p = 0.0721$) and a marginally significant difference for temperature (0.1056) with the higher values always occurring at the downstream site showing that the water quality was decreased for these parameters as it passed through Junction City in this ephemeral stream.

Storm sampling results from Tributary 2 did not meet State Standards for *E. coli* at both the up and

downstream sites in the second year with the results indicating a more degraded water quality at the downstream site for this event. Macroinvertebrate sampling did not occur in Junction City during this study due to adequate summer stream flow.

West Fork Coyote Creek Upstream of Fern Ridge Reservoir Jurisdictions in the Upper Willamette watershed are facing unique problems related to the high levels of bacteria in the waterways. The DEQ reports that the Long Tom River increases bacterial concentrations in the mainstem of the Willamette River by 77 percent (Willamette Basin TMDL, 2004).

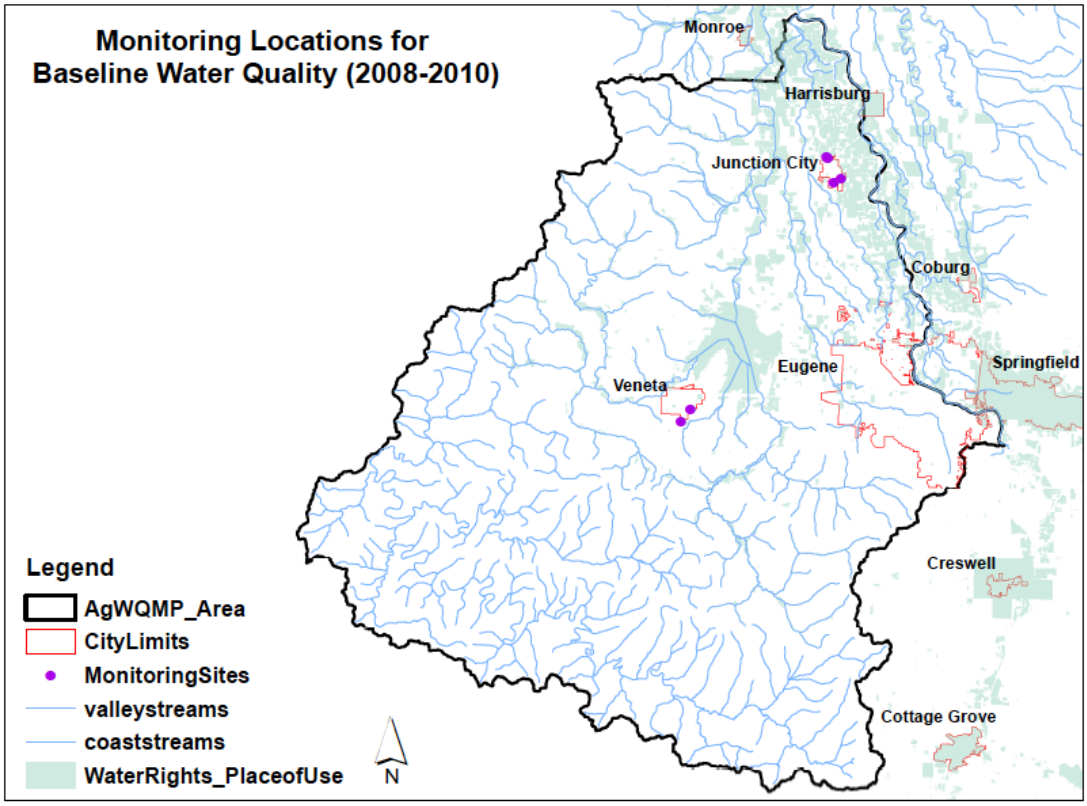
A small ephemeral stream that runs through Veneta collects storm water as it travels north. There were two sampling sites on an ephemeral stream that flows north through Veneta. One is upstream of Veneta near the junction of Strawberry Lane and Territorial Road just outside of Veneta City limits and another is the downstream at a culvert on E. Bolton Rd.

Samples were collected 10 times in a two-year period at these sites due to lack of sufficient summer flowing water. State Standards and DEQ Benchmarks were met for six of the eight parameters at both the up and downstream sites. State Standards for temperature were always met. It is interesting to note that the stream temperature actually dropped from the levels sampled at the upstream site as it moved through town to the downstream site. There is a lot of shading along this area of the creek and there may be other mitigating factors as well. *E. coli* standards were not met twice (20%) at the upstream site and three times (30%) at the downstream site. The State Standard for dissolved oxygen was not met 100% of the time at the upstream site and 50% of the time at the downstream site.

Results show a significant difference between upstream and downstream values for *E. coli* and conductivity with the downstream site (urban) having the higher values. There is also a significant difference for total suspended solids-- the upstream (agriculture) site consistently had the higher values indicating total suspended solids settle out as the stream flows through Veneta without a significant amount being added within city limits.

Storm sampling results exceeded State Standards for *E. coli* at both sites and both years.

Figure 4. Baseline TMDL Effectiveness Monitoring Site Locations



4.4.2 ODA Aerial Photo Monitoring

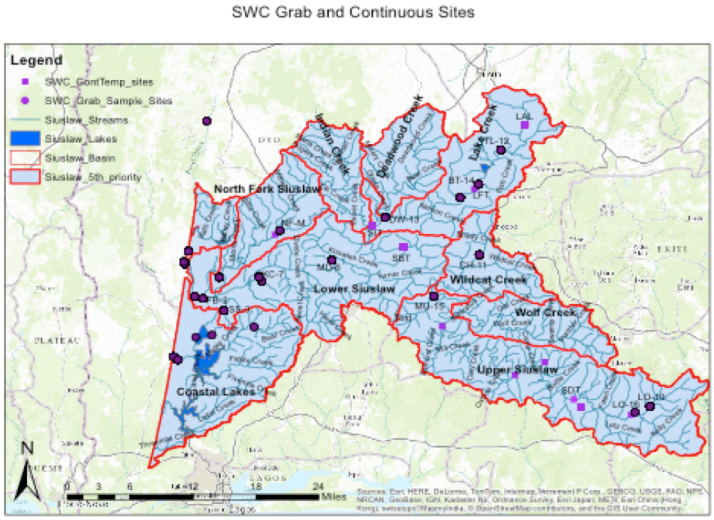
Seven stream reaches were assessed in the Upper Willamette Basin in 2006 and 2011. Riparian index scores improved significantly (i.e. 5% or more) in four of these. Poodle Creek was the only stream with a declining score (3.3%), due mostly to loss of tree cover. Ferguson and Flat creeks both had RIS improve by 6%, while Coyote and Fox Hollow both improved by 5%. Coyote Creek had more mature riparian vegetation in 2011 than 2006; resulting in an increase in tree percentage except on the right 60 and 90 foot bands. Ferguson Creek also had more mature riparian vegetation and less bare agricultural land because many fields that had been bare in 2006 were cultivated in 2011. Riparian vegetation had not matured noticeably on Flat Creek but one ditched reach showed improved vegetation cover. There was a significant increase in tree cover and a decrease in bare agricultural land. Tree cover also improved significantly on Fox Hollow Creek.

Table 2. Riparian index scores from analysis of aerial photographs from 2006 and 2011.			
Stream	**Measured Scores**		
	2006	**2011**	**% Difference**
Coyote Creek	46.98	49.18	+4.7
Ferguson	41.46	43.82	+5.7
Flat Creek	41.87	44.48	+6.2
Fox Hollow	37.96	39.98	+6.9
Poodle Creek	55.24	53.41	-3.3
SF Siuslaw	58.18	57.89	< 1
Spencer	60.82	60.54	< 1

4.4.3 Siuslaw Watershed Council Water Quality Monitoring

The Siuslaw Watershed Council facilitates a wide variety of monitoring projects in the basin and the Siuslaw Volunteer Water Quality Monitoring Program (VWQMP) is one of those projects. Once a month, trained volunteers collect and process surface water samples from sites throughout the watershed; a map is provided below. Continuous temperature monitoring sites were implemented in spring 2014. The data obtained in the VWQMP is baseline data. The watershed council currently measures clarity, salinity (in the estuary), dissolved oxygen, turbidity, bacteria, temperature, and weather conditions. The council's report on water quality data from 2014 can be found at http://www.siuslaw.org/monitoring.

Figure 5. Siuslaw Watershed Council Monitoring Locations



4.4.4 Southern Willamette Groundwater Management Area

DEQ is currently conducting quarterly sampling of 12 groundwater-monitoring locations and conducting annual sampling of 33 additional groundwater- and surfacewater- monitoring locations in the GWMA for nitrate. Some locations are also sampled for chloride and phosphorous. This program includes monitoring 23 shallow monitoring wells, 16 domestic wells, and six surfacewater sites. The domestic wells are generally installed deeper than the monitoring wells. While nitrate contamination trends appear to be decreasing at some monitoring locations, there are some areas in the GWMA where nitrate levels

continue to increase and other areas where no change in nitrate concentration is evident. 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. The threshold for drinking water is 10mg/L as measured by nitrogen (NO_3-N)

In some rural areas, well water nitrate concentrations can be elevated. Households may be unaware of this type of contamination and that increases the risk of health problems associated with nitrate consumption. Much of this nitrate comes from agricultural nitrogen use and thus improvements in N management are needed to reduce the leaching to groundwater. Previous work in the Southern Willamette Valley by researchers at OSU determined the importance of cover crops and irrigation practices in reducing N leaching.

A new lysimeter project started in late 2013 and has grown to include 15 actively managed agricultural fields; many of them were part of the 1990-era study conducted by OSU to examine the influence of current crops and nutrient management on nitrate leaching below the rooting zone. The current study represents current crops in the areas and includes five grass fields, three vegetable fields, two peppermint and wheat fields, and one each of hazelnuts, blueberries, and one control field. New nutrient management practices include slow release fertilizers and precision agriculture approaches in some of the fields. This work will examine the nitrogen balances and rate of N leaching at the field level from the 1990's to the present. Data from this study will be incorporated into the USDA-Agricultural Policy.Environmental Extender (APEX) model. Data from the 1990's study has already been used to calibrate the APEX model to the Willamette Valley. Data from the current study is being used to validate APEX with final goals of the project to provide information and tools that will help farmers, managers, and conservation groups quantify the water quality benefits of management practices they are conducting or funding.

In early 2010, an evaluation of the accomplishments was completed. This evaluation included reporting of agricultural accomplishments by the ODA's Water Quality and Confined Animal Feeding Operations programs, the NRCS, and the Linn, Benton, and Upper Willamette Districts. This evaluation found that 65% of the agricultural measures of implementation had been completed. Based on the Action Plan evaluation, it was determined that an update to the Action Plan was necessary.

On October 26, 2011, an agriculture work group met to review and update the agricultural section of the GWMA Action Plan. The agriculture work group consisted of ODA staff, District staff, NRCS staff, and seven local agricultural producers. The purpose of the agriculture work group meeting was to review updates to the Action Plan and review research needs. The work group asked that information on precision agricultural practices that producers are implementing be included in the Action Plan. The goals of the Action Plan were updated to be consistent with the statutes related to the ODA's Agricultural Water Quality Program and statutes related to the GWMA. Research needs that were identified include: additional research to understand what is happening below the root zone of crops, and the effects of various recommended management practices on leaching of nutrients. The updates to the GWMA Action Plan should be completed in early 2017.

4.5 Biennial Reviews and Adaptive Management

Area Plan Implementation Progress and Effectiveness

The LAC believes producers have come a long way over the years due to improved management practices and there is continued willingness to work together to find solutions to current concerns. Previously, there were no measurable objectives, milestones, and targets in the Area Plan. Ways to measure progress such as Focus Areas and Strategic Implementation Areas will better indicate what improvements have been

made and inform Plan implementation going forward. Focusing work in small geographic areas provides a way to show improvements.

There is a large amount of monitoring data collected by various organizations which needs to be assembled in a cohesive way for easy understanding. Landowners need information provided on a site-specific basis, otherwise, there are too many variables to consider. A better understanding is needed regarding the surface water / ground water relationships. This knowledge could lead to options that have not yet been examined. In addition, research regarding the appropriate timing, intensity, and duration within streamside areas that would be protective of water quality is needed.

Area Plan Regulations

Over the last biennium there were two compliance cases:

- The first case, conducted in response to a compliant regarding livestock in the stream, was determined to be in compliance by ODA. ODA rules do not require exclusion fencing. ODA determined that the streambanks were stable and sufficiently vegetated to filter overland flow. The Junction City Water Control District manages the stream and does not want vegetation that would restrict flow and possibly result in flooding.
- The second case involved a large mint compost pile located where nutrients would leach into surface water. The case was referred to DEQ to evaluate under the Solid Waste Program.

Outreach

Farmers feel beleaguered about regulations; there are new regulations being placed all the time. They often do not have time to deal with all of the rules being established. Simple and concise information provided in one location is needed. It would be helpful to have “like-type” communication and information sharing between farms. Communication and information sharing needs to continue to improve between the public and producers.

Communication between agencies and growers needs to be better to allow for both parties to work together. With regard to ODA’s Strategic Implementation Area process, it would be helpful to provide outreach materials with examples of the various concern-levels (no concern, low, moderate, significant and serious).

Finally, a great amount of resources are expended by agencies to make improvements in water quality. Farmers want to know if the way resources are being spent has been effective.

References

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

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

Bastasch, R. 1998. Waters of Oregon. Oregon State University Press, Corvallis, Oregon.

Beschta, R.L. 1997. Riparian shade and stream temperature: an alternate perspective. Rangelands 19:25-28.

Bilby, R.E. 1984. Characteristics and frequency of cool-water areas in a western Washington stream. Journal of Freshwater Ecology 2:593-602.

Brown, G.W. 1969. Predicting stream temperatures of small streams. Water Resources Research 5:68-75.

Blinn, C. 1998. Managing water on roads, skid trails, and landings. Minnesota Department of Natural Resources, St. Paul, Minnesota.

Bruneau, A., S. Hodges, and L. Lucas. 1995. Water quality and home lawn care. North Carolina Cooperative Extension Service, Raleigh, North Carolina.

Chaney, E., W. Elmore, and W.S. Platts. 1993. Livestock grazing on western riparian areas. U.S. Environmental Protection Agency, Seattle, Washington.

Chen, D.Y., R.F. Carsel, S.C. McCutcheon, and W.L. Nutter. 1998. Stream temperature simulation of forested riparian areas. Journal of Environmental Engineering 124:316-328.

Clark, A. 1998. Landscape variables affecting livestock impacts on water quality in the humid temperate zone. Canadian Journal of Plant Science 78:181-190.

Council for Agricultural Science and Technology. 2012. Assessing the Health of Streams in Agricultural Landscapes: The Impacts of Land Management Change on Water Quality. Special Publication No. 31. Ames, Iowa.

Csuti, B. et al. 1997. Atlas of Oregon Wildlife. Oregon State University Press, Corvallis, Oregon.

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.

Feise, C., E. Adams, and J. LaSpina. 1993. Silage storage. Washington State University Cooperative Extension Service, Pullman, Washington.

Gamroth, M. and J.A. Moore. 1996. Assessing your manure management for water quality risk. Oregon State University Extension Service, Corvallis, Oregon.

Gatchell, L. 1996. Master's Thesis. Oregon State University, Corvallis, Oregon.

Godwin, D. and J.A. Moore. 1997. Manure management on small farm livestock operations. Oregon State University Extension Service, Corvallis, Oregon.

Godwin, D. and B. Rogers. 1998. Riparian area evaluation and management. Section II, Chapter 6 in Watershed Stewardship: A Learning Guide. Oregon State University Extension Service, Corvallis, Oregon.

Guard, J. 1995. Wetland plants of Oregon and Washington. Lone Pine Publications, Redmond, Washington.

Hansen, H. and W. Trimmer. 1997. Irrigation runoff control strategies. Pacific Northwest Extension, Corvallis, Oregon.

Hart, J., G. Pirelli, and L. Cannon. 1995. Fertilizer guide for pastures in western Oregon and western Washington. Oregon State University Extension Service, 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.

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

Hirschi, M. 1994. 50 ways farmers can protect their groundwater. North Central Regional Extension, Urbana, Illinois.

Hirschi, M. 1997. 60 ways farmers can protect surface water. North Central Regional Extension, Urbana, Illinois.

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

Krueger, W.C., T.K. Stringham, and C.E. Kelley. 1999. Environmental and management impacts on stream temperature. Final report. Department of Rangeland Resources, Oregon State University, Corvallis, Oregon.

Lundin, F. 1996. Pasture management guide for coastal pastures in Oregon and Washington. Oregon State University Extension Service, Corvallis, Oregon.

Marx, E.S., J. Hart, and R.G. Stevens. 1999. Soil test interpretation guide. Oregon State University Extension Service, Corvallis, Oregon.

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

Naiman, R.J. and H. Decamps. 1997. The ecology of interfaces: riparian zones. Annual Review of Ecology and Systematics 28:621-658.

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

Natural Resources Conservation Service. 1997a. Conservation practice standard for critical area planting. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997b. Conservation practice standard for cover and green manure crop. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997c. Conservation practice standard for animal trails and walkways. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997d. Conservation practice standard for heavy-use area protection. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997e. Conservation practice standard for diversion. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997f. Conservation practice standard for roof runoff management. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997g. Conservation practice standard for use exclusion. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997h. Conservation practice standard for livestock watering facility. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997i. Conservation practice standard for nutrient management. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997j. Conservation practice standard for underground outlet. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 1997k. Conservation practice standard for grassed waterway. Natural Resources Conservation Service, Portland, Oregon.

Natural Resources Conservation Service. 2001. Conservation practice standard for filter strip. Natural Resources Conservation Service, Portland Oregon.

Oregon Department of Environmental Quality. 2007. Reducing Mercury Pollution in the Willamette River. Oregon Department of Environmental Quality, Portland Oregon.

Oregon Geospatial Data Clearinghouse. 2002. Watershed information for Oregon. Oregon Geospatial Data Clearinghouse, Portland, Oregon.

Oregon Water Resources Department. 2003. Water Rights Information System. Oregon Water Resources Department, Salem, Oregon.

Patching, W.R. et al. 1987. Soil survey of Lane County Area, Oregon. United States Department of Agriculture – Natural Resources Conservation Service, Portland, Oregon.

Penhallegon, R. 1994. Private well testing results for Lane County, Oregon. Oregon State University March 1994 Lane County Extension Report.

Petit, G. 1988. Assessment of Oregon's groundwater for agricultural chemicals. Report to the state of Oregon, Department of Environmental Quality, Portland, Oregon.

Pojar, J. and A. MacKinnon. 1994. Plants of the Pacific Northwest Coast. Lone Pine Publishing, Redmond, Washington.

Population Research Center. 2000. April 1, 2000 census and revised estimates for July 1, 2000 for Oregon, its counties, and cities. Portland State University, Portland, Oregon.

Rogers, B. and G. Stephenson. 1998. Livestock and forage management in western Oregon riparian areas. Section III, Chapter 3 in Watershed Stewardship: A Learning Guide. Oregon State University Extension Service, Corvallis, Oregon.

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

Selker, J. et al. 2004. Nitrates and Groundwater: Why Should We Be Concerned with Our Current Fertilizer Practices? Special Report 1050. Oregon State University, Corvallis, Oregon.

Shelby, R. 1995. Assessment of groundwater recharge and quality under agricultural production in Lane County, Oregon. Master's Thesis. Oregon State University, Corvallis, Oregon.

Sherer, B.M. et al. 1992. Indicator bacterial survival in streams and sediments. Journal of Environmental Quality 21:591-595.

Siuslaw Basin Council and Ecotrust. 2002. A watershed assessment for the Siuslaw Basin. Siuslaw Basin Council, Mapleton, Oregon.

Smesrud, J.K. and J.S. Selker. 1998. On-farm testing of BMPs' reduction of nitrate loading to groundwater. Final report to Oregon Department of Agriculture. Oregon State University, Corvallis, Oregon.

South Santiam Watershed Council. 1998. Guide for using Willamette Valley native plants along your stream. Linn SWCD, Tangent, Oregon.

Thieman, C. 2000. Long Tom Watershed Assessment. Long Tom Watershed Council, Eugene, Oregon.

Thieman, C. 2001. Long Tom Water Quality Monitoring Program Final Report for 1999-2001. Long Tom Watershed Council, Eugene, Oregon.

Thieman, C. 2007. Stream Health and Water Quality in the Long Tom Watershed, 1999-2006. Eugene (OR): Long Tom Watershed Council Technical Report No. 2007-M-01. 2007. 36 p.

Trimmer, W. and H. Hansen. 1994. Irrigation scheduling. Pacific Northwest Extension, Corvallis, Oregon.

United States Geological Survey. 1995. 1995 water resources data for Oregon. United States Geological Survey, Portland, Oregon.

United States Geological Survey. 2001. Calendar year streamflow statistics for the nation. United States Geological Survey, Portland, Oregon.

United States Geological Survey. 2001. Monthly streamflow statistics for the nation. United States Geological Survey, Portland, Oregon.

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

Ward, J.V. 1985. Thermal characteristics of running waters. Hydrobiologia 125:31-46.

Waskom, R. 1994. Best management practices for phosphorus fertilization. Colorado State University Cooperative Extension, Fort Collins, Colorado.

Appendix A: 2010 303(d) List for Upper Willamette and Upper Siuslaw

ALKALINITY/pH

Potential Concern	**Season**
Ferguson Creek, Mouth to Headwaters	
Long Tom River, Mouth to Headwaters	

303(d) List	**Season**
Amazon Creek Diversion Channel, River Mile (RM) 0 to 3.9	Summer
Cedar Creek, Mouth to Headwaters	Fall-Winter-Spring
Long Tom River, RM 26.8 to 52	Fall-Winter-Spring

DISSOLVED OXYGEN

303(d) List	**Season**
Amazon Creek, RM 0 to 22.6	January 1 – May 15
Amazon Creek, RM 0 to 21.7	Year Round
Amazon Creek Diversion Channel (A3 Drain), RM 0 to 3.9	June 1 – September 30
Bear Creek, RM 0 to 12.9	Year Round
Coyote Creek, RM 0 to 26.2	Year Round
Elk Creek, RM 0 to 5.9	Year Round
Feguson Creek, RM 0 to 10	Year Round
Long Tom River, RM 0 to 57.2	January 1 – May 15
Spencer Creek, RM 0 to 8.7	Year Round
Siuslaw River, RM 5.7 to 105.9	Year Round

TEMPERATURE

303(d) List	**Season**
Siuslaw River, RM 0 to 1.6	Year Round
Siuslaw River, South Fork, RM 0 to 7.3	Year Round

MERCURY

303(d) List	**Season**
Amazon Diversion Channel (A3 Drain), RM 0 to 3.9	Year Round

NUTRIENTS

Potential Concern	**Season**
Long Tom River (Phosphorus), Mouth to Headwaters	Summer

BIOLOGICAL CRITERIA

303(d) List
Long Tom River, RM 0 to 24.2

Fox Hollow Creek (Coyote Creek watershed), RM 0 to 7.1

Siuslaw River, RM 60.2 to 105.9
Siuslaw River, South Fork, RM 0 to 3.8

BACTERIA (E. Coli)

303(d) List	**Season**
Long Tom River, RM 0 to 24.2	Fall-Winter-Spring
Amazon Creek, RM 0 to 22.6	Year Round
Amazon Creek Diversion Channel, RM 0 to 6.6	Year Round
Amazon Diversion Channel (A3 Drain), RM 0 to 3.9	Year Round
Fern Ridge Reservoir	Fall-Winter-Spring
Bear Creek, RM 0 to 10.3	Year Round
Ferguson Creek, RM 0 to 8	Year Round
Spencer Creek, RM 0 to 8.7	Fall-Winter-Spring
Spencer Creek Tributary, RM 0 to 2.5	Fall-Winter-Spring
Siuslaw River (Fecal Coliform), RM 5.7 to 105.9	Year Round

TOXICS (may include: *Antimony*, *Arsenic*, *Cadmium*, *Chromium*, *Chlordane*, *Chlorophenozy Herbicides (2,4-d), Copper*, *DDT*, *Dichloroethylenes*, *Dioxin (2,3,7,8-TCDD*, *Dioxins/Furans, Iron, Lead*, *Manganese*, *Nickel*, *Pentachlorophenol*, *Phthalate Esters, Polynuclear Aromatic Hydrocarbons, Silver, Tetrachloroethylene* and *Zinc*)

Fox Hollow Creek. RM 0 to 7.1

303(d) List	**Season**
A-3 Channel, Mouth to Headwaters	Year Round
Amazon Creek, Mouth to Headwaters	Year Round
Amazon Creek Diversion Canal, RM 0 to 6.6	Year Round
Long Tom River, RM 0 to 57.3	
Willow Creek, RM 0 to 2.8	Year Round

TURBIDITY

TMDL Approved
Fern Ridge Reservoir

Appendix B: Common Agricultural Water Quality Parameters of Concern

The following parameters are used by DEQ in establishing the 303(d) List and assessing and documenting waterbodies with TMDLs. Note: This is an abbreviated summary and does not contain all parameters or detailed descriptions of the parameters and associated standards. Specific information about these parameters and standards can be found at: www.deq.state.or.us/wq/assessment/assessment.htm or by calling (503) 229-6099.

Parameters

Bacteria: *Escherichia coli (E. coli)* is measured in streams to determine the risk of infection and disease to people. Bacteria sources include humans (recreation or failing septic systems), wildlife, and agriculture. On agricultural lands, E. coli generally comes from livestock waste, which is deposited directly into waterways or carried to waterways by livestock via runoff and soil erosion. Runoff and soil erosion from agricultural lands can also carry bacteria from other sources.

Biological Criteria: To assess a stream's ecological health, the community of benthic macro invertebrates is sampled and compared to a reference community (community of organisms expected to be present in a healthy stream). If there is a significant difference, the stream is listed as water quality limited. These organisms are important as the basis of the food chain and are very sensitive to changes in water quality. This designation does not always identify the specific limiting factor (e.g., sediment, nutrients, or temperature).

Dissolved Oxygen: Dissolved oxygen criteria depends on a waterbody's designation as fish spawning habitat. Streams designated as salmon rearing and migration are assumed to have resident trout spawning from January 1 – May 15, and those streams designated core cold water are assumed to have resident trout spawning January 1 – June 15. During non-spawning periods, the dissolved oxygen criteria depends on a stream's designation as providing for cold, cool or warm water aquatic life, each defined in OAR 340 Division 41.

Harmful Algal Blooms: Some species of algae, such as cyanobacteria or blue-green algae, can produce toxins or poisons that can cause serious illness or death in pets, livestock, wildlife, and humans. As a result, they are classified as Harmful Algae Blooms. Several beneficial uses are affected by Harmful Algae Blooms: aesthetics, livestock watering, fishing, water contact recreation, and drinking water supply. The Public Health Department of the Oregon Health Authority is the agency responsible for posting warnings and educating the public about Harmful Algae Blooms. Under this program, a variety of partners share information, coordinate efforts and communicate with the public. Once a water body is identified as having a harmful algal bloom, DEQ is responsible for investigating the causes, identifying sources of pollution and writing a pollution reduction plan.

Mercury: Mercury occurs naturally and is used in many products. It enters the environment through human activities and from volcanoes, and can be carried long distances by atmospheric air currents. Mercury passes through the food chain readily, and has significant public health and wildlife impacts from consumption of contaminated fish. Mercury in water comes from erosion of soil that carries naturally occurring mercury (including erosion from agricultural lands and streambanks) and from deposition on land or water from local or global atmospheric sources. Mercury bio-accumulates in fish, and if ingested can cause health problems.

Nitrate: While nitrate occurs naturally, the use of synthetic and natural fertilizers can increase nitrate in drinking water (ground and surface water). Applied nitrate that is not taken up by plants is readily carried by runoff to streams or infiltrate to ground water. High nitrate levels in drinking water cause a range of human health problems, particularly with infants, the elderly, and pregnant and nursing women.

Pesticides: Agricultural pesticides of concern include substances in current use and substances no longer in use but persist in the environment. Additional agricultural pesticides without established standards have also been detected. On agricultural lands, sediment from soil erosion can carry these pesticides to water. Current use agricultural pesticide applications, mixing-loading, and disposal activities may also contribute to pesticide detections in surface water. For more information, see: www.deq.state.or.us/wq/standards/toxics.htm.

Phosphorous/Algae/pH/Chlorophyll a: Excessive algal growth can contribute to high pH and low dissolved oxygen. Native fish need dissolved oxygen for successful spawning and moderate pH levels to support physiological processes. Excessive algal growth can also lead to reduced water clarity, aesthetic impairment, and restrictions on water contact recreation. Warm water temperatures, sunlight, high levels of phosphorus, and low flows encourage excessive algal growth. Agricultural activities can contribute to all of these conditions.

Sediment and Turbidity: Sediment includes fine silt and organic particles suspended in water, settled particles, and larger gravel and boulders that move at high flows. Turbidity is a measure of the lack of clarity of water. Sediment movement and deposition is a natural process, but high levels of sediment can degrade fish habitat by filling pools, creating a wider and shallower channel, and covering spawning gravels. Suspended sediment or turbidity in the water can physically damage fish and other aquatic life, modify behavior, and increase temperature by absorbing incoming solar radiation. Sediment comes from erosion of streambanks and streambeds, agricultural land, forestland, roads, and developed areas. Sediment particles can transport other pollutants, including bacteria, nutrients, pesticides, and toxic substances.

Temperature: Oregon's native cold-water aquatic communities, including salmonids, are sensitive to water temperature. Several temperature criteria have been established to protect various life stages and fish species. Many conditions contribute to elevated stream temperatures. On agricultural lands, inadequate streamside vegetation, irrigation water withdrawals, warm irrigation water return flows, farm ponds, and land management that leads to widened stream channels contribute to elevated stream temperatures. Elevated stream temperatures also contribute to excessive algal growth, which leads to low dissolved oxygen levels and high pH levels.

Appendix C: 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 current information, please contact one of the organizations listed below (see
Appendix D for contact information).

Program	General Description	Contact
Conservation Reserve Enhancement Program (CREP)	Provides annual rent to landowners who enroll agricultural lands along fish-bearing streams. Also cost-shares conservation practices such as riparian tree planting, livestock watering facilities, and riparian fencing. May provide several bonuses to landowners who enroll.	NRCS, SWCDs, 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.	NRCS, SWCDs
Conservation Stewardship Program	Provides cost-sharing to landowners who adopt or maintain a wide range of management, vegetative, and land-based structural practices that address resource concerns such as water quality and wildlife habitat.	NRCS, SWCDs
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.	NRCS, SWCDs
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 DEQ, SWCDs, 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.	NRCS, SWCDs
Federal Reforestation Tax Credit	Provides federal tax credit as incentive to plant trees.	Internal Revenue Service
Forestry Incentives Program (FIP)	Provides cost-sharing for several forest stand improvement practices.	NRCS, SWCDs, Oregon Department of Forestry
Forest Resource Trust	State assistance up to 100 percent of the costs to convert non-stocked forest land to timber stands. Available to non-industrial private landowners.	Oregon Department of Forestry

Program	General Description	Contact
Grassland Reserve Program	Provides long-term contracts and easements to landowners who maintain or enhance high-priority grassland resources including pasture and rangeland.	NRCS, SWCDs
Oregon Watershed Enhancement Board (OWEB)	Provides grants for a variety of restoration, assessment, monitoring, and education projects, as well as watershed council staff support. Also has small grant program that provides up to $10,000 for restoration projects. 25% match requirement on all grants.	SWCDs, Watershed Councils, OWEB
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, NRCS, SWCDs
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.	NRCS, SWCDs
Resource Conservation & Development (RC & D) Grants	Provides assistance to organizations within RC & D areas in accessing and managing grants.	Cascade-Pacific Resource Conservation and Development, (541) 757-4807
State Forestation Tax Credit	Provides for reforestation of under-productive forest land 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
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.	NRCS, SWCDs, Oregon Department of Forestry
Wetlands Reserve Program (WRP)	Provides cost-sharing to landowners who restore wetlands on agricultural lands.	NRCS, SWCDs
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, SWCDs, NRCS

Appendix D: Sources of Information and Technical Assistance

Soil and Water Conservation Districts (SWCDs)
Provide technical assistance in a wide variety of agricultural and natural resource disciplines and help landowners in access federal and local funding programs.

Benton SWCD
456 SW Monroe Ave., Suite 110
Corvallis, OR 97333
(541) 753-7208
office@bentonswcd.org

Upper Willamette SWCD
780 Bailey Hill Rd., Suite 5
Eugene, OR 97402
(541) 465-6436 Ext. 102
office@uwswcd.org

Linn SWCD
33935 Hwy. 99E, Suite C
Tangent, OR 97389
(541) 926-2483
linn.swcd@oacd.org

Siuslaw SWCD
1525 12th St., Suite 10A
Florence, OR 97439
(541) 997-1272
siuswcd@qwestoffice.net

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
31978 N. Lake Creek Drive
Tangent, OR 97389
(541)-967-5927

Lane County
780 Bailey Hill Rd., Suite 5
Eugene, OR 97402
(541) 465-6443

Linn County
31978 N. Lake Creek Dr.
Tangent, OR 97389
(541) 967-5927

Cascade-Pacific Resource Conservation and Development
33630 McFarland Rd.
Tangent, OR 97389
(541) 967-5929

Farm Services Agency (FSA)
Maintains agricultural program records and administers federal cost-share programs. Maintains up-to-date aerial photographs and slides of agricultural and forest lands.

Lane County
780 Bailey Hill Rd., Suite 5
Eugene, OR 97402
(541) 465-6443 ext. 2

Benton County
33630 McFarland Rd.
Tangent, OR 97389
(541) 967-5927

Linn County
33630 McFarland Rd.
Tangent, OR 97389
(541) 967-5927

Oregon Department of Agriculture (ODA)
635 Capitol St NE
Salem, OR 97301
Natural Resources Division: (503) 986-4700
Pesticides Division: (503) 986-4635

The Natural Resources Division includes the Agricultural Water Quality Program, the Confined Animal Feeding Operation Program, the Smoke Management Program, and the SWCD Program.

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)
165 E. 7th Ave, Suite 100
Eugene, OR 97401
(541) 646-7838
http://www.deq.state.or.us

Southern Willamette Valley Groundwater Management Area
c/o DEQ
221 Stewart Ave, Suite 201
Medford, OR 97501
(541) 776-6029
http://gwma.oregonstate.edu/

Responsible to protect Oregon's water and air quality, clean up spills and releases of hazardous materials, and manage 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)
3150 E Main St.
Springfield, OR 97478
(541) 726-3515
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)
PO Box 157
87950 Territorial Hwy
Veneta, OR 97487
(541) 935-2283

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)
Administers Oregon fill and removal law and provides technical assistance to landowners.
775 Summer Street NE, Suite 100
Salem, OR 97301-1279
(503) 986-5200
http://statelands.dsl.state.or.us

Oregon State University Extension Service (OSUES)
Offers educational programs, seminars, classes, tours, publications, and individual assistance to help landowners meet natural resource management goals.

Benton County
4077 SW Research Way
Corvallis, OR 97333
(541) 766-6750

Lane County
783 Grant Street
Eugene, OR 97402
(541) 344-5859

Linn County
104 SW 4th Ave.
PO Box 756
Albany, OR 97321
(541) 967-3871

Oregon Water Resources Department (WRD)
125 E. 8th Ave
Eugene, OR 97401
(541) 682-3620
http://www.wrd.state.or.us

Provides information on streamflows and water rights, issues water rights, and monitors water use. Administers in-stream leasing and temporary water rights transfer programs.

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

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.

Long Tom Watershed Council
751 S. Danebo Ave.
Eugene, OR 97402

(541) 338-7055
http://www.longtom.org

Siuslaw Watershed Council
P.O. Box 422
Mapleton School District Campus
10868 E. Mapleton Road
Mapleton, OR 97453
(541) 268-3044
watershed@siuslaw.org
http://www.siuslaw.org

Appendix E: 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. 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, bigleaf 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 younger age classes and fewer older age classes of vegetation than there were historically, but vegetation is still composed mostly of Douglas fir, western red cedar, bigleaf 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 help provide a clearer picture of the vegetation and riparian functions a site could be anticipated to provide in a compliance situation. 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 benefits of planting species in specific locations in a riparian area.