Lost River Subbasin Agricultural Water Quality Management Area Plan

Developed by the:

Lost River Local Agricultural Water Quality Advisory Committee

Oregon Department of Agriculture

With support from the:

Klamath Soil and Water Conservation District

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Table of Contents

Acronyms and Terms Used in this Document **4**

Foreword **5**

Applicability **5**

Required Elements of Area Plans **6**

Plan Content **6**

Chapter 1: Agricultural Water Quality Management Program Purpose and Background **7**

1.1 Purpose of Agricultural Water Quality Management Program and Applicability of Area Plans **7**

1.2 History of the Ag Water Quality Program **8**

1.3 Roles and Responsibilities **9**

1.3.1 Oregon Department of Agriculture (ODA) 9

1.3.2 Local Management Agency 11

1.3.3 Local Advisory Committee (LAC) 11

1.3.4 Agriculture's Role 11

1.3.5 Public Participation 12

1.4 Agricultural Water Quality **12**

1.4.1 Point and Nonpoint Sources of Water Pollution 12

1.4.2 Beneficial Uses and Parameters of Concern 12

1.4.3 Impaired Water Bodies and Total Maximum Daily Loads (TMDLs) 13

1.4.4 Water Pollution Control Law – ORS 468B.025 and ORS 468B.050 13

1.4.5 Streamside Vegetation and Agricultural Water Quality 14

1.5 Other Water Quality Programs **15**

1.5.1 Confined Animal Feeding Operation (CAFO) 15

1.5.2 Drinking Water Source Protection 16

1.5.3 Groundwater Management Areas (GWMAs) 16

1.5.4 Pesticide Management and Stewardship 16

1.5.5 The Oregon Plan for Salmon and Watersheds 17

1.6 Partner Agencies and Organizations **17**

1.6.1 Oregon Department of Environmental Quality (DEQ) 17

1.6.2 Other Partners 18

1.7 Measuring Progress **18**

1.7.1 Measurable Objectives 18

1.7.2 Land Condition and Water Quality 18

1.7.3 Focused Implementation in Small Geographic Areas 19

1.8 Implementation, Monitoring, Evaluation, and Adaptive Management **20**

1.8.1 Statewide Aerial Photo Monitoring of Streamside Vegetation 20

1.8.2 Agricultural Ambient Water Quality Monitoring Assessment 20

1.8.3 Biennial Reviews and Adaptive Management 20

Chapter 2: Local Background **21**

2.1 Local Roles and Responsibilities **21**

2.1.1 Local Advisory Committee (LAC) 21

2.1.2 Local Management Agency 21

2.2 Area Plan and Regulations: Development and History **21**
2.3 Geographical and Physical Setting **22**
2.3.1 Location, Water Resources, Land Use, Land Ownership, Agriculture, Geographic and Programmatic Scope 22
2.3.3 Maps of the Management Area & Klamath Project 28
2.4 Agricultural Water Quality in the Management Area **30**
2.4.1 Water Quality Standards & 303(d) List of Impaired Water Bodies 30
2.4.2 Basin TMDLs and Agricultural Load Allocations 33
2.4.3 Beneficial Uses and Parameters of Concern 33
2.4.4 Sources of Impairment 33
2.5 Prevention and Control Measures **34**

Chapter 3: Goals, Objectives, and Strategies **41**
3.1 Goal **41**
3.3 Strategies for Area Plan Implementation **42**
3.3.4 Monitoring and Evaluation. 44

Chapter 4: Implementation, Monitoring, and Adaptive Management **47**
4.1 Implementation and Accomplishments **47**
4.2 Water Quality Monitoring—Status and Trends **48**
Lost River - 2014 ..... **48**
4.3 Progress Toward Measurable Objectives **49**
4.4 Aerial Photo Monitoring of Streamside Vegetation **49**
4.5 Biennial Reviews and Adaptive Management **49**

References **51**

Cited Sources **51**

Appendices **53**

Appendix A: Interviews with Local Residents **55**

Appendix B: Common Agricultural Water Quality Parameters of Concern **59**

Acronyms and Terms Used in this Document

ac-ft = acre-feet
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
BLM – Bureau of Land Management
CAFO – Confined Animal Feeding Operation
cfs - cubic feet per second
CNPCP – Coastal Nonpoint Pollution Control Program
CWA – Clean Water Act
CZARA – Coastal Zone Act Reauthorization Amendments
DEQ – Oregon Department of Environmental Quality
FA – Focus Area
GWMA – Groundwater Management Area
HUC – Hydrologic Unit Code
LAC – Local Advisory Committee
LMA – Local Management Agency
Management Area – Lost River Agricultural Water Quality Management Area
MOA – Memorandum of Agreement
NPDES – National Pollution Discharge Elimination System
NRCS – Natural Resources Conservation Service
NWR - National Wildlife Refuge
OARs – Oregon Administrative Rules
ODA – Oregon Department of Agriculture
ODFW – Oregon Department of Fish and Wildlife
ORS – Oregon Revised Statute
OSU - Oregon State University
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
SB 1010 – Senate Bill 1010, now known as the Agricultural Water Quality Management Act
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

"Pasture" as used in this Area Plan means land for grazing livestock; supplemental forage may be provided.

Foreword

This Agricultural Water Quality Management Area Plan (Area Plan) provides guidance for addressing agricultural water quality issues in the Lost River Subbasin Agricultural Water Quality Management Area (Management Area). The purpose of this Area Plan is to identify strategies to enhance water quality from agricultural lands, to prevent and control water pollution from agricultural activities and soil erosion, and to achieve applicable water quality standards.

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

The Oregon Department of Agriculture (ODA) exercises its enforcement authority for the prevention and control of water pollution from agricultural activities under Oregon Administrative Rules (OARs) for the Lost River Subbasin Management Area (603-095-3900 through 603-095-3960) and statewide enforcement procedures provided in OARs 603-090-0060 through 603-090-0120.

Applicability

This Area Plan applies to agricultural activities on all agricultural, rural, and forest lands within the Management Area that are not owned by the federal government and are not held in Tribal Trust. The Area Plan also applies to agricultural lands in current use, those lying idle or on which management has been deferred, and lands (like private roads) not strictly in agricultural use but that support agricultural activities.

This Area Plan does not address conditions resulting from federal activities or activities governed by the Forest Practices Act. Pesticide use is governed by the Pesticide Control Act (Oregon Revised Statutes [ORS] 634); those laws are administered by the ODA Pesticides Division.

The activities of irrigation districts are outside the scope of ODA's Agricultural Water Quality Management Program. This Area Plan only addresses the irrigation activities of landowners.

While the Lost River flows between two states (Oregon and California), this Area Plan addresses only agricultural lands in Oregon.

The adoption of this Area Plan by other designated management agencies (e.g. Tribal governments, municipalities, and federal agencies) is encouraged.

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 (Oregon Administrative Rule (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 the Oregon Department of Agriculture (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 Agricultural Water Quality Management Program.

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

Chapter 3: Local Goals, Objectives, and Implementation Strategies. Chapter 3 presents goal(s), measurable objectives and timelines, and strategies to achieve the goal(s) and objectives.

Chapter 4: Local Implementation, Monitoring, and Adaptive Management. ODA and the Local Advisory Committee (LAC) will work with partners to summarize land condition and water quality status. Trends are summarized 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), this Area Plan guides landowners and partners such as Soil and Water Conservation Districts (SWCDs) in addressing local agricultural water quality issues. The purpose of this 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 the Management Area (OAR 603-090-0000(3)) and to achieve and maintain water quality standards (ORS 561.191(2)). This Area Plan has been developed and revised by ODA, the LAC, with support and input from the SWCD and the Oregon Department of Environmental Quality (DEQ). Throughout the development and revision processes, the public was invited to participate. This included public comment at meetings and public hearings during the Area Plan approval process. This Area Plan is implemented using a combination of outreach and education, conservation and management activities, compliance, monitoring, evaluation, and adaptive management.

The provisions of this Area Plan do not establish legal requirements or prohibitions (ORS 568.912(1)). Each Area Plan is accompanied by OAR regulations 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 (OARs 603-090-0000 to 603-090-0120) and under the regulations for this Management Area (OARs 603-095-3900). The Ag Water Quality Program's general OARs guide the Ag Water Quality Program, and the OARs for the Management Area are the regulations that landowners must follow.

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

- Large commercial farms and ranches.
- Small 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).

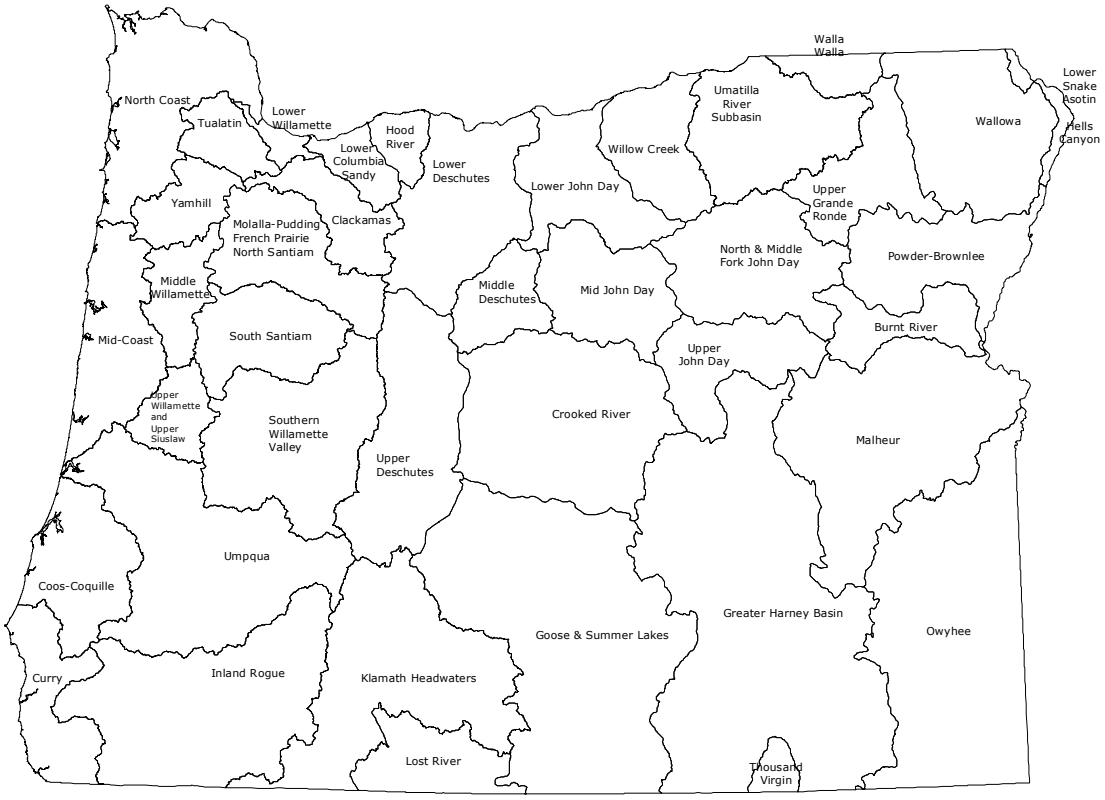
1.2 History of the Ag Water Quality Program

In 1993, the Oregon Legislature passed the Agricultural Water Quality Management Act (SB 1010), directing ODA to develop plans to prevent and control water pollution from agricultural activities and 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). This Area Plan and its associated regulations 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 regulations 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 regulations.
- Conducting biennial reviews of Area Plans and regulations.
- Monitoring, evaluation, and adaptive management.
- Developing partnerships with SWCDs, state, federal, and tribal agencies, 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)

ODA 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 is intended to meet the needs and requirements related to agricultural water pollution, including:

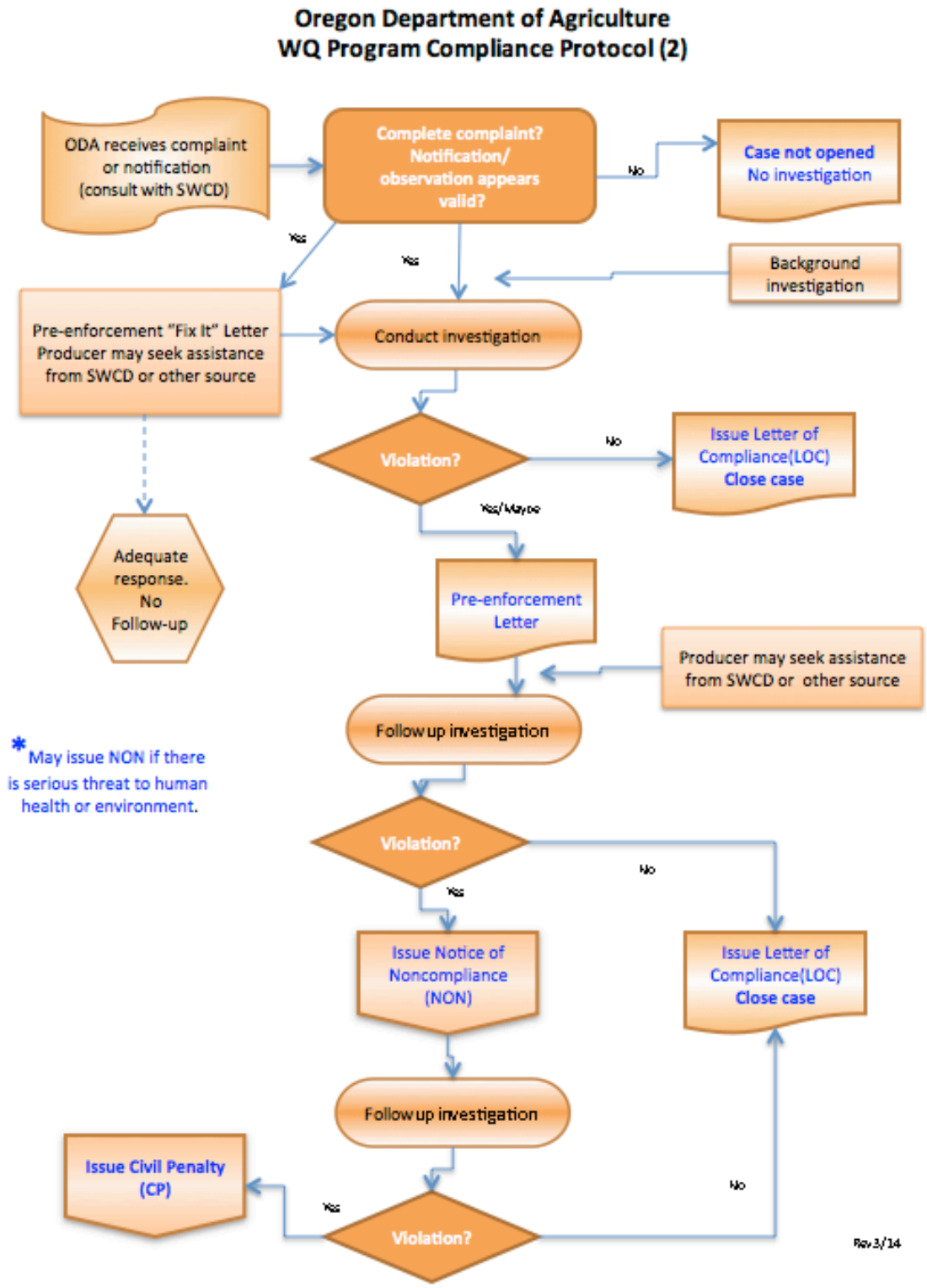
- State water quality standards.
- Load allocations for agricultural nonpoint source pollution assigned under Total Maximum Daily Loads (TMDLs) issued pursuant to the Clean Water Act (CWA), Section 303(d).
- Approved management measures for Coastal Zone Act Reauthorization Amendments (CZARA).
- Agricultural activities detailed in a Groundwater Management Area (GWMA) Action Plan (if a GWMA has been established and an Action Plan developed).

ODA has the legal authority to develop and implement Area Plans and associated regulations 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 will base Area Plans and regulations 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 associated regulations. ODA has responsibility for any actions related to enforcement or determination of noncompliance with regulations (OAR 603-090-0080 through OAR 603-090-0120). ORS 568.912(1) and ORS 568.912(2) give authority to ODA to adopt regulations that require landowners to perform actions necessary to prevent and control pollution from agricultural activities and soil erosion.

The emphasis of this Area Plan is on voluntary action by landowners or operators to control the factors effecting water quality in the Management Area. The regulations are outlined as a set of minimum standards that must be met on all agricultural or rural lands. Landowners and operators who fail to address these regulations may be subject to enforcement procedures, which are outlined below.

Enforcement Action—ODA will use enforcement mechanisms where appropriate and necessary to gain compliance with water quality regulations. Any enforcement action will be pursued only when reasonable attempts at voluntary solutions have failed. 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, the landowner or operator will be directed by ODA to remedy the condition through required corrective actions 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 required corrective actions, civil penalties may be assessed for continued violation of the regulations. See the Compliance Flow Chart for a diagram of the compliance process. If and when other governmental policies, programs, or regulations conflict with this Area Plan or associated regulations, ODA will consult with the agency(ies) and attempt to resolve the conflict in a reasonable manner.

Figure 2: Compliance Flow Chart



1.3.2 Local Management Agency

A Local Management Agency is an organization that ODA has designated to implement an Area Plan (OAR 603-090-0010). The legislative intent is for SWCDs to be Local Management Agencies 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 who voluntarily address natural resource concerns. Currently, all Local Management Agencies 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 up to 12 members, to assist with the development and subsequent biennial reviews of the local Area Plan and regulations. The LAC serves in an advisory role to the director of ODA and to the Board of Agriculture. LACs are composed primarily of 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 regulations.
- Recommend strategies necessary to achieve goals and objectives in the Area Plan.
- Participate in biennial reviews of the progress of implementation of the Area Plan and regulations.
- 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 regulations, which set minimum standards. However, the regulations alone are not enough. To achieve water quality standards, individual landowners also need to attain land conditions that achieve the goals and objectives of the voluntary Area Plan. Each landowner or operator is not individually responsible for achieving water quality standards, agricultural pollution limits, or the goals and objectives of the Area Plan. These are the responsibility of the agricultural community collectively.

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

Area regulations only address impacts that result from agricultural activities. A landowner is responsible for only those conditions caused by activities conducted on land managed by the landowner or occupier. Conditions resulting from unusual weather events or other circumstances not within the reasonable control of the landowner or operator are considered when making compliance decisions. Agricultural landowners may be responsible for some of the above impacts under other legal authorities.

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

- 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.

1.3.5 Public Participation

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

ODA, LACs, and SWCDs conduct biennial reviews of the Area Plans and regulations. Partners, stakeholders, and the general public are invited to participate in the process. Any future revisions to the regulations will include a public comment period and a 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 Confined Animal Feeding Operations (CAFOs) and pesticide applications in, over and within three feet of water. Many CAFOs are regulated under ODA's CAFO Program. Irrigation water discharges may be at a defined discharge point, but does not currently require a permit.

Nonpoint water pollution originates from the general landscape and is difficult to trace to a single source. Nonpoint sources include erosion and contaminated 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 of clean water 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 are usually fish and aquatic life, water contact recreation, and public and private domestic water supply. These uses are generally the first to be impaired as a water body is polluted, 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 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. These water bodies may or may not have established water quality management plans documenting needed 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.

TMDLs 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

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

To implement Senate Bill 502, ODA incorporated ORS 468B into all of the Area Plans and associated regulations in the state. A Department of Justice opinion, dated September 12, 2000, clarifies that ORS 468B.025 applies to point and nonpoint source pollution.

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 (ORS 468B.005)

"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 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.

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, invasive species, 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 local or regional scientific research.

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 water quality functions consistent with what the site would provide with site-capable vegetation.

In some cases, for narrow streams, mature site-capable vegetation may not be needed. For example, shrubs and grass may provide shade, protect streambanks, and filter pollutants. However, on larger streams, mature vegetation is important. Limited exceptions include:

- Junipers are mature site-capable vegetation in central and eastern Oregon, but they reduce bank stability and increase erosion
- Upland species (such as sagebrush) can be the dominant site-capable vegetation along streams with erosional down-cutting, but they do not improve water quality

1.5 Other Water Quality Programs

1.5.1 Confined Animal Feeding Operation (CAFO)

ODA is the lead state agency for the CAFO Program. The CAFO Program was developed to ensure that operators and producers do not contaminate ground or surface water with animal manure. Since the early 1980s, CAFOs 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, ODA was directed by the 2001 Oregon State Legislature to convert the CAFO Program from a Water Pollution Control Facility permit program to a federal National Pollutant Discharge Elimination System (NPDES) program. ODA and DEQ jointly issued a NPDES CAFO Permit in 2003 and 2009. The 2009 permit will expire in May 2014, and it is expected that a new permit will be issued at that time. The NPDES CAFO Permit is compliant with all Clean Water Act requirements for CAFOs; it 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. CAFO NPDES Permits protect both surface and ground water resources.

1.5.2 Drinking Water Source Protection

Oregon implements its drinking water protection program through a partnership between DEQ and the Oregon Health Authority. The program provides individuals and communities with information on how to protect the quality of Oregon's drinking water. DEQ and the Oregon Health Authority encourage community-based protection and preventive management strategies to ensure that all public drinking water resources are kept safe from future contamination. For more information see: www.deq.state.or.us/wq/dwp/dwp.htm. Agricultural activities are required to meet those water quality standards that contribute the safe drinking water.

1.5.3 Groundwater Management Areas (GWMAs)

Groundwater Management Areas are designated by DEQ when groundwater in an area has elevated contaminant concentrations resulting, at least in part, from nonpoint sources. Once the GWMA is declared, a local groundwater management committee comprised of affected and interested parties is formed. The committee then 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. These include 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. If after a scheduled evaluation point DEQ determines that the voluntary approach is not effective, then mandatory requirements may become necessary.

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, DEQ, and the Oregon Health Authority. 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 can be addressed through multiple programs and partners, including the PSP Program described above.

Through the PSP Program, 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). DEQ, ODA, 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. There has been noteworthy progress since 2000 in reducing pesticide concentrations and detections.

ODA led the development and implementation of a Pesticides Management Plan (PMP) for the state of Oregon (www.oregon.gov/ODA/PEST/water_quality.shtml). 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. The PMP sets forth a process for preventing and responding to pesticide detections in Oregon's ground and surface water resources by managing the pesticides that are currently approved for use by the U.S. EPA and Oregon in both agricultural and non-agricultural settings.

1.5.5 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 salmon, because they have such 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 regulations throughout Oregon.

1.6 Partner Agencies and Organizations

1.6.1 Oregon Department of Environmental Quality (DEQ)

The U.S. EPA has delegated authority to DEQ under the CWA authority for protection of water quality in Oregon. In turn, DEQ is the lead state agency with overall authority to regulate for water quality in Oregon. DEQ coordinates with other state agencies, including ODA and Oregon Department of Forestry, to meet the needs of the CWA. DEQ sets water quality standards and develops TMDLs for impaired waterbodies. In addition, DEQ develops and coordinates programs to address water quality including National Pollution Discharge Elimination Permits (for point sources), 319 program, Source Water Protection, 401 Water Quality Certification, and GWMAs. DEQ also coordinates with ODA to help ensure successful implementation of Area Plans as part of its 319 program.

DEQ designated ODA as the Designated Management Agency for water pollution control activities on agricultural and rural lands in the state of Oregon to coordinate meeting agricultural TMDL load allocations. A Memorandum of Agreement (MOA) between DEQ and the ODA recognizes that ODA is the agency responsible for implementing the Ag Water Quality Program established under ORS 568.900 to ORS 568.933, ORS 561.191, and OAR Chapter 603, Divisions 90 and 95. The MOA between ODA and DEQ was updated in 2012 and describes how the agencies will work together to meet agricultural water quality requirements.

The MOA includes the following commitments:

- ODA will develop and implement a monitoring strategy, as resources allow, in consultation with DEQ.
- ODA will evaluate Area Plans and regulation effectiveness in collaboration with DEQ.
    - ODA will determine the percentage of lands achieving compliance with Management Area regulations.
    - 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 with the objective of determining:
    - 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 Plan.
    - Whether the rate of progress is adequate to achieve the goals of the Area Plan.

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 regulations. The petition must

allege with reasonable specificity that the Area Plan or associated regulations are not adequate to achieve applicable state and federal water quality standards (ORS 568.930(3)(a)).

1.6.2 Other Partners

ODA 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 Extension Service, 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 implemented 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 this progress. ODA is working with SWCDs, LACs, and our partners to develop and implement objectives and strategies that will produce measurable outcomes for agricultural water quality.

1.7.1 Measurable Objectives

Measurable objectives allow the Ag Water Quality Program to better evaluate progress toward meeting water quality standards and load allocations where TMDLs have been completed. Many of these measurable objectives relate to land condition and are mainly implemented through focused work in small geographic areas (section 1.7.3). The measurable objectives for this Area Plan are in Chapter 3, and progress toward achieving the objectives is summarized in Chapter 4.

At a minimum, the measurable objectives of the Ag Water Quality Program and this Area Plan are to:

- Increase the percentage of lands achieving compliance with the regulations.
- Increase the percentage of lands meeting desired land conditions outlined in the Area Plan.

1.7.2 Land Condition and Water Quality

Land conditions can serve as useful surrogates (indicators) for water quality parameters. For example, streamside vegetation is generally 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.
- It requires extensive monitoring of water quality at an intensive temporal scale to evaluate progress; it is expensive and may fail to demonstrate short-term improvements.
- Improved land conditions can be documented immediately, but there may be a significant lag time or a need for more extensive implementation before water quality improves.
- Agricultural improvements in water pollution are primarily through improvements in land and management conditions.

Water quality monitoring data may help ODA and partners to measure progress or identify problem areas in implementing the Area Plan; although, as described above, it may be less likely to evaluate 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 significant water quality or land condition concerns that are associated with agriculture. ODA's intent in selecting Focus Areas is to deliver systematic, concentrated outreach and technical assistance in small geographic areas ("Focus Areas") through the SWCDs. A key component of this approach is measuring conditions before and after implementation to document the progress made with available resources. The focused implementation 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 can provide 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 the appropriate source specific conservation practices and demonstrate the effectiveness of these conservation practices.
- A higher density of projects allows neighbors to learn from neighbors.
- A higher density of prioritized projects leads to greater connectivity of projects.
- Limited resources are used more effectively and efficiently.
- Work in one Focus Area, followed by other Focus Areas, will eventually cover the entire Management Area.

SWCDs choose 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 remainder of the Management Area will continue to be addressed through general outreach and technical assistance.

Strategic Implementation Areas
Strategic Implementation Areas are small watersheds selected by ODA, in cooperation with partners, and after review of water quality and other available information. ODA leads the assessment of current conditions and the landowner outreach. Strategic Implementation Areas and Focus Areas are both tools to concentrate efforts in small geographic areas to achieve water quality standards. As with Focus Areas, SWCDs and partners work with landowners to improve conditions that may impact water quality. However, Strategic Implementation Areas also have a compliance evaluation and assurance process that allows ODA to proactively gain compliance with Ag water quality regulations.

1.8 Implementation, Monitoring, Evaluation, and Adaptive Management

Implementation of the Area Plan and associated regulations will be assessed by evaluating the status and trends in agricultural land conditions. Measurable objectives will be assessed across the entire Management Area and within the Focus Area. ODA conducts land condition and water quality monitoring at the statewide level and will analyze this and other agencies' and organizations' local monitoring data. The results and findings will be summarized 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), 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 acquired specifically for this purpose. ODA focuses on land condition monitoring efforts on streamside areas because these areas have such a broad influence over water quality. Stream segments representing 10 to 15 percent of the agricultural lands in each Management Area were randomly selected for monitoring. ODA examines streamside vegetation at specific points in 90-foot bands along the stream from the aerial photos and assigns each sample stream segment a score based on ground cover. 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 one correct riparian index score. The main point is to measure positive or negative change. The results are summarized in Chapter 4 of the Area Plan.

1.8.2 Agricultural Ambient Water Quality Monitoring Assessment

ODA currently evaluates water quality data from monitoring sites in DEQ's water quality database that reflects agricultural influence on water quality. These data are also published in the DEQ water quality database and evaluated at the statewide level to determine trends in water quality at agricultural sites statewide. Results from monitoring sites in the Management Area, along with local water quality monitoring data, are described in Chapter 4.

1.8.3 Biennial Reviews and Adaptive Management

The Area Plan and associated regulations 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 associated regulations. This evaluation includes enforcement actions, landscape and water quality monitoring, and outreach efforts over the past biennium across the Management Area and for the Focus Area. In addition, progress toward achieving agricultural load allocations may be documented (if a TMDL has been established). As a result of the biennial review, the LAC submits a report to the Board of Agriculture and the director of ODA. This report describes progress and impediments to implementation, and recommendations for modifications to the Area Plan or associated regulations necessary to achieve the purpose of the Area Plan. The results of this evaluation will be used to update the goal(s), measurable objectives, and 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 1998 to assist with the development of the Area Plan and regulations and with subsequent biennial reviews. Members are:

Lost River LAC Members	
Current Members (2014): Glenn Barrett: Co-Chair: Langell Valley, ranch Bill Kennedy, Co-Chair: Poe Valley, ranch Bob Gasser: Merrill, Basin Fertilizer Jim Hainline: Klamath National Wildlife Refuge Luther Horsley: Straits Drain, small grains Tracey Liskey: Straits Drain, cattle & crops Frank Hammerich:	Previous members: Louis Randall: Langell Valley, ranch Rod Blackman:, Blackman Farms Arjen deHoop: Poe Valley, dairy Bill Rust: Klamath Falls, Klamath SWCD Deb Crisp: Malin, Tulelake Growers & KSWCD Andy Hamilton: Langell Valley, fish biologist

2.1.2 Local Management Agency

The implementation of this Area Plan is accomplished through an Intergovernmental Agreement between ODA and the Klamath 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 Area Plan and regulations were approved by the director of ODA in 2004.

Since approval, the LAC met in 2008, 2010, and 2012 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.

This Area Plan addresses bacteria, nutrient, and temperature concerns related to agricultural activities on lands in the Management Area that are neither federal nor held in Tribal Trust. This Area Plan does not address conditions resulting from activities of federal agencies, such as streambank erosion along the Lost River caused by water fluctuations from Bureau of Reclamation dam operations.

In November 1995, the Klamath Total Maximum Daily Load (TMDL) advisory committee was created to help Oregon's Department of Environmental Quality (DEQ) develop TMDLs for the Lost River Subbasin. The committee included members from the agricultural community. The state mandated that an Area Plan be developed to address agriculture's contributions to bacteria, nutrients, and temperature concerns.

The Oregon Agricultural Water Quality Management Act, passed in 1993 (ORS 568.900-568.933), and OAR 603-090 outline the process for the development and implementation of area plans to prevent and

control water pollution resulting from agricultural activities. The process includes the formation of a Local Advisory Committee (LAC) that consists primarily of landowners in the affected area to assist the ODA in the development of the Area Plan and Rules.

The Lost River LAC was first convened by ODA in February 1998. They were assisted by the Klamath Soil and Water Conservation District (SWCD). Members were recommended by the Klamath SWCD, agriculturalists, and local agencies. Members were appointed by the Director of ODA after consultation with the Board of Agriculture. LAC members represent the interests of local landowners, producer groups, irrigation districts, fish biologists, rural communities and businesses, and the Klamath SWCD.

Technical support is supplied by: Oregon State University (OSU) Klamath Experiment Station, OSU-Klamath County Cooperative Extension Service, Klamath SWCD, Natural Resources Conservation Service (NRCS), ODA, Oregon Departments of Fish and Wildlife (ODFW) and DEQ, US Bureau of Reclamation, Bureau of Land Management (BLM), US Fish and Wildlife Service, and others.

The intent of this Area Plan is to protect water quality in the Lost River Subbasin Water Quality Management Area through voluntary activities by landowners, while sustaining the agricultural economy. ODA recognizes and accepts that some level of erosion and run-off are natural or unavoidable with agricultural operations. ODA uses regulatory measures as a last resort when voluntary approaches do not adequately protect water quality.

This Area Plan addresses conditions affecting water quality that result from agricultural management of streamsides, uplands, livestock, and croplands. To the greatest degree possible, prevention and control of agricultural pollution is encouraged in a cooperative spirit through the voluntary efforts of landowners, aided by information and technical and financial assistance from local, state, and federal agencies, and others.

An Area Plan was developed by a separate LAC for the Klamath Headwaters, and it primarily addresses the tributaries that flow into Upper Klamath Lake. Both Area Plans need to be examined for an area-wide view of agricultural planning for water quality in the Klamath Basin in Oregon.

California does not have a similar process in place for dealing with water quality issues related to agriculture.

2.3 Geographical and Physical Setting

2.3.1 Location, Water Resources, Land Use, Land Ownership, Agriculture, Geographic and Programmatic Scope

Location

The Management Area is located in extreme southcentral Oregon, near Klamath Falls (see Map 1) and consists of the Oregon portion of the Lost River subbasin, as defined by the US Geological Survey. Its 1,313 square miles (840,320 acres) include the land draining into the Klamath River between Link River and Keno dams, Swan Lake Valley, and the Oregon portion of the Lost River drainage[1]. Another 1,685 square miles (1,078,380 acres) of the Lost River Subbasin are in California and are outside the jurisdiction of this Area Plan. The Management Area is in Klamath County except for a small area in Lake County. Principal cities include: Merrill, Malin, Bonanza, and most of Klamath Falls. Elevation above sea level ranges from 4,050 to 6,300 feet, and averages around 4,200 feet.

The Management Area includes about one-half of the lands that rely on the US Bureau of Reclamation Klamath Project for irrigation (see Map 2).

Principal water bodies include:

- Klamath River from Link River Dam downstream to Keno Dam, including Lake Ewauna
- Oregon portions of the Lost River and its tributaries
- Swan Lake Valley, a naturally closed subbasin northeast of Klamath Falls. Floodwaters from the Pine Flats area near Dairy are pumped to the Lost River in the winter.

More detailed maps are available from the US Geological Survey (http://www.usgs.gov) and other sources.

Climate

Temperatures at Klamath Falls average 29ºF in winter and 67ºF in the summer[2]. Average winter minimum throughout the Management Area are 11-20ºF, and average summer maximum are 68-72ºF[3]. Monthly rainfall peaks in December, with a secondary peak in May just prior to the dry summers[1,4]. Average annual precipitation is 14 inches[2], with a low of 10-12 inches near Malin and Merrill and a high of 18-20 inches near Gerber Reservoir[3]. Lake evaporation in the area is 36 to 42 inches annually, of which 80 percent occurs from May through October[4]. The growing season varies considerably from year to year, but averages approximately 120 days from about May 15 to September 15[2].

Geology and Soils

The Management Area lies in the Klamath Ecological Province and is typified by large basins consisting of lakebeds surrounded by extensive ancient lake terraces interspersed with basaltic mountains[3].

Many soils in the Klamath Province are related to ancient sedimentary and fragmented volcanic rock lakeshore terraces and basins[3]. These soils generally have loamy surface layers and loamy to clayey subsoils. The surface is often stony or gravelly, and hard unbroken ground may be present. These features are important to irrigated cropland agriculture on sloping lands. Many rangelands are typified by basalt stones and outcrops on the surface, especially on upland slopes and plateaus. Associated soils commonly are shallow over clayey subsoils. These soils readily erode if herbaceous cover is depleted. Stones, exposed by erosion, can form a stone pavement that seriously impedes re-establishment of forage plants.

Bottomlands, low terraces, and floodplains are dominated by moderately deep or very deep, moderately well-drained to very poorly drained soils[4]. These soils have slopes of 0-2 percent, are sometimes subject to flooding, and all have a high water table. Benches, terraces, and low hills are dominated by shallow to very deep, excessively drained and well-drained soils. Slopes range from zero to 35 percent, and land is mostly used for irrigated crops. Mountainous areas are dominated by shallow to very deep, well-drained soils derived from tuff and basalt. Rock outcrops are common. Slopes range from one to 60 percent, and land generally is used for timber, range, and wildlife habitat.

High concentrations of phosphorus may enter Management Area streams via two natural soil pathways. Soils naturally high in phosphorus have been documented in the Wood River Valley upstream of the Management Area[5]. In the Management Area, mapping by the Oregon Department of Geology has shown a high percentage of basaltic andesites as the surface rocks in and near Langell Valley[6]. These basaltic andesites (volcanic rock) have higher P_20_5 percentages (0.52-0.84) than are typical in most volcanic terrains.

Hydrology

The Management Area consists of a modified hydrologic system. A large Bureau of Reclamation agricultural project known as the Klamath Project reconstructed the hydrology of this basin through a

complex system of pumps and canals. The water from the Lost River is reused many times by the different users, mainly agriculture and wildlife refuges.

The Lost River begins with California tributaries to Clear Lake, a large shallow reservoir[1]. Upon leaving Clear Lake, the Lost River enters Oregon and flows through Langell Valley. Miller Creek flows into the Lost River in Langell Valley; Miller Creek's flows are regulated at Gerber Reservoir. Near Bonanza, the river turns west; large springs in this area contribute substantial inflow (over 35,000 ac-ft per season) to the shallow, sluggish stream with a gradient of < 1 ft/mile[7]. Upon flowing through Olene Gap, 10 miles east of Klamath Falls, the river turns southeast and flows along the base of Stukel Mountain. It re-enters California near Merrill, Oregon and flows through a series of canals to provide irrigation water to the Tulelake area[2]. It floods and is retained in two National Wildlife Refuges (NWRs) (Tule and Lower Klamath lakes) before reentering Oregon and flowing to the Klamath River via Straits Drain.

The Lost River historically ended in Tule Lake in California and did not flow to the Klamath River; Tule Lake and Lower Klamath Lake were not connected[8]. The Klamath Project connected Tule and Lower Klamath lakes via a tunnel through Sheepy Ridge through which water is now pumped.

The US Geological Survey and the Oregon Water Resources Department cooperated in the Upper Klamath Basin Groundwater Study http://or.water.usgs.gov/projs_dir/or180/. This study characterizes and quantifies the groundwater system in 8,000 square miles of California and Oregon. The results help agencies and water users evaluate potential effects of new development on existing groundwater users and help identify areas where additional groundwater development can occur without adversely affecting streamflow.

Historical

Tule Lake was a large natural sump with no surface outlet, which at times had a surface covering 90,000 acres[1]. During periods of high runoff, flows from Lost River would raise Tule Lake to its highest elevation. The lake would then slowly recede during the summer and fall due to evaporation. Lower Klamath Lake received its waters when the Klamath River naturally backed up around Keno, raising the water level enough for the Klamath River water to flow through a natural channel (where Straits Drain now exists) to Lower Klamath Lake[9].

Klamath Project

The Klamath Project, located on the Oregon-California border, was one of the earliest federal reclamation projects[1,2,9]. In early 1905, Oregon and California state legislatures ceded title ("Cession Acts") in Lower Klamath and Tule lakes to the United States for project development under provisions of the Reclamation Act of 1902. Construction was authorized by the Secretary of the Interior on May 15, 1905, for project works to drain and reclaim lakebed lands of the Lower Klamath and Tule lakes; to store waters of the Klamath and Lost rivers; to divert irrigation supplies; and to control flooding of the reclaimed lands. As Tule Lake receded, reclaimed lands were leased by the government for farming until opened to homesteading. To protect developed homestead lands from flooding, areas at lower elevations were designated as sump areas and reserved for flood control and drainage. Some of the marginal sump acreage subject to less frequent flooding was made available for leasing, but retained in federal ownership. The ceded lands were offered by the United States to homesteaders from 1917-1948. Project construction costs were repaid to the U.S. government. The flood control sumps and the remaining leased lands are now part of Tule Lake NWR in California and the Lower Klamath NWR.

The Bureau of Reclamation manages the Lost River primarily for irrigation and flood control[2]. The Klamath Project irrigates 123,767 acres in Oregon, almost all of which are in the Management Area[4]. Two main sources supply water for the Klamath Project. The natural source consists of the Lost River. The Lost River is controlled by various dams in Oregon. The other source consists of Upper Klamath Lake and the Klamath River, which are introduced artificially into the Lost River through the Lost River Diversion Canal. Water can flow both ways in the nearly eight-mile long canal, allowing excess water from Lost River to flow to the Klamath River during periods of high flow and providing water from Klamath River to Lost River when irrigation demand is high. The A-Canal diverts water from Upper Klamath Lake a short distance above Link River Dam. This allows Klamath Lake water to enter the Lost River at several locations, the furthest upstream being approximately two miles below Harpold Dam. Upstream of that point, irrigation water is supplied exclusively by Clear Lake and Gerber Reservoir. Malone Dam and the Miller Creek Diversion Dam (below Gerber Reservoir) divert water into peripheral canals that irrigate approximately 18,000 acres of pasture and cropland. Langell Valley, historically a complex of wetlands, was drained via the Lost River Improvement Channel in 1949. The channelized portion of the Lost River below Malone Reservoir functions as drainage, flood control, and water delivery to the Langell Valley Irrigation District river pumps and the Horsefly Irrigation District pumping plants near Bonanza.

Between 1951 and 1967, Project lands in the Management Area received about 368,000 ac-ft per year[1]. Roughly 266,000 ac-ft (73 percent of the total Klamath Project water supply) were imported annually from Upper Klamath Lake and the Klamath River, primarily through the A-Canal. The amount of water diverted varies every year, depending on seasonal flows and rainfall, and is a small percentage of the average 1,154,000 ac-ft of Klamath River water that annually flows over the Link River Dam[10]. About 20,000 ac-ft are diverted annually from the Klamath River via the Lost River Diversion Canal. Clear Lake, Gerber Reservoir, and Bonanza-Big Springs each contribute 35,000-38,000 ac-ft annually to the Project[1].

The average annual efficiency across to the Klamath Project is 92 percent[11]. An effective sophisticated seasonal pattern of water use has evolved in the Klamath Project. Early in the irrigation season water is distributed to meet immediate irrigation requirements and to replenish soil moisture throughout the Project area. The stored soil moisture allows the Project to meet peak consumptive use demands even when these demands exceed the Projects' capacity to divert and deliver surface water. Tailwater is reused multiple times and therefore is vital for maintaining the high irrigation efficiency.

Klamath Basin lakes evaporate 3.5 ac-ft of water annually[12]. This is greater than the 2.5 ac-ft consumed by Klamath Project crops.

The Klamath Drainage District serves over 27,000 acres that drain into the Straits Drain[13]. An average of 2.27 ac-ft per acre is diverted annually from the Klamath River. Some water is reused within the District with the assistance of tailwater recovery pumps, and an average of 43,430 ac-ft is returned to the Straits Drain annually.

Historical summer streamflows on the Klamath River at Link River Dam range from 200-1,100 cubic feet per second (cfs[4)]. In addition, two power plants along the Link River have 'power claims' established prior to 1905 that amount to 355 cfs[1]. Average annual stream flow of the Lost River at Malone Diversion Dam is 33,960 acre-feet, and 174,830 acre-feet at Harpold Reservoir[4].

Geothermal Activity

Geothermal waters heat homes and buildings, including the Oregon Institute of Technology[1]. Geothermal wells on the east flank of the Klamath Hills are used to heat greenhouses and raise tropical fish[14]. Many hot springs are located in the river and in aquifers near the river[15]. Hundreds of warmwater wells are present with temperatures ranging from 68ºF to 104ºF. Some springs with temperatures exceeding 140ºF are found near Olene Gap, the northeastern part of Klamath Falls, and the southwest flank of the Klamath Hills[15]; temperatures of 199ºF have been recorded on the east flank of the Klamath Hills[14]. The hot waters are located near, and are presumably related to, major geologic fault and fracture zones. Additional undeveloped geothermal resources are known to exist in the region; numerous studies have been conducted and reports are available.

The LAC associates geothermal activity with elevated background water temperatures in the Management Area.

Land Use

The Management Area is characterized by rural lands. Over 60 percent (509,000 acres) is privately owned[16]. The rest is managed primarily by the U.S. Fish and Wildlife Service, BLM, and the U.S. Forest Service. Limited forests exist in the Management Area, with most of the woodlands consisting of juniper stands[4]. These areas are used primarily for range and wildlife habitat. Western junipers have expanded rapidly onto noncultivated and nonforested areas[3]. Junipers are known for high water consumption and aggressive competition for forage species[12,17,18]. This can increase soil erosion and contribute nutrients, including phosphorus, to streams[14]. Heavy infestations undoubtedly diminish water recharge to streams and groundwater.

Agriculture is a significant land use in Klamath County. Klamath County's gross farm and ranch sales approximated $155 million in 2004[19]. Crops accounted for approximately $65.5 million, two-thirds of which came from hay and forage. Livestock, including primarily beef cattle, horses, and $16 million from dairies, contribute the rest. With an economic multiplier of 2.0, each dollar of agricultural income in the county generated $2 million of economic activity locally, thus contributing over $300 million in 2004. The Management Area includes a significant portion of the crop production in Klamath County. Crops include alfalfa, potatoes, sugar beets, garlic, onions, strawberry plantlets, mint, field peas, small grains, pasture, and range lands (primarily used for cattle production). The Management Area also includes Klamath County's dairies.

The irrigation season extends year-round, but is predominantly March through October[2]. The first water rights for irrigation were claimed in 1870, for lands in Swan Lake Valley and in Langell Valley along the Lost River[4]. Water rights have been adjudicated for Langell Valley and much of Poe Valley, whose water comes solely from Gerber Reservoir and Clear Lake, but water rights associated with Klamath River water currently are being adjudicated.

Approximately 70,000 acres of agricultural lands upstream of the Management Area (in the Upper Klamath Lake watershed) have been converted to wetlands or short-term water storage sites.

The US Fish and Wildlife Service manages a system of NWRs in the Klamath Basin primarily for waterfowl habitat; the wide and shallow lakes are important stops for migratory waterfowl on the Pacific Flyway. Bear Valley NWR and about 7,000 acres of Lower Klamath NWR are in the Management Area. Bear Valley NWR drains into Lower Klamath NWR. Clear Lake NWR is in California at the headwaters of the Lost River. Upper Klamath and Klamath Marsh NWRs are upstream of the Management Area via the Klamath River. Most of Lower Klamath NWR (43,000 acres) and all of Tule Lake NWR (37,000 acres) are in California; the Lost River floods and flows through them and exits into Oregon via Straits Drain. Three of these Klamath Basin refuges (Clear Lake, Tule Lake, and Lower Klamath) are within the Klamath Project, and the Bureau of Reclamation manages some of these waters for flood control and irrigation while the Fish and Wildlife Service manages for fish and wildlife. All of these areas, whether in the Management Area or not, contribute to water quality concerns in the Management Area.

HISTORICAL PERSPECTIVE

Sources:

Interviews with Barney Hoyt, Mary Taylor, Ann Fairclo, George Stevenson, Taylor High, Van Landrum (1924-2002), Alvin Cheyne, Walter Smith, Ron McVay, Tag Howland, Louis Randall, Earl Miller, Marilyn Livingston, and Margaret Cheyne. 1999-2000.

Of the people interviewed, the earliest memories go back to 1925 with many families homesteading the area as early as 1885. It was unanimous amongst all interviewees that the water in the Lost River was always "green" with algae. Most people could remember swimming in the river at some point in their childhood but had to bathe immediately afterward to remove the algae.

Several species of fish were remembered; suckers, catfish, chubs, sunfish, perch and occasionally a trout or bass was caught. Many people stated that during the early part of the 1900's it was very unusual to see a deer. There is a story (recorded by Peter Skene Ogden) of 50 experienced hunters nearly starving to death in the Klamath Basin on one of their expeditions. They reportedly had to eat their horses to stay alive and said it had not been worth the effort it took to get here. Most people interviewed remembered a wide variety of animals: beaver, otter, muskrat, quail, pheasant, deer, coyotes, cougars, bobcats, and antelope. There are documented claims of six cougars killed in one day. Wolves were present and believed to have been a factor in the lack of game.

It was said repeatedly that the Lost River flooded nearly every year, and would be intermittent some years during the summer months until the Wilson Reservoir Dam was built in 1911.

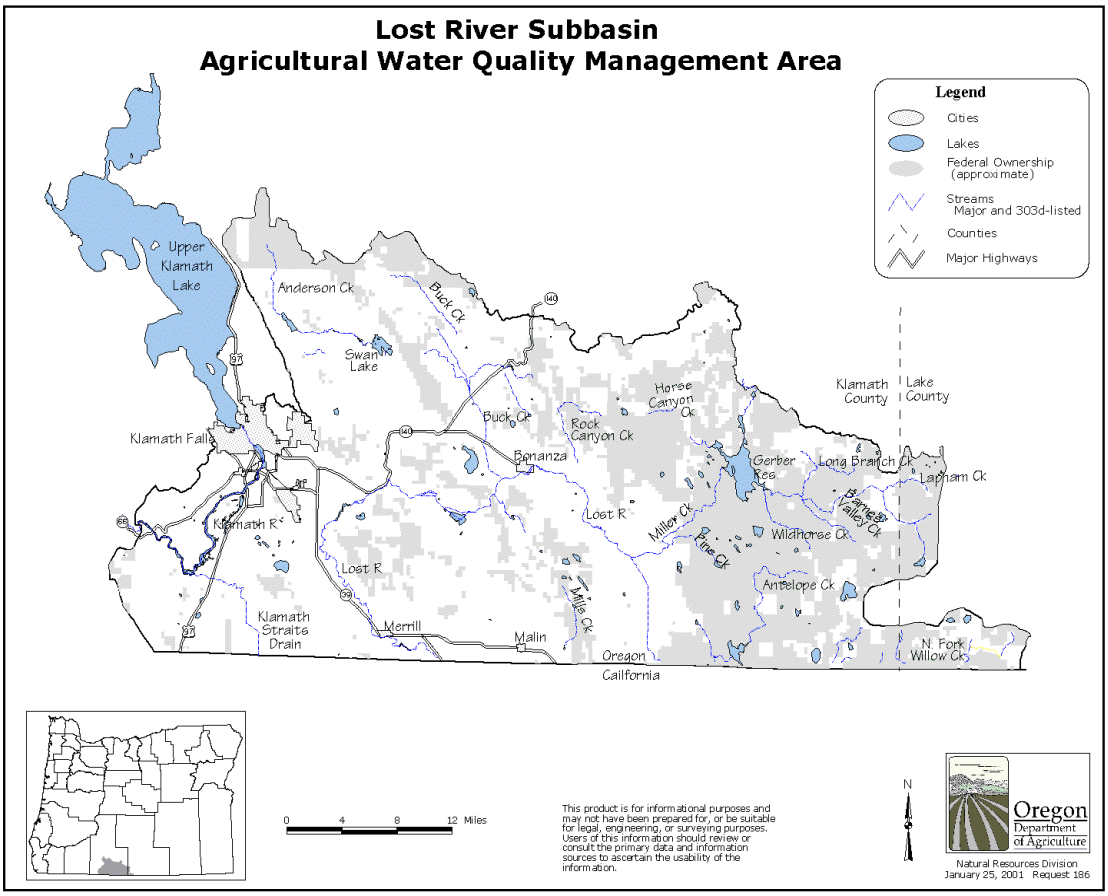
Crops were more limited than today. The primary crops grown were grain, hay (mostly meadow), pasture, potatoes, and dry land rye[20]. John Applegate, an early explorer, stated in one of his reports that potatoes were grown commercially prior to 1900. There were cattle and sheep (several thousand sheep at one time) and most people had several milk cows.

There are many hot springs in the Lost River and surrounding area. People used to scald hogs at Olene Gap. The water was believed to have been around 150ºF. Bathhouses were located throughout the Lost River subbasin on the hot springs. Walt Smith heats his home from one of the hot springs near the river and it is 145ºF. The hot spring at the old bathhouse near Cheese Factory Road is 150ºF.

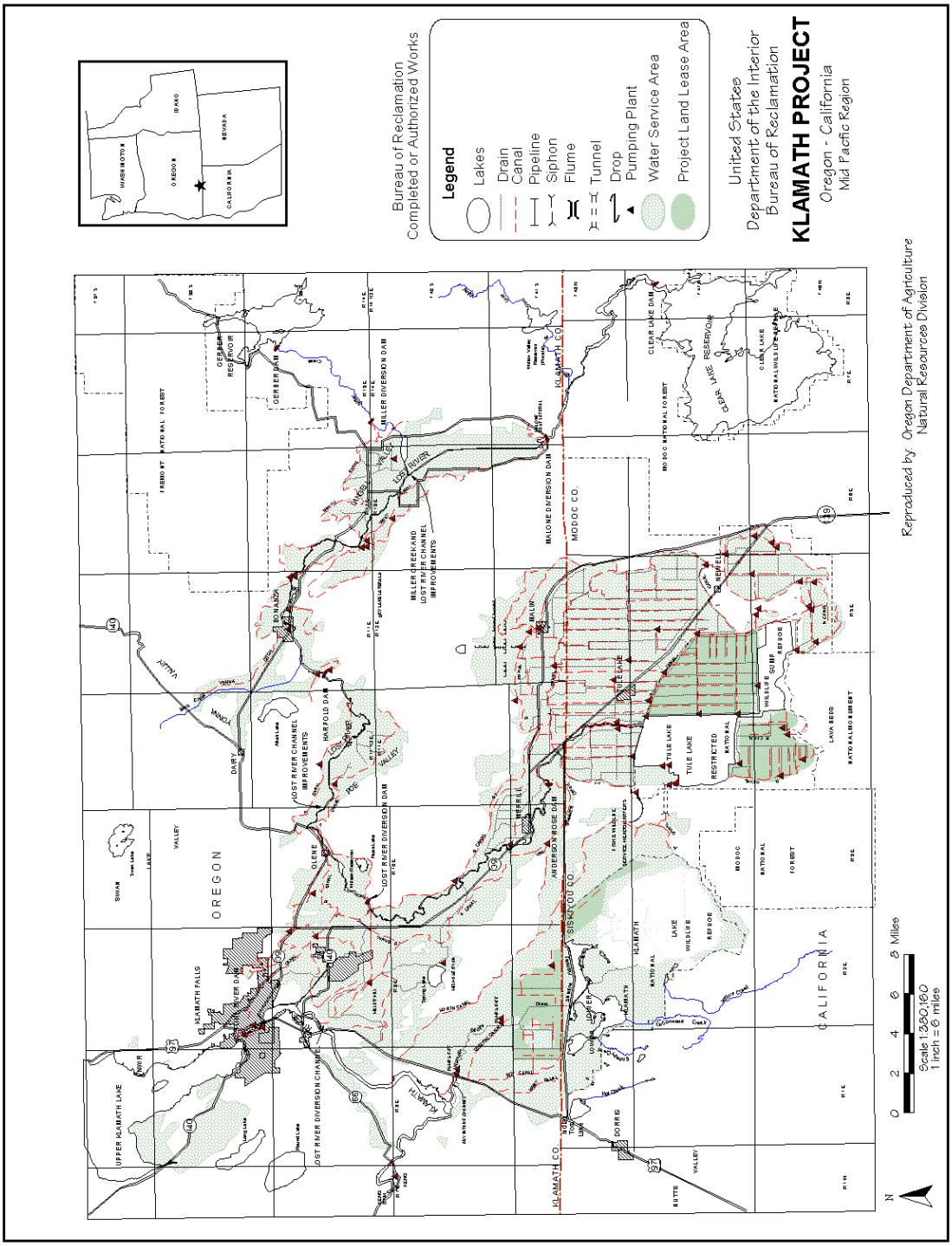
Water from Klamath Lake enters the Management Area via the Klamath River. The water quality of Klamath Lake was always bad. Applegate reported having to travel during the cool part of the day and having to wear masks or scarves to help eliminate the odor. In 1855, Abbot journeyed to Cove Point; his journal stated that the water was brown and bitter, and animals would not drink it. Fremont reported that the water in Klamath Lake at Rattlesnake Point was too putrid to water horses.

2.3.3 Maps of the Management Area & Klamath Project

Lost River Subbasin Agricultural Water Quality Management Area



Klamath Project



2.4 Agricultural Water Quality in the Management Area

2.4.1 Water Quality Standards & 303(d) List of Impaired Water Bodies

The Federal Clean Water Act requires that each state designate the beneficial uses of water, select water quality parameters most directly related to the beneficial uses, and set standards for those parameters.

WATER QUALITY STANDARDS

The Department of Environmental Quality sets water quality standards in Oregon. The following standards apply to Management Area streams on the 2010 303(d) list.

Table 1. Water Quality Standards and Criteria for Parameters on 2010 303(d) list in the Management Area[21].

Water Quality Parameter	Associated Beneficial Uses	Water Quality Limited Criteria needed for Listing	Time Period
Ammonia Toxicity	Aquatic Life	The ammonia concentration (mg/L) considered to be toxic varies primarily with temperature and pH. EPA provided a complex formula in 1985 for calculating toxic levels based on temperature and pH.	None specified
Chlorophyll *a*	Water Contact Recreation, Aesthetics, Fishing, Water Supply, Livestock Watering	3-month average chlorophyll *a* value exceeds 0.015 mg/L.	Summer Fall-Winter-Spring
Dissolved Oxygen (DO)	Resident Fish and Aquatic Life, Salmonid Spawning & Rearing (2004 revision)	- Lost River and the Klamath River in the Management Area are classified as "cool water". Dissolved oxygen may not be < 6.5 mg/L. If DEQ has adequate information and at its discretion, DO may not be < 6.5 mg/L as a 30-day mean minimum, < 5.0 mg/L as a 7-day minimum mean, and < 4.0 mg/L as an absolute minimum. (OAR 340-041-0016(1)(c) and Map 180A) - Rest of Management Area: During times and in waters that support salmonid spawning until fry emergence from the gravels: DO shall not be < 11 mg/L; unless intergravel DO > 8 mg/L, then DO criterion is 9; or where conditions of barometric pressure, altitude and naturally occurring temperatures preclude attainment of the 11 or 9 mg/L standard, then DO shall not be < 95 percent saturation. For listing, more than 10 percent and at least two of the samples must exceed the appropriate standard for a season of interest.	Rearing: as identified by Oregon Department of Fish and Wildlife (ODFW) staff Spawning through fry emergence: as identified by ODFW staff
pH	Resident Fish & Aquatic Life,	More than 10 percent of the samples and a minimum of two fall outside of the range 6.5 to	Summer

	Water Contact Recreation	9.0.	Fall-Winter-Spring
Temperature	Fish & Aquatic Life	- Lost River and the Klamath River in the Management Area are classified as "cool water". Cool water may not be warmed by > 0.5°F above the ambient condition unless a greater increase would not reasonably be expected to adversely affect fish or other aquatic life. (OAR 340-041-0028(9)) and Map 180A. - Rest of Management Area is classified as "Redband Trout Use". The seven-day average maximum temperature may not exceed 68°F. (OAR 340-041-0028(4)(e) and Map 180A) "For farming or ranching operations on state or private lands, water quality standards are intended to be attained and are implemented through the Agricultural Water Quality Management Act (ORS 568.900 to 568.933) and rules thereunder, administered by the ODA. Therefore, farming and ranching operations that are in compliance with the Agricultural Water Quality Management Act requirements will not be subject to DEQ enforcement under this rule." (OAR 340-041-0028(12(f))	Year-round

WATER QUALITY PARAMETERS OF CONCERN

Table 2 shows the Management Area rivers and streams on Oregon's 2010 303(d) list[21]. Current information on the 303(d) list can be found at:
http://www.deq.state.or.us/WQ/assessment/rpt0406/search.asp#db

Table 2. Location and seasonality of violations of Oregon's Water Quality Criteria in the Management Area (from 2010 303(d) list)

	Water Quality Parameters					
Stream Segment	**Ammonia Toxicity**	**Chlorophyll *a***	**Dissolved Oxygen**	**pH**	**Temperature**	**Aquatic Weeds or Algae**
	(too high)	**(too high)**	**(too low)**	**(too high)**	**(too high)**	
Klamath River: Link River to Keno Dam, ~RM 231-251	year-round	summer	year-round	summer		
Lost River: Klamath Straits Drain	year-round	summer	year-round			
Lost River: California to California (RM 4.8-65.4?)	year-round	summer	year-round			
Lost River: impoundments		summer	*Summer*	summer		
Antelope Creek					year-round (summer ?)	
Barnes Valley Creek					year-round	
Ben Hall Creek					year-round	Undefined (one health advisory issued by Oregon Harmful Algae Bloom Surveillance (HABS) program through Oct 2010 based on cell counts or toxicity levels.
Buck Creek					year-round	
East Branch Lost R.					*year-round*	
Horse Canyon Creek					*old 64°F standard*	
Lapham Creek					year-round	
Long Branch Creek					year-round	
Miller Creek					old 64°F standard - summer	
North Fork Willow Creek					old 64°F standard - summer	
Rock Creek					year-round	

The supporting data were collected by BLM, U.S. Forest Service, Bureau of Reclamation, U.S. Geologic Survey, and DEQ.

Based on the available data, the following general observations have been noted:

- Water quality at low elevation sites of the Lost River is generally worse than water quality at high elevation sites.
- Water quality in the Lost River deteriorates within the NWRs. The NWRs are located on a reach of the Lost River that flows from Oregon into California and then back to Oregon. This California reach of the river is outside the jurisdiction of this Area Plan.
- The amount of dissolved oxygen in the Klamath River decreases as the river moves downstream from Link River to Keno Dam (Map 2). Dissolved oxygen levels are very low at times during the summer. Possible sources include very large loads of algae discharging from Upper Klamath Lake and the slow, meandering nature of the river. At times, dissolved oxygen in the Straights Drain is higher than in the Klamath River where it enters.

Low dissolved oxygen, high pH, ammonia toxicity, and excessive chlorophyll *a* generally result from excessive plant growth, which is stimulated by high nutrient concentrations in the water. Higher temperatures also stimulate plant growth. These parameters are related to the designated benefical use (fish habitat).

The DEQ has made it clear that more data are needed to accurately determine the locations, extent, and sources of specific water quality issues[22].

2.4.2 Basin TMDLs and Agricultural Load Allocations

The Upper Klamath and Lost River Subbasins TMDL, which includes the Klamath River from Upper Klamath Lake to the state line, was approved by EPA on May 30, 2012, with the exception of the temperature TMDLs. The EPA did not approve or disapprove of the temperature TMDLs. Currently, the Upper Klamath and Lost River TMDLs are undergoing a reconsideration process. Following completion of the reconsideration process, DEQ will submit a revised TMDL for puclic comment. This Area Plan fulfills the DEQ's expectations for implementing the Lost River Subbasin TMDLs by addressing the loads allocated to agriculture.

2.4.3 Beneficial Uses and Parameters of Concern

As described by DEQ, beneficial uses for the Management Area include domestic water, irrigation, livestock watering, fisheries, recreation, and aesthetics.

2.4.4 Sources of Impairment

A primary source of pollution in the Management Area is poor water quality from Upper Klamath Lake, which enters the: Klamath River at Link River Dam; Klamath Project at A, North, and ADY Canals; and Lost River through the Lost River Diversion Canal. Pollutants from point sources (industrial and municipal discharges) and non-point sources (agriculture, urban runoff, refuge activities) affect background conditions. ODA recognizes and accepts that some level of erosion and run-off are natural or unavoidable with agricultural operations.

Pinpointing the numeric contributions from nonpoint sources is difficult due to the complex hydrological system.

The LAC recognizes that water quality from Upper Klamath Lake, river operations by the Bureau of Reclamation, wildlife refuges, urban areas, irrigation districts, and activities in California affect water quality. These issues are outside the responsibilities and control of private landowners in the Management Area.

2.5 Prevention and Control Measures

2.5.1 Area Rules as Implementation Strategy

In addition to the voluntary strategies, Area Rules are included as an implementation strategy. Area Rules are developed and adopted to achieve water quality standards and to prevent and control water pollution. Area Rules that describe conditions on the land are based on a scientific relationship between the land condition and specific water quality problems. For example, Area Rule (3)(a) addresses those characteristics of riparian areas that provide water temperature moderation and filtration of potential pollutants. Land condition-based Area Rules provide landowners a straightforward way to determine if their management is protective of water quality. Landowners are not required to monitor water quality to determine compliance with land condition-based Area Rules. Landowners that are in compliance with the Area Rules are not held responsible for water quality conditions that the Rule was designed to protect.

In addition to the land condition-based rules that address upland erosion, streamside areas, and livestock waste; a general waste management rule, Area Rule (5), is included. Rule (5) cites a long-standing law that prohibits causing pollution or allowing waste to enter public waters. The purpose of including reference to this existing law is to clarify that ODA would have direct enforcement authority under the rules, and would have the additional authority, when necessary, to levy civil penalties for flagrant violations. ODA recognizes and accepts that some level of erosion and run-off are natural or unavoidable with agricultural operations. Rule (5) is used when agricultural activities cause conditions that significantly limit attainment of water quality standards or threaten beneficial uses of the water. If additional land management activities are necessary to address water quality problems, ODA does not initiate enforcement actions, except for flagrant violations[·], if the landowner undertakes voluntary remedial action consistent with this plan. This enforcement policy is consistent with existing rules in OAR 603-090-0000(4)(e).

The following Area Rules provide for resolution of complaints and possible water quality problems.

Complaints and Investigations (OAR 603-095-3960)

(1) When the department receives notice of an alleged occurrence of agricultural pollution through a written complaint, its own observation, through notification by another agency, or by other means, the department may conduct an investigation. The department may, at its discretion, coordinate inspection activities with the appropriate Local Management Agency.

(2) Each notice of an alleged occurrence of agricultural pollution will be evaluated in accordance with the criteria in ORS 568.900 to 568.933 or any rules adopted thereunder to determine whether an investigation is warranted.

(3) Any person allegedly being damaged or otherwise adversely affected by agricultural pollution or alleging any violation of ORS 568.900 to 568.933 or any rules adopted thereunder may file a complaint with the department.

[·] Flagrant Violation is defined by OAR 603-090-0060(2) as "any violation where the respondent had actual knowledge of the law and knowingly committed the violation."

(4) The department will evaluate or investigate a complaint filed by a person under section OAR 603-095-3960(3) if the complaint is in writing, signed and dated by the complainant and indicates the location and description of:

(a) The waters of the state allegedly being damaged or impacted; and

(b) The property allegedly being managed under conditions violating criteria described in ORS 568.900 to 568.933 or any rules adopted thereunder.

(5) As used in section OAR 603-095-3960(4), "person" does not include any local, state or federal agency.

(6) Notwithstanding OAR 603-095-3960, the department may investigate at any time any complaint if the department determines that the violation alleged in the complaint may present an immediate threat to the public health or safety.

(7) If the department determines that a violation of ORS 568.900 to 568.933 or any rules adopted thereunder has occurred, the landowner may be subject to the enforcement procedures of the department outlined in OARs 603-090-0060 through 603-090-0120.

2.5.2 Area Rules

The Area Rules are enforceable by ODA and are cited here in bold text in boxes for your information. The Area Plan is not enforceable. The Area Plan and Rules complement each other. The Area Plan provides an overall proactive strategy for meeting the Plan's water quality objectives and for complying with the Area Rules.

All landowners conducting agricultural activities in the Management Area on lands (including timber lands) that are neither federal nor held in Tribal Trust must comply with the Area Rules (OAR 603-095-3900 through 603-095-3960). "Landowner" includes any landowner, land occupier or operator (OAR 603-095-0010(24)). The landowner's responsibility is to implement measures that ensure compliance with these Area Rules.

Sanctions can come into effect from ODA if a landowner is out of compliance with the Area Rules. ODA enforcement/compliance activities are conducted as provided by ORS 568.900 through 568.933 and OARs 603-90 and 603-95.

The appropriate SWCD is informed by ODA of compliance actions.

Activities governed by the Forest Practices Act are outside the jurisdiction of this Area Plan. Pesticide use is governed by the Pesticide Control Act (ORS 634); those laws are administered by the ODA Pesticides Division.

Area Rules may change over time as information becomes available on land conditions and water quality.

Oregon Administrative Rules 603-095-3940

Requirements

(1) (a) A landowner is responsible for only those conditions resulting from activities controlled by the landowner. A landowner is not responsible for conditions resulting from activities by landowners on other lands. A landowner is not responsible for conditions that are natural, could not have been reasonably anticipated, or that result from unusual weather events or other exceptional circumstances. Landowners will not be required to implement practices or management systems that are not practical and effective for their operation. Where a prohibited condition results from the requirement(s) of another government entity, ODA will work with the other government entity and the landowner to resolve the condition. As long as the landowner is cooperating with ODA in resolving the condition, ODA will not assess a civil penalty against the landowner for that condition. ODA will consider costs, benefits, and economic feasibility when working with a landowner to resolve a compliance issue. ODA will seek input from the local management agency prior to requiring a schedule of corrective practices.

(b) Unless otherwise restricted by state or federal law, conditions resulting from limited duration activities are exempt.

The following Area Rules 603-095-3940(2) through (5) establish requirements where there are agricultural management or soil-disturbing activities.

Sheet, rill, and wind erosion *(Parameter addressed: nutrients)*

Definitions:
Wind erosion = the actual movement of soil by wind to such a degree that the top soil is being noticeably destroyed or conditions which will result in a noticeable movement of the topsoil by wind action. (ORS 568.810 (2))

Sheet erosion = removal of a fairly uniform layer of soil from the land surface by runoff water. (OAR 603-95-0010(15))

Rill erosion = erosion process in which numerous small channels only several inches deep are formed and which occurs mainly on recently disturbed soils. The small channels formed by rill erosion would be obliterated by normal smoothing or tillage operations. (OAR 603-95-0010(14))

"T" = maximum average annual amount of soil loss from erosion, expressed in tons per acre per year, that is allowable on a particular soil. This represents the tons of soil (related to the specific soil series) that can be lost through erosion annually without causing significant degradation of the soil or potential for crop production. "T" values for the Management Area are listed in the 1971 Klamath County Soil Survey.

Requirement (OAR 603-095-3940):

(2) (a) Combined sheet, rill, and wind erosion of soil, averaged through a crop rotation period, must be less than or equal to T.

(b) If an alternative standard is needed for certain soils, ODA and the Klamath SWCD, acting as the Local Management Agency, will request an alternative recommendation from the NRCS State Conservationist for an appropriate erosion control standard.

Streamside Areas *(Parameters addressed: bacteria, nutrients, temperature)*

Role of Streamside Vegetation to Prevent and Control Pollution

Across Oregon, the Ag Water Quality Program emphasizes streamside vegetation protection and enhancement where needed to prevent and control agricultural water pollution. There are several reasons for this emphasis.

- Streamside vegetation improves water quality for multiple parameters, including: temperature, sediment, bacteria, nutrients, toxics, and pesticides.
- The presence of healthy streamside vegetation indicates that agriculture is addressing water quality concerns.
- Landowners have the authority and ability to take steps to improve streamside vegetation.
- Streamside vegetation provides additional functions, including fish and wildlife habitat.
- Streamside vegetation keeps water cool and banks stable.

Adequate streamside vegetation provides three primary water quality functions (Council for Agricultural Science and Technology, 2012; National Council for Air and Stream Improvement, 2000; State of Oregon, 2000). Local agricultural water quality regulations require that agricultural activities provide these functions

- Stream temperature moderation (vegetation blocks direct solar radiation).
- Reduced streambank erosion (roots stabilize banks and dissipate stream energy).
- Filtration of pollutants (e.g., bacteria, nutrients, toxics, sediment) from overland flows.

Adequate streamside vegetation also provides additional water quality functions (see references listed in paragraph above):

- Water storage that provides cooler and longer duration late season flows.
- Sediment trapping that builds streambanks and floodplains.
- Infiltration of water into the soil profile.
- Narrowing and deepening of channels.
- Biological uptake of sediment, organic material, nutrients, and pesticides.
- Maintenance of streamside integrity during high flow storm events.

The Ag Water Quality Program uses the concept of "site-capable vegetation" to describe the vegetation that agricultural streamsides need to provide the functions that prevent and control water pollution. 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, wildlife, fire, floods) and historical and current human influences (e.g., channelization, roads, invasive species, 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), NRCS soil surveys, and other scientific references.

In some cases, mature site-capable vegetation may not be needed to provide the three primary water quality functions. For example, mature trees may not be necessary to protect water quality; willows or other shrubs may suffice to provide adequate shade and protect streambanks on small streams.

In other cases, mature site-capable vegetation may not provide these three functions:

- Mature junipers are site-capable vegetation in central and eastern Oregon, but they reduce bank stability and increase erosion.

- Invasive grasses can be the dominant site-capable vegetation along streams, but they generally do not provide all of the required water quality functions.
- Upland species (such as sagebrush) can be the dominant site-capable vegetation along streams with erosional down cutting, but they do not improve water quality.

Requirement (OAR 603-095-3940):
(3) (a) By December 31, 2005, agricultural activities must allow the establishment or improvement of vegetation to provide bank stability and shading of natural streams, consistent with the vegetative capability of the site. Evaluation of vegetation will consider conditions for a stream reach in contiguous ownership.
(b) Except as provided in (a), grazing, weed control, and other common agricultural activities are allowed in riparian areas.
(c) Channel maintenance provided or under ORS 196.600 to 196.905 (Removal Fill laws) is not subject to 603-095-3940(4)(a).

The LAC recognizes that water gaps may be an acceptable tool when used in conjunction with appropriate riparian management.

Greenline Riparian-Wetland Monitoring is recommended, but not required, for monitoring riparian condition[23]. It is a process developed by the BLM to generate baseline data that describes existing conditions, and it is designed to detect changes in plant community succession.

Livestock Waste Management *(Parameters addressed: bacteria, nutrients)*

Requirement (OAR 603-095-3940):
(4) (a) Effective on rule adoption, landowners must prevent movement of animal waste into waters of the state from animal handling or feeding operations that concentrate animal waste.
(b) Waste storage and application shall be done in such a way as to keep from exceeding beneficial use for forage and/or crops.

Waste Management *(Parameters addressed: bacteria, nutrients, all wastes)*

Requirement (OAR 603-095-3940):
(5) Effective on rule adoption, no person subject to these rules shall violate any provision of ORS 468B.025 or ORS 468B.050.

This Area Rule does not establish new requirements. ORS 468B.025 and 468B.050 are existing state laws.

ORS 468B.025 states that no person shall:
(1) (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) Violate the conditions of any waste discharge permit issued under ORS 468B or ORS 568.

ORS 468B.050 refers to situations when permits are required; such as, for certain confined animal feeding operations.

The requirements of ORS 468B.025 rely on the definition of water pollution and waste (see below). Water pollution means "alteration of the...properties of any waters of the state...which will or tends to, either by itself or in connection with any substance,...render such waters harmful, detrimental or injurious to...beneficial uses…" (ORS 468B.005(7)). Wastes consist of substances that will or may cause water pollution and therefore interfere with beneficial uses.

Definitions:
Wastes include manure, commercial fertilizers, soil amendments, composts, vegetative materials, or any other substances that will or may cause water pollution (OAR 603-095-0010(53)).

Waste discharge means the discharge of waste, either directly or indirectly, into waters of the state (OAR 603-095-0010(54)).

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 (ORS 468B.005(7)).

Waters of the state include lakes, bays, ponds, impounding reservoirs, springs, wells, rivers, streams, creeks, marshes, inlets, canals, and all other bodies of surface or underground waters, natural or artificial, public or private (except those private waters which do not connect to natural surface or underground waters) within Oregon (from ORS 468B.005(8)).

Chapter 3: Goals, Objectives, and Strategies

ODA and the LAC will review this chapter at each biennial review and may update it if needed.

MISSION

Protect water quality in the Lost River Subbasin Agricultural Water Quality Management Area, while sustaining the agricultural economy.

Guiding Principles:

- Rely on scientifically-credible data and techniques,
- Emphasize maintenance, restoration, education, and monitoring,
- Use common sense to develop cost-effective, practical, flexible, and realistic solutions,
- Maintain a non-threatening, positive atmosphere,
- Recognize natural background water quality, including geothermal input,
- Recognize that proper agricultural practices improve water quality,
- Recognize that economic viability of agriculture is necessary to achieve improvements.

3.1 Goal

1. Prevent and control water pollution from agricultural activities to protect beneficial uses in the Lost River Subbasin Agricultural Water Quality Management Area.

2. Achieve the following land conditions on agricultural lands throughout the management area that contribute to good water quality:
   - Streamside vegetation provides streambank stability, filtration of overland flow, and moderation of solar heating, consistent with site capability.
   - Combined sheet, rill, and wind erosion of soil, averaged through a crop rotation period, is less than or equal to T.
   - Livestock waste is prevented from entering waters of the state.
   - Waste storage and application is carried out in such a way as to keep from exceeding beneficial use for forgae and/or crops.
   - Provisions in 468B are not violated:
     - No person shall cause pollution of 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 waters of the state by any means.

This Area Plan focuses on:

- Bacteria
- Nutrients
- Temperature

Several river segments in the Lost River Subbasin are identified by Oregon's DEQ on its 2004/2006 303(d) list as water-quality limited for dissolved oxygen, pH, chlorophyll *a*, ammonia toxicity, and temperature. Reductions in nutrient levels are expected to alleviate the concerns related to low dissolved oxygen, high pH, chlorophyll *a*, and ammonia toxicity.

3.2 Objectives

1. Maximize the beneficial effects of agricultural irrigation and grazing practices on bacteria loads, nutrients, and water temperature, while acknowledging that background water quality is limited due to hot springs, historic channelization, and the volcanic origin of soils.

2. Increase public awareness of water quality concerns beyond the realm of this Area Plan or the responsibility of the private landowner, including:
   - Natural background conditions (geothermal springs, nutrients, algae, low-gradient streams),
   - Fluctuation of flow in the Lost River (Bureau of Reclamation),
   - Commingled waters (Lost River and Klamath River),
   - Interstate waters (Oregon and California),
   - High water temperatures correlated with solar radiation and high ambient temperature,
   - Lack of streambank shade on wide channelized streams and impoundments,
   - Unusual weather,
   - Urban and suburban runoff.

3.2.1 Measurable Objectives

A Focus Area is a small watershed with significant water quality or land condition concerns that are associated with agriculture. ODA's intent in selecting Focus Areas is to deliver systematic, concentrated outreach and technical assistance in small geographic areas ("Focus Areas") through the SWCDs. A key component of this approach is measuring conditions before and after implementation to document the progress made with available resources:

- By June 30, 2014, a Focus Area (a small geographic area) will be identified within the Management Area, where the local SWCD will focus outreach and technical assistance work.

The current Focus Area for this Management Area is Poe Valley. An Action Plan for the current biennium has been developed and approved by ODA outlining the key components of the process:

- Conduct a pre-assessment of current land conditions.
- Identify areas of concern.
- Conduct education and outreach to landowners.
- Offer technical assistance to landowners and financial assistance, if needed.
- Conduct a post-assessment after project implementation.
- Report progress to ODA and the LAC.

The Klamath SWCD provides services to two Management Areas, the Lost River Subbasin and the Klamath Headwaters. Due to limited resources, the Klamath SWCD is not currently able to focus many resources on the Poe Valley Focus Area. The Poe Valley Focus Area is considered to be an open Focus Area, but the milestones and timelines are currently longer term due to the limited resources available. ODA will work with the LAC and the Klamath SWCD to determine appropriate timelines and measurements of progress in their Focus Area and Management Area. These appropriate measurable objectives, milestones, and timelines will be incorporated into the Lost River Subbasin Plan at the 2016 Biennial Review.

3.3 Strategies for Area Plan Implementation

To achieve clean water, an effective strategy must reduce transport of pollutants to surface water and infiltration of pollutants into ground water. The primary strategies to minimize pollution from

agricultural and rural lands lie in reducing erosion, pollutants in runoff, and infiltration of pollutants to groundwater. Pollution is minimized through a combination of landowner education, land treatment, and implementation of appropriate management practices.

Voluntary efforts are the primary means to prevent and control agricultural sources of pollution. However, regulatory measures are included as an implementation strategy. ODA pursues enforcement to gain compliance with Area Rules only when reasonable attempts at a voluntary solution have failed. (See below.)

VOLUNTARY APPROACH

Prevention and control of agricultural pollution is encouraged in a cooperative spirit through the voluntary efforts of landowners, aided by information and technical and financial assistance from watershed councils, local, state, and federal agencies, and others. The Klamath and Lakeview SWCDs are the main local support agencies.

Education plays a critical role in the success of this Area Plan. The NRCS and SWCDs work together to provide farmers and ranchers in the Management Area with information about the goals and objectives of the Area Plan and requirements of the Area Rules.

Landowners have flexibility in choosing management approaches and practices to address water quality issues on their lands. (Area Rules cannot prohibit specific practices.) Landowners may choose to develop management systems to address problems on their own, or they may choose to develop a voluntary conservation plan to address applicable resource issues. Landowners may seek planning assistance from their SWCD, NRCS, any other agency, or a consultant.

The following strategies are used by the appropriate SWCD in cooperation with the landowner.

1. Plan and implement technically sound and economically feasible conservation practices that contribute to meeting Area Plan objectives.
    a. Develop voluntary conservation plans with planning and implementation assistance.
    b. Promote incentive and cost-share programs to assist implementation of plans and related practices, by annually identifying water quality funding needs with agencies that provide cost-share and technical assistance to agricultural operators.

2. Create a high level of awareness and an understanding of water quality issues among the agricultural community and rural public, in a manner that minimizes conflict and encourages cooperative efforts.
    a. Incorporate Area Plan implementation as a priority element in the SWCDs' annual work plans and long-range plans, with support from partner organizations.
    b. Promote and conduct cooperative, on-the-ground projects with partner organizations to solve critical problems identified by landowners and land managers.
    c. Showcase successful practices and systems and conduct annual tours for landowners and media.
    d. Recognize successful projects and practices through appropriate media and newsletters.
    e. Conduct educational programs to promote public awareness of water quality issues and their solutions.
    f. Proactively offer and provide site evaluations on any lands within the Management Area to assess conditions that may affect water quality.
    g. Prioritize subwatersheds within the Management Area for targeting implementation and improvement strategies.

3. Encourage adequate funding and administration of the program to achieve Area Plan goals and objectives by systematic, long-range planning and focusing of coordinated efforts on full-scale, watershed-based approaches; identifying needs; developing projects; actively seeking funding; and ensuring successful implementation of funded projects.

3.3.4 Monitoring and Evaluation.

For a description of monitoring and evaluation activities, see Chapter 4.

Scientifically-sound monitoring can provide valuable information on how much effect the Area Plan is having, how extensively it is being implemented, and where more efforts are needed. The LAC expects to participate in local monitoring efforts.

The LAC acknowledges that monitoring is an important, ongoing activity throughout the Management Area. Several assessments are being conducted that will help determine current water quality conditions.

ODA is responsible for monitoring land conditions that influence water quality in agricultural areas. ODA will provide funding to support this activity. The LAC, ODA, and the Klamath SWCD will evaluate the effectiveness of the Area Plan in improving water quality and riparian conditions. The monitoring program will be revisited upon TMDL establishment to address TMDL goals.

During the biennial review process, ODA, the LMA, and the LAC will review:

- The activities that have occurred to achieve plan goals and objectives in the management area and the small focus area.
- Water quality and land condition assessment and monitoring data in the management area and the small focus area.
- Compliance activities conducted by ODA in the management area.

EXISTING WATER QUALITY

Natural background water quality is affected by low gradient streams, hot springs, channelization, phosphorus from eroding volcanic bedrock, wetland processes, high waterfowl populations, and other local phenomena. Due to the complex nature of the system, it has been difficult to quantify natural, background water quality.

Insufficient data have been collected to determine the geographic extent, magnitude, and source of water quality concerns. The LAC strongly desires to see more extensive analysis of existing data and collection of new data to more precisely determine agriculture's contribution to water quality in this subbasin. This will help the LAC refine and improve the Area Plan in the coming years.

EXISTING LAND CONDITIONS

Landowners may wish to monitor existing land conditions, such as vegetative composition of riparian areas and the soil loss due to sheet, rill, and wind erosion. For riparian vegetation, photographic records with a time sequence of photographs taken from the same point are the simplest method for qualitative assessments and for monitoring of trends. The greenline transect provides a more quantitative measurement of riparian vegetation.

AREA PLAN IMPLEMENTATION & PROGRESS

ODA, in collaboration with the LAC and the Klamath SWCD, is responsible for determining progress towards Area Plan goals. The Klamath SWCD, as the local management agency, maintains a Memorandum of Agreement with ODA that outlines their responsibilities for providing and tracking educational outreach and technical assistance.

The Klamath SWCD and ODA, in collaboration with the LAC:

- Formulate key questions to be answered by monitoring.
- Participate in developing and evaluating outreach and education programs designed to increase public awareness and understanding of water quality issues.
- Review reports and conduct demonstration projects and tours to promote successful management practices and systems.
- Evaluate the adequacy of technical and financial assistance sources available to the agricultural community to implement alternative practices, monitoring, and education. Additional resources are pursued where needed.

Progress and success of implementation efforts are assessed through compliance with Area Rules and state standards and the measurement of water quality improvement over time.

Chapter 4: Implementation, Monitoring, and Adaptive Management

4.1 Implementation 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 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 Summary (Dec 2012 – Dec 2014)
Outreach and Education:

- KSWCD - Conducted 5 demonstrations on no-till and pasture aeration
- NRCS – Local Working Group Meeting at OIT – Introduction of 2014 Farm Bill

Technical Assistance:
Klamath SWCD:

- Landowner Contacts: 25
- Site visits: 10

NRCS:

- Landowner Contacts: Based upon number of contracts - 50
- Site visits: Based upon number of contracts - 75

Projects implemented to improve water quality on ag lands:
Klamath SWCD:

- Over 100 acres of no-till planting

NRCS:

- Forest Stand Improvement and Brush Management – 359 acres
- Fencing – 144,756 feet
- Irrigation Water Conveyance – 26,836 feet
- Irrigation System, sprinkler – 5,123 acre
- Irrigation System, surface or subsurface – 45 acre
- Irrigation Water Management – 2,003 acre
- Livestock Watering Facilities – 12 each
- Nutrient Management – 3,112 acre
- Prescribed Grazing – 776 acre
- Wetland Restoration – 5,778 acre

Funding and Grants:
Klamath SWCD:

- ODA/OWEB support to LMA: $ 50,000 per year (2 management areas)

4.2 Water Quality Monitoring—Status and Trends

ODA currently evaluates water quality data from monitoring sites in DEQ's water quality database that reflects agricultural influence on water quality. These data are also published in the DEQ water quality database and evaluated at the statewide level to determine trends in water quality at agricultural sites statewide.

Lost River Basin – 2012

Existing data on DEQ's water quality database only has two sites with continuous data in this basin, both on the mainstem of the Lost River. One site is located at the A-R Dam, and the other is in Merrill at Highway 39. The A-R Dam site has data that continues until 1998 with many gaps between 1985-1997. The Highway 39 site has continuous data beyond 2001. This site also covers nearly all the Lost River drainage, so it provides a good single point for looking at water quality trends in the basin. It would be useful to have at least one more sampling location on the mainstem Lost River. Potential sites for this would be at the F canal diversion, and at the East Langell Valley Road crossing.

In addition to the data on DEQ's water quality database, there are many other groups that have done focused studies (i.e. short duration monitoring) in the Lost River Basin. One notable study was performed by University of California-Davis in 2002. This project involved extensive sampling in the Lost River and Tulelake areas from 1999 through 2001. Results of this sampling showed elevated P and N concentrations entering the Tulelake Irrigation District, along with high salt loads. This report also stated that tile line drainage had lower temperatures than surface drainage.

As of December 2010, the Lost River at A-R Dam site did not have data beyond 2002. The site at Highway 39 appears to still be monitored. Data from this site showed elevated *E. coli*, to 840 counts, along with high pH (to 9.2), and turbidity (to 35 NTU). There were also some high nitrate concentrations, up to 3.15 mg/l, and all the TP results were above 0.08 mg/l, with a high concentration of 0.73 mg/l. Dissolved oxygen saturation had a tremendous range, from a low of 13% to a high of 210%. This fluctuation is likely due to high concentrations of algae.

Review of DEQ's water quality database in October 2012 showed the Highway 39 site as being the only one with recent data. Since 2010, this site continued to have high ammonia concentrations (to 0.85 mg/l); two high *E. coli* counts (222 and 921, in July and May 2012); high pH (to 9.2), high nitrate (to 1.12 mg/l); a very wide range of dissolved oxygen saturation (from 58% to 132%), and high TP (to 0.82 mg/l). It should be noted that this monitoring site is in the mid to upstream section of the Lost River, not far from the California border.

Lost River - 2014

The Oregon Water Quality Index (OWQI) analyzes a defined set of water quality variables and produces a score describing general water quality. The water quality variables included in the OWQI are temperature, dissolved oxygen (percent saturation and concentration), biochemical oxygen demand, pH, total solids, ammonia and nitrate nitrogen, total phosphorus, and bacteria. The OWQI transforms raw data into unitless subindex values which are aggregated to generate an overall score for a particular monitoring site. Scores range from 10 (worst case) to 100 (ideal water quality). These subindices are combined to give a single water quality index value ranging from 10 to 100.

Lost River @ Highway 39: The 2013 OWQI score was 28, giving it a Very Poor rating. During this year and surrounding years, a substantial amount of acreage was not irrigated. Also of note, no water was released from Harpold dam due to drought conditions. Dissolved oxygen, total solids, nitrogen, and phosphorus concentrations were all very high. This monitoring site also had elevated temperature, pH, and biological oxygen demand. This site had the second lowest index score among all agricultural sites

monitored in 2013. The LAC noted that this site is not representative of the Lost River Subbasin. The water at this sampling site (Lost River @ Highway 39) is a complex mix of water sources including the Klamath River and irrigation district tailwater. The LAC would like to have another DEQ ambient sampling site at a more representative location in the Lost River Subbasin to capture more accurate data regarding Lost River water conditions.

4.3 Progress Toward Measurable Objectives

Measurable Objectives for a Focus Area and the Management Area will be set at the 2016 Biennial Review.

4.4 Aerial Photo Monitoring of Streamside Vegetation

ODA conducted aerial photo monitoring in Lost River once in 2006. Riparian cover along the monitored Lost River segment was predominantly agricultural grass. Riparian cover in the Rocky Creek segment was approximately half trees and half agricultural grass. Currently no reference sites exist to compare with the monitored sites, to know what kind of vegetation may be expected. If reference sites were identified, they could be used to compare with aerial photo monitored sites.

4.5 Biennial Reviews and Adaptive Management

Additional language will be added at the 2016 Biennial Review.

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Appendices

A. Interviews with Local Residents: Lost River LAC Historical Subcommittee

B. Common Agricultural Water Quality Parameters of Concern

Appendix A: Interviews with Local Residents

LOST RIVER LAC HISTORICAL SUBCOMMITTEE

August 11, 1999 Interview with Barney Hoyt. Conducted by Don Russell and Deb Crisp

Barney Hoyt moved to this area in 1950. He has been active in the agricultural community ever since.

He recalls the conditions of the river as being much like it is now. Barney commented that he couldn't recall anyone in his family ever swimming in the Lost River, however he stated that he would not want to swim in it now or then.

Barney stated that the river has always fluctuated depending on the time of year.

Barney recalled that the plant communities haven't changed a lot since the 1950's. He also recalled the flooding that occurred in 1964. He believes that a lot of the lease lands were opened up to store the extra water. He stated that if it weren't for the facilities for water movement in the basin, the flooding would have been much worse than it was.

Don asked if Barney knew of any hot springs or geothermal areas in the Lost River. Barney recalled that at one time there was talk of using the hot springs in the Olene area for barley malting facilities.

Barney recalled there being an abundance of catfish in the river. He did not recall the tribes using the river for sustenance.

Barney remembers the US Bureau of Reclamation working on the Diversion Canal after he moved here. Barney used to be on the ASCS?? committee and recalled using trees and other objects to help control erosion in the river after it had been channelized. He recalled working with Bill Johnson (Klamath Soil and Water Conservation District).

Barney stated that he believes that the movement from flood irrigation to sprinkler irrigation has helped to reduce the amount of water needed to irrigate crops, and also to reduce erosion. He recalls that there are fewer acres of potatoes in the basin, and almost no flood irrigated row crops are now grown. The majority of the crops are now sprinkler irrigated with the exception of pastures.

Don stated that it is an accepted number that the irrigation water is used six to seven times as it passes through the system.

Barney stated that he thinks the algae content in the irrigation system is lower than it used to be. He also stated that there are fluctuations in the algae content at different times of the year. At times, the water is very clear and you can see the bottom of the ditch.

Barney believes sprinkler irrigation is very vital to improving water quality.

LOST RIVER LAC HISTORICAL SUBCOMMITTEE

APRIL 4, 2000 INTERVIEW WITH: Van Landrum, Alvin Cheyne, Walter Smith, Ron McVay, Tag Howland, Louis Randall, Earl Miller, Marilyn Livingston, Margaret Cheyne

Of the people interviewed, the earliest memories were 1925. Many families homesteaded the area as early as 1885. The water in the Lost River was reported to have been "very green." You had to take a bath after swimming in the river. The water was terrible. When asked if anyone would swim in the river today, the group said yes. However, you would have to bathe afterward.

Don asked the group about fishing and the types of fish in the river system. Tag stated that the only good fishing was where Miller Creek dumped into the Lost River. There were many catfish. Don asked the group about suckers. Louis stated that the Lost River was only intermittent before the dam was put in. Earl showed a map from 1908 that shows the intermittent areas of the river. Louis stated that about six miles of the river dried up when the water was low.
Walt stated that he used to catch many fish, mostly perch, but once in awhile he would catch a sucker.

Don asked if the group felt that the water quality has degraded, stayed the same, or improved. Everyone agreed that the water quality does not seem to have changed very much.

Alvin stated that there used to be bathhouses all over, wherever there was a good hot spring. Alvin asked Walt if he knew the temperature. Walter stated that the water he uses to heat his home is 145 degrees and the old bathhouse near Cheese Factory Rd is 150 degrees.

There were many different types of animals. Muskrats, beavers, deer, antelope. There were many cougars. There are documented claims of killing six cougars in one day. The dear and antelope were not very plentiful in the past. There is a story of a group of 50 experienced hunters nearly starving to death in the Klamath Basin. They reportedly had to eat their horses and said that it had not been worth their effort to come here. Walt stated that in the 1930's and 1940's it was a big deal to see a deer.

Van Landrum offered some history of the Applegate family and what the conditions were according to their reports. In 1874, it was reported that there was open water a quarter mile past milepost 67. It was stated that water flowed east but vary rarely west in the Lost River. Van then explained the plan that Applegate developed to drain the Tulelake basin and claim the land. Van stated that the present Diversion Canal is almost a duplicate of Applegate's plan.

In 1855, the Williamson surveys were completed. Abbot was on the left bank. Abbot's journal went as far as Cove Point. It stated that the water was brown, bitter, and animals would not drink it. Van stated that the algae is growing because of the nutrients contributed from the marshlands. Alvin Cheyne stated that in Fremont's reports, the water in the Link River was too putrid to water horses.

Alvin stated that there have been studies done that show that the top one inch of lake bottom has more nutrients that the water coming into the lake. Earl Miller stated that four times as much nitrogen flows out of the lake as flows into it.

The basin was homesteaded in the late 1800's and on into the early 1900's. At that point in time, landowners were given land patents. In the 1880's, the Klamath River flooded and flooded a lot of previously patented land. In 1905, much of that land was still under water. That flooded land was ceded to the federal government. The government then drained and reclaimed the previously farmed ground.

Earl stated that in 1889, the Straits Drain was dredged and the lower bank of the Klamath River was built up.

Don asked when row crops were started here. Walt stated that his family had row crops in 1936. Earl stated that in one of Applegate's reports, it states that there were commercial potatoes produced before 1900. Ron's family started row crops in 1923. Ron stated that in 1917 potatoes sold for $15.00 per 100#. Tag stated that before World War II sugar beets were grown between Alturas and Likely, CA.

Bill asked if there were many fires. No one stated remembering many fires, but the numbers of juniper trees have definitely increased. Louis stated that he remembered the upper end of Langell Valley burning, burned from Clear Lake across the flats past Tulelake.

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

Template Language

Descriptions of Common Agricultural Parameters of Concern: This language can be used or added to existing language.

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.

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.