Greater Harney Basin Agricultural Water Quality Management Area Plan

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Developed by the

Oregon Department of Agriculture

and the

Greater Harney Basin Local Advisory Committee

with support from the

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Acronyms and Terms

Ag Water Quality Program – Agricultural Water Quality Program
Area Plan – Agricultural Water Quality Management Area Plan
Area Rules – Agricultural Water Quality Management Area Rules
CAFO – Confined Animal Feeding Operation
CWA – Clean Water Act
DEQ – Oregon Department of Environmental Quality
GWMA – Groundwater Management Area
LAC – Local Advisory Committee
LMA – Local Management Agency
Management Area – Agricultural Water Quality Management Area
NPDES – National Pollution Discharge Elimination System
NRCS – Natural Resources Conservation Service
OAR – Oregon Administrative Rules
ODA – Oregon Department of Agriculture
ODF – Oregon Department of Forestry
ORS – Oregon Revised Statute
OWRD – Oregon Water Resources Department
OWEB – Oregon Watershed Enhancement Board
OWRI – Oregon Watershed Restoration Inventory
PMP – Pesticides Management Plan
PSP – Pesticides Stewardship Partnership
SIA – Strategic Implementation Area
SWCD – Soil and Water Conservation District
TMDL – Total Maximum Daily Load
USDA – United States Department of Agriculture
US EPA – United States Environmental Protection Agency
WPCF – Water Pollution Control Facility
WQPMT – Water Quality Pesticides Management Team

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Foreword

This Agricultural Water Quality Area Plan (Area Plan) provides guidance for addressing water quality related to agricultural activities in the Agricultural Water Quality Management Area (Management Area). The Area Plan identifies strategies to prevent and control water pollution from agricultural lands.

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

Required Elements of Area Plans

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

Plan Content

Chapter 1: Agricultural Water Quality Program Purpose and Background. Presents consistent and accurate information about the Ag Water Quality Program.

Chapter 2: Local Background. Provides the local geographic, water quality, and agricultural context for the Management Area. Describes the water quality issues, Area Rules, and potential practices to address water quality issues.

Chapter 3: Implementation Strategies. Presents goal(s), measurable objectives, strategic initiatives, proposed activities, and monitoring.

Chapter 4: Progress and Adaptive Management. Describes progress toward achieving the goal of the Area Plan and summarizes results of water quality and land condition monitoring.

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Chapter 1: Agricultural Water Quality Program

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

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

The provisions of the Area Plan do not establish legal requirements or prohibitions (ORS 568.912(1)).

Each Area Plan is accompanied by Area Rules that describe local agricultural water quality regulatory requirements. ODA will exercise its regulatory authority for the prevention and control of water pollution from agricultural activities under the Ag Water Quality Program's general regulations (OAR 603-090-0000 to 603-090-0120) and under the Area Rules for this Management Area (OAR 603-095-3340). The general regulations guide the Ag Water Quality Program, and the Area Rules for the Management Area are the regulations with which landowners must comply. Landowners are encouraged through outreach and education to implement conservation and management activities.

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

- Farms and ranches,
- Rural residential properties grazing 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).

Water quality on federal land in Oregon is regulated by DEQ and on Tribal Trust land by the respective tribe, with oversight by the United States Environmental Protection Agency (US EPA).

1.2 History of the Ag Water Quality Program

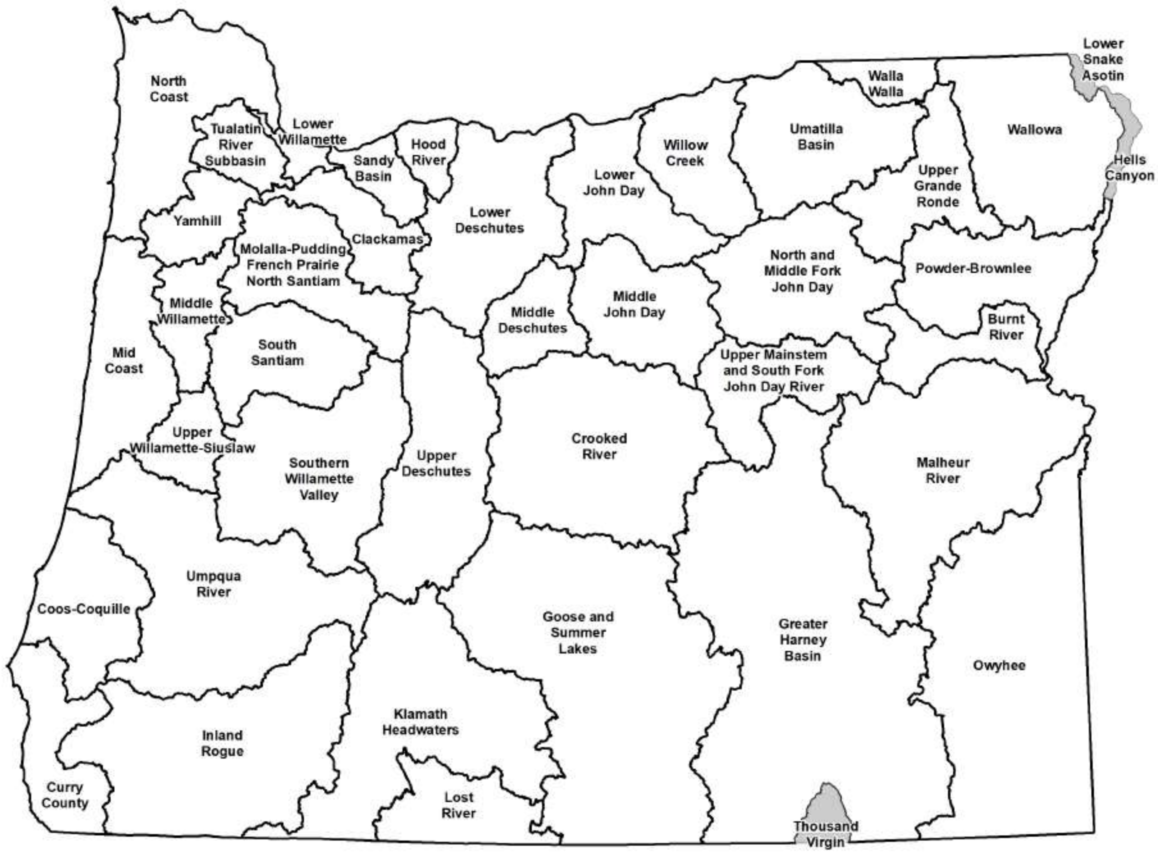
In 1993, the Oregon Legislature passed the Agricultural Water Quality Management Act directing ODA to develop plans to prevent and control water pollution from agricultural activities and soil erosion and to achieve water quality standards (ORS 568.900 through ORS 568.933). The Oregon Legislature passed additional legislation in 1995 to clarify that ODA is the lead agency for regulating agriculture with respect to water quality (ORS 561.191).

Between 1997 and 2004, ODA worked with LACs and SWCDs to develop Area Plans and Area Rules in 38 watershed-based Management Areas across Oregon (Figure 1.2). Since 2004, ODA, LACs, SWCDs, and other partners have focused on implementation including:

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

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

Figure 1.2 Map of 38 Agricultural Water Quality Management Areas*



*Gray areas are not included in Ag Water Quality Management Areas

1.3 Roles and Responsibilities

1.3.1 Oregon Department of Agriculture

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 was established to develop and implement water quality management plans for the prevention and control of water pollution from agricultural activities and soil erosion. State and federal laws that drive the establishment of an Area Plan include:

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

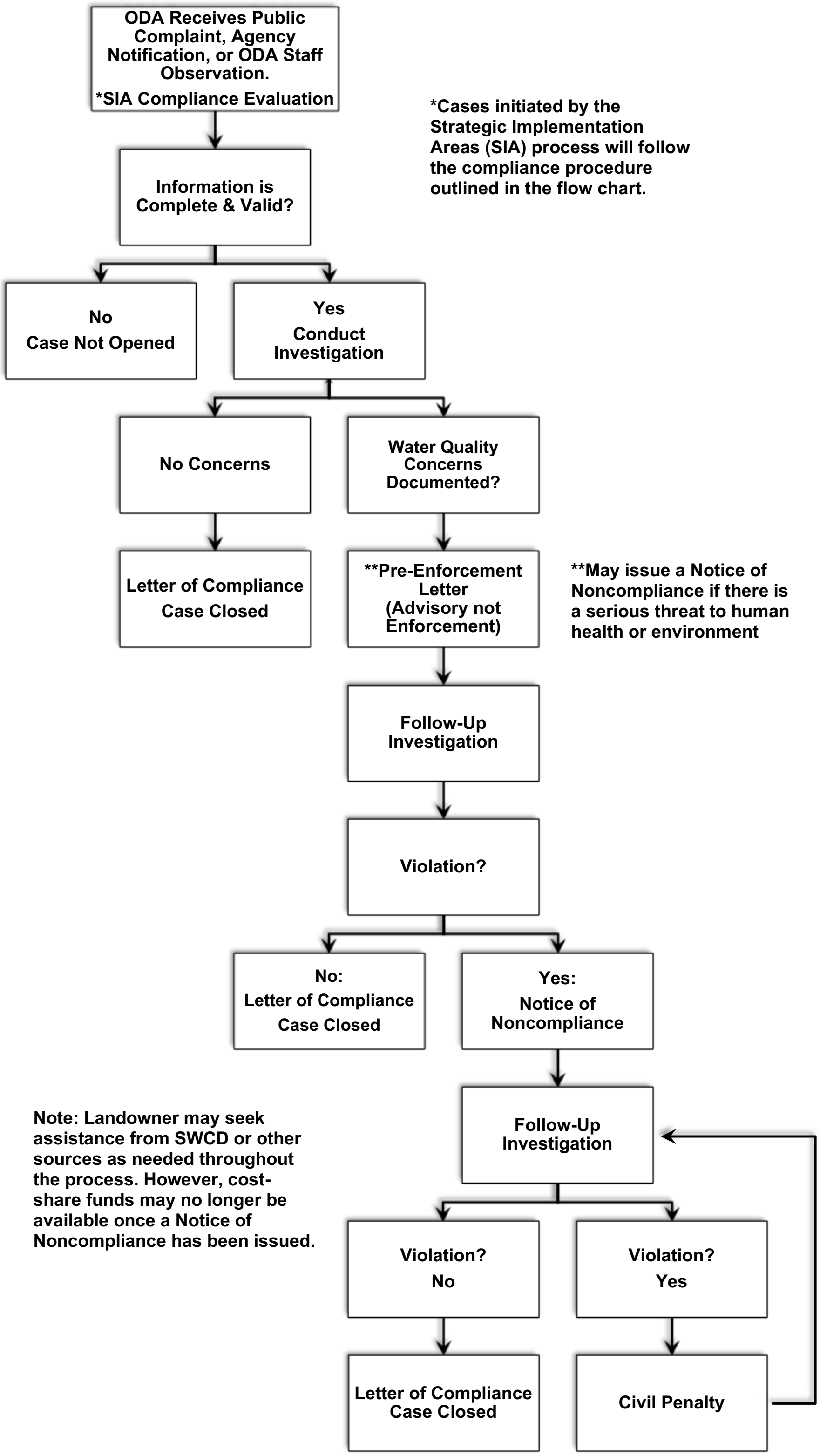
ODA bases Area Plans and Area Rules on scientific information (ORS 568.909). ODA works in partnership with SWCDs, LACs, DEQ, and other partners to implement, evaluate, and update the Area Plans and Area Rules. If and when other governmental policies, programs, or rules conflict with the Area Plan or Area Rules, ODA will consult with the appropriate agencies to resolve the conflict in a reasonable manner.

ODA is responsible for any actions related to enforcement or determination of noncompliance with Area Rules (OAR 603-090-0080 through OAR 603-090-0120). ORS 568.912(1) and ORS 568.912(2) give ODA the authority to adopt rules that require landowners to perform actions necessary to prevent and control pollution from agricultural activities and soil erosion.

The Area Rules are a set of standards that landowners must meet on all agricultural or rural lands. "Landowner" includes any landowner, land occupier, or operator per OAR 603-95-0010(24). All landowners must comply with the Area Rules. ODA will use enforcement where appropriate and necessary to achieve compliance with Area Rules. Figure 1.3.1 outlines ODA's compliance process. ODA will pursue enforcement action only when reasonable attempts at voluntary solutions have failed (OAR 603-090-0000(5)(e)). If a violation is documented, ODA may issue a pre-enforcement notification or an enforcement order such as a Notice of Noncompliance. If a Notice of Noncompliance is issued, ODA will direct the landowner to remedy any conditions 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, ODA may assess civil penalties for continued violation of the Area Rules.

Any member of the public may file a complaint, and any public agency may file a notification of a potential violation of the Area Rules. ODA also may initiate an investigation based on its own observation or from cases initiated through the Strategic Implementation Area process (See Figure 1.3.1).

Figure 1.3.1 Compliance Flow Chart



1.3.2 Local Management Agency

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

The day-to-day implementation of the Area Plan is accomplished through an Intergovernmental Grant Agreement between ODA and each SWCD. Every two years, each SWCD submits a scope of work to ODA to receive funding to implement the Area Plan. 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 Area Rules as needed.

1.3.3 Local Advisory Committee

For each Management Area, the director of ODA appoints an LAC (OAR 603-090-0020) with up to 12 members. The LAC serves in an advisory role to the director of ODA and to the Board of Agriculture. The role of the LAC is to provide a high level of citizen involvement and support in the development, implementation, and biennial reviews of the Area Plan and Area Rules. The LAC's primary role is to advise ODA and the LMA on local agricultural water quality issues as well as evaluate the progress toward achieving the goals and objectives of the Area Plan. LACs are composed primarily of agricultural landowners in the Management Area and must reflect a balance of affected persons.

The LAC is convened at the time of the biennial review; however, the LAC may meet as frequently as necessary to carry out its responsibilities, which include but are not limited to:

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

1.3.4 Agricultural Landowners

The emphasis of the Area Plan is on voluntary action by landowners to control the factors affecting water quality in the Management Area. In addition, each landowner in the Management Area is required to comply with the Area Rules. To achieve water quality goals or compliance, landowners may need to select and implement an appropriate suite of measures. The actions of each landowner will collectively contribute toward achievement of water quality standards.

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

Under the Area Plan and Area Rules, agricultural landowners are not responsible for mitigating or addressing factors that are caused by non-agricultural activities or sources, such as:

- Hot springs, glacial melt water, unusual 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,
- Impacts on water quality and streamside vegetation from wildlife such as waterfowl, elk, and feral horses,
- Other circumstances not within the reasonable control of the landowner.

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

1.3.5 Public Participation

ODA, LACs, and LMAs conduct biennial reviews of the Area Plan and Area Rules. Partners, stakeholders, and the general public are invited to participate in the process. Any revisions to the Area Rules will include a formal public comment period and a formal public hearing.

1.4 Agricultural Water Quality

The federal CWA directs states to designate beneficial uses related to water quality, decide on parameters to measure to determine whether beneficial uses are being met, and set water quality standards based on the beneficial uses and parameters.

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. 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 all permitted CAFOs are subject to ODA's CAFO Program requirements. Irrigation return flow from agricultural fields may drain through a defined outlet, but is exempt under the CWA and does not currently require a permit.

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

1.4.2 Beneficial Uses and Parameters of Concern

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

Many waterbodies throughout Oregon do not meet state water quality standards. The most common water quality concerns statewide related to agricultural activities are temperature, bacteria, biological criteria, sediment and turbidity, phosphorous, nitrates, algae, pH, dissolved oxygen, harmful algal blooms, pesticides, and mercury. Water quality impairments vary across the state; they are summarized for this Management Area in Chapter 2.

1.4.3 Impaired Waterbodies and Total Maximum Daily Loads

Every two years, DEQ is required by the CWA to assess water quality in Oregon, resulting in the "Integrated Report." CWA Section 303(d) requires DEQ to identify waters that do not meet water quality standards. The resulting list is commonly referred to as the "303(d) list" (http://www.oregon.gov/deq/wq/Pages/WQ-Assessment.aspx). In accordance with the CWA, DEQ must establish TMDLs for pollutants on the 303(d) list. For more information, visit www.oregon.gov/deq/wq/tmdls/Pages/default.aspx.

A TMDL includes an assessment of conditions (based on water quality data, land condition data, and/or computer modeling) and describes a plan to achieve water quality standards. TMDLs specify the daily amount of pollution a waterbody can receive and still meet water quality standards. TMDLs generally apply to an entire basin or subbasin, not just to an individual waterbody on the 303(d) list. In the TMDL, point sources are assigned "waste load allocations" that are then incorporated into National Pollutant Discharge Elimination System (NPDES) permits. Nonpoint sources (agriculture, forestry, and urban) are assigned a "load allocation."

As part of the TMDL process, DEQ identifies Designated Management Agencies and Responsible Persons, which are parties responsible for submitting TMDL implementation plans. TMDLs designate ODA as the lead agency responsible for implementing the TMDL on agricultural lands. ODA uses the applicable Area Plan(s) as the implementation plan for the agricultural component of the TMDL. Biennial reviews and revisions to the Area Plan and Area Rules must address agricultural or nonpoint source load allocations from relevant TMDLs.

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

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

To implement the intent of ORS 561.191, ODA incorporated ORS 468B.025 and 468B.050 into all 38 of the Area Rules in Oregon.

ORS 468B.025 (prohibited activities) states that:
"(1) Except as provided in ORS 468B.050 or 468B.053, 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."

ORS 468B.050 identifies the conditions when a permit is required. A permit is required for CAFOs that meet minimum criteria for confinement periods and have large animal numbers or have wastewater facilities. The portions of ORS 468B.050 that apply to the Ag Water Quality Program state that:

"(1) Except as provided in ORS 468B.053 or 468B.215, without holding a permit from the Director of the Department of Environmental Quality or the State Department of Agriculture, which permit shall specify applicable effluent limitations, a person may not:
(a) Discharge any wastes into the waters of the state from any industrial or commercial establishment or activity or any disposal system."

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

' "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.' (ORS 468B.005(5)).

' "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.' (ORS 468B.005(10)).

' "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.' (ORS 468B.005(9)). Additionally, the definition of "wastes" given in OAR 603-095-0010(53) 'includes but is not limited to commercial fertilizers, soil amendments, composts, animal wastes, vegetative materials or any other wastes.'

1.4.5 Streamside Vegetation and Agricultural Water Quality

Across Oregon, the Ag Water Quality Program emphasizes streamside vegetation protection and enhancement. Streamside vegetation can provide three primary water quality functions: shade to reduce stream temperature warming from solar radiation, streambank stability, and filtration of pollutants. Other water quality functions from streamside vegetation include: water storage in the soil for cooler and later season flows, sediment trapping that can build streambanks and floodplains, narrowing and deepening of channels, and biological uptake of sediment, organic material, nutrients, and pesticides. In addition, streamside vegetation provides habitat for numerous species of fish and wildlife. Streamside vegetation conditions can be monitored to track progress toward achieving conditions that support water quality.

Site-Capable Vegetation

The Ag Water Quality Program uses the concept of "site-capable vegetation" to describe the streamside 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 that are beyond the program's statutory authority (e.g., channelization, roads, modified flows, previous land management). Site-capable vegetation can be determined for a specific site based on: current streamside vegetation at the site, streamside vegetation at nearby reference sites with similar natural characteristics, Natural Resources Conservation Service (NRCS) soil surveys and ecological site descriptions, and/or 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 streams on agricultural lands. The Area Rules for each Management Area require that agricultural activities allow for the establishment and growth of streamside vegetation to provide the water quality functions equivalent to what site-capable vegetation would provide.

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

In many cases, invasive, non-native plants, such as introduced varieties of blackberry and reed canary grass, grow in streamside areas. This type of vegetation has established throughout much of Oregon due to historic and human influences and may provide some of the water quality functions of site-capable vegetation. ODA's statutory authority does not require the removal of invasive, non-native plants, however, ODA encourages landowners to remove these plants voluntarily. In addition, the Oregon State Weed Board identifies invasive plants that can impair watersheds. Public and private landowners are responsible for eliminating or intensively controlling noxious weeds, as described in state and local laws. For more information, visit www.oregon.gov/ODA/programs/weeds.

1.4.6 Soil Health and Agricultural Water Quality

An increasingly important concept in Oregon and across the United States is soil health. The Ag Water Quality Program promotes soil health to reduce erosion and keep sediment out of surface waters, thereby helping to maintain and improve water quality. Healthy soils have relatively high organic matter and well-formed soil structure. These characteristics may resist erosion and increase water infiltration, leading to less surface runoff and greater groundwater recharge; the resultant groundwater flows in some cases can help moderate stream water temperatures. According to the NRCS and others, there are four Soil Health Principles that together build highly productive and resilient soils: minimize disturbance and maximize cover, continuous living roots, and diversity above and below the surface.

Healthy soils make farms and ranches more resilient. The western United States is experiencing higher temperatures, more weather variability, and greater storm intensity. Forecasts predict continued high-intensity storms in the winter and spring, combined with more frequent droughts, which may result in more erosion, especially on bare ground. Building soil health increases resiliency to extreme weather, protects water quality, and helps keep farms and ranches viable. Incorporating soil health practices can help landowners adapt and reduce risks. For more information, visit www.nrcs.usda.gov/wps/portal/nrcs/detail/or/soils/health.

1.5 Other Water Quality Programs

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

1.5.1 Confined Animal Feeding Operation Program

ODA is the lead state agency for the CAFO Program, which was developed to ensure that operators do not contaminate ground or surface water with animal manure or process wastewater. The CAFO Program coordinates with DEQ to issue permits. These permits require the registrant to operate according to a site-specific, ODA-approved, Animal Waste Management Plan that is incorporated into the CAFO permit by reference. For more information, visit oda.direct/CAFO.

1.5.2 Groundwater Management Areas

Groundwater Management Areas (GWMAs) are designated by DEQ where groundwater is polluted from, at least in part, nonpoint sources. After designating a GWMA, DEQ forms a local groundwater management committee comprised of affected and interested parties. The committee works with and advises the state agencies that are required to develop an action plan to reduce groundwater contamination in the area.

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

If there is a GWMA in this Management Area, it is described in Chapter 2.

1.5.3 The Oregon Plan for Salmon and Watersheds

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

1.5.4 Pesticide Management and Stewardship

ODA's 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, Oregon formed the interagency Water Quality Pesticide Management Team (WQPMT) to expand efforts to improve water quality in Oregon related to pesticide use. 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 federal, state, and local monitoring programs to assess the possible impact of pesticides on Oregon's water quality. Pesticide detections in Oregon's streams can be addressed through multiple programs and partners, including the PSP.

Through the PSP, state agencies and local partners work together to monitor pesticides in streams and to improve water quality (www.oregon.gov/ODA/programs/Pesticides/Water/Pages/PesticideStewardship.aspx). ODA, DEQ, and Oregon State University Extension Service work with landowners, SWCDs, watershed councils, and other local partners to voluntarily reduce pesticide levels while improving water quality and crop management. Since 2000, the PSPs have made noteworthy progress in reducing pesticide concentrations and detections.

ODA led the development and implementation of a Pesticides Management Plan (PMP) for the state of Oregon (www.oregon.gov/ODA/programs/Pesticides/water/pages/AboutWaterPesticides.aspx). The PMP, completed in 2011, strives to protect drinking water supplies and the environment from pesticide contamination, while recognizing the important role that pesticides have in maintaining a strong state economy, managing natural resources, and preventing human disease. By managing the pesticides that are approved for use by the US EPA and Oregon in agricultural and non-agricultural settings, the PMP sets forth a process for preventing and responding to pesticide detections in Oregon's ground and surface water.

1.5.5 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 preventive management strategies to ensure that all public drinking water resources are kept safe from current and future contamination. For more information, visit www.oregon.gov/deq/wq/programs/Pages/dwp.aspx.

1.6 Partner Agencies and Organizations

1.6.1 Oregon Department of Environmental Quality

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

A Memorandum of Agreement between DEQ and ODA recognizes that ODA is the state agency responsible for implementing the Ag Water Quality Program. ODA and DEQ updated the Memorandum of Agreement in 2012 and reviewed and confirmed it in 2018 (http://www.oregon.gov/ODA/shared/Documents/Publications/NaturalResources/DEQODAmoa.pdf).

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

1.6.2 Other Partners

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

1.7 Measuring Progress

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

1.7.1 Measurable Objectives

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

The Ag Water Quality Program is working throughout Oregon with SWCDs and LACs toward establishing long-term measurable objectives to achieve desired conditions. ODA, the LAC, and the SWCD will establish measurable objectives and associated milestones for each Area Plan. Many of these measurable objectives relate to land conditions and primarily are developed for focused work in small geographic areas (section 1.7.3). ODA's longer-term goal is to develop measurable objectives, milestones, and monitoring methods at the Management Area scale.

The State of Oregon continues to improve its ability to use remote-sensing technology to measure current streamside vegetation conditions and compare these to the conditions needed to meet stream shade targets. As the State's use of this technology moves forward, ODA will use the information to help LACs and LMAs set measurable objectives for streamside vegetation. These measurable objectives will be achieved through implementing the Area Plan, with an emphasis on voluntary incentive programs.

At each biennial review, ODA and its partners will evaluate progress toward measurable objectives and milestone(s) and why they were or were not achieved. ODA, the LAC, and LMA will evaluate whether changes are needed to continue making progress toward the measurable objective(s) and will revise strategies to address obstacles and challenges.

The measurable objective(s) and associated milestone(s) within the Management Area are in Chapter 3 and progress toward achieving the measurable objective(s) and milestone(s) is summarized in Chapter 4.

1.7.2 Land Conditions and Water Quality

Land conditions can serve as useful surrogates (indicators) for water quality parameters. For example, because shade blocks solar radiation from warming the stream, streamside vegetation, or its associated shade, generally is used as a surrogate for water temperature. In some cases, sediment can be used as a surrogate for pesticides or phosphorus, which often 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,
- Improved land conditions can be documented immediately,
- Water quality impairments from agricultural activities are primarily due to changes in land conditions and management activities,
- It can be difficult to separate agriculture's influence on water quality from other land uses,

- There is generally a lag time between changes on the landscape and the resulting improvements in water quality,
- Extensive monitoring of water quality would be needed to evaluate progress, which would be expensive and may not demonstrate improvements in the short term.

Water quality monitoring data will help ODA and partners to measure progress or identify problem areas in implementing Area Plans. However, as described above, water quality monitoring may be slower to document changes than land condition monitoring.

1.7.3 Focused Implementation in Small Geographic Areas

Focus Areas

A Focus Area is a small watershed with water quality concerns associated with agriculture. The Focus Area process is SWCD-led, with ODA oversight. The SWCD delivers systematic, concentrated outreach and technical assistance. A key component is measuring conditions before and after implementation to document the progress made with available resources. The Focus Area approach is consistent with other agencies' and organizations' efforts to work proactively in small watersheds.

Focus Areas have the following advantages: a proactive approach that addresses the most significant water quality concerns, multiple partners that coordinate and align technical and financial resources, a higher density of projects that may lead to increased connectivity of projects, and a more effective and efficient use of limited resources.

The current Focus Area for this Management Area is described in Chapter 3.

Strategic Implementation Areas

Strategic Implementation Areas (SIAs) are small watersheds selected by ODA, in consultation with partners, based on a statewide review of water quality data and other available information. ODA conducts an evaluation of likely compliance with Area Rules and contacts landowners with the results and next steps. The Oregon Watershed Enhancement Board (OWEB) and other partners make funding and technical assistance available to support conservation and restoration projects. These efforts should result in greater ecological benefit than relying solely on compliance and enforcement. Landowners have the option of working with the SWCD or other partners to voluntarily address water quality concerns. ODA follows up, as needed, to enforce the Area Rules. Finally, ODA completes a post-evaluation to document progress in the SIA.

Any SIAs in this Management Area are described in Chapter 3.

1.8 Progress and Adaptive Management

1.8.1 Biennial Reviews

The ODA, LAC, LMA, and partners evaluate progress of Area Plan implementation through the biennial review process. At each biennial review, they discuss: 1) progress toward meeting measurable objectives and implementing strategies, 2) local monitoring data from other agencies and organizations, including agricultural land conditions and water quality, and 3) ODA compliance activities. As a result of these discussions, ODA and partners revise implementation strategies and measurable objectives in Chapter 3 as needed.

ODA provides information from the Oregon Watershed Restoration Inventory (OWRI) on restoration project funding and accomplishments at biennial reviews and uses the information for statewide reporting.

The majority of OWRI entries represent voluntary actions of private landowners who have worked in partnership with federal, state, and local groups to improve aquatic habitat and water quality conditions. OWRI is the single largest restoration information database in the western United States. For more information, visit www.oregon.gov/oweb/data-reporting/Pages/owri.aspx.

1.8.2 Water Quality Monitoring

In addition to monitoring landscape conditions, ODA relies on water quality monitoring data where available. These data may be provided by other state or federal agencies or local entities; ODA seldom collects water quality samples outside of compliance cases.

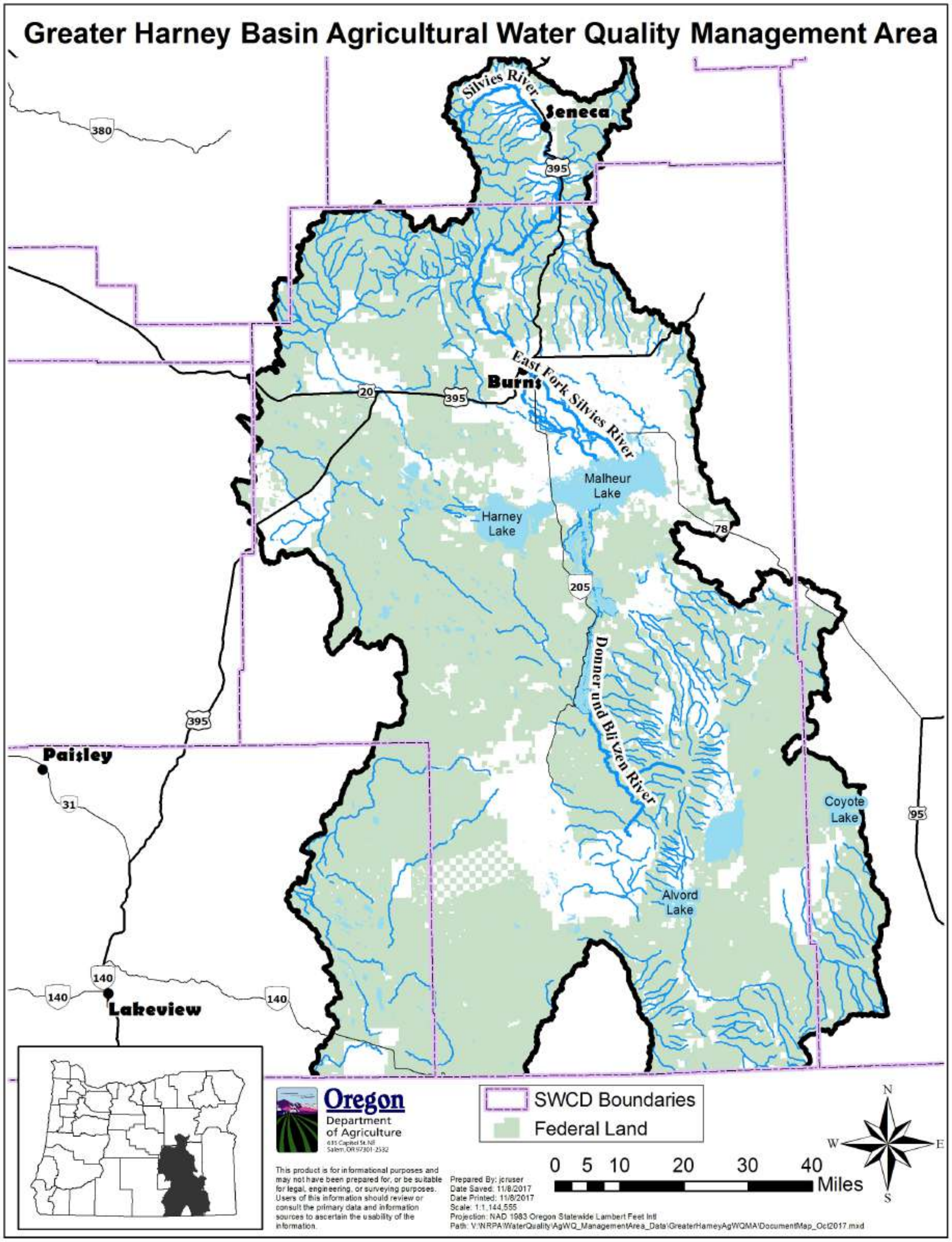
As part of monitoring water quality status and trends, DEQ regularly collects water samples every other month throughout the year at over 130 sites on more than 50 rivers and streams across the state. Sites are located across the major land uses (forestry, agriculture, rural residential, and urban/suburban). Parameters measured include alkalinity, biochemical oxygen demand (BOD), chlorophyll a, specific conductance, dissolved oxygen (DO), DO percent saturation, bacteria (*E. coli)*, ammonia, nitrate and nitrite, pH, total phosphorus, total solids, temperature, and turbidity.

DEQ provides status and trends reports for selected parameters in relation to water quality standards. ODA will continue to work with DEQ to summarize the data results and how they apply to agricultural activities.

Water quality monitoring efforts in this Management Area are described in Chapter 3, and the data are summarized in Chapter 4.

Chapter 2:   Local Background

The Greater Harney Basin Agricultural Water Quality Management Area consists of the Malheur Lake Basin, as defined by the State of Oregon, with the exclusion of the Thousand Virgin Subbasin.



2.1 Local Roles

2.1.1 Local Advisory Committee

The Area Plan was developed with the assistance of the LAC. The LAC was formed to assist with the development of the Area Plan and Area Rules and with subsequent biennial reviews. Table 2.1.1 lists the current members of the LAC.

Table 2.1.1.1 Current LAC members

Name	Geographic Representation	Agricultural Product or Interest Representation
Jack Southworth (Chair)	Bear Valley	Rancher
Karen Moon (Vice-Chair)	Crane, Greater Harney Basin Management Area	Landowner, Harney County Watershed Council
Gary Defenbaugh	Trout Creek	Rancher
Sally Bartlett	Burns Paiute Reservation	Burns Paiute Tribal Council
David Banks	Greater Harney Basin Management Area	ODFW Fish Biologist
Steve Rickman	Burns Area, Silvies River	Rancher
Ronald Whiting	Burns Area and Poison Creek	Rancher
Brett Seward	Princeton	Rancher
Brandon Haslick	Greater Harney Basin Management Area	Burns Paiute Tribe Fisheries Program Manager
Tom Sharp	Burns area, Prather Creek and Jack Mountain	Rancher
Ken Bentz	Crane and Cow Camp Creeks, Greater Harney Basin Management Area	Rancher, Ranchland Real Estate Broker, Harney SWCD Board Director
Steven Doverspike	East of Burns, West Fork Silvies River, Hay Creek, Immigrant Creek and Silver Creek	Rancher
Steve Grasty	Harney County	Former Harney County Judge, agricultural economics, protection of agriculture's interest.

The LAC receives additional technical support from other entities including local, state, and federal agencies, the Burns Paiute Tribe, and others. As resources allow, SWCD, NRCS, Oregon State University Cooperative Extension, Eastern Oregon Agricultural Research Station, and Northern Great Basin Agricultural Experiment Station staff can assist landowners in evaluating effective practices for meeting water quality objectives. Personnel in these offices and with other agencies can also design and assist with implementation of practices and assist in identifying any sources of cost-sharing funds for the construction and/or use of some of these practices.

Table 2.1.1.2 Primary technical advisors

Name	Description
Chad Boyd	Eastern Oregon Agricultural Research Station
Matt Obradovisch	Bureau of Land Management
Dustin Johnson	Oregon State University Extension Service
Maria Snodgress	Oregon Department of Agriculture
Zola Ryan	Natural Resources Conservation Service
Shannon Brubaker	Harney Soil and Water Conservation District

2.1.2 Local Management Agency

Implementation of the Area Plan is accomplished through Intergovernmental Grant Agreements between ODA and the Harney, Lakeview, and Grant SWCDs. This Intergovernmental Grant Agreement defines the SWCDs as the LMAs for implementation of the Ag Water Quality Program in this Management Area. The SWCDs were also involved in development of the Area Plan and Area Rules.

The LMA implements the Area Plan by conducting the activities detailed in Chapter 3, which are intended to achieve the goals and objectives of the Area Plan.

2.2 Area Plan and Area Rules: Development and History

The director of ODA initially approved the Area Plan and Area Rules in 2003.

Since approval, the LAC has met biennially to review the Area Plan and Area Rules. The biennial review process includes an assessment of progress toward achieving the goals and objectives in the Area Plan.

2.3 Geographical and Physical Setting

Location
The Management Area is in southeastern Oregon and consists of most of the Malheur Lake Basin, as defined by the Oregon Water Resources Department. It includes the Silver, Silvies, Harney-Malheur lakes, Guano, Donner und Blitzen, and Alvord Lake Subbasins; it does not include the Thousand Virgin Subbasin as DEQ currently does not intend to develop a TMDL for that area within the foreseeable future. The Management Area encompasses 9,745 square miles (6,236,500 acres) and includes the towns and communities of Wagontire, Riley, Suntex, Burns, Hines, Seneca, Crane, Princeton, Diamond, Frenchglen, and Fields (see map). The Management Area includes 80 percent of Harney County, 10 percent of Lake and Grant counties, and 5 percent of Malheur County.

More detailed information on the various subbasins in the Management Area can be found in assessments prepared by the Harney County Watershed Council for the Silvies River, Silver Creek, Harney-Malheur Lakes Subbasins, and subsequent assessments.

Climate[1,2,3]
Elevation above sea level ranges from 4,025 feet at Harney Lake to 9,730 feet at the top of Steens Mountain and averages approximately 5,200 feet. The climate is semiarid with long, rather severe winters and short, warm summers, which have a high proportion of clear, sunny days. The average monthly temperatures range from 22˚F to 59˚F in Seneca (January and July, respectively), 23˚F to 66˚F in Burns, 31˚F and 66˚F at the P-Ranch near Frenchglen, and 30˚F to 69˚F at the Whitehorse Ranch in Malheur County. Recorded extremes range from –50˚F to 107˚F. The average annual precipitation ranges from 8-12 inches in lower elevations to over 40 inches in higher elevations. The low precipitation months are July, August, and September. During the average year, less than 4-inches of precipitation falls during the irrigation season (April through September). During the summer months, much of the Management Area is subject to cloudbursts and thunderstorms that can cause severe erosion and flood damage.

Much of the precipitation falls as snow, which accumulates between November and March. Annual snowfall varies from a few inches in the valleys to more than 70-inches in the mountains. The mountain snowpack is the principal source of streamflows. The natural thawing of rivers in the spring can cause considerable ice damage to streambanks and streamside vegetation.[4]

The short growing season ranges from 90-120 days in the open lower valleys to 60-90 days in the upper valleys.

Prevailing winds are from the west. Strong winds are common throughout the year, especially from March to June. Easterly summer winds generally result in high temperatures and low humidity. In 1972 and 1973, it was estimated that 80-96 percent of the inflow to Malheur Lake was lost to evapotranspiration.[5] During the winter, cold continental air from the northeast brings subzero weather over the Management Area. Freezing weather has been recorded in every month of the year.

Soils and Geology[2,3]

The Management Area is largely a young high lava plain comprised of three geomorphic subdivisions: Central Mountains, Harney high lava plain, and Basin and Range.

The northern portion is mountainous. This area generally slopes to the south with the lowest elevation about 4,500' and summits of 5,100' to 8,000'. The Silvies River, Silver Creek, and other small drainages are entrenched in this upland to form steep-walled canyons except where constrictions have left large alluvial valleys.

The Harney High Lava Plain in the central portion of the Management Area consists of approximately 600 square miles of moderate relief. It is dotted with cinder cones and lava buttes and includes closed basins containing playa lakes that have water at certain times of the year. The northern 400 square miles is called Harney Valley and is one of the largest compact bodies of nearly level lakebed alluvium in Eastern Oregon. Malheur and Harney lakes, near its center, receive the drainage of the Silvies River, Silver Creek, and Donner und Blitzen River.

During times of great rainfall that coincided with the Pleistocene glacial stages, water from a large lake in Harney Basin drained eastward into Malheur River. At first its course was through Malheur Gap at Princeton and later, when Pleistocene lavas blocked this channel, through the Crane Creek Gap at Crane until it was also blocked. Lakes have formed at low points, some perennial and alive, others intermittent, saline, and alkaline. Harney Lake, a large saline-alkaline lake is the ultimate drainage of the northern Management Area. Malheur Lake, a live lake, is the largest body of water in the Management Area. Other live lakes, numerous playas, and dry lakes occur throughout the area.

Basin and Range covers the southern two-fifths of the Management Area. It offers an exceptional display of crustal breakup by block faulting characterized by north-trending fault-block mountains and internal drainages into which sediments from the hills and mountains are deposited. Hart Mountain and Poker Jim Ridge form the western border; they slope gently eastward into the wide Catlow Valley, a down-dropped block, which was a large Pleistocene lake and is now a dry alluvial basin. Steens Mountain to the east shows many signs of glaciation. The larger lakes become dry at infrequent intervals while most of the lakes are dry except for a short period following spring runoff.

Geothermal sources are located throughout the Management Area, primarily near Soldier Creek, Burns, Crane, Harney Lake in the north, and in the Alvord Desert and other localities in the south.[6]

Ten groups of soils are delineated in the Management Area. The lowland soils were developed in alluvium of different forms and vary from deep, well drained, fertile soils to shallow, very strongly alkaline soils with hardpans in the subsoil. Croplands and the areas susceptible to development are composed of these soils. The upland soils developed mostly from volcanic materials. Most of the upland soils that support timber are deep and well drained, while the soils supporting range are shallow over silica-lime hardpans.

Local elevated concentrations of metals and salts occur within water bodies in the Management Area[7]. The accumulation of metals and salts in regions of internal drainage such as the Greater Harney Basin is common and a result of natural processes.

Two major factors create elevated levels of potentially toxic elements such as arsenic, mercury, and boron[7]. The first is that the Greater Harney Basin is surrounded by volcanic units that are formed both by direct accumulation of volcanic rocks (flows, cinder cones and shallow intrusives) and secondary accumulations of volcanic material spread by both airborne and water laid processes and deposited as sediments. Worldwide, volcanically derived units are typically elevated in-group IIB, IIIA, IVA, and VA periodic table elements (e.g. boron, arsenic, tin, and mercury). In the Hines area, a study done for DEQ (Report on Baseline Arsenic-in-Soil Study for the Snow Mountain Pine Industrial Park Area, Resnick-Glerup Property, TKS Consulting Ltd., August 1999), showed natural arsenic levels elevated to about five parts per million (ppm), two and one-half to five times the worldwide average (D.A. Berkman, Field Geologists Manual, 1976). Elevated levels of these elements in soil accumulations are a product of retention of relatively non-soluble compounds in soil horizons as the rocks weather. Residual buildups in contained waterbodies result from the accumulation of more soluble compounds in areas of cyclic water accumulation and evaporation.

The second factor is that thermal ground water and thermal spring activity in young volcanic terrain, such as the Great Basin of Oregon, Idaho, and Northern Nevada is inherently high in many of those same potentially toxic elements. The surface and groundwater component of these thermal water systems contribute soluble forms of these elements and increases their natural concentrations in the region's water bodies.

Vegetation[2,6]

Vegetation varies from forested mountains in the north to sagebrush-covered mountains and flatlands in the south.

Approximately 80 percent of the Management Area is classified as rangeland. Rangeland vegetation varies by location: open areas of grass in the northern forests; juniper/brush areas in the central portion; sagebrush/grass sites in the semi-arid south; and tracts such as the Alvord Desert that are devoid of vegetation.

Forested land occupies 12 percent of the Management Area in the northern section at elevations above 5,600'. The forests are almost exclusively conifers, predominantly ponderosa pine, with stringers of hardwoods in the valleys. Minor conifer species include Douglas fir, white fir, lodge pole pine, alpine fir, and Engelman spruce. Usually a belt of western juniper separates the conifer forest from the shrub/grasslands within the forests. Areas of grassland, occasionally exceeding 1,000 acres, are intermingled within the forests. These areas occur in all elevation zones and furnish much of the summer feed for livestock and big game. Domestic livestock and wildlife graze almost all of the forestland sometime during the year.

A significant portion of the Management Area has wetland characteristics that result largely from spring runoff, irrigation, and fluctuating lake levels. Marshes in the central portion of the Management Area include seasonally flooded grass sedge meadowland.

Recognition of the benefits of reducing monocultures of juniper and sagebrush has resulted in prescribed fires and other juniper reduction projects conducted by private landowners, Harney County Watershed Council, Harney SWCD, Eastern Oregon Agricultural Research Station, Bureau of Land Management, US Forest Service, and others.

Hydrology[2,3,5,6,8,9,10]

The Management Area exhibits hydrological cycles that are characteristic of both a closed basin as well as the more classic runoff situation wherein the streams flow into the ocean.

The Management Area is composed of several closed basins. The Silver, Silvies, and Donner und Blitzen rivers empty into Malheur and Harney lakes. Willow Creek and Whitehorse Creek basins flow into Coyote Lake. The Trout Creek basin streams naturally sink and only connect to the dry Alvord Lake. Water in the Guano and Alvord Subbasins generally drains into dry lakebeds. The 'Harney Basin' consists of the flat valley surrounding Malheur and Harney lakes and includes the Silvies River floodplain.

The vast majority of the Management Area streams are intermittent. All of the larger perennial streams start either in the Ochoco and Malheur national forests in the north or Steens Mountain in the south. Except for the Catlow-Alvord area, larger streams ultimately drain into Harney/Malheur Lake. Many streams have zero flows in some parts of their channels during the low-flow period of some years.

Land management directly influences the yield and quality of water and, in turn, all segments of the economy of the basin. The water yield, which varies from year to year, is approximately 8-inches of runoff in the higher areas and less than one-inch in the desert-like areas. The total average annual yield was about 572,500 acre-feet for the 1935-64 period. Groundwater recharge was estimated at 260,000 acre-feet with the citation of Robison, 1968. Discharge to streams is estimated at 89,200 acre-feet available to recharge groundwater. Natural streamflow is characterized by high runoff in the spring and low runoff the remainder of the year. In most years, 60-80 percent of the annual discharge occurs in March, April, and May, except for the Donner und Blitzen River and Trout Creek, which peak approximately one month later. During this period of natural high runoff, farmers and ranchers maximize the use of these high flows through flood irrigation, which can benefit the environment through groundwater re-charge, cooling of return flows through subsurface flows, forage production, and the creation of wildlife habitat.

Subbasins

The *Silvies River* originates in the Blue Mountains and flows approximately 180 river miles southward into Malheur Lake. It drains approximately 1,350 square miles. Bear Creek is a major tributary and enters the Silvies just above Seneca. Emigrant Creek enters above the steep Silvies Canyon and contributes one-quarter of the flow of the Silvies River. The gradient begins to flatten out below Silvies Canyon and the river becomes very silty. The Silvies enters the Harney Valley approximately five miles northwest of Burns. The Harney Valley contains many sloughs and other wetlands, which can be attributed to irrigation practices, spring runoff, and fluctuating lake levels within the closed Subbasin. Waters may eventually flow into Malheur Lake.

Silver Creek comprises all drainage into Harney Lake west of The Narrows. It drains approximately 1,700 square miles and lower elevation tributaries are intermittent. Silver Creek flows south from the Ochoco National Forest into Moon Reservoir, then on through Warm Springs Valley. In flood stage, water in Silver Creek divides at the upper end of Warm Springs Valley, so that part continues along the eastern side of the Valley and enters Harney Lake. The bed of Silver Lake typically is dry except for some small pools supplied by springs at its northern and eastern edges. When filled to overflowing, Silver Lake covers an area of about 4,000 acres with a maximum depth of four to six feet.

Malheur Lake is one of the largest freshwater marshes in the United States and receives water from four principal sources. In a typical year, approximately 62 percent of the inflow comes from the Donner und Blitzen River, 25 percent from the Silvies River, 12 percent from direct precipitation, and 1 percent from groundwater. *Harney Lake* receives water from Silver and Warm Springs creeks and acts as a sump for the entire Harney Basin, thus being very alkaline. Malheur and Harney lake levels fluctuate annually depending on the total runoff available from the Silvies and Donner und Blitzen rivers. Whenever the Malheur Lake level rises above an elevation of 4,091.5', it overflows into Mud Lake at The Narrows, which in turn overflows into Harney Lake when the surface exceeds an elevation of 4,093.5'. Harney Lake normally has a water surface elevation about eight feet lower than Malheur Lake. During extremely dry years, such as 1889, 1924, and 1934, both Malheur and Harney lakes were dry. The area of Malheur Lake varies from an average minimum of about 25,000 acres to an average maximum of 45,000 acres. The maximum depth of Malheur Lake at normal stage does not exceed seven feet; Harney Lake is deeper. Its water surface area averages 30,000 acres. However, due to wet winters in 1980-1985, the three lakes combined with a surface water elevation of 4,102' above sea level and covered 173,000 acres.

The *Donner und Blitzen River* receives its flow from the western and northern sides of Steens Mountain and flows north into Malheur Lake. It drains somewhere between 750 and 1,000 square miles and is approximately 70 miles long. The Donner und Blitzen and its tributaries have fairly steep gradients on Steens Mountain and very low gradients in Blitzen Valley. Steens Mountain is barren of timber with the exception of large patches of juniper, quaking aspen, and one grove of fir trees. The snow forms immense drifts in the canyons, and for this reason often produces a season-long runoff. The main flow occurs irregularly from as early as February but usually in May and June as a result of snowmelt, a month to six weeks later than flows from the upper Silvies watershed.

Portions of the Donner und Blitzen River are designated as "wild" under the United States' Wild and Scenic Rivers Act due to their wild trout, scenery, and geologic features.

The Trout Creek and Oregon Canyon mountains rise from 3,937 feet (above mean sea level) at the desert floor to 8,202 feet above mean sea level (AMSL). Streams flow through deep, rugged canyons of steep rimrock. The lowest elevations contain irrigated hay fields where the streams empty onto flat valleys. The *Willow Creek and Whitehorse Creek basins* are located between the Oregon Canyon Mountains to the east and the Trout Creek Mountains to the west. Both drainages flow northward into the pluvial Coyote Lake and are currently isolated from each other. The Whitehorse Creek watershed is 129 mi^2, and the Willow Creek watershed is 50 mi^2. Behnke (1992) suggested that these two drainages may have had intermittent connectivity through pluvial Coyote Lake several thousand years ago, but Coyote Lake has been dry in recent history. The Willow Creek basin includes small, intermittent tributaries, whereas the Whitehorse basin includes perennial Whitehorse, Little Whitehorse, Fifteenmile, Doolittle, and Cottonwood creeks. The primary vegetation consists of sagebrush Atemisia spp., rabbit brush Chrysothamnus spp., and native bunchgrasses (e.g., *Agropyron spicatum*, *Festuca idahoensis*, *Stipa thurberiana*, *Sitanion hystri*, and *Poa sandbergii*) in the uplands and willow (*Salix spp*.), wild rose (*Rosa gymnocarpa*), sedges (*Carex spp*.), and sagebrush along streams. Mountain mahoganies (*Cerocarpus ledifolius*) cover some of the high-elevation areas, scattered quaking aspens (*Populus tremuloides*) occur on hillsides and riparian areas and some cottonwoods (*Populus angustifolia*) remain in the basin.[23]

The *Trout Creek Basin* is bordered by the Steens and Pueblo Mountains on the west, the Oregon-Nevada state line to the south, and Big and Little Trout Creek and their tributaries in the Trout Creek Mountains to the east. This area is known as the Alvord Basin and is defined by fault-block mountains trending in a north-south direction and forming an interior basin. Elevations range from 4,025 to 9,670 feet above sea level and contain mountain peaks, rolling hills, buttes and desert playas. The climate in the Alvord Basin is semi-arid with low precipitation generally, but some areas of higher precipitation. Average precipitation varies from 7" at Andrews, Oregon to more than 18" in the Steens Mountains. The dominant form of precipitation is snow. Summer temperatures can exceed 100 ˚F while winter temperatures may drop below 0 ˚F. Evapotransporation rates range from 3.1" in December to 11.4" in July. Major vegetation types in this basin are: bunch grasses (e.g. *F. idahoensis, S. thurberiana, P. sandbergii*) and sagebrush (*Artemisia spp*.); Desert shrub communities (*Atriplex spp*.) in saline soils and old lake beds;

Mountain mahogany stands occur at higher elevations and riparian areas contain willows (*Salix spp*.), sedges (*Carex spp*.), wild rye (*Elymus spp*.) and aspens (*P. tremuloides*). All streams in this basin have peak flows during spring receding to low flows during the late summer. All streams naturally sink and only connect to the dry Alvord Lake during extremely wet years. Major streams in this area include: Big and Little Trout creeks, Cottonwood Creek (Trout Creeks), Denio Creek, Van Horn Creek, Wildhorse Creek, Pike Creek, Little Alvord Creek, Big Alvord Creek, Cottonwood Creek (Steens), Willow Creek, McCoy Creek and Mann Creek.

The closed *Guano Basin* receives drainage from surrounding hills and mountains including Steens Mountain, Hart Mountain, the Pueblo Mountains, and Poker Jim Ridge. The closed *Alvord Basin* receives drainage from the Steens, Trout Creek, Pueblo, and Sheepshead mountains.

Groundwater

Due to geological processes, the rocks bordering the central alluvial plain dip inward to form a closed basin; therefore, drainage is generally toward Malheur and Harney lakes. The valley fill alluvium washed into Harney Valley by the various streams in the area, creating a groundwater reservoir that supplies a considerable amount of perennial groundwater. However, the water yielding capacity of alluvial aquifers varies throughout the valley due to the discontinuous and irregular distribution and highly differing recharge rates of the water-bearing beds. Recharge to the groundwater system occurs mainly in the highlands and along rivers. Downward flow from the shallow to deep alluvium occurs along rivers. Portions of the Guano and Alvord Subbasins contain substantial quantities of groundwater, however quantities vary seasonally and with prevailing climate conditions.[3]

Geothermal sources are located throughout the Management Area and may contribute to higher stream temperatures.[4] Examples include:

- Wells southeast of Burns near Lawen measure 130-160˚F.[12]
- Three clusters of thermal springs occur in the Alvord Basin;[13] those near Borax Lake have been measured at 95-104˚F.[14]
- Exploratory drilling near Borax Lake discovered thermal water at 325˚F 2,000 feet below the surface.[15]

Numerous thermal wells occur throughout the management area.

The USGS and Oregon Water Resources Department (OWRD) are conducting a quantitative, technical, hydrogeologic investigation within the 5,240 square-mile Harney Basin with particular emphasis in the 2,440 square-mile "Greater Harney Valley Area." The investigation technical results are scheduled to be published in a report by December 2020.

Land Use

Malheur National Wildlife Refuge[17]

The Malheur National Wildlife Refuge was established in 1908 as a refuge and breeding ground for migratory water birds. It originally consisted of 81,786 acres. Sixty-five thousand acres (primarily the Blitzen Valley) were added in 1935 and the last large segment, the 14,751-acre Double-O Unit, was purchased in 1941. More recent purchases have increased the refuge area to over 186,000 acres. Malheur Lake and the Donner und Blitzen River constitute the major portions of the refuge.

Economics and Agriculture[2,4,6,11,18,19,20]

Approximately 8,000 people inhabit the Management Area. Harney County's population in 2014 was estimated at 7,265, with most people living in Burns and Hines. A few hundred more live in adjoining counties, particularly in the Seneca area. Harney, Malheur, Grant, and Lake counties are all defined as economically distressed by the state. The US Census Bureau estimates that Harney County's 2015 per capita income was $21,040.

The top commodities in the management area are generally cattle, alfalfa hay, and native meadow hay. Harney County has a large agricultural sector that depends heavily on water for irrigation. Very little non-irrigated cropland exists due to the low annual precipitation and the short growing season.

Farming operations are generally limited by the short growing season and the limited annual precipitation. However, with close attention to irrigation practices and cropping patterns, agriculture has established itself as one of the basic economic elements of the Management Area.

Diversion of floodwaters in early spring is the most common method of irrigation water management. Flooded fields provide prime waterfowl habitat and draw over 40,000 tourists annually to view the waterfowl migration and breeding; these tourists contribute over $3 million annually to the local economy. Groundwater is also used to irrigate crops and provide water for stock and wildlife. Stock water from wells has been used as a management tool to improve the distribution of both wildlife and livestock.

<u>Water Rights</u>[21]

Water rights (surface and groundwater) have been issued for approximately 355,000 acres within the Management Area; 261,816 acres for surface water and 93,622 acres for groundwater. Some areas in Harney County still have unadjudicated water rights; these include, but are not limited to, streams on the east side of Steens Mountain and Riddle Creek on the west side. Fourteen instream water rights are in place, most with a 1989 date. The instream rights are for portions or tributaries of Trout Creek, Wildhorse Creek, Silver Creek above Riley, and Silvies River at Silvies Valley. There are no instream leases.

Water rights on the Silvies River essentially provide year-round irrigation. Although the decree defines the irrigation season as being March 20 to September 1, water users are awarded a right to use waters of the Silvies and its tributaries at other times when such use will be beneficial to the land and the crops grown thereon when the ground is not frozen and the same can be used without needless waste.

The Silver Creek decree defines the irrigation season as March 1 to August 1, and water running before March 1 can be stored in Moon Reservoir for irrigation season. The Donner und Blitzen order defines the irrigation season as March 1 to October 1.

For the Silvies River, Silver Creek, and Donner und Blitzen River, the beginning of the irrigation season was established to coincide as nearly as possible with the beginning of spring runoff. This also was established on Trout, Little Cottonwood, and Willow creeks in the Alvord Subbasin. On certain other streams such as Wildhorse, Rattlesnake, Mill, and Coffeepot creeks, no irrigation season was set since streamflow varied from year to year according to time and quantity of snowmelt and thus had to be used when available.

The Silvies River, Silver Creek, and Donner und Blitzen River are all over-appropriated (as is most of the state). The Management Area is essentially closed to new surface water appropriations or groundwater applications that have the potential to *substantially* interfere with surface water flows.

Certain uses don't require a water right; exempt uses are listed in ORS 537.141 and ORS 537.545.

<u>Benefits of Flood Irrigation to Migratory Birds</u>[22]

One of the most important migration and production areas in the Pacific Flyway consists of the Refuge and private lands in the Silvies River floodplain, Malheur Slough area, Diamond Valley, Silver Creek drainage, Donner und Blitzen Valley, Krumbo Valley, "00" Valley, Catlow Valley, Alvord Subbasin, Barton/Dry Lake, and the Silvies River near Seneca. These lands supply waterfowl with habitat through both natural marshlands and flood irrigation. Flood irrigation is a historical, common, and acceptable ranching activity. Flood irrigation of meadows during the spring and summer directly benefits many species of migratory birds (e.g. sandhill cranes; northern pintails; ibis; and snow, Ross', and greater white-fronted geese) by providing high quality feeding and resting habitat during migration. Flooding of hay meadows in spring actually mimics natural hydrologic processes that occurred annually for thousands of years within the region prior to permanent European settlement.

The timing of spring migration and the arrival of many species of migratory birds in the Management Area coincide with annual runoff, irrigation, and flooding events. In addition to the flooding of meadows, the annual flooding creates many shallow seasonal wetlands and sloughs that support a rich diversity of aquatic invertebrates and plants that are essential to sustain the birds during their northward migration. Many of the migratory birds that stop in the Management Area to feed and rest eventually make their way to breeding grounds in eastern Siberia and Wrangel Island Russia, Alaska, Arctic Canada, northern boreal forests, and the prairie pothole regions of Canada and the United States.

The flood-irrigated meadows and seasonal wetlands in the Management Area also support numerous *breeding* species of migratory birds such as Canada geese, cinnamon teal, greater sandhill cranes, long-billed curlews, snipe, willet, Wilson's phalarope, and yellow-headed and red-winged blackbirds.
Some examples of the species and number of birds that depend on flood irrigation in the Management Area are (numbers are from surveys conducted in the last 10 years by Refuge personnel):

- Snow and Ross' goose (spring migration): 400,000+
- Northern pintail (spring migration): 250,000
- American widgeon (spring migration): 147,000+
- Green-winged teal (spring migration): 65,000+
- Lesser sandhill crane (spring migration): 10,000+
- Greater sandhill crane (breeding): 300+ pairs
- White-faced ibis (breeding): 2,500+ pairs
- Long-billed curlew (breeding): 1,500+

2.4 Agricultural Water Quality

2.4.1 Water Quality Issues

Temperature concerns in the Management Area were included by Oregon's DEQ on its 2012 303(d) list, which identifies 'water-quality limited' streams as required by the Federal Clean Water Act. Dissolved oxygen concerns, biocriteria (aquatic invertebrates) concerns and heavy metals were also identified in a few streams. Some streams previously listed for heavy metals were delisted in the 2012 303(d) list.

2.4.1.1 Beneficial Uses

State agencies use the term "beneficial use" in different ways.

The CWA of 1972 requires states to designate beneficial uses related to water quality that must be protected for the public interest. The beneficial uses of water for Oregon are codified in OARs and are listed in Table 1 below. This Area Plan addresses issues associated with these uses.

The OWRD uses the term "beneficial use" in a different manner. Water rights are issued by OWRD based upon its definitions of beneficial use, which is water used for a "beneficial purpose without waste." Adjudicated surface water rights in the Management Area are for: irrigation, livestock, domestic, power generation, and to maintain a designated meander line in Malheur Lake (1908 certificate). Ground water has never been adjudicated in Oregon; all those uses are allowed through the permit process. Permitted uses for surface and groundwater in the Management Area include, but are not limited to: domestic, livestock, irrigation, refuge management, fire protection, recreation, stored water, commercial, and municipal.

While the issue of water rights is outside the scope of this Area Plan, the LAC stresses the importance of water rights. This Area Plan should not be construed as an infringement upon these rights.

Table 1. Beneficial uses (related to the Clean Water Act) in the Management Area that have to be supplied from a water source (OAR 340-41-0190).

Beneficial Use	Natural Lakes	All Rivers and Tributaries
Public Domestic Water Supply[1]		X
Private Domestic Water Supply[1]		X
Industrial Water Supply		X
Irrigation	X	X
Livestock Watering	X	X
Fish & Aquatic Life[2]	X	X
Wildlife and Hunting	X	X
Fishing	X	X
Boating	X	X
Water Contact Recreation	X	X
Aesthetic Quality	X	X

[1]With adequate pretreatment (filtration and disinfection) and natural quality to meet drinking water standards.
[2]Fish Use designations are detailed in Table 190B. The only designations that apply are: Redband Trout, Lahontan Trout, Borax Lake Chub, and cool water species.

Some of these beneficial uses may not be attainable in waterbodies due to natural conditions. For instance, many of the natural lakes are too alkaline to provide livestock water; some streams and lakes may be naturally too warm to support some species of fish.

Beneficial Uses Most Likely to be Adversely Affected[1, 12]

The focus of this Area Plan is to encourage the positive management of streams and riparian areas to support beneficial uses, including irrigation. Salmonids, resident fish, and aquatic life are affected by the greatest number of water quality parameters (primarily temperature, dissolved oxygen, nutrients, pH, sedimentation, and turbidity). Waters within the Management Area are listed for not meeting Oregon's water temperature, dissolved oxygen criteria, aquatic invertebrates (biocriteria) and metals (see next section)[2]. Temperature is a concern for 'salmonid fish rearing and spawning' and 'resident fish and aquatic life'. However, some native fish within the Management Area tolerate slightly warmer waters.

Redband trout and Lahontan cutthroat trout are the two native salmonids within the Management Area. Redband trout are distributed throughout the Management Area whereas Lahontan cutthroat occur on the east slope of the Steens Mountain Range and Willow and Whitehorse creeks and their tributaries in the Trout Creek Mountains. Other fish of concern within the Management Area include: Malheur mottled sculpin, Alvord chub, Catlow Tui chub, and the Borax Lake chub. Table 2 provides information as to the origin, status, and general water temperature requirements for all the fish species found in the Management Area.

Table 2. Fish Species of the Greater Harney Basin[1,3,12]					
Common Name	**Scientific Name**	**Temperature Preference***	**Native Migratory Fish**	**State Status**	**Federal Status**
Native Species					
Lahontan cutthroat trout	*Oncorhyncus clarki henshawi*	Cold	Yes	Threatened	Threatened
redband trout	*O. mykiss* ssp.	Cold	Yes	Sensitive	NA
mountain whitefish	*Prosopium williamsoni*	Cool	Yes	NA	NA
bridgelip sucker	*Catostomus columbianus*	Cool	Yes	NA	NA
largescale sucker	*C. macrocheilus*	Cool	Yes	NA	NA
northern pikeminnow	*Ptychocheilus oregonensis*	Cool	Yes	NA	NA
chiselmouth	*Acrocheilus alutaceus*	Cool	No	NA	NA
speckled dace	*Rhinichthys asculus*	Cool	No	NA	NA
longnose dace	*R. cataractae*	Cool	No	NA	NA
Malheur mottled sculpin	*Cottus bendirei*	Cool	No	Sensitive	NA
mottled sculpin	*C. bairdi*	Cool	No	NA	NA
redside shiner	*Richardsonius balteatus*	Cool	No	NA	NA
Tui chub	*Gila bicolor*	Cool	No	NA	NA
Alvord chub	*G. alvordensis*	Cool	No	Sensitive	NA
Catlow Tui chub	*G. bicolor* ssp.	Cool	No	Sensitive	NA
Borax Lake chub	*G. boraxobius*	Warm	No	Endangered	Endangered
Non-native Species					
bluegill	*Lepomis macrochirus*	Warm	No	NA	NA
brook trout	*Salvelinus fontinalis*	Cold	No	NA	NA
brown trout	*Salmo trutta*	Cold	No	NA	NA
brown bullhead	*Ictalurus nebulosus*	Warm	No	NA	NA
largemouth bass	*Micropterus salmoides*	Warm	No	NA	NA
smallmouth bass	*M. dolomieui*	Warm	No	NA	NA
pumpkinseed	*Lepomis gibbosus*	Warm	No	NA	NA
white crappie	*Pomoxis annularis*	Warm	No	NA	NA
yellow perch	*Perca flavescens*	Warm	No	NA	NA
Non-native, Non-game Species					
common carp	*Cyprinus carpio*	Warm	No	NA	NA
goldfish	*Carassius auratus*	Warm	No	NA	NA

*Approximate water temperature ranges are: cold <65 ˚F, cool 65-72˚F, and warm >72˚F
NA = not applicable

2.4.1.2 WQ Parameters and 303(d) list

Parameters of Concern

Sediments carried in streams can adversely affect aquatic life by increasing water temperature through thermal absorption, reducing light penetration and visibility, reducing water infiltration through stream substrate (harming incubating fish eggs and reducing spawning habitat), and irritating gill filaments. Sediment deposition can also change the width:depth ratio of a stream, which directly influences stream temperature.

Turbidity is a measure of the cloudiness of water and is often used as a surrogate measure for suspended sediment.

Rill and gully **erosion** is not a significant problem in the Management Area due to low precipitation and nearly level slopes that are farmed[10]. However, it can be locally significant in areas of high runoff and steep gradients. It is also aggravated by storm events, including summer thunderstorms and springtime ice flows caused by sudden thawing. Irrigation-induced erosion is also not a significant problem because irrigated lands are predominately flat and used for hay and pasture, which provide permanent cover that minimizes erosion. Poorly managed livestock grazing has contributed to streambank erosion in some areas. When the riparian areas are degraded, significant sediment loads are transported during spring runoff and flood events.

High levels of **bacteria** can cause human illnesses under the right circumstances. Thus, the most sensitive beneficial use protected by the bacteria standard is water contact recreation (activities such as swimming or fishing where people could swallow or have water touch open cuts or sores). The bacteria standard does not allow bacteria in numbers high enough to interfere with waters used for domestic purposes, livestock watering, irrigation, or other beneficial uses.

Two other factors related to fish habitat can influence water quality, although these factors have been determined not to require establishment of a TMDL. **Reduced stream flows** can contribute to a general reduction in available habitat and interfere with fish migration. In addition, low flows can contribute to warmer water, increased pH, reduced dissolved oxygen, Slow-moving streams are more susceptible to warming and they are less turbulent, all of which can contribute to reduced oxygen levels. Management to decrease density of conifer stands has the potential increases soil moisture and increase water flows, which can decrease water temperature.[11] **Modification of physical habitat** can harm all aquatic life. Channelization reduces the amount of habitat (stream length is usually reduced as meanders are eliminated), as well as the instream habitat complexity such as the normal mixture of pools, riffles, and runs. Loss of riparian vegetation often destabilizes streambanks, which results in increased erosion, increased stream sedimentation, loss of instream habitat complexity and cover, and the loss of future large woody debris that naturally falls into streams.

<u>303(d) List</u>

Every two years DEQ is required by the CWA to assess water quality in Oregon, resulting in the "Integrated Report." CWA Section 303(d) requires DEQ to identify waters that do not meet water quality standards. The resulting list, commonly referred to as the "303(d) list," contains streams that are determined to be water quality limited by DEQ. If a stream is water-quality limited, the landowner is not in violation of the Area Rules as long as his or her activities do not contribute to the water quality problem.

An update to the Integrated Report is currently going through final review at DEQ. DEQ anticipates submittal to EPA by April 2020. Until final EPA approval, the most current, active Integrated Report is the 2012 version. This section discusses the water quality parameters on that list. Current information on the 303(d) list can be found at: https://www.oregon.gov/deq/wq/Pages/WQ-Assessment.aspx.

Table 3. Location and seasonality of documented water quality concerns in the Greater Harney Basin Management Area from the 2012 303(d) list.[2]

Water Quality Criterion	Stream Segments on the 303(d) List	
Water temperature exceeds 64˚F or 68˚F during season of concern. (Some streams are listed under the old 64 ˚F criterion instead of the updated 68˚F criterion.)	**<u>Silver Subbasin</u>** Claw Creek (Mile 0-15.1)* Egypt Creek (0-8.9) Nicoll Creek (0-14.1) Salt Canyon Creek (0-1.2) Sawmill Creek (0-10.7) Silver Creek (8.3-63.6) Wickiup Creek (0-9) **<u>Silvies Subbasin</u>** Hay Creek (0-12.3) Little Bear Creek (0-5.8) Myrtle Creek (0-17.6) Scotty Creek (0-9.5) Silvies River (0-104.8) Skull Creek (0-5.9) **<u>Harney/Malheur Lakes Subbasin</u>** Coffeepot Creek (0-10.3) Coyote Creek (0-7.8) Mill Creek (0-7.1) Paul Creek (in the closed Barton/Dry Lake basin) (0-10.2) Rattlesnake Creek (0-15.1)	**<u>Donner und Blitzen Subbasin</u>** Ankle Creek (0-7.6) Bridge Creek (0-15.6) Bridge Creek Canal (0-1.5) Deep Creek (0-7.2) Donner und Blitzen River (0-77.3) Fish Creek (0-7.5) Indian Creek (0-4.2) Krumbo Creek (0-18.7) Little Blitzen River (0-12.8) McCoy Creek (0-26.2) Mud Creek (0-4.8) **<u>Guano Subbasin</u>** Home Creek (0-21.3) Rock Creek (0-52.5) Skull Creek (0-13.3) **<u>Alvord Lake Subbasin</u>** Big Trout Creek (0-16.6) Denio Creek (0-6.1) Little Wildhorse Creek (0-2.5) Van Horn (0-8.2) Willow Creek (0-33.5) Willow Creek (0-5.3)
Biocriteria: Waters of the state must be of sufficient quality to support aquatic species without detrimental changes in the res ident biological communities. (Year round)	**<u>Silver Subbasin</u>** Dodson Creek (0-8.4) Nicoll Creek (0-14.1) Rough Creek (0-10.6) Silver Creek (0-63.6) **<u>Alvord Lake Subbasin</u>** Willow Creek (0-33.6)	**<u>Silvies Subbasin</u>** Antelope Creek (0-9.6) Bear Canyon Creek (0-6.4) Camp Creek (0-16.7) Van Aspen Creek (0-7.8)
Dissolved oxygen less than required (year-round)	**<u>Silvies Subbasin</u>** Silvies River (Mile 0-104.8): <6.5 mg/L **<u>Alvord Lake Subbasin</u>** Willow Creek (Mile 0-33.6)	
Heavy metals (sources unknown)	**<u>Donner und Blitzen Subbasin</u>** Bridge Creek (0-3.1) – iron,	

* River miles are measured from the mouth; the mouth is designated as Mile 0. The miles of river on this list may over-represent the actual miles with water quality concern because: 1) establishment of the location of the mouth may be arbitrary on intermittent streams and 2) many of the stream reaches included in this list contain intermittent sections.

Water temperatures are critical to fish growth and survival at all life stages. Warm stream temperatures increase stress and disease, raise metabolism, lower growth rates, and enhance conditions for introduced non-native predators. Temperature affects the dissolved oxygen potential in water - the warmer the water, the less dissolved oxygen it can hold. Fish cope with thermal stress by adjusting their behavior during the warmer summer months. Sometimes cold water fish will seek refuge during the heat of the day in nearby cooler waters that are fed by springs or ground water, while others may migrate great distances to seek out the cooler headwaters. Coldwater species of fish also adapt their body structure, chemistry, and physiology to become more efficient at the metabolic processes that regulate such things as swimming, avoiding predators, and nutrient intake during thermal stress.

The temperature standard has several different temperature requirements (criteria), based on the type of aquatic use being supported (OAR 340-041-0028). Waters supporting Redband and Lahontan trout should not exceed 68˚F. Waters supporting the Borax Lake chub may not be cooled more than 0.5˚F below the natural condition. Determining whether the stream temperature is above or below the temperature standard is based on the average of the maximum daily water temperatures for the stream's warmest, consecutive seven-day period during the year. Water temperature measurements must be taken with continuous recording temperature sensors, in well-mixed and representative locations of streams. A one-time measurement above the standard is not a violation of the standard. When stream flow is exceptionally low or air temperature is exceptionally high, the temperature criterion is waived (an example is when the flow is less than the expected ten-year low flow or the air temperature is above the 90th percentile of a seven-day average).

Landowners are only responsible for the condition of the vegetation on their property and not the temperature of the water that moves through their property. If monitoring shows that agricultural landowners have the streamside vegetation appropriate to site capability, or there are no agricultural activities preventing the growth, recruitment, and establishment of riparian vegetation on the landowner's property, and the TMDL load allocations (i.e. temperature) are not being met, then DEQ will consider this information when revisions are made to the TMDL.

Stream temperatures are influenced primarily by direct solar radiation, air temperature, and movement of groundwater into streams.[4,5,6,7,8,9] Basic approaches to minimizing increases in stream temperature include: provide shade where appropriate, keep the stream narrow, and keep water flowing.[4]

Elevated stream temperatures in the Management Area may be correlated with natural low flows, high ambient temperatures, water withdrawals, removal of streambank vegetation, and lack of groundwater recharge.[10] In addition, geothermal sources may elevate stream temperatures.[11]

Dissolved oxygen

Water must contain enough dissolved oxygen to support aquatic life. **Insufficient oxygen**[5] concentrations usually result from low stream flows, warm stream temperatures, and excessive nutrients. Streams get most of their oxygen from the air; slow-moving streams do not absorb as much oxygen from the air. Warm water cannot hold as much dissolved oxygen as cooler water. Excessive aquatic plant or algal growth can harm fish and other aquatic life by creating extremes in water pH and low levels of dissolved oxygen. (The death and subsequent decomposition of aquatic plants can consume large quantities of dissolved oxygen.) Excessive plant growth can be stimulated by the availability of nutrients, warm temperatures, and light, which in turn are often caused by low stream flow and lack of protective vegetative cover.

Dissolved oxygen is measured in mg/L of water or percent saturation. The water quality criteria vary depending on the type of stream system the standard is being applied to.

Metals

Elevated levels of iron, manganese, and beryllium were measured in 1999; however, manganese and veryllium were removed in the 2012 303(d) list. The source of these metals in the water is unknown and could be natural. They will not be addressed in this Area Plan.

2.4.1.3 TMDLs and Agricultural Load Allocations

DEQ developed TMDLs for temperature and dissolved oxygen for the Alvord Lake Subbasin in 2003. EPA approved the Alvord Lake Subbasin TMDLs in 2004. These TMDLs rely on streamside vegetation to meet water quality standards. This Area Plan is the implementation plan for the agricultural component of the Alvord Lake Subbasin and any future TMDLs that apply to the Management Area. Area Plan biennial reviews and revisions will address any new pollutant load allocations assigned to agriculture in future TMDLs.

2.4.1.4 Drinking Water

There are no public water systems using surface water in the Management Area, but there are 19 public water systems using groundwater wells serving approximately 5,000 people on a regular basis, in addition to visitors. Some public water systems in the management area have recently had alerts for detections of total coliform and/or *E. coli* in the distribution system: City of Seneca, The Narrows, Frenchglen Hotel, Sagehen Hill Rest Area, Delintment Lake West, and Parish Cabin. The drinking water maximum contaminant level for nitrates is 10 mg/L. Both of the public water systems with high nitrate are on the west side of Steens Mountain and far from cropland and other intensive agriculture. Problematic wells have water depths <100ft, indicating contamination of shallow groundwater rather than deeper aquifers.

The Domestic Well Testing Act database (real estate transaction testing data) for 1989-2015 indicates 10 significant detections of nitrate (>7mg/L) in private wells out of 176 wells included in the database for this area. One well in Princeton had a value of 26.9mg/L, while two near Crane had values >15mg/L with another testing at 11.4mg/L, all over the health-based limit of 10mg/L. The other 6 tests with values >7mg/L were all in the northern part of main block of private land near Highway 20. Given the prevalence of tests <7mg/L in this same area, attention may be needed to well depth, well construction, and proximity to nutrient sources such as septic systems, fertilizer use, and concentrations of livestock. Wells for public water systems in this same area do not have nitrate problems and tend to be at greater depths.

2.4.2 Sources of Impairment

Most of the water quality impairments in the Greater Harney Basin Management Area are specific to low dissolved oxygen and elevated stream temperatures.

Dissolved oxygen impairments are often linked to elevated water temperatures as warmer water encourages the growth of algae and other aquatic plants. Excessive amounts of plant and algal life can deplete oxygen in the water column during nighttime hours when photosynthesis cannot occur and when plants die and decompose. Nutrient enrichment of the water also fuels plant and algal growth. Common sources of nutrients from agriculture are livestock wastes and agricultural fertilizers. Healthy riparian and upland vegetation (as identified in the Area Plan) helps to reduce the chance that nutrients will enter surface water. Waste management is addressed in the Area Rules. Elevated stream temperatures are most commonly the result of low summer streamflows. These low flows may be caused by changes in climate, land management activities (like water withdrawals for beneficial uses like irrigation), normal seasonal reductions of streamflow, natural disturbances (like wildfire or flood events) that cause the removal of riparian vegetation or changes in channel morphology or other causes. Elevated stream temperatures can also be the result of reductions in groundwater discharge to streams (either because of increased groundwater pumping or decreased groundwater recharge) and the high sediment loads related to erosive processes (natural and manmade). Protection of riparian and streamside areas for moderation of stream temperatures are addressed in Area Rules.

2.5 Regulatory and Voluntary Measures

2.5.1 Area Rules

OAR 603-095-3300 through 603-095-3360 were developed for the Management Area (Area Rules) and complement the voluntary strategies in the Area Plan. ODA will pursue enforcement to gain compliance with the Area Rules **only** when reasonable attempts at a voluntary solution have failed.

The *Area Rules* are enforceable by ODA and are cited here for your information. The *Area Plan* is not enforceable; it provides an overall proactive strategy for meeting the Plan's water quality objectives and for complying with the Area Rules.

Any actions related to determination of noncompliance with Area Rules or enforcement are taken up directly by ODA, as outlined in OAR 603-090-0000 through 603-090-0120.

All landowners conducting agricultural activities on lands (including timber lands) that are neither federal lands nor held in Tribal Trust must comply with the Area Rules (OAR 603-095-3300 through 603-095-3360). '*Landowner'* includes any landowner, land occupier or operator (ORS 568.903). The landowner's responsibility is to implement measures that ensure compliance with these Area Rules. ODA can issue sanctions if a landowner is out of compliance with the Area Rules.

Some Area Rules may become more specific over time, as information becomes available on land conditions and water quality.

Limitations (OAR 603-095-3340(1))
Landowners must comply with OAR 603-95-3340(2) through (3) within the following limitations. 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.

Desired Streamside Riparian Condition (OAR 603-095-3340(2))
(a) Effective January 1, 2006, consistent with site capability, persons shall allow regeneration and growth of riparian vegetation along natural waterways to provide for:
(i) Bank stabilization,
(ii) Filtration of sediments and nutrients,
(iii) The sustainability of riparian community integrity through spring runoff and larger storm events, and
(iv) Shade and aquatic habitat.
(b) Part (a) allows water gaps, livestock watering, and hardened livestock crossings in streams that otherwise have desired streamside riparian conditions.
(c) Part (a) does not apply to natural waterways, such as sloughs and backwater areas that only hold water for short periods of time during spring runoff.
(d) Technical criteria to determine compliance:
(i) Management activities maintain or improve streambank integrity, with a goal of withstanding a 25-year storm event; and
(ii) Ongoing renewal and growth of riparian vegetation demonstrates sustainability and vigor.
(e) Compliance will be determined through objective methods using commonly accepted monitoring protocols.
(f) Definitions that apply specifically to OAR 603-095-3340(2):

(i) ***Riparian*** **means a wetland transition zone that connects riverine aquatic habitats to upland areas.**
(ii) ***Natural waterways*** **are streams or rivers that were created through natural processes. They may be altered by human activities, but not created as a result of human activities. Irrigation ditches that contain water diverted from the main channel are not natural waterways.**
(iii) ***Riparian Community Integrity*** **is the sustainability of a healthy and vigorous riparian community over time.**

Site capability is the riparian vegetation that can be expected based on existing ecological conditions and human infrastructure. It is influenced by physical and biological factors such as elevation, aspect, geology, climate, and the current plant community. It is also influenced by disturbances such as flooding. Site conditions that affect the establishment and development of streamside vegetation are further modified by human infrastructure (such as roads, power and telephone lines, and irrigation and drainage systems) and resident wildlife and wild horse use.

Waste Management (OAR 603-095-3340(3))
Effective on rule adoption, no person subject to these rules shall violate any provision of ORS 468B.025 or ORS 468B.050.

The Waste Management Rule references existing state law (ORS 468B.025 and ORS 468B.050). 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.

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)).

2.5.2 Voluntary Measures

Water quality is and should be maintained or enhanced through a combination of landowner education and implementation of appropriate Management Measures. Voluntary efforts are and should be the primary means to prevent and control agricultural sources of pollution. With adequate funding and staff, SWCDs are the main support agencies at the local level. NRCS, Harney County Watershed Council, Harney County Weed Board, Harney County Weed Management Partnership, Oregon State University Extension, Eastern Oregon Agricultural Research Station, ODA, DEQ, OWRD, Oregon Department of Fish and Wildlife, US Forest Service, Bureau of Land Management, US Fish and Wildlife Service, USDA Farm Service Agency, Burns Paiute Tribe, and others may provide information and/or technical and financial assistance.

Landowners have flexibility in choosing management approaches and practices to address water quality issues on their lands. Landowners may choose to develop management systems to address identified problems on their own, or they may choose to develop a voluntary conservation plan to address applicable resource issues. Landowners may seek planning and financial assistance from any agency or a consultant.

Natural factors that may limit improvement in riparian condition may include area precipitation patterns, severe weather conditions, the presence of noxious weeds, soil types, channel morphology, destruction by wildlife and wild horses, and the condition of uplands.

Management Intent

To help achieve water quality standards in the Management Area, an effective strategy should be based on site capability and will result in the maintenance or improvement of:

- Riparian vegetation along streams
- Stream channel morphology
- Wet meadows and seasonal wetlands
- Upland condition

The Greater Harney Basin LAC believes that this strategy will result in the greatest improvements in stream temperatures. Also, there may be positive effects on other water quality parameters such as: algal growth, dissolved oxygen, sediments, turbidity, and bacteria. Properly managed livestock grazing can be a useful part of this strategy.

Noxious weeds displace desired vegetation by creating monocultures, and they severely disrupt the proper structure and function of riparian and upland ecosystems. Noxious weeds generally provide less shade, filtering capacity, and stabilizing root mass than the plants they replace[15].

Noxious weed infestations tend to spread rapidly to adjacent lands in uplands, riparian areas, and flood zones – especially on bare and degraded lands. Once noxious weeds have invaded, control can be very problematic and expensive. Noxious weed management issues need to be addressed in the early stages of restoration and enhancement projects. Cooperative efforts among landowners and agencies are critical to the control of noxious weeds. For a list of weeds of concern in the Greater Harney Basin, see the Harney County Noxious Weed List (see end of this section).

Maintain or Improve Riparian Vegetation along Streams

Riparian vegetation consists of plants that depend on or tolerate the presence of water near the ground surface for at least part of the year. Riparian vegetation can include sedges, willows, cottonwoods, and other plants, depending on conditions at the site such as soil type, slope aspect, stream gradient, elevation, and water table characteristics.

Adequate riparian vegetation helps:

- Minimize streambank erosion by increasing the cohesiveness and structural strength of streambanks and by reducing flow velocities;[1,2,3]

- Reduce maximum summer water temperature;[4,5]
- Maintain late season flows by increasing the ability of the adjacent soils to store water during runoff seasons;[6,7,8]
- Moderate winter stream temperatures through the inflows of relatively warmer groundwater from adjacent soils;[9]
- Filter out and process excess nutrients, bacteria, and sediment in runoff that could pollute adjacent streams;[10,11,12,13]
- Keep riparian soils cool for moisture retention.[14]

Adequate riparian vegetation should:
- Include a variety of plant species and ages. Land managers and agency personnel should recognize that differing climate, soils, and water regimens within the basin precludes all streams from having the same vegetative site capability. In addition, fire, flood, and drought may significantly influence short-term site capability;
- Include plants that have root masses capable of withstanding high streamflows, e.g. sedges and willows;
- Provide adequate cover to protect the streambank and dissipate energy during high flows;
- Include sufficient ground cover to filter out excess sediment or nutrients in overland flows.

Management options to consider that may help improve riparian vegetation include:
- Providing off-stream watering areas for livestock;
- Early-season flood irrigation to recharge groundwater and sub-surface water storage which will help augment late season stream flows;
- Control of noxious weeds;
- Planting of willows and other riparian shrubs;
- Leaving a buffer of un-harvested grass when haying next to creeks;
- Leaving a buffer of untilled ground when farming next to creeks;
- Change season-of-use of pastures to improve livestock distribution. Use of herding and fencing to better control livestock access to riparian areas;
- Developing alternative forage for wildlife.

Maintain or Improve Stream Channel Morphology[16,17]
A stream is considered stable if its banks maintain their integrity during a 25-year storm event. Channel morphology is key to streambank stability.

Channel morphology refers to the shape and physical characteristics of a stream. These include: how much the stream meanders (“sinuosity”), the slope of the streambanks, and how deeply cut (“incised”) the stream is. Morphology is influenced by natural features such as geology and climate, valley shape, the maturity of a stream (recently-developed streams rarely meander), wildlife access, and human activities.

Again, it is important to point out that not all streams in the Management Area have the same potential for channel morphology and that climate, valley shape, soils and water regimen make each subbasin unique. The following are general characteristics:
- As riparian vegetation matures, stream channels are expected to narrow and deepen (known as a ‘low width-to-depth ratio’). These stream channels will have less water surface area exposed to solar radiation (thereby reducing heating rates during summer) and will be more connected to their floodplain;
- Better floodplain connectivity has the added benefit of increasing storage during periods of high streamflow;
- Streams with a low width-to- depth ratio may also meander more, which will reduce flow velocities and reduce the damage from flooding;
- Streams with a low width-to-depth ratio should have well-vegetated banks, where possible, that resist damage during high streamflows;

- Some streams with a low width-to-depth ratio have been incised to bedrock. They must be allowed to regain their meanders within the incised channel and capture sediment to build up the streambed;
- Streambanks naturally change in form or location over time; some bank instability usually occurs in undisturbed streams. Excessively unstable streambanks can contribute to:
  - Sediment in the stream channel caused by slumps and surface erosion;
  - Fine sediment in the water;
  - Wider channels, which increases exposure of water to solar radiation;
  - Decreasing stream depth and alteration of fish habitat;
  - Confining a stream within its banks during high flows so it can't access its floodplain and dissipate its energy.

Management options to consider that may help improve stream channel morphology site-specifically include:

- The proper design, location, installation and maintenance of roads, culverts, bridges, stream crossings and upstream storage systems;
- Increasing riparian vegetation to aid bank stability;
- Maintaining a vegetative buffer;
- Leave large, woody debris in streams;
- Removal of livestock from riparian areas when banks are unstable and livestock have been identified as a contributing factor or will prevent recovery;
- Where beneficial, install structures to slow stream velocity and to reconnect the stream with the flood plain. Landowners should be aware that permits may be required.

Maintain or Improve Wet Meadows and Seasonal Wetlands[18]

Flood irrigation of meadows is a long-practiced method of irrigation in the Management Area. The well-managed capture and diversion of high spring flows by ranchers to irrigate meadows mimics natural hydrologic processes and benefits both man and wildlife. The capture and diversion of high spring flows mimics natural hydrologic processes. Diverted water eventually returns to the river channel via overland flow or groundwater percolation. The diverted water creates shallow seasonal wetlands that attract hundreds of thousands of migrating waterfowl, shorebirds and wading birds during spring migration. Groundwater percolation of diverted irrigation water serves to cool and augment late summer stream flows.

Traditional flood irrigation is an economical approach to irrigating hay crops. In systems where there is little or no water storage, flood irrigation using high spring flows is an efficient use of that water; in many instances, may be the only method of irrigation available to a landowner.

The loss of traditional flood irrigation practices would cause both environmental and economic hardships in the Management Area. Thousands of acres of wildlife habitat, specifically seasonal wetland/wet meadows, would be lost. Presently, about 100,000 acres of wetlands are lost annually to development in the continental U.S. In the arid Intermountain West, up to 75 percent of the historical wetland habitats have been lost to development. Two of the wetland types most heavily affected by development are seasonal wetlands and wet meadows. Therefore, each acre of existing wetland/wet meadow habitat is extremely important. Working cooperatively with private landowners to maintain traditional flood irrigation of meadows is one step in mitigating for the loss of these wetland habitats. In addition, other methods of irrigation are more costly.

However, irrigation water withdrawals should be managed so that aquatic life, especially native fish, is not harmed by low flows.

Management options to consider that may help improve wetlands include:

- Improve efficiency of irrigation water delivery;
- Improve the quality of surface water return flows through creation of treatment wetlands;

- Improve fish passage and protection. Work with partners to develop more economically feasible fish screens;
- Use cross dikes and leveling to improve irrigation water distribution and increase efficiency;
- Build up bottom of streams in incised channels to: reactivate floodplains; raise water tables below wet meadows habitats; reclaim wet meadows that have been lost to encroachment of upland vegetation; and improve instream fish habitat complexity.

Maintain or Improve Upland Condition[19,20,21,22,23]
'Upland areas' are the rangelands, forests and croplands upslope from the riparian areas. These areas extend to the ridge tops of watersheds. The upland portion of the Greater Harney Basin is primarily made up of public lands.

With a protective cover of grass, shrubs, or trees consistent with site capability, these areas will capture, store and safely release precipitation thereby reducing the potential of excessive soil erosion or pollution in spring and augmenting the volume of late season stream flows. Again, noxious weeds are undesirable[15].

Expansion of juniper stands threatens the integrity of plant and animal communities and late summer stream flows in the Management Area. Junipers were naturally restricted to rocky ridges and cliffs where there was little grass to fuel fires. Recent efforts to suppress fires have allowed juniper stands to expand and replace more diversified plant and animal communities throughout the uplands. Diverse plant communities support more wildlife; help supply cleaner, cooler water for streams; and provide forage for livestock. Juniper domination leaves the soil more exposed to rapid runoff and erosion. Juniper may use enough water during the summer to reduce aquifer recharge, an indispensable factor in maintaining late season stream flows. Increased late season flows would help improve water quality.

Lack of disturbance can create vegetative monocultures that reduce the landscape diversity needed to support wildlife[24] and watershed health. For example, numerous studies have shown that sagebrush control increases soil moisture levels, especially in the lower portions of the soil profile.[25]

Proper management of upland vegetation considers physical and biological conditions of the management area, controls soil erosion, and minimizes transport of soil and nutrients to the stream. Upland management also considers livestock production while protecting fish and wildlife habitat.

To limit erosion and augment late season stream flows, upland management should consider the following:

- Minimize bare or exposed soil. Soil surface should be occupied by a healthy grass plant, forb, shrub, or tree; areas should be covered by decaying plant litter.
- In forested areas, optimize tree spacing to best utilize tree productivity and snow storage. Dense stands of trees catch too much snow on the branches and lose the precipitation to sublimation and limit storage on the surface. Stands that are too open lose forest productivity and do not provide enough shading to preserve snow pack late into the spring. Proper tree density is site-specific.
- Healthy stands of perennial grasses are better at filtering sediments and limiting erosion than stands of annual grasses.

Management options to consider that may help improve uplands include:

- Thinning or removal of overstocked stands of trees and brush;
- Controlled burning;
- Seeding of perennial grass plants;
- Manage pastureland so that areas on the soil surface not occupied by perennial grass plants are covered with decomposing plant litter ('take half, leave half';
- Control of noxious weeds;
- The construction of well-designed off-stream water impoundments.

Soil Erosion Prevention and Control

Effective management practices for controlling soil erosion and sediment delivery include but are not limited to:

- Conservation tillage (crop residue management) - reduced tillage, minimum tillage, direct seeding, modified conventional tillage, reservoir tillage, sub-soiling, or deep chiseling,
- Nutrient management – soil testing and fertilizer placement,
- Cover crops – perennial or annual,
- Contour farming practices - strip cropping, divided slopes, terraces (level and gradient), cross-slope tillage,
- Crop rotations,
- Early or double seeding in critical areas,
- Vegetative buffer strips -filter strips, grassed waterways, field borders, contour buffer strips,
- Irrigation scheduling - soil moisture monitoring and application rate monitoring,
- Prescribed burning,
- Prescribed grazing,
- Weed control,
- Road design and maintenance,
- Sediment retention basins and runoff control structures,
- Reforestation,
- Tree thinning - commercial and pre-commercial,
- Streambank protection.

HARNEY COUNTY WEED CLASSIFICATION (revised December 2016)

Noxious weeds for the purpose of this policy shall be rated “A”, “B”, or “C”.

“A” Pest - A weed of known economic importance known to occur in the county in small enough infestations to make eradication practicable, or not known to occur but its status in surrounding counties makes future occurrence seem imminent. *Species not yet known to occur in the county.
ACTION - Infestations are subject to eradication where found with possible County assistance when funds are available.

“B” Pest - A weed of known economic importance and of limited distribution in the county, and is subject to intensive control or eradication where feasible at the county level.
ACTION - Infestations are handled at County discretion with possible County assistance when funds are available.

“C” Pest - A weed of known economic importance and of general distribution that is subject to control, intensive control, or eradication as local conditions warrant.
ACTION - Infestations handled at owner’s discretion.

“A” Rated Weeds	
African rue	*Peganum harmala*
Black henbane	*Hyoscyamus niger*
Diffuse knapweed	*Centaurea diffusa*
*Hoary Alyssum	*Berteroa incana*
*Leafy spurge	*Euphorbia esula*
Musk thistle	*Carduus nutans*
Orange hawkweed	*Hieracium aurantiacum*
Pheasant eye	*Adonis annua*
Purple loosestrife	*Lythrum salicaria*
*Rush skeleton weed	*Chondrilla juncea*
Salt cedar	*Tamarix ramosissima*
Scotch broom	*Cytisus scoparius*
Spotted knapweed	*Centaurea maculosa*
*Squarrose knapweed	*Centaurea virgate*
Tansy ragwort	*Senecio jacobaea*
Yellow starthistle	*Centaurea solstitialis*
Yellow toadflax	*Linaria vulgaris*

"B" Rated Weeds

Dalmatian toadflax	*Linaria dalmatica*
Hounds tongue	*Cynoglossum officinale*
Mediterranean sage	*Salvia aethiopis*
Perennial pepperweed	*Lepidium latifolium*
Puncture vine	*Tribulus terrestris*
Russian knapweed	*Acroptiln repens*
Scotch thistle	*Onopordum acanthium*

"C" Rated Weeds

Canada thistle	*Cirsium arvense*
Halogeton	*Halogeton spp.*
Klamath weed	*Hypericum perforatum*
Medusahead rye	*Taeniatherum caput-medusa*
Morning Glory	*Convolvulus arvensis*
White top	*Cardaria draba*

List subject to change at the discretion of the Harney County Weed Board

Chapter 3: Implementation Strategies

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

The LAC established these objectives to achieve the Area Plan goal:

1. Educational programs regarding land treatment, and
2. Encouragement of desirable agricultural management practices that maintain or improve
    - Riparian vegetation along streams
    - Stream channel morphology
    - Wet meadows and seasonal uplands
    - Upland conditions

The following conditions on agricultural lands contribute to good water quality in this Management Area:

1. Sufficient site-capable vegetation is established along streams to stabilize streambanks, filter overland flow, and moderate solar heating,
2. Crop lands are covered throughout the year with either production crops, crop residues, or cover crops,
3. Pastures have minimal bare ground,
4. Irrigation runoff does not deliver sediment, nutrients, or chemicals to streams,
5. Leachate and residues from livestock manure are not entering streams or groundwater.

LAC Mission: To promote agricultural management that maintains, improves, or protects water quality in the Greater Harney Basin while sustaining a viable agricultural economy and community.

3.1 Measurable Objectives and Strategic Initiatives

Measurable objectives allow the Ag Water Quality Program to evaluate progress toward meeting water quality standards and TMDL load allocations. Any measurable objectives are stated here. Progress is reported in Chapter 4.

3.1.1 Management Area

The LAC intends to strategically address water quality throughout the Management Area by systematically working in Demonstration (Focus) Areas. Measurable Objectives will be developed for Demonstration Areas after the initial assessment has been completed. All efforts in Demonstration Areas are voluntary unless ODA receives a complaint about a specific property or self-initiates an investigation.

3.1.2 Focus Area

The Silvies River Watershed Demonstration Area is part of ODAs and Harney SWCDs Focus Area strategic initiative. The Silvies River originates in the Blue Mountains of Grant County and flows to Malheur Lake in Harney County; it is a closed basin. The Silvies Subbasin is approximately 60 miles long and 23 miles wide and drains approximately 1,350 square miles. The Silvies watershed encompasses 844,976 acres, with 554,151 of those acres in Harney County. Within Harney County, the Silvies River runs approximately 288 stream miles. Land ownership is 45 percent private and 55 percent public.

Agricultural production in the watershed is primarily wild hay and beef cattle. Land use is predominantly grazed range, supporting beef cattle operations. Commercial crop production largely consists of feed crops for livestock, is restricted by a short growing season, and is predominantly limited to hearty varieties of alfalfa, pasture mix, wild hay/native meadow hay (which is flood irrigated by the Silvies River and surrounding tributaries), and spring grains. Very little non-irrigated cropland exists in the area due to low annual precipitation and the short growing season.

Assessment Method: riparian assessment using the State and Transition Model.

The State and Transition Model approach is completed by stratifying the demonstration area into assessment and monitoring units that require gathering any of the following background information that exists: aerial photographs, satellite imagery, written and oral histories, disturbance history (e.g., burn maps), management history, property maps, plant species lists, ecological sites and site descriptions, and soil maps. The demonstration area was stratified by management unit (typically by pasture and/or field). Each management unit was then stratified into the three primary ecological types (i.e., high elevation sagebrush rangeland, low elevation sagebrush rangeland, and riparian) using a combination of existing knowledge and/or data, ecological site descriptions, GIS techniques, and field reconnaissance. For the purpose of this Area Plan, the SWCD will report on riparian ecological states. Categories will be as follows:
Ecological States:

- State A: ≥70% ground cover of deep-rooted riparian vegetation and anchored rock. Width-to-depth ratio appropriate for the Rosgen classification of the stream. Annual flow usually reaches floodplain.
- State B: 50-69% ground cover of deep-rooted riparian vegetation and anchored rock. Width-to-depth ratio appropriate for Rosgen classification. Annual flow usually reaches floodplain.
- State C: <50% ground cover of deep-rooted riparian vegetation and anchored rock. Width-to-depth ratio not within desirable range for Rosgen classification. Annual flow does not reach floodplain.
- State D: <50% ground cover, vegetation inundated with non-desirable species. Stream entrenched and highly unstable. Annual flow does not reach the floodplain.

The initial assessment was completed in 2017. However, in 2018 data gaps were identified and the SWCD reassessed the Silvies River Watershed Demonstration Area. Concluding the reassessment, the measurable objective was revised and milestone 2 was developed per the 2018 reassessment data.

Milestone 1: By June 20, 2019, conduct restoration work on 8.0 stream miles that will lead to an increase in State A from 88.7 stream miles to 96.7 stream miles.

Milestone 2: By June 30, 2021 conduct restoration work on 8.7 stream miles that will lead to an increase in State A from 90.8 stream miles to 98.7 stream miles.

Measurable Objective: By June 30, 2029, increase State A ag stream miles from 90.8 miles to 96.3 (5% increase); while also decreasing the amount of ag stream miles of State C from 9.6 to 7.2 (2% decrease).

Results for this focus area are provided in Chapter 4.

3.2 Proposed Activities

ODA, the LAC, the LMA, and other partners have identified the following priority activities, described in Table 3.2, to track progress toward meeting the goal and objectives of the Area Plan.

Table 3.2 Planned Activities for 2019-2022 by Harney SWCD

Activity	4-year Target	Description
Community and Landowner Engagement		
# active events that target landowners/managers (workshops, demonstrations, tours)	7	E.g. meet and greet listening sessions with landowners
# landowners/managers participating in active events	445	
Technical Assistance (TA)		
# landowners/managers provided with TA (via phone/walk-in/email/site visit)	70	
# site visits	28	
# conservation plans written*	8	
On-the-ground Project Funding		
# funding applications submitted	12	
# funding applications awarded	10	
* Definition: any written management plan to address agricultural water quality. Can include NRCS-level plans. Can include: nutrients, soil health, grazing, riparian planting, forest thinning to improve upland pastures to reduce livestock pressure on riparian areas, etc. Cannot include projects with no or weak connection to agricultural water quality (weed eradication not for riparian restoration, fuels reduction, alternative energy, rain gardens/rain harvesting, non-agricultural culvert replacement, and instream habitat enhancement that does not also improve water quality)		

3.2.1 Harney County Candidate Conservation Agreement with Assurance (CCAA) for Greater Sage Grouse

Though the CCAA is focused on the uplands and does not include water quality criteria, it is worth noting the efforts of the SWCD and landowners' commitment to conservation. The basic conservation approach of Harney County's programmatic CCAA is an ecologically-based approach to maintain current sage-grouse habitat and to improve deficient habitat. This approach relies on habitat models that describe factors that impact plant community composition and structure over time. These models indicate specific threats that can be influenced by management to improve habitat quality for sage-grouse; these threats are in-turn, the basis for habitat-related conservation measures. Also identified are species-specific threats and the associated conservation measures for non-habitat factors that directly and indirectly impact sage-grouse populations (e.g. West Nile virus, insecticide use). Additionally, every watershed or subbasin assessment completed for Harney County has identified vegetation conversion as a limiting factor and has established related objectives or action items. Many of these assessments linked these vegetation conversions to the decline in sage-grouse and/or established specific objectives for sage-grouse habitat enhancement.

3.3 Water Quality and Land Condition Monitoring

Monitoring is encouraged for landowners who want to document improvements in their riparian vegetation and stream conditions. Those wishing to do so could contact their local SWCD or watershed council for assistance. Photo-monitoring (keeping a record with photographs) is a simple and effective method to document changes in vegetation. To monitor temperature, dissolved oxygen, and other water quality parameters, specific equipment is needed. DEQ, SWCDs, watershed councils, and other local entities could partner with the LAC to monitor water quality.

Water quality in the Management Area currently is monitored on a limited basis by: DEQ, ODFW, US Forest Service, and the Bureau of Land Management. These groups primarily measure water temperature; although some of them monitor fish and aquatic insect populations, physical stream habitat, turbidity, and air temperature.

3.3.1 Water Quality

Surface Water
DEQ monitors four sites in the Management Area as part of their ambient monitoring network: Silvies River at West Loop Road, Whitehorse Creek at Whitehorse Ranch Road, Donner und Blitzen River upstream of Page Springs Campground and South Fork Blitzen River at Blitzen Crossing. Additionally, there were thirty-two stations that had data from 2015-2018 as part of DEQs 2019 Oregon Water Quality Status and Trends Analysis. See Chapter 4 for a summary of this report.

Groundwater
The Harney County Watershed Council continues to participate with OWRD and the US Geological Survey groundwater study that has been working to develop an updated water budget for the Harney Basin. The OWRD/USGS report is being completed and will be submitted for USGS peer review in early 2020. Findings of the report are showing that the subbasins that make up the Harney Valley are over-appropriated for both surface and groundwater. Work is underway through the Community-Based Water Planning Collaborative (Place Based Planning grant through OWRD) to create an integrated water resources plan for the current and future needs of Harney County's water resources into the future. The Collaborative has been meeting for 3½ years and is now in the solutions phase of the project. Discussions on reducing agricultural water use through numerous means including CREP, improved irrigation technology, and the installation of two AgriMet stations within the community, and the development of voluntary agreements with OWRD are all on the table. Results of a rural domestic well survey asking questions of users about problems experienced with domestic wells has been completed and results will be shared with the Collaborative in January/February. The Council has had two local groundwater monitoring grants through OWEB to help contribute data to the OWRD/USGS study. Data has been shared with OWRD and the grants will be completed in spring of 2020.

3.3.2 Land Conditions

All land condition assessments are done in the Focus Area. Additional Focus Areas will be selected as others are wrapped up.

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

Chapter 4: Progress and Adaptive Management

4.1 Measurable Objectives and Strategic Initiatives

The following sections and tables provide the assessment results and progress toward measurable objectives and milestones in the last two years. See Chapter 3.1 for background and assessment methods.

4.1.1 Management Area

The LAC intends to strategically address water quality throughout the Management Area by systematically working in Demonstration (Focus) Areas.

4.1.2 Silvies River Watershed Demonstration (Focus) Area

Measurable Objective: Increase agricultural stream miles in State A from 90.8 stream miles (79%) to 96.3 stream miles (84%) by June 30, 2029; while also decreasing State C stream miles from 9.6 (8%) to 7.2 (6%).

Milestones:

1. By June 20, 2019, conduct restoration work on 8.0 stream miles that will lead to an increase in State A from 88.7 stream miles to 96.7 stream miles.
2. By June 30, 2021 conduct restoration work on 8.7 stream miles that will lead to an increase in State A from 90.8 stream miles to 98.7 stream miles.

Assessment Results (Past and Current Conditions):

Table 4.1.2a. Tracked Restoration Work Implemented (stream miles)

Class	2017 Condition	Restoration in 2017-2019	2019 Condition
A	88.7	2.1	90.8
B	12.7	1.5	14.2
C	13.2	-3.6	9.6
D	0	0	0
Not Ag	0	0	0
Total Ag Acres	**114.6**	**0**	**114.6**

Table 4.1.2.b. Lotic Riparian Systems: Ecological State A, B, C, D Assessment Results (stream miles)

Ecological State	2017 Assessment	2018 Reassessment
A	88.7	90.8
B	12.7	14.2
C	13.2	9.6
D	0	0
Not Ag	158.3	158.3
Total Ag Acres (A+B+C+D)	**114.6**	**114.6**

Progress Toward Measurable Objectives and Milestones:

- Measurable Objective was developed in July 2018 per the results of the 2018 Reassessment. The next assessment is scheduled to be completed by June 30, 2021 after which the SWCD, ODA and the LAC can review any progress and/or impediments and then determine if appropriate to adjust the implementation strategy to achieve the measurable objective.

- Milestone 1 was not met and was short by 5.9 miles. However, progress was made on 2.1 miles. Work will continue, and a second milestone was developed per the 2018 reassessment.
- Milestone 2 is currently in progress and will be evaluated by the SWCD, ODA and the LAC after June 30, 2021.

Adaptive Management Discussion:
The milestone was not met because the HSWCD focused on reassessing the majority of the Focus Area. This is due to the lack of documentation from the previous biennium's field surveys conducted by former staff which resulted in confusion on where the State B and C landowners were located. By reassessing, HSWCD were able to create a concrete list of landowners to contact and offer assistance to for the remainder of the 2017-19 biennium and throughout the 2019-2021 biennium. During this 2017-2019 biennium, the HSWCD made several changes to their methodology to increase organization and maximize surveying efficiency. Now the HSWCD is using the newly installed changes and has shifted their approach from data collecting to outreach for the 2019-2021 biennium with the goal to increase the number of restoration projects.

4.2 Activities and Accomplishments

ODA, the LAC, the LMA, and other partners identified the following priority activities to track progress toward meeting the goal and objectives of the Area Plan. ODA will review the four-year results and then provide a report at the end of the 2021-2023 Biennium.

Future Area Plans will compare results and targets in Table 4.2a.

Table 4.2a Activities conducted in 2017-2019 biennium by Harney SWCD

Activity	2-year results
Community and Landowner Engagement	
# active events that target landowners/ operators	6
# landowners/managers participating in active events	523
Technical Assistance (TA)	
# landowners/operators provided with TA	68
# site visits	52
# conservation plans written*	12
On-the-ground Project Funding	
# funding applications submitted	13
# funding applications awarded	9
* Definition: any written management plan to address agricultural water quality. Can include NRCS-level plans or simpler plans. Can include: nutrients, soil health, water quality, irrigation, grazing, riparian planting, forest thinning to improve upland pastures to reduce livestock pressure on riparian areas, etc. Cannot include projects with no or weak connection to ag water quality (weed eradication that is not for riparian restoration, fuels reduction, alternative energy, non-ag rain gardens/rain harvesting, non-ag culvert replacement, and instream habitat enhancement that does not also improve water quality)	

Table 4.2b and 4.2c summarize information from the OWRI on restoration project funding and accomplishments in the Management Area. The majority of OWRI entries represent voluntary actions of private landowners who have worked in partnership with federal, state, and local groups to improve aquatic habitat and water quality conditions. OWRI data includes most, but not all projects, implemented in the Management Area.

Table 4.2b Implementation funding (cash and in-kind) for projects on agricultural lands reported 1997-2018

Landowners	OWEB	BLM	DEQ	NRCS	Other*	TOTAL
1,062,356	3,208,756	2,271,643	0	271,566	735,625	**$7,278,380**

*includes city, county, tribal, other state and federal programs, and non-profit organizations. There were too many entities to list.

Table 4.2c Miles and acres treated on agricultural lands reported 1997-2018

Activity Type	Miles	Acres	Count*
Riparian	237	3,790	Not applicable (NA)
Fish Passage	0	NA	0
Instream	4	NA	NA
Wetland	NA	3,740	NA
Road	0	NA	0
Upland	NA	89,560	NA
TOTAL	241	97,090	0

* # of hardened crossings, culverts, etc.

4.3 Water Quality Monitoring—Status and Trends

DEQ Status & Trends Report

DEQ evaluated *E. coli*, pH, dissolved oxygen, total suspended solids, total phosphorus, and temperature data in the Management Area. Thirty-two stations had data from 2015-2018. (DEQ. Oregon Water Quality Status and Trends Analysis. 2019.)
https://www.oregon.gov/deq/wq/programs/Pages/wqstatustrends.aspx

The following locations are part of DEQ's ambient monitoring program: Donner and Blitzen River at Page Springs Campground, South Fork Blitzen River at Blitzen Crossing, and Silvies River at West Loop Road).

Alvord Lake, Guano, and Harney-Malheur lakes Subbasins had only one location each (Whitehorse Creek, Guano Creek, and Rattlesnake Creek, respectively). Most of the stations in the Silvies were in the Malheur National Forest.

Table 4.3.1 Attainment of water quality standards for 2015-2018 in Greater Harney Subbasins

Subbasin Name (# of sites)	Parameter					
	E. coli	pH	Dissolved oxygen	Temperature	Total Phosphorus (mg/L)[1]	Total Suspended Solids (mg/L)[2]
	# sites and attainment status (# attain - # do not attain - # insufficient data)				# sites; median	
Alvord Lake (1)	0-1-0	1-0-0	0-1-0 (improving)	-	1; 0.15	1; 12
Donner und Blitzen (4)	2-0-2	3-1-0	0-3-1	0-1-3	3; 0.3	3; ~3
Guano (1)	-	1-0-0	0-1-0	-	1; 0.065	1; 17
Harney-Malheur Lakes (1)	-	-	-	0-1-0 (at National Forest boundary)	-	-
Silver (4)	-	-	-	1-3-0	-	-
Silvies (21)	1-0-20	0-3-18	0-4-17	7-10-4 (all sites are in National Forest)	1; 0.06	1; 5

[1] DEQ has no benchmark for total phosphorus in this Management Area; ODA benchmark for potential water quality concerns = 0.08 mg/L
[2] DEQ has no benchmark for total suspended solids in this Management Area

Data indicate concerns with 1) bacteria and phosphorus in Whitehorse Creek, 2) phosphorus in the Donner und Blitzen subbasin, and 3) temperature and dissolved oxygen throughout the Management Area, including in the National Forest. Dissolved oxygen issues are likely related to warm stream temperatures and low flows. Data are insufficient to determine to what extent these concerns are related to agricultural activities.

4.4 Biennial Reviews and Adaptive Management

ODA, the LAC, the LMA, and other partners met on February 13, 2020, to review implementation of the Area Plan and provided recommendations for the future (Tables 4.4a and 4.4b).

Table 4.4a Summary of biennial review discussion

Summary of Progress and Impediments
Progress has been made on increasing streamside vegetation throughout the Management Area. Lack of baseline data to show how far they have come. Landowners are essential for progress, communication is key. Landowners and government are communicating and working well, if that doesn't occur progress often stalls. Improvements can be limited due to circumstances in the watershed above the landowner. Some landowners may not have much flexibility to make significant improvements. Outreach sometimes still difficult; after years utilizing numerous outreach methods, some people in the community still do not know what and who the SWCD, WC and NRCS are. The LMAs often are strategic with outreach and opportunistic with technical assistance, at least initially. People tend to be followers, there are some who take initiative and others who wait until they see the results with their neighbors before they want to improve their land. Regulations can serve as an impediment. LMAs have lines of landowner and projects, but not enough capacity and implementation funds to accomplish all.
Recommended Modifications and Adaptive Management
Continue conversations between government and landowners. Keep the Area Rules and Plan simple enough that they can be understood. Increase capacity and implementation funds for the Management Area. Review funding applications for proposed projects to ensure written well and soundness of the project.

Table 4.4b Number of compliance actions in 2018-2019

Actions	Letter of Compliance	Pre-Enforcement Notification	Notice of Noncompliance	Civil Penalty
Compliance Actions Outside SIA(s)	0	0	0	0
Compliance Actions Within SIA(s)	NA	NA	NA	NA

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