Crooked River Agricultural Water Quality Management Area Plan

Developed by the:

Oregon Department of Agriculture

and

Crooked River Local Advisory Committee

With support from the:

Crook County Soil and Water Conservation District

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Acronyms and Terms Used in this Document

Ag Water Quality Program – Agricultural Water Quality Management Program
Area Plan – Agricultural Water Quality Management Area Plan
Area Rules – Agricultural Water Quality Management Area Rules
CAFO – Confined Animal Feeding Operation
CNPCP – Coastal Nonpoint Pollution Control Program
CRWMA – Crooked River Weed Management Area
CWA – Clean Water Act
CZARA – Coastal Zone Act Reauthorization Amendments
DEQ – Oregon Department of Environmental Quality
DMA – Designated Management Agency
GWMA – Groundwater Management Area
HABs – Harmful Algal Blooms
LAC – Local Advisory Committee
LMA – Local Management Agency
Management Area – Agricultural Water Quality Management Area
MOA – Memorandum of Agreement
NPDES – National Pollution Discharge Elimination System
NRCS – Natural Resources Conservation Service
OAR – Oregon Administrative Rules
ODA – Oregon Department of Agriculture
ODF – Oregon Department of Forestry
OHA – Oregon Health Authority
ORS – Oregon Revised Statute
OWEB – Oregon Watershed Enhancement Board
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
WQPMT – Water Quality Pesticides Management Team

Foreword

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

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

Required Elements of Area Plans

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

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

Plan Content

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

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

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

Chapter 4: Local Implementation, Monitoring, and Adaptive Management. ODA and the Local Advisory Committee (LAC) will work with knowledgeable sources to summarize land condition and water quality status and trends to assess progress toward the goals and objectives in Chapter 3.

Chapter 1: Agricultural Water Quality Management Program Purpose and Background

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

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

The provisions of the Area Plan do not establish legal requirements or prohibitions (ORS 568.912(1)). Each Area Plan is accompanied by Area Rules that describe local agricultural water quality regulatory requirements. ODA will exercise its regulatory authority for the prevention and control of water pollution from agricultural activities under the Ag Water Quality Program's general regulations (OAR 603-090-0000 to 603-090-0120) and under the Area Rules for this Management Area (OAR 603-095-3440). The Ag Water Quality Program's general rules guide the Ag Water Quality Program, and the Area Rules for the Management Area are the regulations that landowners are required to follow. Landowners will be encouraged through outreach and education to implement conservation management activities.

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

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

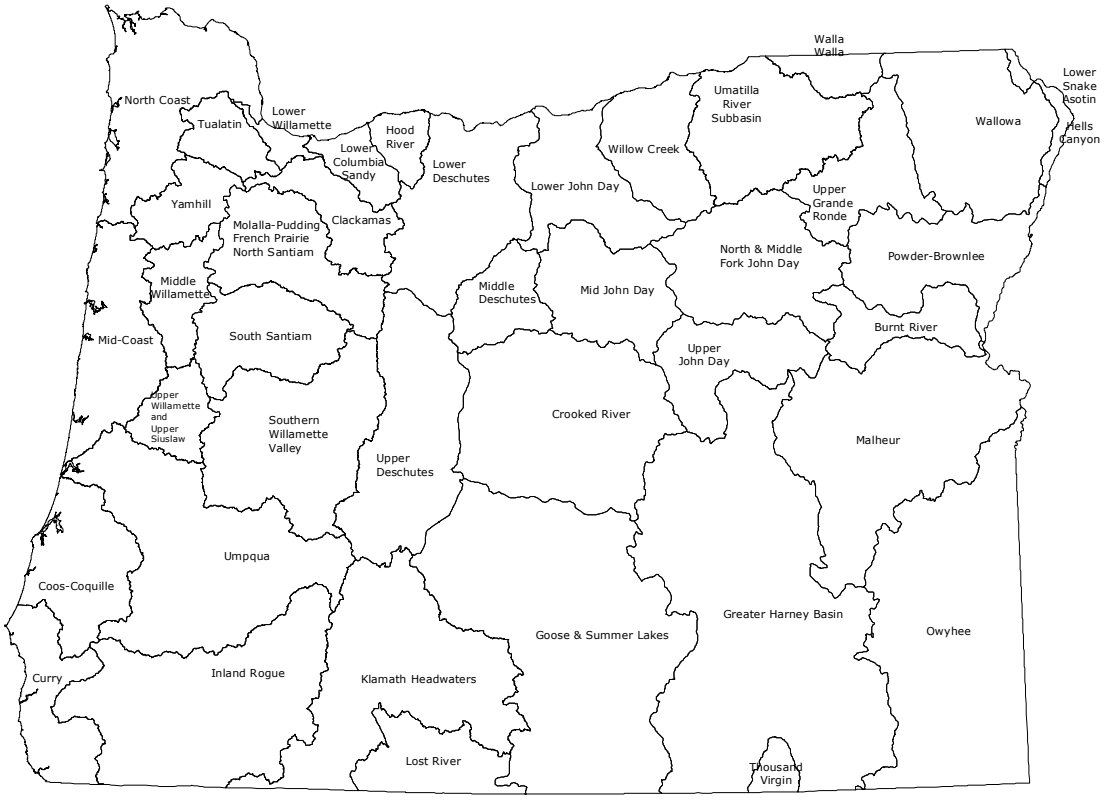
1.2 History of the Ag Water Quality Program

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

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

- Providing education, outreach, and technical assistance to landowners.
- Implementing projects to improve agricultural water quality.
- Investigating complaints of potential violations of Area Rules.
- Conducting biennial reviews of Area Plans and associated Area Rules.
- Monitoring, evaluation, and adaptive management.
- Developing partnerships with SWCDs, state and federal agencies, tribes, watershed councils, and others.

Figure 1: Map of 38 Agricultural Water Quality Management Areas



1.3 Roles and Responsibilities

1.3.1 Oregon Department of Agriculture

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

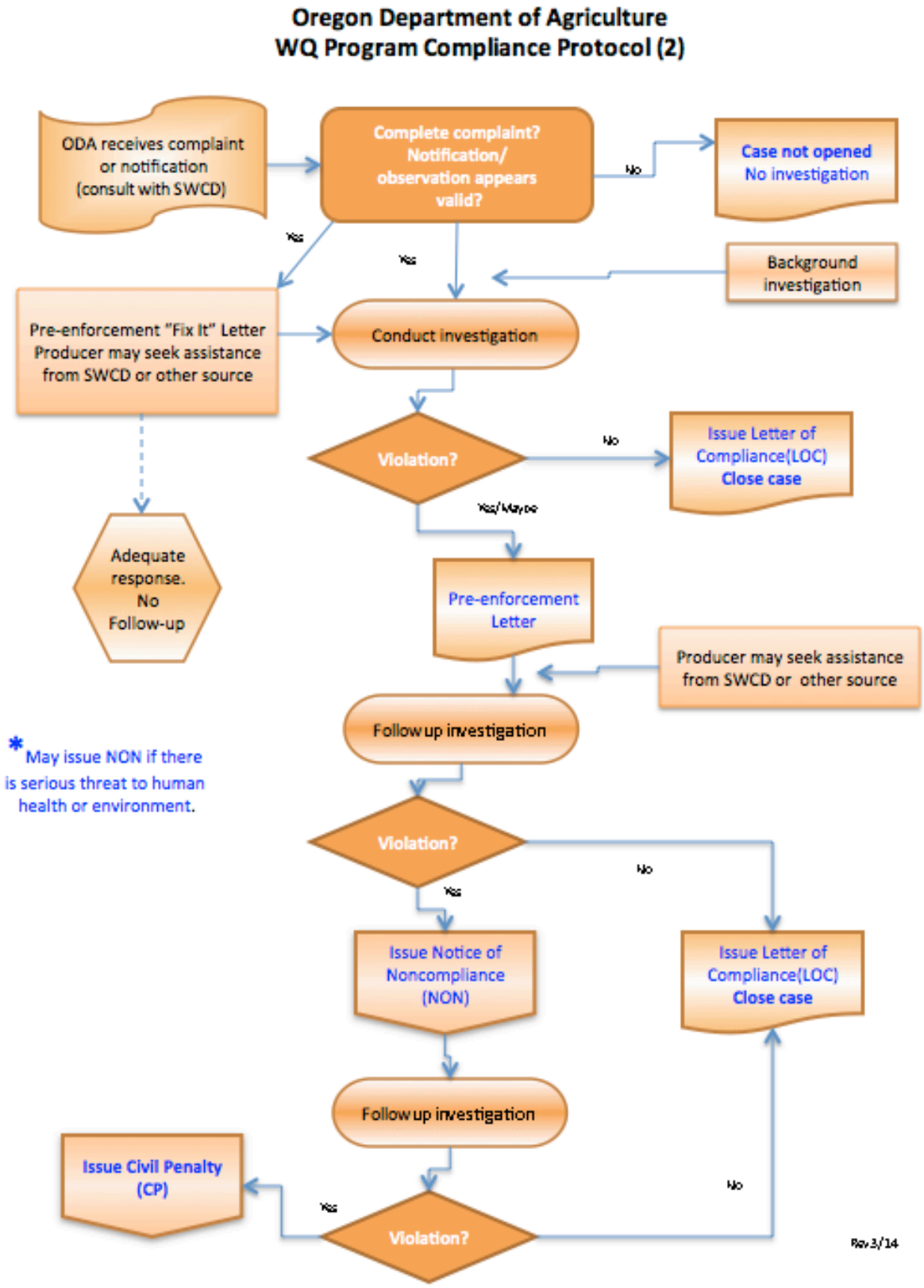
- State water quality standards.
- Load allocations for agricultural nonpoint source pollution assigned under Total Maximum Daily Loads (TMDLs) issued pursuant to the Clean Water Act (CWA), Section 303(d).
- Approved management measures for Coastal Zone Act Reauthorization Amendments (CZARA).
- Agricultural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

The Oregon Department of Agriculture has the legal authority to develop and implement Area Plans and associated Area Rules for the prevention and control of water pollution from agricultural activities and soil erosion, where such plans are required by state or federal law (ORS 568.909 and ORS 568.912). ODA bases Area Plans and Area Rules on scientific information (ORS 568.909). ODA works in partnership with SWCDs, LACs, DEQ, and other partners to implement, evaluate, and update the Area Plans and Area Rules. ODA has responsibility for any actions related to enforcement or determination of noncompliance with 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 emphasis of the Area Plan is on voluntary action by landowners or operators to control the factors affecting water quality in the Management Area. The Area Rules are outlined as a set of minimum standards that landowners and operators must be met on all agricultural or rural lands.

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

Figure 2: Compliance Flow Chart



1.3.2 Local Management Agency

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

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

1.3.3 Local Advisory Committee

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

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

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

1.3.4 Agriculture's Role

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

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

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

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

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

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

1.3.5 Public Participation

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

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

1.4 Agricultural Water Quality

1.4.1 Point and Nonpoint Sources of Water Pollution

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

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

1.4.2 Beneficial Uses and Parameters of Concern

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

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

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

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

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

A TMDL includes an assessment of water quality data and current conditions and describes a plan to achieve conditions so that water bodies will meet water quality standards. TMDLs specify the daily amount of pollution a water body can receive and still meet water quality standards. In the TMDL, point sources are allocated pollution limits as "waste load allocations" that are then incorporated in NPDES waste discharge permits, while a "load allocation" is attributed to nonpoint sources (agriculture, forestry, and urban). The agricultural sector is responsible for helping achieve the pollution limit by meeting the load allocation assigned to agriculture specifically, or to nonpoint sources in general, depending on how the TMDL was written.

Total Maximum Daily Loads generally apply to an entire basin or subbasin, and not just to an individual water body on the 303(d) list. Water bodies will be listed as achieving water quality standards when data show the standards have been attained.

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

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

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

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

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

ORS 468B.025 states that:

> "(1) ...no person shall:
>
> > (a) Cause pollution of any waters of the state or place or cause to be placed any wastes in a location where such wastes are likely to escape or be carried into the waters of the state by any means.

(b) Discharge any wastes into the waters of the state if the discharge reduces the quality of such waters below the water quality standards established by rule for such waters by the Environmental Quality Commission.

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

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

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

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

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

"Wastes" means sewage, industrial wastes, and all other liquid, gaseous, solid, radioactive or other substances, which will or may cause pollution or tend to cause pollution of any waters of the state. Additionally, OAR 603-095-0010(53) includes but is not limited to commercial fertilizers, soil amendments, composts, animal wastes, vegetative materials, or any other wastes.

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

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

1.4.5 Streamside Vegetation and Agricultural Water Quality

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

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

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

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

Site-Capable Vegetation

The Ag Water Quality Program uses the concept of "site-capable vegetation" to describe the vegetation that agricultural streams can provide to protect water quality. Site-capable vegetation is the vegetation that can be expected to grow at a particular site, given natural site factors (e.g., elevation, soils, climate, hydrology, wildlife, fire, floods), and historical and current human influences that are outside the program's regulatory purview (e.g., channelization, roads, modified flows, previous land management). Site-capable vegetation can be determined for a specific site based on: current streamside vegetation at the site, streamside vegetation at nearby reference sites with similar natural characteristics, Natural Resources Conservation Service (NRCS) soil surveys and ecological site descriptions, and local or regional scientific research.

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

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

In many cases, invasive, non-native plants such as introduced varieties of reed canary grass and types of blackberry grow along streamside areas. This type of vegetation has established throughout much of Oregon due to historic and human influences, and may provide a degree of site capability functions. ODA's statutory authority does not require the removal of these plants. ODA recognizes removal as good conservation activity and encourages producers to remove them. Voluntary programs through Soil and Water Conservation Districts and Watershed Councils provide technical assistance and financial incentives to implement control and restoration projects. In addition, the Oregon State Weed Board identifies invasive plants that can negatively impact watersheds. Public and private landowners are responsible for eliminating or intensively controlling noxious weeds as may be provided by state and local law enacted for that purpose. For further information, visit www.oregon.gov/ODA/programs/weeds.

1.5 Other Water Quality Programs

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

1.5.1 Confined Animal Feeding Operation Program

Oregon Department of Agriculture is the lead state agency for the CAFO Program. The CAFO Program was developed to ensure that operators do not contaminate ground or surface water with animal manure. Since the early 1980s, CAFOs in Oregon have been registered to a general Water Pollution Control Facility permit designed to protect water quality, while allowing the operators and producers to remain economically viable. A properly maintained CAFO does not pollute ground or surface water. To assure continued protection of ground and surface water, the 2001 Oregon State Legislature directed ODA to

convert the CAFO Program from a Water Pollution Control Facility permit program to a federal National Pollutant Discharge Elimination System (NPDES) program. Oregon Department of Agriculture and DEQ jointly issue the NPDES CAFO Permit, which complies with all CWA requirements for CAFOs. This permit does allow discharge in certain circumstances as long as the discharge does not violate water quality standards.

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

1.5.2 Groundwater Management Areas

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

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

1.5.3 The Oregon Plan for Salmon and Watersheds

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

1.5.4 Pesticide Management and Stewardship

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

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

Through the PSP, state agencies and local partners work together to monitor pesticides in streams and to improve water quality (www.deq.state.or.us/wq/pesticide/pesticide.htm). ODA, Department of

Environmental Quality, and Oregon State University Extension Service work with landowners, SWCDs, watershed councils, and other local partners to voluntarily reduce pesticide levels while improving water quality and crop management. Since 2000, the PSPs have made noteworthy progress in reducing pesticide concentrations and detections.

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

1.5.5 Drinking Water Source Protection

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

1.6 Partner Agencies and Organizations

1.6.1 Oregon Department of Environmental Quality

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

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

The MOA includes the following commitments:

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

- Whether existing strategies have been effective in achieving the goals and objectives of the Area Plans.
- Whether the rate of progress is adequate to achieve the goals of the Area Plans.

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

1.6.2 Other Partners

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

1.7 Measuring Progress

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

1.7.1 Measurable Objectives

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

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

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

1.7.2 Land Conditions and Water Quality

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

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

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

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

1.7.3 Focused Implementation in Small Geographic Areas

Focus Areas

A Focus Area is a small watershed with water quality or concerns associated with agriculture. Through the Focus Area process, the SWCD delivers systematic, concentrated outreach and technical assistance in small geographic area. A key component of this approach is measuring land conditions before and after implementation, to document the progress made with available resources. The Focus Area approach is consistent with other agencies' and organizations' efforts to work proactively in small geographic areas, and is supported by a large body of scientific research.[1]

Systematic implementation in Focus Areas provides the following advantages:

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

Soil and Water Conservation Districts select a Focus Area in cooperation with ODA and other partners. In some cases, a Focus Area is selected because of efforts already underway or landowner relationships already established. The scale of the Focus Area matches the SWCD's capacity to deliver concentrated

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

outreach and technical assistance, and to complete (or initiate) projects over a biennium. The current Focus Area for this Management Area is described in Chapter 3.

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

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

1.8 Monitoring, Evaluation, and Adaptive Management

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

1.8.1 Statewide Aerial Photo Monitoring of Streamside Vegetation

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

1.8.2 Agricultural Ambient Water Quality Monitoring

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

1.8.3 Biennial Reviews and Adaptive Management

This and all Area Plans and associated Area Rules around the state undergo biennial reviews by ODA and the LAC. As part of each biennial review, ODA, DEQ, SWCDs, and the LAC discuss and evaluate the progress on implementation of the Area Plan and Area Rules. This evaluation includes discussion of enforcement actions, land condition and water quality monitoring, and outreach efforts over the past

biennium. ODA and partners evaluate progress toward achieving measurable objectives, and revise implementation strategies as needed. The LAC submits a report to the Board of Agriculture and the Director of ODA describing progress and impediments to implementation, and recommendations for modifications to the Area Plan or associated Area Plans necessary to achieve the goal of the Area Plan. ODA and partners will use the results of this evaluation to update the measurable objectives and implementation strategies in Chapter 3.

Chapter 2: Local Background

2.1 Local Roles and Responsibilities

2.1.1 Local Advisory Committee

The Area Plan was developed with the assistance of the LAC. The LAC was formed in 2004 to assist with the development of the Area Plan and associated regulations, and with subsequent biennial reviews. Current LAC members are:

Name	Location	Description
Greg Bedortha (Chair)	Paulina	Cattle
Bill Sigman (Vice-Chair)	Lower Crooked River	Cattle, Hay, Grain, Mint
Lawrence Weberg	Lone Pine	Retired Rancher
Mylen Bohle	Prineville	Extension Agronomist
Doug Breese	Ochoco Creek	Cattle, Hay
Russell Rhoden	Prineville	Ochoco Irrigation District
Tim Huntley	Prineville	Crook County High School, Trout Unlimited
Jerry McBeth	Prineville	Ranch hand
John Morgan	Prineville	Farming
Lee Dunn	Prineville	
Trent Smith	Paulina	
Jeff Hancock	Redmond	
Jim Eisner (technical support)		BLM
Alternate: Matt Smith	Paulina	Cattle

2.1.2 Local Management Agency

The implementation of the Area Plan is accomplished through an Intergovernmental Agreement between ODA and the Crook County SWCD. This Intergovernmental Agreement defines the SWCD(s) as the LMA(s) for implementation of the Area Plan. The SWCD was also involved in development of the Area Plan and associated regulations.

2.2 Area Plan and Regulations: Development and History

The director of ODA approved the Area Plan and associated regulations in June of 2004.

Since approval, the LAC has met every two years to review the Area Plan and associated regulations. 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

2.3.1 Location, Climate, Water Resources, Ecological Provinces, Hydrology, Historic and Current Land Conditions, Land Use, Socio-Economic Conditions

LOCATION

The Management Area is in central Oregon and consists of the Crooked River Basin, except for the Crooked River Ranch area near the mouth of the Crooked River and the Trail Crossing area west of Smith Rock. (The Crooked River Ranch area is in the Upper Deschutes Management Area, and the Trail Crossing area is in the Middle Deschutes Management Area). The Management Area encompasses approximately 4,500 square miles (2.9 million acres) and includes the towns and communities of Terrebonne, Powell Butte, Prineville, Paulina, Post, Suplee, Alfalfa, Millican, Brothers, and Hampton (see map). The Management Area includes portions of seven counties.

Table 1: Counties within the Management Area	
County	**% of Management Area**
Crook	64
Deschutes	26
Grant, Jefferson, Harney, Lake, Wheeler	1 - 4% each

The Management Area includes a wide range of ecological conditions, from moist forest in the north and east to desert in the west and south. Landforms include valleys, plains, foothills, the Maury and Ochoco mountain ranges, headwaters, and downstream watersheds.

The highest point is Snow Mountain (elevation 7,162 feet) on the southeastern boundary of the Management Area near the Harney County Line. The lowest point is near the mouth of the Crooked River, with an elevation of approximately 1,900 feet.

CLIMATE

The Crooked River Basin is located in the South Central Oregon climatic zone; a semi-arid area of high desert prairie punctuated by small mountain ranges and isolated peaks. Average annual precipitation is between eight and ten inches per year at lower elevations and may reach 30-40 inches at higher elevations (falling primarily as snow in the winter). The highest monthly precipitation totals occur in the winter months, with a secondary maximum during the late spring and early summer (Figure 1). High intensity thunderstorms can contribute large proportions of annual rainfall locally and contribute to increased erosion. As distance increases to the east, away from the Cascade Mountains, the spring-summer peaks become much more pronounced.

Climate is characterized by cold nights throughout the year, particularly at higher elevations, and hot daytime summer temperatures (Figure 2). Summer daytime temperatures are quite warm at lower elevations, but the growing season is relatively short, particularly at higher elevations, and frost has been recorded in every month.

Mean annual temperatures, total precipitation, and snowfall vary widely from year to year (Figures 3 and 4). Precipitation at higher elevations follows the general patterns recorded at Prineville, except that there is more rain and snowfall.

Figure 1. Monthly precipitation patterns at Prineville (1971-2015)[2]

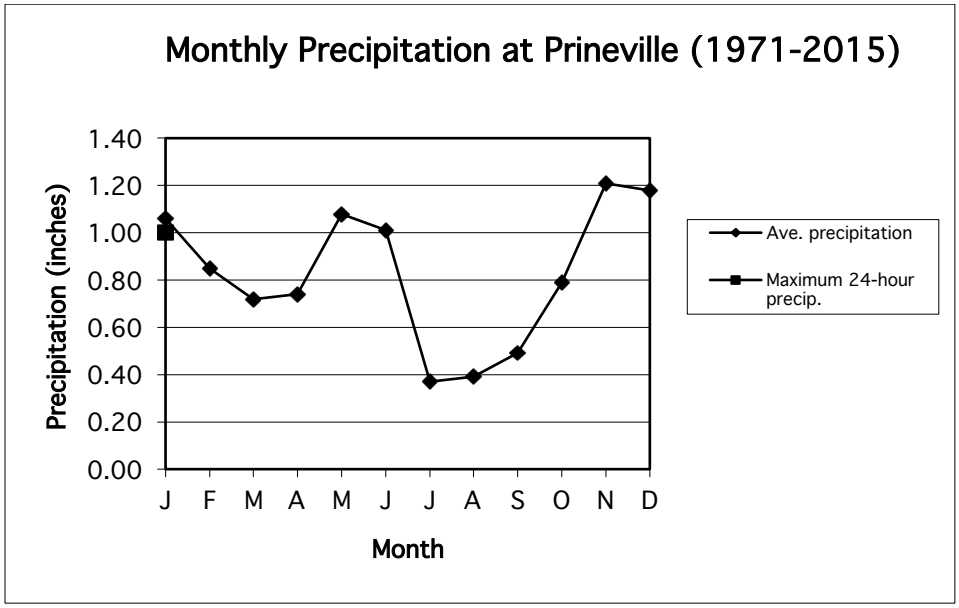
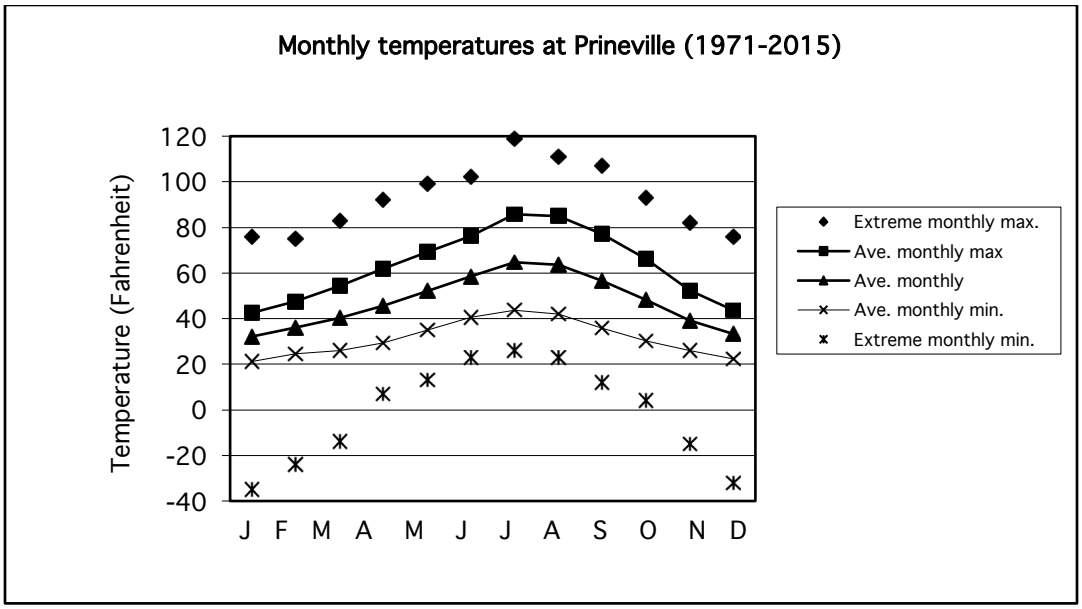


Figure 2. Monthly temperature patterns at Prineville (1971 – 2015)[2]



[2] Oregon Climate Service: http://www.ocs.orst.edu

Figure 3. Average annual precipitation at Prineville for 100 years[2]

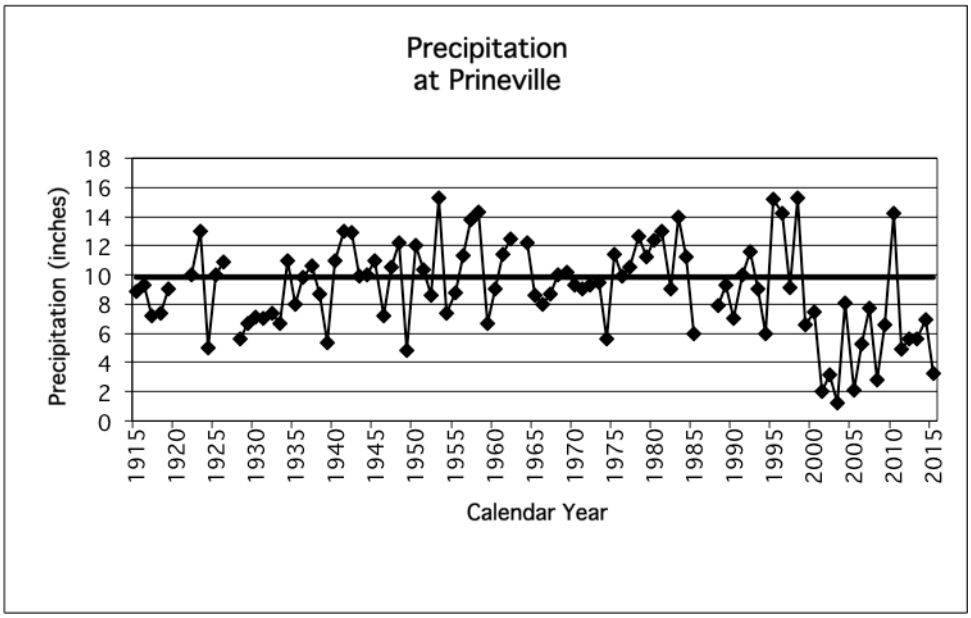
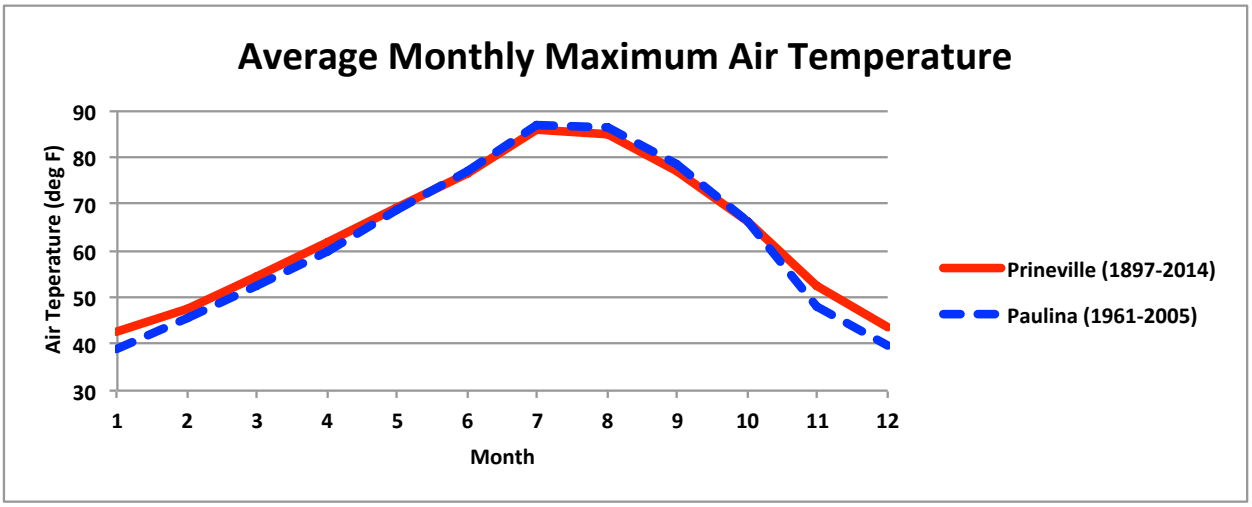


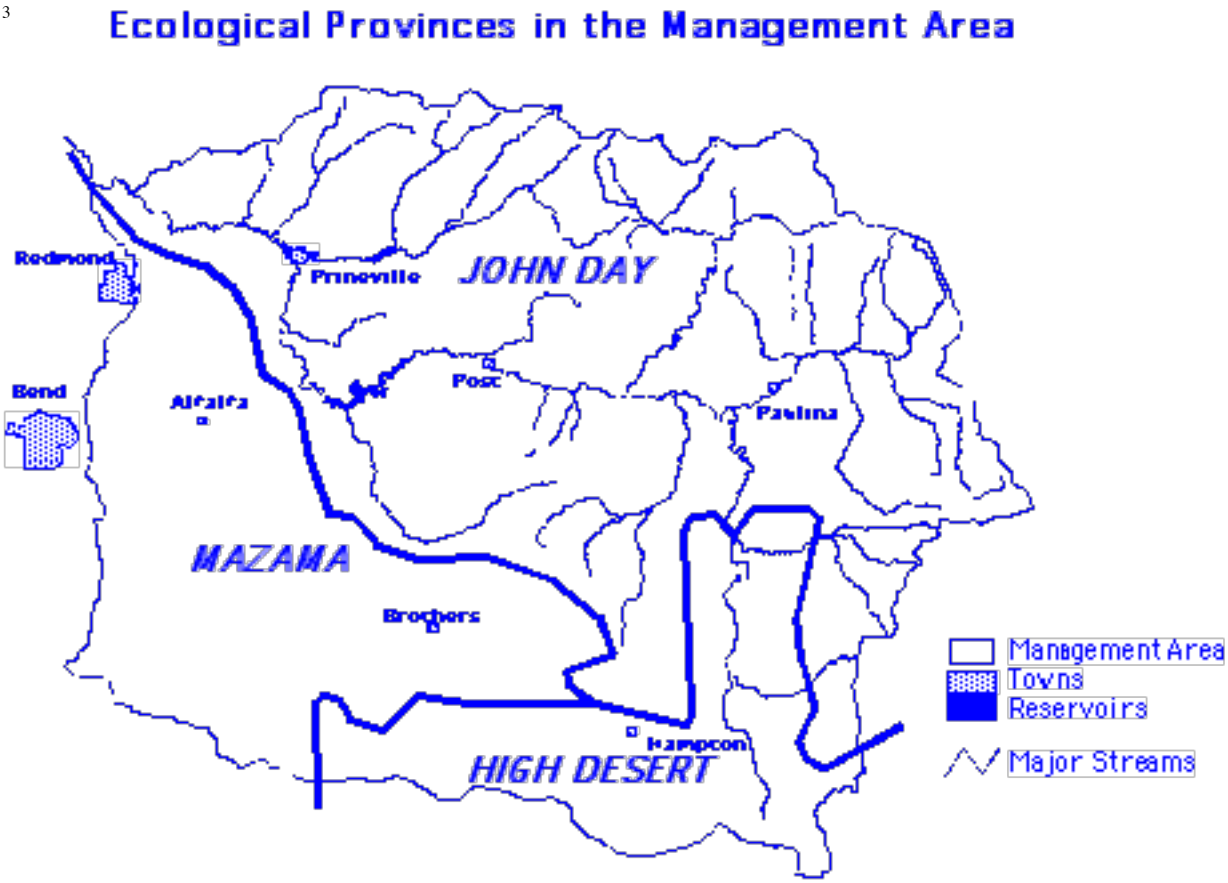
Figure 4. Average Monthly Max Air Temperature[2]



[2] Oregon Climate Service: http://www.ocs.orst.edu

ECOLOGICAL PROVINCES: Geology, Soils and Vegetation Patterns
The Crooked River Basin includes three ecological provinces, which are based on broad soil/plant relationships determined from a combination of geologic and ecological features.

[3]



The **John Day ecological province** is characterized by extensive geologically eroded, steeply dissected hills of thick, ancient sedimentary materials interspersed with buttes and plateaus capped with basalt or tuffaceous rock. The majority of the Management Area is located within this ecological province, including the entire Upper Crooked River Subbasin, and most of the Lower Crooked River and the Beaver South Fork subbasins.

The soils are finely textured, sticky when wet, and highly susceptible to precipitation-driven erosion. Irrigated agriculture occurs around Prineville, but cropland in the remainder of this ecological province is limited to narrow irrigated valleys. Most of the land is used to produce livestock and livestock forage. The original vegetative potential of these sites has been lost or diminished throughout most of the basin, except at relict sites where perennial grasses are present. Control of juniper and noxious weed expansion, and reduced soil erosion can increase the potential for vegetation recovery on these arid rangelands.

The southwestern portion of the Management Area is located in the **Mazama ecological province,** which is covered by a continuous mantle of pumice and other volcanic material deposits distributed when Mt. Mazama erupted explosively about 6,500 years ago. Communities include Alfalfa, Powell Butte, Brothers, Millican, Terrebonne, and the eastern portions of Redmond's urban growth boundary.

[3] Graphic from an undocumented website

Soils have developed in combinations of pumice and volcanic ash overlying basaltic bedrock or ancient soils at a depth from 10 inches to 15 feet. Upland soils are characterized by thick deposits of pumice, or pumice overlying loamy soil. Low lying areas include deep, coarse, gravelly pumicey soils of basins and draws in forested uplands, and deep, gravelly loam adjacent to marsh areas.

The overlying pumice mantle is believed to act as mulch, which aids vegetation. Pumice soils are one of the easiest to modify through management activities, such as compaction from equipment and livestock use. Pumice also weathers more rapidly than other volcanic rock types

Vegetation is typically sagebrush and bunchgrass. Portions of the Mazama province are used for irrigated agriculture.

The **High Desert ecological province** is characterized by closed basins surrounded by terraces formed in ancient lakes. Low mountains, isolated buttes, basaltic ridges, and block faulted igneous formations are interspersed. Elevations average between 4,000 and 4,500 feet. The only community within this province is Hampton.

Soils range from deep loam to deep clayey soils in basins and from deep sandy to shallow clayey soils on terraces and fans where hardpans are common. On most terraces and fans the soil surface is rocky, likely a result of fractured basalt.

The province is a dry and cold region, with an average annual precipitation of approximately ten inches and a possibility of frost throughout each week of the year. Extremes of hot and cold temperatures are common throughout the province. Vegetation communities are dominated by shrub-grasslands, and the limited conifer areas that are present are dominated by juniper.

HYDROLOGY: RIVER SYSTEMS & WATER FLOWS

The Crooked River flows east to west from headwaters in North Fork Crooked River, South Fork Crooked River and Beaver Creek systems. The total length of the Crooked River from the headwaters of the North Fork Crooked River is approximately 155 miles. Average annual discharge of the Crooked River is 1,131,000-acre feet (at Lake Billy Chinook). The streams naturally experience sudden high flows, but are even more prone to flooding now due to suboptimal upland conditions[4].

Natural stream flow is relatively low due to the semi-arid climate. Many streams are intermittent. Approximately two-thirds of the total annual precipitation comes in the form of snow during the months of October through April. Large variations occur on an annual and seasonal basis, with snowmelt and summer rainstorms contributing to high runoff and flow events. Tributaries originating in the Ochoco Mountains contribute substantially to the flow of the Crooked River with inputs from both snow and rain. Tributaries originating to the south do not contribute as much water, but can be influenced heavily by high intensity storm events such as summer thunderstorms. Flow within the Crooked River originates from springs in the upper headwaters and lower mainstem, and from snowmelt at the higher elevations.

The South Fork of the Crooked River is formed by the outflow of several springs, some of them hot, and exceed the DEQ water quality temperature standard at the source. The mainstem Crooked River begins at the confluence of the South Fork and Beaver Creek, which receives its flow from springs as well as snow melt and rain from the Ochoco Mountains. Temperatures of springs near Paulina and Suplee have been measured at 70-112°F[4]. The North Fork Crooked River, also fed by springs and snowmelt, adds considerable flow to the mainstem. Springs and tributary streams continue to contribute flow above

[4] Crooked River Local Advisory Committee. Personal communication.

Prineville. Below Prineville, there are no known springs of significant size until river mile 15 (downstream of the Management Area) where large springs augment the flow to the confluence.

Bowman Dam creates Prineville Reservoir, and Ochoco Dam creates Ochoco Reservoir. They have multiple benefits: flood control, irrigation, recreation, cooler water temperatures below the dam, summer flows down stream, and redband trout fisheries below the dam. The construction of Bowman dam changed the timing of peak flows as well as their size in the Crooked River. Before construction of the dam, 75 percent of the average flow of the Crooked River occurred in March, April, and May. Natural seasonal flow patterns are altered below both dams, with high flows during the irrigation season when water is released, and lower flows while water is stored for the next irrigation season. Altered stream flow has resulted throughout the basin from the numerous public and private reservoirs created for water storage. Post-reservoir characteristics below large reservoirs such as Ochoco and Prineville include: reduced annual maximum mean flow, elimination of peak high flows, reduction in late winter and early spring flows, and an increase in summer and fall flows. Agriculture in the Lower Crooked River Subbasin depends almost totally on storage behind dams.

In 2013, the Crooked River Watershed Council along with collaborating partners OWEB, NOAA-American Rivers, BLM, and the project owner Quail Valley Ranch, removed the Stearns Dam in the Crooked River below Bowman Dam. The dam removal project was undertaken to improve fish passage and allow free movement of fish at the site.

A water reallocation plan for Prineville Reservoir may be forth-coming from the Bureau of Reclamation that will address agricultural and non-agricultural land and water uses.

HISTORIC LAND CONDITIONS

In the mid-to-late-1800s, there were more springs and watercourses in the basin. Many streams that are currently intermittent were perennial. There was more riparian* vegetation, including sedges, grasses, and woody species, and stream channels were still well connected to the broad valley bottom floodplains. The Crooked River 'flooded' practically annually, with a meandering channel that took up the entire valley floor.

In the 1800s, riparian and floodplain areas had significantly more woody vegetation than now. Willows were a primary component of riparian species (Ochoco means 'willow' in Paiute) but other common species included cottonwoods, aspen, alder, as well as shrub species such as chokecherry, hawthorn, or dogwood. The floodplains were dominated by Great Basin wild rye, other bunchgrass species, and swamp grass, with very little invasion of juniper and sagebrush.

Vegetation in riparian areas declined rapidly after Euro-American settlement in the basin during the middle 1800s.

In the mid-to-late 1800's, vegetation was more open in both forests and rangelands. Western juniper distribution and density were much less, with juniper restricted to the rocky ridge tops, which are areas naturally resistant to fire. In general, the western edge of the Management Area (in the Mazama Ecological Province) had more juniper than the remainder of the basin. Early journals commonly note the valleys full of waist high grasses and the abundance of forage for livestock. Forests in the Ochoco Mountains had more open Ponderosa Pine stands. Fire was much more frequent and less severe, mostly burning grasses and low ground covers.

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* *Riparian areas are a transition between saturated areas and upland areas. Riparian areas are characterized by vegetation that requires permanent surface or subsurface water.*

Agriculture in the Past

From the time of European settlement in roughly 1870 through the 1930s, livestock grazing was the major land use throughout the entire basin. Initial grazing was dominated by cattle and horses, sheep moved into the area around 1880. By the turn of the century, the lack of grazing control coupled with the high numbers of sheep, cows and horses, were contributing to the conversion of shrub steppe to encroaching western juniper. Horses were a significant source of range damage in the South Fork Crooked River/Hampton Buttes region of the basin.

The change from native grasses to sagebrush affected the streams. The interaction between high grazing pressure and variable climate (drought followed by intense summer storms), as well as the loss of beaver through extensive trapping and its associated habitats, contributed to major stream incision and loss of riparian vegetation in the late 1800 to early 1900s. This was accompanied by increasing conflicts over use of the range.

In 1906, the Ochoco National Forest was created as part of the Blue Mountain and Maury Mountain Forest Reserves. In 1911, the Ochoco National Forest was formally created. Logging and livestock overuse and grazing conflicts (cattle versus sheep) were the early issues addressed. Unrestricted grazing on public domain lands ended with the passage of the Taylor Grazing Act of 1934.

Stream alterations have occurred over time. The Crooked River and many tributary streams were channelized following the 1964 flood to facilitate water movement out of the system. This effort disconnected the streams from their floodplains and increased the energy of the streams on the channel banks. Expansion of agricultural, industrial and residential developments in valley bottoms altered stream morphology and vegetation throughout the basin. As a result, many streams eroded vertically or laterally, water tables dropped, sagebrush replaced meadow grasses, and subsequent recovery of riparian vegetation communities is slow. An extensive reservoir and irrigation system has altered the timing and intensity of flows in much of the lower basin. In some locations, this has resulted in impairing the ability of native vegetation to remain established or re-colonize denuded areas. Ochoco (1921) and Prineville (1961) In other locations, stable flows and cold water created by these developments have created blue-ribbon fisheries, sought after by fly fisherman from throughout the region.

The majority of water rights in the upper basin (Paulina/Post) were allocated by the late 1880s. Irrigated agriculture expanded rapidly just after the turn of the century, with major diversion systems installed on the Crooked and Deschutes Rivers in 1908. The mainstem Lower Crooked River, where no springs provide water, and the lower reaches of most small tributaries were dry in late summer and early fall; only the North Fork and uppermost tributaries contained water at this time of year. Overall effects of irrigation expansion included: positive and negative effects on water quality; changed timing of water availability; and fish passage barriers created by dams and diversions.

Reservoirs limit the amount of sediment available in streams throughout the Lower Crooked River sub-basin. Changes in the timing and size of peak and channel maintenance flow events have changed channel-forming processes in the Crooked River and Ochoco Creek. Natural wetland and riparian areas, particularly within the Prineville urban area, have been filled, removed or relocated, altering the storage and transport of water through this area of the basin. Roads in the basin generally follow stream courses; many riparian areas are modified by the presence of roads and road crossings can result in channel degradation.

Historically, management practices implemented reflected the best available knowledge at the time to resolve natural resource concerns. For instance, in the 1950s the federal government encouraged the removal of willows in creek bottoms to help the water move through the system faster. Government

reports in the late 1970s considered riparian areas to be "sacrifice areas" for livestock grazing. And, the federal government for years had advocated straightening of stream channels.

CURRENT LAND CONDITIONS

Riparian Areas

Stream channelization and land use practices have contributed in down cutting of many of the streams and rivers within the Crooked River Basin. As such, these channels do not connect with their floodplains and water moves quickly through the system. In addition, upland soil and vegetation conditions contribute to flash floods. The "upper country" (Post/Paulina area) of the watershed is heavily impacted by floods due to landscape conditions that lead to flash floods and a lack of control structures. Additionally, thunderstorms, geology, soils, and topography also contribute to flash floods in the Post/Paulina area. Prineville and Ochoco reservoirs are critical in controlling floodwaters in the Lower Crooked River Sub-basin.

Voluntary involvement by private landowners in riparian improvements has increased since the 1960s. Management changes continue to reduce livestock impacts to riparian areas. Primary management changes include riparian fencing to exclude cattle, the creation of riparian pastures and modified grazing schedules, and off-stream water developments to encourage livestock use of upland areas.

These management changes have resulted in increased vegetation in riparian zones; but the composition and extent of the riparian community has not been restored. Particularly at lower elevations, riparian communities in the basin are dominated by non-native grasses or herbaceous vegetation that lacks the root stability of the woody vegetation or sedge communities that existed historically. Restoring riparian function may take a long time due to current channel conditions.

Rangelands

- Approximately two-thirds of the land within the Management Area is range. Characteristics include:
- High levels of junipers and shrubs,
- Expansion of noxious weeds (often worse when cattle are excluded),
- Increasing fragmentation between blocks of native range habitat,
- Fire regimes that are more severe than historical conditions, and
- Slow recovery from past damage in lower precipitation regions of the basin.

The Management Area has historically supported juniper, but since 1936, western juniper has spread rapidly throughout the John Day ecological province, and into the Upper Beaver South Fork Subbasin. The spread of this species is primarily a result of the exclusion of fire and intensive grazing pressures at the turn of the century. In addition, juniper has an affinity for calcium, and the clay ancient sediments of the John Day province are typically calcareous.

Forestlands

Approximately 20 percent of the land within the Crooked River Basin is forested (excluding juniper areas), with the majority contained within the Ochoco and Deschutes National Forests. The current pattern and occurrence of forested vegetation in the Crooked River Basin has changed from historic conditions, which is influencing watershed function and water yield.

Major changes to forest communities in the basin include:

- Overall increase in stand density,
- Increase in small to medium sized trees,
- Shortage of large structure and old trees, and

- Increase in the expanse, density, and canopy cover of western juniper and conifers.

Croplands and Irrigated Agriculture

Approximately 106,215 acres of land within the Crooked River Basin is used for irrigated agriculture, and its significance has increased over recent decades due to agricultural and livestock market changes. Presently, irrigated crops within the basin are predominately hay, pasture, and wheat with smaller acreages of mint, garlic, grass and vegetable seed.

The 20,000+ acres served by irrigation districts near Prineville (Ochoco, Lowline, and People's) receive water stored by reservoirs on the Crooked River. Water applied to irrigated lands west of Prineville (e.g. Terrebonne, Alfalfa, Powell Butte, and Lone Pine) is stored in Deschutes River reservoirs before being delivered to the Management Area. The remaining Management Area irrigators rely on non-stored runoff from healthy watersheds to supply their irrigation needs.

LAND USE

Fifty-six percent of the Management Area is publicly owned, primarily by the Federal government. The Bureau of Land Management (BLM) manages 35 percent of the Management Area; and the US Forest Service (USFS) manages 23 percent as the Ochoco, Deschutes, and Malheur National Forests. The remaining 26,650-acres of public lands, or one percent, are owned by the state of Oregon.

Fifty-one percent of stream miles run through private lands, 31 percent run through BLM-managed lands, and 16 percent run through National Forests.

Land use is dominated by agriculture and forestry (over 90 percent), with rural residential comprising the third largest category.

In the late 1970s, 73 percent of the Management Area was classified as range, with grazing as the primary use, 21 percent as forest, four percent as irrigated agriculture, and two percent as urban and other uses. Since then, the percent of forestlands has remained about the same, but the proportion of irrigated lands has increased relative to the proportion of grazed lands as the economic significance of crops has expanded. In addition, the conversion of agricultural lands to rural residential and urban development is increasing in the Management Area, which could harm water quality due to a lack of comprehensive riparian guidelines.

Livestock grazing is still a major land use in the basin; however, the advent of irrigation in the early-1900s brought large-scale agriculture to the basin. Soil capabilities, a short growing season, and limited sources and supplies of water for irrigation limit agricultural cropland in the basin.

The number of farms in Crook County increased from 334 in 1978 to 622 in 2007. From 2007 to 2012, the number of farms decreased from 622 to 551. The average size of farms decreased from an average of 2,580 acres in 1978 to 1,224 acres in 2007. From 2007 to 2012, the size of farms increased from 1,224 acres to 1,493 acres. [5]

Livestock ranching and hay production dominate economic and land use activity in the county. Crop alternatives are severely limited by the availability of water and the short growing season. Potential production of forage is low except in restricted meadows and high precipitation areas. Improved grazing management techniques have resulted in a gradual improvement in range quality over the past few decades.

[5] Census of Agriculture. www.agcensus.usda.gov

Recreation is a growing enterprise but the potential is constrained by the distance from populated areas, limited year round access roads, and the seasonal nature of most recreational activities. Reservoirs provide recreation, such as camping, fishing, and boating that depend on water quantity and are becoming a key sector of the economy. Also, excellent tail water fisheries have been created below the reservoirs.

SOCIO-ECONOMIC CONDITIONS

The majority of the Management Area lies within Crook County. The Management Area also includes small portions of Deschutes, Grant, Lake, Jefferson, Wheeler and Harney counties. While there are significant differences in the socio-economic conditions between Crook and Deschutes counties, the areas of Deschutes that lie within this management area are very similar to Crook County.

In 2015, Crook County's population is estimated to be 21,085 people. Portland State University Population Research Center reported that as of July 1, 2015, the population of Crook County had increased by 1.5 percent from 2014. Of that population, about 45 percent live in Prineville (the only incorporated town in Crook County) with the remainder of the population living in the unincorporated parts of the County.[6]

Traditionally, the economy has been based on natural resources. Forest products (primary and secondary manufacturing) and agriculture have provided the underlying stability to the community. Today, Crook County's economy also includes manufacturing, trade, government, data centers, and recreation/tourism.[7]

In 2015, Crook County's unemployment rate was 8.3 percent. Since 1990, Crook County's unemployment rate has always been higher than Deschutes County and the state average for Oregon.[8]

In 2013, the top two sales of agricultural commodities produced in Crook County were $46,986,000. Livestock sales (primarily cattle and calves) were $28.7 million and hay sales (alfalfa and other hays) were $18.3 million.[9]

2.3.2 Geographic and Programmatic Scope

The geographic and programmatic scope is concurrent with the rules and the rules provide:

603-095-3420

Geographic and Programmatic Scope

The Management Area consists of the Crooked River Basin with the following exceptions near the mouth of the Crooked River: 1) lands south of the Crooked River and west of the range line between R12E and R13E in T14S to exclude the entire Crooked River Ranch subdivision, which is in the Upper Deschutes Agricultural Water Quality Management Area, and lands north of the Crooked River and west of Sherwood Canyon near Smith Rock, which are in the Middle Deschutes Agricultural Water Quality Management Area

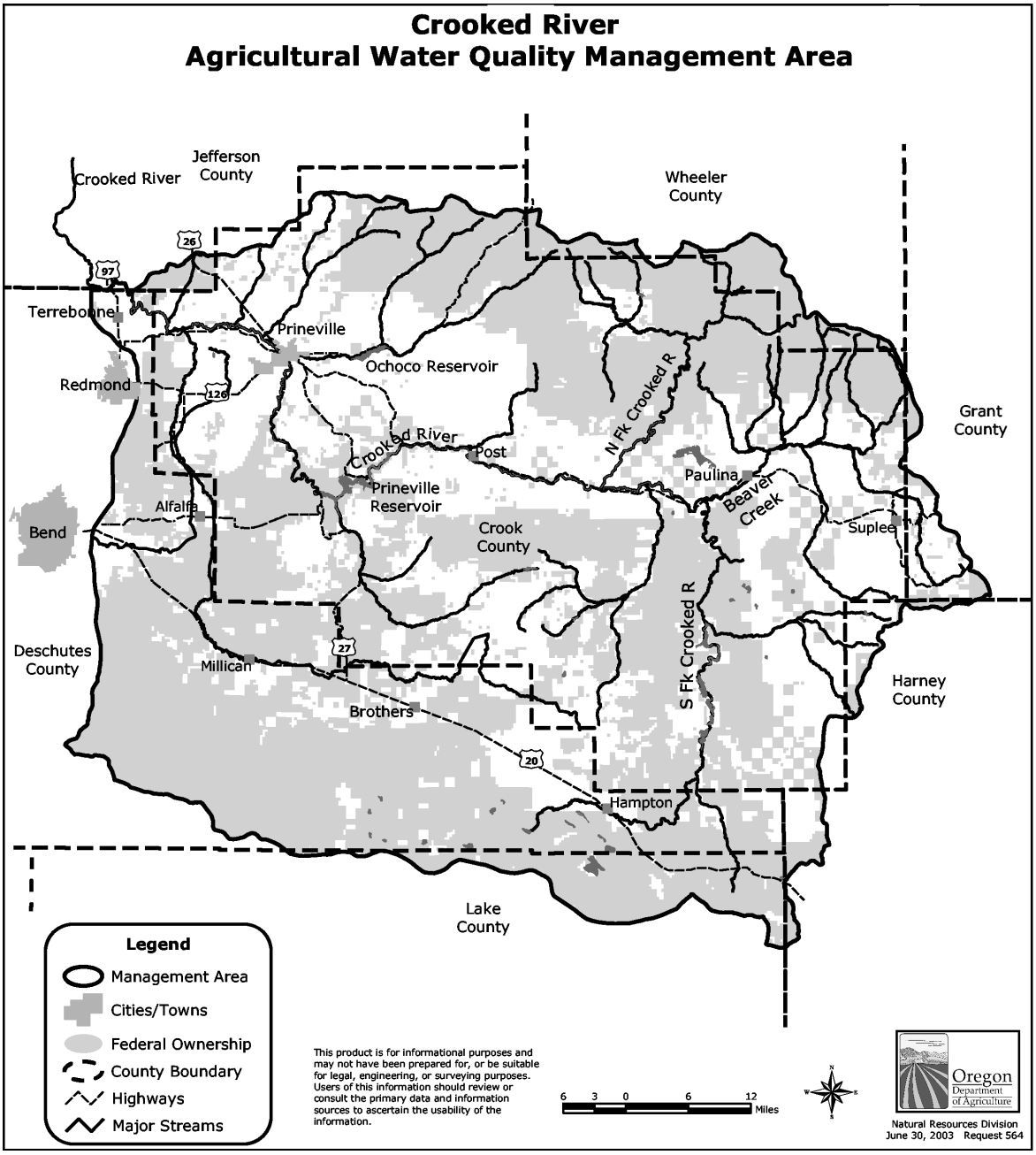
[6] Portland Stateu University Population Research Center. www.pdx.edu/prc/annual-oregon-population-report

[7] Crook County Rural Living Handbook, 2009

[8] Oregon Workforce Statistics, http://www.qualityinfo.org/olmisj/OlmisZine

[9] Oregon Agricultural Information Network. http://oain.oregonstate.edu

2.3.3 Map of the Management Area



2.4 Agricultural Water Quality in the Management Area

2.4.1 Watershed Health

A healthy watershed captures, stores, and beneficially releases water.

Watershed health results from properly functioning uplands and riparian areas. Most of the capture and storage of precipitation occurs in the uplands, which generally make up 98-99 percent of the watershed area. Healthy riparian areas have sufficient vegetation to stabilize streambanks, filter out nutrients, provide shade, and store moisture in the soil profile. A properly functioning stream transports water and sediment in such a way that the stream channel can withstand a 25-year flood event without excessive erosion.

Capture = Precipitation is captured by vegetation and the soil surface. Fixed site factors that influence the efficiency of capture include: soil texture and depth, topography, and weather. Landowners can enhance the opportunity for water to enter the ground where it falls by managing upland vegetation. Key management objectives are to:

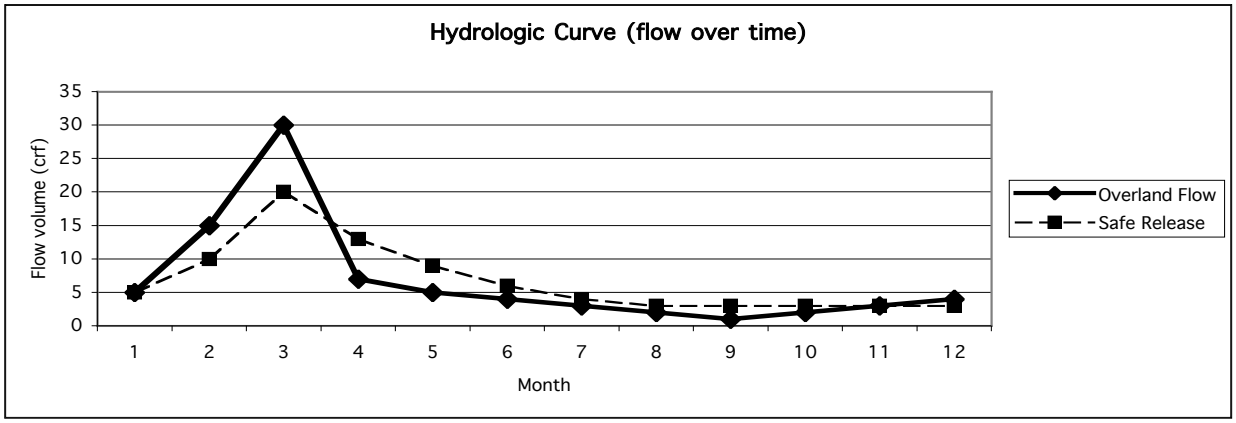
- Provide sufficient vegetative cover to reduce raindrop impact and to trap precipitation,
- Increase organic litter on top of the soil, and
- Improve root mass to enhance permeability.

Storage = Water is stored in the soil profile and in groundwater. Fixed site factors include soil depth, structure, and texture. Management objectives include:

- Desirable vegetation with healthy root systems to promote soil structure
- vVgetative cover and organic matter to help reduce excess evaporation

Beneficial Release = Water is released beneficially via increased subsurface flows and decreased overland flows, resulting in extended late-season flows and reduced erosion and sedimentation. Management objectives consist of having desirable, vigorous vegetation to reduce stream temperature and to promote capture and storage of water.

The overall objective is to moderate peak flows in the spring and to maintain late season flows. This is known as "taking the peak off the hydrologic curve," as shown in example below.



Vegetation is key to watershed health! Watershed health is key to water quality! Healthy vegetation in both the uplands and in the riparian areas improves soil conditions, which improves water infiltration and reduces soil erosion. This helps to capture, store and safely release water later in the season. Releasing water later in the summer reduces water temperatures in two ways. The first way is that a higher volume of water requires more energy to heat it. Secondly, infusion of groundwater, usually between 45 and 55°F, can help moderate stream temperatures and provide cold water refugia for aquatic life.

THREATS TO WATERSHED HEALTH

Noxious Weeds (see Appendix B)

Noxious weeds are a threat to native ecosystems, competing with native vegetation and changing forage availability for wildlife and livestock. Noxious weeds negatively impact watershed conditions, often leading to increased runoff and erosion[10]. Invasive plant species are also recognized as a serious threat to agriculture, impacting both livestock and croplands. Many landowners are actively controlling or eliminating infestations on their own lands.

Western Juniper[11][12][13][14][15]

Although western juniper is a native plant, the **expansion of western juniper** into rangelands is a primary watershed health concern. Crook County has more than 857,000 acres of juniper (covers over 50 percent of Crook County's rangeland). Juniper expansion has reduced vegetative ground cover, which has contributed to: increased overland flow, loss of topsoil, and sedimentation of streams during high intensity precipitation events. Juniper expansion is also changing vegetation communities and reducing forage availability for livestock and wildlife, in addition to increasing erosion potential. Juniper crowns intercept more than half of the annual precipitation (reduced capture), and juniper transpires water year-round compared to seasonal transpiration of other vegetation (reduced storage). Juniper woodlands have up to 10 times the erosion rate of sagebrush-grass ecotypes.

Juniper were naturally restricted to rocky ridges and cliffs where there was little grass to fuel fires. Juniper expansion is largely a result of fire suppression policies, although land management trends have also accelerated its expansion. Climate changes in the late 1800s (a period of cooler and wetter years) and grazing practices supported seedling establishment.

While juniper is recognized as valuable habitat for some wildlife species; Oregon's commitment to water quality must include effective control of juniper *expansion* because of the vegetative impact on sage grouse, mule deer, and small bird populations,

Increased Forest Canopy

Forests in the Management Area historically consisted of a diverse mosaic of uneven-aged trees; now they consist more of small trees growing close together. Increased forest canopy often reduces stream

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[10] Lacey, J.R., C.,B. Marlow, and J.R. Lane. Influence of spotted knapweed (*Centaurea maculosa*) on surface runoff and sediment yield. Weed Technol. 3:627-631. 1989

[11] Deboodt, Tim. Crook County OSU Extension Livestock Agent. Personal communication. 2003.

[12] Miller, R.F. and J.A. Rose. Historic expansion of *Juniperus occidentalis* (western juniper) in southeast Oregon. Great Basin Natur. 5591): 37-45. 1995.

[13] Miller, R.F., T.J. Svejcar, and J.A. Rose. Impacts of western juniper on plant community composition and structure. J. Range Manage. 53:574-585. 2000.

[14] Wall, T.G., R.F. Miller, and T.J. Svejcar. Juniper encroachment into aspen in the northwest Great Basin. J. Range Manage. 54:691-698. 2001.

[15] Owens, M.K., R. Lyons, and C. Kneuper. Evaporation and interception water loss from juniper communities on the Edwards Aquifer Recharge Area. Texas Agricultural Experiment Station and Extension Service Quarterly Report. April 2, 2001.

flows[16][17][18] due to factors such as increased evapotranspiration and the capture of precipitation by the forest canopy.[19][20]

Excessive or Inadequate Sediment

Erosion, sediment movement and deposition are natural watershed processes. Aquatic organisms have evolved with the local natural rate and pattern of erosion and sedimentation. Many streams in the Management Area have naturally high sediment loads due to geology, topography and climate characteristics. This is particularly true for the steeper portions of the basin. One of the most dramatic examples of sediment movement is runoff events associated with thunderstorms.

Land management activities and changes in land cover patterns can accelerate the natural erosion rate and alter the timing and amount of sediment delivered to streams. Primary human-related factors related to increased erosion and sedimentation on non-forest lands include: expansion of western juniper and noxious weeds, irrigation systems, roads, rural residential development, and agriculture. High sedimentation rates within Prineville Reservoir reduce photosynthesis in the reservoir, thereby reducing available food and habitat for fish. While excessive erosion is a concern in many areas of the basin, a lack of bedload and sediment transfer due to Bowman Dam at Prineville Reservoir is a concern for maintenance and restoration of riparian and channel conditions on the lower Crooked River. Due to the contruction of the Bowman Dam, the lower Crooked River is often faced with long periods of controlled high water flows (45 plus days) within the riverbanks instead of a flash flood system of an uncontrolled watershed. The long periods of high water flows is causing sediment issues which need to be addressed.

2.4.2 303(d) List of Impaired Water Bodies

Primary parameters of concern identified on the 303(d) list are temperature, pH, dissolved oxygen, bacteria, biological criteria and total dissolved gas (Table 3). Because data have been collected from relatively few sites, the 303(d) list may: 1) not accurately reflect the extent of water quality concerns in the Management Area, 2) over-emphasize water quality concerns, or 3) not reflect the capability to meet the state water quality criteria.

Table 3. Locations of exceedances of Oregon's Water Quality Criteria in the Management Area as listed on the 2010 list[2].

Subbasin	Streams	Year Listed
Lower Crooked River	Crooked River mouth to Baldwin Dam (Mile 0-51)	
	Temperature	1998
	E. coli	2010
	pH	1998
	Crooked River: Baldwin Dam to Prineville Reservoir (51-70)	
	Total dissolved gas	1998
	pH	2010
	Crooked River (0-124.4)	
	Biologial Criteria	2010
	Dissolved Oxygen – cool water	2010
	Canyon Creek (0-5.5)	

[16] Douglass, J.E, and W.T Swank. Streamflow and modification through management of eastern forests. USDA For. Serv. Res. Paper SE-94. Southeastern For. Exp. Sta. Asheville, N.C. 15 pp. 1972.

[17] Hornbeck, J.W., Martin, C.W. and C. Eagan. Summary of water yield experiments at the Hubbard Brook Experimental Forest, New Hampshire. Can. J. For. Res. 27:2043-2052. 1997.

[18] Books, R.T. and N. Lust, eds. *The Science of Managing Forests to Sustain Water Resources*. Special issue of Forest Ecology Volume 143. 2001.

[19] *Stream Corridor Restoration; Principles, Processes and Practices*. Federal Interagency Stream Restoration Working Group. October 1998.

[20] Bormann, F.H. and G.E. Likens. *Pattern and Process in a Forested Ecosystem*. Springer-Verlag, New York. 256 pp. 1979.

	Temperature	2004
	Dry River (0-91.9)	
	E. Coli	2010
	Hamilton Creek (0-1.7)	
	Temperature	2004
	Harvey Creek (0-1.4)	
	Temperature	1998
	Little Hay Creek (0-3.6)	
	Temperature	2004
	Little McKay Creek (0-6.7)	
	Temperature	1998/2004
	Marks Creek (0-17.1)	
	Temperature	1998/2004
	Marks Creek (7.5-17.1)	
	Biological Criteria	2010
	McKay Creek (0-19.5)	
	Temperature	1998/2002
	pH	2010
	McKay Creek (0-14.7)	
	E. coli	2010
	Mill Creek (0-11.5)	
	Temperature	1998/2002
	Mill Creek, East Fork (0-7.6)	
	Temperature	1998/2004
	Mill Creek, West Fork (0-4.9)	
	Temperature	1998
	Ochoco Creek (0-36.4)	
	Temperature	1998/2002
	E. coli.	2010
	Ochoco Creek (25.3-30)	
	Biological Criteria	2010
Upper Crooked River	Allen Creek (Mile 0-10.1)	
	Temperature	1998
	Bear Creek (0-34.3)	
	Biological Criteria	2010
	Temperature	1998/2002
	Cow Creek (0-7.2)	
	Temperature	2002
	Crazy Creek (0-3.5)	
	Temperature	1998
	Crooked River (0-124.4)	
	Biological Criteria	2010
	Dissolved Oxygen	2010
	Crooked River: Prineville Reservoir to North Fork Crooked R. (82.6-109.2)	
	Temperature	1998/2002
	pH	1998/2002
	Crooked River, North Fork (0-44.7)	
	Temperature	1998/2002
	Crooked River, North Fork (26.8-44.7)	
	Biological Criteria	2010
	Deep Creek (0-10.6)	
	Temperature	1998/2002
	Deep Creek (6.3-10.6)	
	Biological Criteria	2010
	Deer Creek above private reservoir to headwaters (0.9-4)	
	Temperature	1998
	Double Corral Creek (0-5.4)	
	Temperature	1998
	Fox Canyon Creek (0-6.8)	
	Temperature	2002
	Biological Criteria	2010

	Fox Creek (0-4.9)	
	Temperature	1998
	Gray Creek (0-6.7)	
	Temperature	1998
	Happy Camp Creek (0-6.7)	
	Temperature	1998
	Horse Heaven Creek (0-14)	
	Temperature	1998
	Howard Creek (0-9.5)	
	Temperature	1998
	Indian Creek (0-9.1)	
	Temperature	1998
	Jackson Creek (0-5.9)	
	Temperature	1998
	Klootchman Creek (1-5.3)	
	Temperature	1998
	Little Horse Heaven Creek (0-2.9)	
	Temperature	1998
	Little Summit Creek (0-10)	
	Temperature	1998
	Biological Criteria	2010
	Lookout Creek (0-1.5)	
	Temperature	1998
	Lytle Creek (0-4.2)	
	Temperature	1998
	Peterson Creek (0-10.7)	
	Temperature	1998
	Porter Creek (0-4.5)	
	Temperature	1998
	Biological Criteria	2010
	Shotgun Creek (0-5.9)	
	Temperature	1998
	Toggle Creek (0-5.3)	
	Temperature	2004
	Wickiup Creek (0-8.6)	
	Temperature	2002
	Wildcat Creek (0-4.3)	
	Temperature	1998
Beaver Creek/South Fork Crooked	Beaver Creek, South Fork (Mile 0-26.4)	
	Temperature	2002
	Beaver Creek (0-20)	
	Dissolved Oxygen – cool water standard	2010
	Begg Creek (0-2.2)	
	Temperature	2004
	Beaverdam Creek (0-10.8)	
	Temperature	1998/2004
	Dippingvat Creek (0-7.7)	
	Temperature	1998
	Dry Paulina Creek (0-13.1)	
	Temperature	1998
	East Wolf Creek (0-3.3)	
	Temperature	2004
	Powell Creek (0-12.7)	
	Temperature	1998
	Rager Creek (0-8.5)	
	Temperature	2004
	Roba Creek (0-7.2)	
	Temperature	1998/2004
	Biological Criteria	2010
	South Fork Crooked River (0-18)	
	Temperature	2002
	South Fork Crooked River (0-54)	

	Dissolved Oxygen – cool water standard	2010
	Sugar Creek (0-11.5)	
	Temperature	2002
	Twelvemile Creek (2.2-2.8)	
	Biological Criteria	2010
	Wolf Creek (0-17.l)	
	Temperature	2002
	Wolf Creek, North Fork (0-10.3)	
	Temperature	1998/2004
Note: River miles are measured from the mouth; the mouth is designated as Mile 0.		

2.4.3 Basin TMDLs and Agricultural Load Allocations

Total Maximum Daily Loads expected from DEQ for the Management Area have not yet been completed by DEQ. DEQ began work on TMDLs in the Management Area back in 2005, however they have not been completed due to lack of resources. At this point, DEQ does not have a schedule for resuming this work. The Area Plan will be the implementation plan for Agriculture's Load Allocation for each TMDL parameter in the Management Area, and may be revised to address TMDL requirements.

2.4.4 Beneficial Uses, Parameters of Concern, and Potential Water Quality Concerns

BENEFICIAL USES

The Federal Clean Water Act required states to designate beneficial uses related to water quality that must be protected for the public interest. These beneficial uses of water are codified in OARs and generally apply basin-wide to all waters of the state (Table 4). 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(10)).

Table 4. Beneficial uses (related to the Clean Water Act) in the Management Area (OAR 340-41-0130; date 2003).

Beneficial Use	Cooked River Mainstem	All Other Basin Streams
Public Domestic Water Supply[1]	**X**	**X**
Private Domestic Water Supply[1]	**X**	**X**
Industrial Water Supply	**X**	**X**
Irrigation	**X**	**X**
Livestock Watering	**X**	**X**
Fish & Aquatic Life[2]	**X**	**X**
Wildlife & Hunting	**X**	**X**
Fishing	**X**	**X**
Boating	**X**	**X**
Water Contact Recreation	**X**	**X**
Aesthetic Quality	**X**	**X**
Hydropower	**X**	

[1]With adequate pretreatment (filtration and disinfection) and natural quality to meet drinking water standards.
[2] Figures 130A and 130B in OAR 340-41-0130 indicate where specific salmonid Beneficial Uses are designated. All streams in the Crooked River watershed appear to be designated for "Salmon and Trout Rearing and Migration"; no streams are designated for "Salmonid Spawning".

Beneficial Uses Most Likely to be Adversely Affected

The focus of this Area Plan is to encourage the positive management of streams, riparian areas, and uplands to support beneficial uses of the water. Salmonids, resident fish, and aquatic life are the most sensitive beneficial uses for a number of water quality parameters (including temperature, sedimentation, turbidity, nutrients, pH, and dissolved oxygen). The bacteria standard protects the beneficial use of Water Contact Recreation.

Salmonids (includes salmon and trout)[21]

The Pelton-Round Butte Dam complex was completed in 1968 on the Deschutes River, below the mouth of the Crooked River. Before completion of the complex, summer steelhead, spring chinook salmon, bull trout and redband trout were historically present. The first formal fish surveys took place in the 1950s after substantial habitat and population declines had already occurred. Despite 75 years of major habitat changes, the 1952-54 surveys located steelhead up to 120 miles from the mouth of the Crooked River. Historical accounts indicate that most salmon and steelhead in the Upper Deschutes Basin historically spawned and reared young in the main tributaries: Crooked River, Wychus Creek, and Metolius River. The completion of the dam complex eliminated upstream passage of anadromous fish to the Crooked River Subbasin. However, the offspring of wild redband were reintroduced into the South Fork and are starting to naturally reproduce. It is also likely that wild redband have naturally repopulated the South Fork. The renovation of the Opal Springs hydroelectric facility in 1980 limited bull trout movement into the Crooked River from the Deschutes River. Starting in 2009 and continuing to the present, steelhead and Chinook salmon fry are annually released as part of the larger reintroduction effort in as a result of the relicensing the dam complex.

WATER QUALITY PARAMETERS OF CONCERN

Water quality conditions within the Crooked River Basin are highly variable, with higher elevation streams in the Ochoco Mountains generally having good to excellent water quality, and lower elevation sites having lower overall water quality[21]. Primary contributors to the poor water quality are related to land and water conditions such as: low summer flows, the existence of reservoirs and diversions, degraded upland and riparian vegetation, and stream channels that lack stable banks and connection with the floodplain. Land uses that can influence water quality in the basin include logging, roads, grazing, irrigated and non-irrigated agriculture, confined animal feeding operations (CAFO), recreation, urban and rural residential development, reservoirs, and seasonal sewage treatment plant activities.

The Department of Environmental Quality currently maintains two water-quality monitoring stations on the Crooked River, located at Lone Pine Road (30 miles above the mouth) and Conant Basin Road (92 miles above the mouth of the Crooked River and approximately six miles above Prineville Reservoir). Through 1993, DEQ monitored an additional station on the Crooked River at Highway 126 on the west edge of Prineville, 48 miles above the mouth. The US Forest Service and BLM monitor water quality on their lands in the Management Area. The Crooked River Watershed Council has been monitoring stream temperatures, bacteria, dissolved oxygen, and pH throughout the watershed.

Documented Water Quality Concerns

Section 303(d) of the Clean Water Act directs states to develop a list of water quality limited streams, which are streams that do not meet water quality standards and do not support their beneficial uses. This list is called the 303(d) list. The last 303(d) list was updated and finalized by DEQ in 2012. Information on the 303(d) list can be found at: *http://www.deq.state.or.us/wq/assessment/rpt2010/search.asp*

The Clean Water Act also directs states to develop Total Maximum Daily Loads (TMDLs) for 303(d)-listed streams. These TMDLs result in allocations of pollutant loads, e.g. degrees of temperature or

[21] *Crooked River Basin Characterization*. Crooked River Watershed Council. 2002.

tons/acre of sediment, to different sources such as private agriculture, urban areas, and federal lands. TMDLs have not yet been completed for the Crooked River Management Area.

Elevated summer temperatures

Oregon's temperature standard was revised in March 2004 and has several different temperature requirements (criteria), based on the type of aquatic use being supported[22]. Only one currently applies to the Management Area: waters supporting salmonid rearing and migration or other aquatic life should not exceed 64.4°F. No streams are currently designated in the Management Area for salmonid spawning, which has a criterion of 54.4°F. However, that will likely change in the lower Crooked River with the reintroduction of the steelhead. 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 criteria may be waived (340-041-0028(12).

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 coldwater 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 swimming, avoiding predators, etc. during thermal stress.

Stream temperatures are influenced primarily by direct solar radiation, air temperature, and movement of groundwater into streams[23]. Basic approaches to minimizing increases in water temperature include: provide shade where appropriate, keep the stream narrow, increase volume of water, and keep water flowing. Vegetation affects all these factors, and human activity, depending on the site, may have a direct influence on vegetation.

Elevated pH

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.) These conditions can be stimulated by the availability of nutrients, warm temperatures and light, which in turn may be exacerbated by low stream flows and lack of protective vegetative cover. DEQ monitoring at their two ambient sites indicates high concentrations of nutrients both during periods of low flow (little dilution) and during heavy precipitation (high runoff). Increased nutrient concentrations can affect both in-stream pH and dissolved oxygen.

Spawning and rearing of salmonid fish species are the most sensitive beneficial uses affected by pH. Values of pH outside the range in which a species evolved may result in both direct and indirect toxic effects. Elevated pH levels can cause dramatic increases in toxicity of other pollutants and cause fish kills.

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[22] *Oregon's 2010 Section 303(d) List of Water Quality Limited Waterbodies*. Oregon Department of Environmental Quality.

[23] Moore, J.A. and J.R. Miner. *Stream Temperatures: Some Basic Considerations*. Oregon State University Extension Service. EC 1489. May 1997.

The maximum pH criterion for the Deschutes River Basin is 8.5. The Crooked River drains the Ochoco Mountains and has similar geologically to the rest of eastern Oregon, which has a maximum pH criterion of 9.0. As part of the Total Maximum Daily Load (TMDL) process, the LAC believes that DEQ should raise the maximum pH criterion for the Crooked River Subbasin from 8.5 to 9.0, to reflect the local geology. Soil pH from the city of Prineville has been documented as high as 11.0 along the Crooked River. In order for the pH to be changed to correctly reflect the Crooked River Subbasin, the pH parameter listing will need to go through the TMDL process.

Elevated total dissolved gases
The mainstem Crooked River is listed for total dissolved gases from Baldwin Dam to Prineville Reservoir because of elevated saturation levels below Bowman Dam after periods of high flows. The way the water is released from the dam during high flows is the only believed source of this problem.

Elevated bacteria
High levels of bacteria can cause human illnesses. 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 also does not allow bacteria in numbers high enough to interfere with waters used for domestic purposes, livestock watering, irrigation, or other beneficial uses. *Escherichia coli (E. coli)* is one bacterial contaminant that is monitored as an indicator of fecal contamination. DEQ has established acute and chronic water quality criteria for *E. coli*. Potential sources of fecal contamination and *E. coli* include livestock manure, sewer or septic system leaks, urban stormwater runoff, waterfoul and wildlife waste. DNA source testing should be done for *E. coli* samples to identify where the source of *E. coli* is coming from.

Biological Criteria
Biological Criteria listings indicate waters that don't adequately support aquatic insects and similar invertebrates (benthic macroinvertebrates). These organisms are important as the basis of the food chain and are very sensitive to changes in water quality. To assess a stream's biological health, the community of benthic macroinvertebrates is sampled and compared to the community expected if the stream were in good shape ("reference community"). If the difference is too great, the stream section is designated as 'water quality limited.' This designation does not identify the limiting factor (e.g. sediment, excessive nutrients, temperature).

POTENTIAL WATER QUALITY CONCERNS

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

Three other factors related to fish habitat can influence water quality. **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, and reduced dissolved oxygen. Slow-moving streams may be more susceptible to warming and they are less turbulent, all of which can contribute to reduced oxygen levels. **Modification of physical habitat** can harm all aquatic life. Historical channelization reduced the amount of habitat (stream length is 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. In addition, **drought** conditions have been a contributing factor for the decline of fish habitat in the Crooked River Management Area. Habitat throughout the basin has been improving in some locations because of numerous fencing and habitat restoration projects, improvements to irrigation diversions and improved grazing management on both private and public lands.

In September 2011, DEQ published the Deschutes Basin Water Quality Status and Action Plan[24]. It discusses water quality concerns and emphasizes the following actions related to agriculture:

1. Surface Water Actions
    a. Reduce temperatures, improve flow volume and patterns, and improve habitat through:
        - Better land management and conservation
        - Increasing native, streamside habitat
        - Improved water conservation
        - Increased instream flows
        - Channel restoration
        - Juniper reduction
        - Combating invasive weeds
    b. Reduce erosion and nutrient and pesticide levels in water through better land and crop management
2. Groundwater Actions
        - Minimize nitrate contamination from agriculture
        - Assess effects of groundwater pumping and irrigation efficiency projects on stream flows
        - Assess cause, extent and magnitude of risks associated with bacteria in groundwater

The LAC believes that the Deschutes Watershed Action Plan as it addresses the Crooked River Basin is limited in its available data and reference to agriculture activities and influences.

2.4.5 Sources of Impairment

Sources of water pollution can be generalized into two types: point source pollution and nonpoint source pollution. Point source pollution emanates from clearly identifiable discharge points such as wastewater treatment plants, piped effluent from industrial operations and other discrete conveyances. Permits are required for significant point source discharges. These permits, administered by DEQ, require that certain effluent standards be met or require a zero discharge level. Certain Confined Animal Feeding Operations (CAFO) require permits, which are administered by ODA.

Nonpoint source pollution is pollution emanating from landscape scale sources and cannot be traced to a single point. Agricultural operations are concerned with preventing or controlling pollution from nonpoint sources and concentrated runoff from these sources. Nonpoint sources of pollution in the Crooked River watershed may include eroding agricultural and forest lands, eroding streambanks, runoff and erosion from roads and urban areas, and runoff from areas used by livestock and other agricultural operations. Pollutants from nonpoint sources are carried to the surface water or groundwater through the action of rainfall, snowmelt, irrigation and urban runoff, and seepage. Runoff from nonpoint sources can concentrate into identifiable sources entering waterways as point sources.

A major nonpoint source of water quality impairment is heat input that results in high water temperatures. Water temperature naturally fluctuates with air and soil temperatures on a daily and seasonal basis, however, temperature increases may be caused by both natural and man-caused events resulting from vegetation removal, low seasonal flows, changes in channel shape and alteration to the floodplain (among others). Channelization or alteration of stream courses can alter gradient, width/depth ratio and sinuosity, causing sediment and temperature increases.

[24] Deschutes Basin Water Quality Status and Action Plan. www.deq.state.or.us/wq/watershed/Docs/DeschutesPlan.pdf

While there may not be severe impacts on water quality from a single source or activity, the combined effects from all sources may contribute, along with impacts from other land uses and activities, to the impairment of beneficial uses of the Crooked River.

2.5 Prevention and Control Measures

Area Rules (OAR 603-095-3400 through 603-095-3460) complement the voluntary strategies. ODA pursues 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.

All landowners conducting agricultural activities on non-Federal and non-Tribal Trust lands (including timber lands) must comply with the Area Rules (OAR 603-095-3400 through 603-095-3460). '*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. Sanctions can come into effect from ODA if a landowner is out of compliance with the Area Rules.

Effective dates of the Area Rules vary, depending on current State Law and on the ease with which compliance with these Area Rules can be attained. For example, landowners were allowed until the year 2009 to comply with the Streamside Riparian Area Management Rule because most of these changes take time and may require planning and implementation of management changes. However, landowners are encouraged to take current action in adapting their management techniques so they can control the conditions on their property.

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

AREA RULES

<u>Oregon Administrative Rules 603-095-3440</u>

(1) Landowners must comply with OAR 603-95-3440(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.

(2) Streamside Riparian Area Management

(a) Effective January 1, 2009, agricultural management must allow establishment, growth, and active recruitment of streamside riparian vegetation, consistent with site capability, to moderate solar heating, stabilize streambanks, and filter sediment and nutrients from overland flows.

(b) Except as provided in (a), grazing, weed control, and other common agricultural activities are allowed in riparian areas.

(c) Water gaps and hardened crossings are allowed in streams that otherwise meet conditions required under (a).

(3) Waste Management

Effective on rule adoption, no person subject to these rules shall violate any provision of ORS 468B.025 or ORS 468B.050.

AREA RULE ENFORCEMENT

In addition to the voluntary strategies, Area Rules (OAR 603-095-3400 through 603-095-3460) are included as an implementation strategy; ODA uses enforcement where appropriate and necessary to gain compliance with the Area Rules. Any enforcement action is pursued only when reasonable attempts at a voluntary solution have failed. ODA seeks input from the local SWCD prior to evaluating conditions for compliance or requiring a schedule of corrective practices. ODA will consult with the local SWCD regarding appeals and requests for alternate measures provided by ORS 568.912 and OAR 603-090-0040 and 0050. The following Area Rules provide for resolution of complaints.

ODA is required to make a reasonable attempt to notify the landowner that entry of property is necessary prior to entering. ODA will not enter private property to collect information without landowner consent or a search warrant, except as provided by state and federal law.

<u>Complaints and Investigations (OAR 603-095-3460)</u>

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

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

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

(4) The department will evaluate or investigate a complaint filed by a person under section OAR 603-095-3460(3) if the complaint is in writing, signed and dated by the complainant and indicates the location and description of:

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

(b) The property allegedly being managed under conditions violating criteria described in ORS 568.900 to 568.933 or any rules adopted thereunder.
(5) As used in section OAR 603-095-3460(4), "person" does not include any local, state or federal agency.
(6) Notwithstanding OAR 603-095-3460, the department may investigate at any time any complaint if the department determines that the violation alleged in the complaint may present an immediate threat to the public health or safety.
(7) If the department determines that a violation of ORS 568.900 to 568.933 or any rules adopted thereunder has occurred, the landowner may be subject to the enforcement procedures of the department outlined in OARs 603-090-0060 through 603-090-0120.

2.5.1 Waste Management Rule

The Waste Management Rule currently is 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.

This rule ensures that concentrated nutrients, pathogens associated with high animal density areas, high sediment concentrations in run-off, toxics, or other potential pollutants are not readily transported to waters of the state.

Wastes associated with livestock operations can include manure from seasonal feeding and birthing areas, gathering areas and corrals, rangelands and pasture, and any other situations not already covered by Oregon's Confined Animal Feeding Operation (CAFO) laws. Fecal coliform counts that exceed state water quality criteria indicate noncompliance with the Waste Management Rule. Livestock grazing is allowed to the extent it does not violate state water quality standards and complies with the Area Rules. Compliance with the Streamside Riparian Area Management Rule will help keep wastes from being carried into waters of the state.

Wastes may also include excess sediment discharges. Landowners who are actively discharging significant quantities of sediment may be in violation of the Waste Management Rule.

2.5.2 Streamside Area Management Rule

The Streamside Riparian Area Management Rule requires activities that prevent streamside riparian vegetation from developing to cease by 2009; it does not require that adequate vegetation be present by 2009. The rule does not specify particular activities that must cease and does not require any specific activity to take place. Landowners are not responsible for wildlife browsing and grazing use.

This Rule does not require that all sediment be kept out of streams by 2009. This rule refers to the filtration of sediment caused by human activities, not sediment resulting from natural processes.

Sufficient vegetation to filter out sediment also helps reduce the amount of bacteria and nutrients entering streams.

2.5.4 Beneficial Management Practices and Management Intent: Healthy, Productive Riparian Areas; Healthy, Productive Uplands; Properly Managed Croplands; and Properly Managed Livestock

Voluntary efforts are the primary means to prevent and control agricultural sources of water pollution. Landowners in the Management Area are generally aware of water quality concerns and appropriate practices to address those concerns. Many landowners are actively implementing projects to improve upland and riparian conditions.

SWCDs are the main support agencies at the local level. The NRCS, Crooked River Watershed Council, Crook County Weed Board, Oregon State University Extension Service and Central Oregon Agricultural Research Center, Deschutes Resources Conservancy, Oregon Watershed Enhancement Board (OWEB), ODA, DEQ, Oregon Water Resources Department (WRD), Oregon Department of Fish & Wildlife, ODF, US Forest Service, Bureau of Land Management (BLM), United State Department of Agriculture Farm Service Agency (USDA FSA), 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 problems on their own, or they may choose to develop a voluntary conservation plan (e.g. an NRCS-approved farm 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 land conditions may include area precipitation patterns, soil types, stream channel morphology, upland topography, wildlife, and invasive plants.

The LAC would like to see a priority placed on development and promotion of economic benefits of juniper control. This would encourage landowners to manage or control juniper, thereby improving watershed health.

To help achieve water quality standards in the Management Area, an effective strategy should result in:

- **Healthy, productive riparian areas**
- **Healthy, productive uplands**
- **Properly managed croplands**
- **Properly managed livestock**

Site capability is a key concept for vegetation management. *Site capability* is the vegetative condition that can be expected at any given site, based on site potential and human infrastructure. *Site potential* is the highest ecological status of vegetation that an area can attain. Site potential is influenced by physical and biological factors such as elevation, aspect, geology, climate, wildlife, and the current plant community. It is also influenced by disturbances found in riparian systems, 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.

Proper Functioning Condition (PFC)[25] is a familiar concept to many landowners in the Management Area. A stream at PFC can withstand a 25-year storm event without excessive bank erosion. Streams at PFC are likely to provide most if not all of the functions required to help achieve water quality standards.

A stream is considered to be at PFC when adequate vegetation, landform, or large woody debris is present to:

- Dissipate stream energy associated with high waterflow, thereby reducing erosion and improving water quality;
- Filter sediment, capture bedload, and aid floodplain development;
- Improve flood-water retention and ground-water recharge;
- Develop root masses that stabilize streambanks against erosion;
- Develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and
- Support greater biodiversity.

1. Healthy, Productive Riparian Areas

Healthy riparian areas have appropriate vegetation and stable streambanks. Depending on site capability, these streams also have sufficient structure such as rock and large woody debris to reduce flow velocities and reduce the damage from flooding.

Riparian Vegetation

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

Riparian vegetation helps:

- Minimize streambank erosion by increasing the cohesiveness and structural strength of streambanks and by reducing flow velocities,[26][27][28]
- Moderate summer water temperature,[29][30]

[25] *Riparian Area Management: A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas*. TR 1737-15. BLM. 2015.

[26] Green, T.R., S.G. Beavis, C.R. Dietrich, and A.J. Jakeman. Relating stream-bank erosion to in-stream transport of suspended sediment. Hydrological Processes 13:777-787. 1999.

[27] Selby, M.J. *Hillslope materials and processes*. Oxford University Press, Oxford. 1982.

[28] Abernathy, B., and I.D. Rutherford. Where along a river's length will vegetation most effectively stabilize stream banks? Geomorphology 23:55-75. 1998.

[29] Beschta, R.L. Riparian shade and stream temperature; an alternative perspective. Rangelands 19:25-28. 1997.

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

- Maintain later season flows by increasing the ability of the adjacent soils to store water during runoff seasons,[31][32][33]
- Filter out and process excess nutrients, bacteria, and sediment in runoff that could pollute adjacent streams.[34][35][36][37]

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 potential.
- Include plants that have root masses capable of withstanding high streamflows.
- 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.
- Provide shade, where allowed by site capability.

Riparian vegetation required by the Area Rules is based on site capability and includes: visible ongoing renewal of riparian vegetation, vigorous growth, and the maintenance of a majority of each year's new growth of woody vegetation (trees and shrubs). Noxious weeds are undesirable as they generally provide: less shade, filtering capacity, and less stabilizing root mass than the plants they replace as well as decreasing economic output Native vegetation is preferred where practical, due to its integral role within the ecosystem.

Stable Streambanks

A stream is considered stable if its banks maintain their integrity during a 25-year storm event. Channel morphology is key to streambank stability.[38][39]

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, how deeply cut ("incised") the stream is, etc. Morphology is influenced by natural features such as geology and weather and by human activities.

Vegetation and structure (rocks and large woody debris) are key to maintaining bank stability by reducing flow velocities and protecting streambanks from excessive erosion.

As riparian vegetation matures, channels of low gradient streams are expected to narrow and deepen (known as a 'low width to depth ratio'). These stream channels will have less water surface area

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[31] Auble, G.T., J.M. Friedman, and M.L. Scott. Relating riparian vegetation to present and future streamflows. Ecological Applications 4:544-554. 1994.

[32] Hirschi, M., R. Frazee, G. Czapar, and D. Peterson. *Sixty ways farmers can protect surface water*. North Central Regional Pub. 589. University of Illinois, Urbana, IL. 1997.

[33] Whiting, P.J., and M. Pomeranets. A numerical study of bank storage and its contribution to streamflow. Journal of Hydrology 202:121-136. 1997.

[34] Godwin, D. and J.A. Moore. *Manure management in small farm livestock operations: Protecting surface and groundwater*. Extension Bulletin EM 8649. Oregon State University Extension Service. Corvallis, OR. 1997.

[35] Munoz-Carpena, R., J.E. Parsons, and J.W. Gilliam. Modeling hydrology and sediment transport in vegetative filter strips. Journal of Hydrology 214:111-129. 1999.

[36] Castelle, A.J., A.W. Johnson, and C. Conolly. Wetland and stream buffer size requirements: A review. Journal of Environmental Quality 23:878-882. 1994.

[37] Hjelmfelt, A. and M. Wang. Modeling hydrologic and and water quality responses to grass waterways. Journal of Hydrologic Engineering 4:251-256. 1999.

[38] Rosgen, D.L. *Applied River Morphology*. Wildland Hydrology. 1996.

[39] *Riparian Area Management: Process for Assessing Proper Functioning Condition*. Bureau of Land Management. Technical Reference 1737-9. 1993.

exposed to solar radiation (thereby moderating 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, reducing velocities during periods of high streamflow, and increasing releases of water later in the year. Streams with a low width to depth ratio will also meander more, which will reduce flow velocities and reduce the damage from flooding.

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.

Management options that may contribute to healthy riparian areas include:

1) Proper management of upland vegetation.
2) Use of herding and/or fencing to better control livestock access to riparian areas.
3) Off-stream watering areas for livestock.
4) Early-season flood irrigation to recharge groundwater and sub-surface water storage that help augment late season stream flows.
5) Control of noxious weeds.
6) Timing of livestock grazing to allow recovery of riparian vegetation
7) Planting of willows and other riparian shrubs.
8) Maintain a vegetative buffer along creeks.
9) Proper design, location, installation and maintenance of roads, culverts, bridges, stream crossings and upstream storage systems.
10) Leave large, woody debris in streams if possible.
11) Proper use of grade control structures.

2. Healthy, Productive Uplands

Approximately 40 percent of the uplands in the Management Area are privately owned.[40] The Management Area receives little precipitation and experiences prolonged droughts. Upland sites in good condition may naturally include sparsely vegetated areas.

With a protective cover of grass, shrubs or trees consistent with site capability, uplands 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.[41]
Indicators of healthy uplands include:

- Healthy riparian areas,
- Recruitment of beneficial plant species,
- Ground cover to aid in infiltration of water and to limit runoff of nutrients and sediment,
- Lack of noxious weeds.

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

[40] Dedrick, Jason. Crooked River Watershed Council Coordinator. Personal communication. 2003.
[41] Interpreting Indicators of Rangeland Health, NCRS Technical Reference 1734-6. Available at: ftp://ftp.ftw.nrcs.udsa.gov/pub/glti/IntIndRangeHealth.pdf

Factors to evaluate upland area condition may include:

- Plant species composition to measure plant health and diversity.
- Ground cover (live plants, standing plant litter, or ground litter) as a measure of potential erosion. Bare areas are a natural condition in many places.
- Evidence of overland flow (e.g. rills and gullies).
- Site productivity (domestic livestock and wildlife carrying capacity).
- Riparian area health and condition.

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

- Minimize bare or exposed soil. Based on site capability, soil surface should be occupied by herbaceous vegetation, shrubs, and/or trees.
- Presence of soil organic matter (litter and biotic crust) and rock.
- 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 stand density is site-specific.
- Healthy stands of perennial grasses are usually better at filtering sediments and limiting erosion than stands of annual grasses.

Management options that may contribute to healthy uplands include:

- Thinning of overstocked stands of trees, including juniper,
- Controlled burning,
- Seeding of perennial grass plants,
- Livestock grazing designed to maintain or improve vegetation and encourage the incorporation of organic matter into the soil,
- Control of noxious weeds,
- Well-designed off-stream water aimed at improving grazing distribution of livestock.

3. Properly Managed Croplands

Diversion of water from a water body to be applied on land to grow crops is a recognized beneficial use of water. Irrigation water use is regulated by the WRD in the form of water rights, which specify the rate and amount of water that can be applied to a particular parcel of land. Water rights are not addressed in this Area plan; they are under the jurisdiction of the WRD (refer to WRD Rules OAR 690-300-0010 for more details).

Irrigation in the Management Area is done by flooding, sprinkler, or drip application. Water usually is diverted from a surface source (stream or pond) but may also be from groundwater sources. Irrigation water is often used more than once as it returns to the stream and is available for instream uses or by other irrigators.

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

Characteristics of an irrigation system that has minimal effect on water quality include:

- Delivery of water efficiently to the land within legal water rights,
- Minimal overland return flows that do not carry sediment, farm chemicals, or excess nutrients to a stream,
- Scheduling of water application appropriate to the site including consideration of soil conditions, crop needs, weather and topography,
- Applied nutrients do not leach to groundwater in unacceptable amounts.

Management options for croplands that may protect water quality may include:

- Cropping
  - Properly place, design, and maintain roads, culverts, bridges, and crossings,
  - Use conservation tillage: reduced tillage, direct seeding, subsoiling, and chemical fallow,
  - Plant annual and perennial cover crops,
  - Farm on the contour: strip cropping, divided slopes, terraces, contour tillage,
  - Select crops that hold soil in place and enhance a crop rotation,
  - Create and maintain sediment basins and vegetative buffer strips: riparian buffers, filter strips, grassed waterways, field borders, contour buffer strips, interception ditches,
  - Control weeds.
- Irrigation
  - Schedule irrigation based on crop needs, soil type, weather, topography, and infiltration rates,
  - Improve irrigation efficiency,
  - Select, locate, maintain, and operate diversions to minimize effects on water quality,
  - Minimize return flows through the use of cover crops, straw mulch, and grass filter strips,
  - Install backflow devices ("check valves"),
  - Grade and slope property to retain runoff whenever possible,
  - Manage vegetation: burning, chemical, clipping, critical area planting,
  - Stabilize ditch banks (structural and bioengineering),
  - Install outfall protection to reduce erosion at culverts,
  - Size ditches appropriately to handle maximum flows.
- Crop Nutrients and Farm Chemicals
  - Apply nutrients based on plant needs through water, soil, and tissue testing,
  - Use Integrated Pest Management.

4. Properly Managed Livestock

Ranches of various sizes, including small noncommercial operations, should be able to support healthy livestock. Careful management of areas used for grazing, feeding and handling is useful to the success of livestock operations, and these areas have the potential to affect water quality.

Livestock management can be done in a manner that limits soil erosion and minimizes the delivery of sediment and animal wastes from drylots and pastures to nearby streams or irrigation conveyances. A proper grazing management program promotes and maintains adequate vegetative cover for protection of watershed health.

Management options for livestock that may protect water quality include:

1. Managed grazing: livestock distribution; grazing intensity, duration, frequency, and season of use,
2. Maintain riparian vegetation along streams and filter strips along canals and ditches,
3. Use of fencing: temporary, cross, and/or riparian,
4. Manage livestock watering,
5. Provide salt, minerals, and shade away from streams,
6. Manage livestock wastes properly,
7. Manage runoff from irrigated pastures,
8. Harrow irrigated pastures if needed,
9. Use or compost organic wastes.

Chapter 3: Measurable Objectives and Strategic Initiatives

Mission

Promote cost-effective agricultural management practices through education and voluntary implementation that maintain or enhance water quality in the Crooked River Management Area.

Goal

To prevent and control water pollution from agricultural activities and soil erosion and to achieve applicable water quality standards.

3.1 Measurable Objectives

Measurable Objectives are being developed to measure progress and effectiveness of Oregon's efforts to protect and improve agricultural water quality. The intent is to show that Oregon agriculture is improving water quality and the state and federal financial investment in agricultural water quality improvements are paying off and showing measurable results. Measurable Objectives need to be specific, measurable, achievable, relevant, and time-bound.

3.1.1 Basin / Management Area Measurable Objectives

ODA, the Crooked River LAC, and the Crook County SWCD will develop basin-wide measurable objectives over the next biennium. At future biennial reviews, ODA, Crook County SWCD, and the Crooked River LAC will evaluate progress towards the Measurable Objective (and associated Milestones and Timelines) and use an adaptive management approach to modify the milestones and objectives, if needed.

Many projects have been implemented in the basin. The LAC, Crook County SWCD, and ODA will work together to collect baseline data, analyze that data, and then develop measurable objectives.

3.1.2 Focus Area Measurable Objectives

Dry River (Canyon) Focus Area Measurable Objectives

Dry River (Canyon) area was identified within the Management Area, where the Crook County SWCD will focus voluntary outreach and technical assistance work for the next two years.

- By January 1, 2018 or as resources allow, Central Oregon Irrigation District (COID) Watershed Council, and LMA will compile data that identifies:
    - Cubic Feet Per Second (CFS) of tailwater entering the Crooked River from Dry River (Canyon) (presence, absence, and how much). No direct point sources as the water is irrigation owned and therefor solely used for agriculture. COID tracks flow data.

Measureable objectives, milestones, and timelines were be established for Focus Area. ODA and the LMA will report back to the LAC on the status of land conditions, and outreach and technical assistance efforts in the area, at the 2016 biennial review.

- By the 2016 biennial review, the LMA will report back to the LAC and ODA on information about the number and size of water quality improvement projects status in the focus area since area plan and rules adoption, including where landowners accepted voluntary assistance, as resources allow.
- By the 2020 biennial review, in conjunction with appropriate partners, the LMA will have offered technical assistance, to landowners in the focus area with lands where agricultural activities appear to be impacting Dry River (Canyon), as resources allow.
- By July 1, 2020, the LMA will complete a follow-up assessment in the area and evaluate land condition changes.

- **Measurable Objective:** The LAC, SWCD, and ODA will work on developing a Measureable Objective over the next two years.
- Once pre-assessment is completed, the LMA will develop implementation strategies and objectives that decrease agricultures impact on water quality.

The above measurable objectives, milestones, and timelines are subject to change based on Assessment and available resources. See section 4.2.1 for current conditions and results in Focus Area.

The LAC would like to see Focus Areas given a higher priority for funding opportunities through state agencies.

3.2 Strategic Initiatives

3.2.1 Focus Area

The current Focus Area for this Management Area is the Dry River Canyon. The Crook County SWCD developed an Action Plan for the current biennium, approved by ODA, that outlines the key components of the Focus Area process.

The overall method is to locate the direct sources of input/concern, and minimize to the extent practicable, irrigation run-off to enter waters of the state. The Crook SWCD hopes to improve the "water quality parameters of concern" by working with landowners to reduce the amount of agriculture tail water entering the canyon, reducing *E.coli* and nitrate levels while also decreasing temperature. After the pre-assessment phase where water quality monitoring parameters are collected and analyzed and site or structure potential is found, the Crook SWCD will be able to determine a reachable objective for percentage of decreased flows, bacteria, sediment, and temperature figures. The best use practice (i.e. wetland, reclamation structure, etc.) and construction location will then be determined for implementation phase.

Water temperature, E.coli, nitrate, phosphorus, and flow levels have been monitored using CRWC's water quality monitoring parameters and protocol, which coincide with DEQ's specifications. The work was conducted by CRWC's monitoring specialist and the Crook SWCD. Aerial photography, irrigation right allocations, and maps from COID were used to help prioritize monitoring locations. There are currently monitoring stations within the canyon that COID manages that are equipped with remote sensing capabilities that can monitor flow levels. As an essential partner, COID has conducted the flow monitoring within the Dry Canyon at most locations from 2011.

Average daily flow of tailwater within Dry River Canyon has been monitored. COID will continue to monitor these flows as monitoring tail water flows will be the most effective management tool for all partners wanting to see an actual decrease within Dry River Canyon. Tail water is qualitatively different than natural flows (rivers, streams, springs, runoff, etc.) within other watershed systems. Most tail water comes from irrigation runoff that then enters back into irrigation ditches and canals, or can be captured in natural systems as well. For this particular watershed, tail water is the most constant source of water where flow and water quality parameters can be measured. Most importantly, irrigation tail water is a measurable flow that can be managed with certain infrastructure and education where natural flows are usually uncontrollable. The Dry River Canyon is NOT a "live" stream, but can contribute significant amounts of tail water to the Lower Crooked River; measuring that flow will quantify the water quality data more appropriately than riparian vegetation in this watershed, part of their contribution to finding a solution.

The Crook County SWCD will report the results to ODA at the end of each fiscal biennium via the Action Plan. As part of the next Biennial Review, ODA will summarize the results in Chapter 4, discuss and

evaluate progress with the LAC, and use adaptive management to adjust implementation strategies if needed. See section 4.2.1 for measurable objectives, current conditions, and results in Focus Area.

3.2.2 Strategic Implementation Area (SIA)

ODA is implementing a SIA approach in Oregon to help prevent and control water pollution from agricultural activities by working with agricultural landowners and natural resources partners in small watersheds. SIAs are priority areas where ODA identifies and assists those who may need help complying with water quality regulations. Through SIAs, ODA systematically conducts agricultural water quality outreach, measures land condition changes over time, and conducts compliance efforts that may lead to enforcement.

ODA completed a characterization for watersheds at the 6th field hydrologic unit code (HUC) level statewide on agricultural lands. This characterization calculates scores for temperature, bacteria, nutrients, sediment, and aquatic species of concern (salmonid species and other native aquatic species endemic to Oregon) for each 6th field HUC with surface water and agricultural land. The scores are combined for comparison and allow ODA to identify high priority 6th field watersheds to be considered for SIAs in the 2015-2017 biennium.

Currently, there are no SIAs in the Management Area.

3.3 Strategies and Activities

To the greatest degree possible, prevention and control of agricultural pollution is encouraged in a cooperative spirit through the voluntary efforts of landowners, aided by information and technical and financial assistance from local, state, and federal agencies, and others.

Education is the key to the success of this Area Plan. Groups and agencies work together to provide landowners in the Management Area and the interested public with information about the goals and objectives of the Area Plan and requirements of the Area Rules.

To protect or improve water quality, an effective strategy must increase awareness of the problems and the range of potential solutions, motivate appropriate voluntary action, and provide for technical and financial assistance to plan and implement effective water pollution prevention and control measures. The SWCD(s) and other partners will cooperate to implement the following strategies at the local level with landowners:

- Provide landowners with information and technical and financial assistance to minimize agriculture's contribution to water quality concerns.
- Pursue and identify cost-effective juniper-control and range improvement projects to improve watershed health.
- Continue to include landowners, land managers, and the communities in the revisions and implementation of the Area Plan and associated Area Rules.
- Inform the general public about how agriculture benefits the community.
- Inform members of the community of everybody's effects on water quality within the Management Area.

3.3.1 Community and Landowner Outreach

Create a high level of awareness and an understanding of water quality protection among the agricultural community and general public, in a manner that minimizes conflict and encourages cooperative efforts, through education and technical assistance.

a. Incorporate Area Plan implementation as a priority element in the SWCDs' Annual Work Plans and Long Range Plans, with adequate funding and staff and support from partner organizations.

b. Inform landowners of the Area Plan and Rules.
c. Showcase successful strategies and systems.
d. Recognize successful projects and strategies through appropriate media and newsletters.
e. Conduct educational programs to promote public awareness of water quality issues and their solutions.
f. Offer and provide site evaluations on any lands within the Management Area to assess conditions that may affect water quality.
g. Prioritize subwatersheds within the Management Area for targeting implementation strategies.

3.3.2 Conservation Planning and Conservation Activities

Maintain or improve the quality of water in the Management Area through planning and implementation of technically sound and economically feasible conservation strategies (see 2.5.4) that contribute to meeting Area Plan objectives.

3.3.3 Funding

Identify funding sources to achieve Area Plan goals and objectives. Where possible, combine or build-in private-entity revenue-generating aspects of projects to extend benefits from funding sources and create sustainable jobs in the local economy.

Costs of implementing this Area Plan are difficult to assess in the absence of detailed, site-specific inventories of resource problems and quantification of nutrient and sediment loadings and other water quality issues of concern.

To implement this Area Plan, the SWCDs need support and resources for staff to conduct the following:

- Educational programs (production and presentation),
- Identification of high priority areas for implementation,
- Ongoing evaluation of Area Plan progress toward achieving water quality goals,
- Coordinated planning and implementation activities with other agencies, organizations, and individuals working on similar goals,
- Watershed assessments,
- Water quality monitoring,
- Meeting management and facilitation.

Landowners may need financial and technical assistance to meet Area Plan objectives and Area Rule requirements. Technical and cost-sharing assistance for installation of certain management practices may be available through current USDA conservation programs such as Environmental Quality Incentive Program (EQIP) and Continuous Conservation Reserve Program (CCRP), and other programs such as the EPA's nonpoint source implementation grants and the OWEB. Other agencies may also be available to provide technical assistance or financial assistance to private landowners.

3.4 Monitoring and Evaluation

A monitoring program is being developed by ODA and its partners and implemented as funding becomes available, to:

- Track Area Plan implementation and compliance with the Area Rules,
- Evaluate Area Plan effectiveness (improvements in water quality and land conditions).

The Oregon Department of Environmental Quality and the Crooked River Watershed Council (CRWC) conduct water quality monitoring in the management area. DEQ currently collects data at two sites in the area as part of its statewide ambient water quality monitoring network. These sites are on the main stem

Crooked River at Conant Basin Road (river mile 89.4) and Lone Pine Road near Terrebonne (river mile 29.5).

The CRWC has monitored water quality for the purpose of long term trend analysis and to guide project priorities in the watershed. Thirty-two sites were monitored at least once monthly from April through October 2010 through 2014. Field measurements for temperature, pH, turbidity, conductivity, and dissolved oxygen are taken, and lab samples for *E. coli*, nitrate, and total phosphorous were collected. Continuous stream temperature was also collected at these sites, logging the stream temperature every hour. Water quality sampling was designed to be expansive enough to provide both reach trend and basin scale information. Site selection consideration for reach trend analysis includes adjacent land management practices, impoundments, channel morphology, and stream inputs. Sample points bracket areas delineated by these conditions, allowing trend or impact in the target reach to be observed. The aggregation of extensive sample point and reach trend information collected in the watershed is used to provide partners with a basin scale understanding of water quality conditions

Data from 2004 through 2014 are available on the CRWC's website at http://www.crwc.info/. The site includes continuous temperature data and an interactive map that allows visitors to view station information and sort or graph data by parameter and location.

Monitoring is encouraged for landowners who want to document improvements in their riparian vegetation and stream conditions. Those wishing to do so should contact their local SWCD or watershed council. Photomonitoring (keeping a record with photographs) is a simple and effective method.

For monitoring water quality, the Oregon Plan for Salmon and Watersheds' *Water Quality Monitoring Technical Guide Book* (July 1999) is the preferred reference manual; however, other protocols also can be obtained from the local SWCDs or watershed councils. Specific monitoring protocols depend on the condition being assessed.

Due to the importance of data gathered from water quality monitoring it is imperative for funding to be available to track water quality data and trends throughout the Management Area.

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

Chapter 4: Implementation, Monitoring, and Adaptive Management

4.1 Progress Toward Measureable Objectives

4.1.1 Basin / Management Area Measurable Objectives

ODA, the Crooked River LAC, and the Crook County SWCD will develop basin/management area measurable objectives over the next biennium. At future biennial reviews, ODA, Crook County SWCD, and the Crooked River LAC will evaluate progress towards the Measurable Objective (and associated Milestones and Timelines) and use an adaptive management approach to modify the milestones and objectives, if needed.

4.1.2 Focus Area Measureable Objectives

Dry River (Canyon) Focus Area Measurable Objectives

- By July 1, 2013, a small geographic area will be identified within the Management Area, where the Crook County SWCD will focus voluntary outreach and technical assistance work for the next two years. – **COMPLETED**
- By January 1, 2015 or as resources allow, Central Oregon Irrigation District (COID), Watershed Council, and LMA will complete an assessment that identifies:
  - Cubic Feet Pert Second (CFS) flow entering the Crooked River from Dry River (Canyon) (presence, absence, and how much), - **COMPLETED**
  - Acres of noxious weeds located within the Assessment Area, - **COMPLETED**. The CRWMA completed weed mapping and treatment in 2015 of the 10 mile stretch of canyon above the Crooked River to include the county "A" listed weeds, Yellow Flag Iris and Yellow star thistle.
  - Identify critical water quality parameters (temperature, *E. coli*, nitrate, phosphorus, dissolved oxygen, conductivity, turbidity, salinity, and pH,), - **COMPLETED.** CRWC has lost all water monitoring funds. COID tracks flow. We have changed to FAAP due to the only resolution is to prevent water entering Crooked River so the water quality parameters were determined unnecessary.
  - Identify all sources of possible pollutants including agricultural, point sources, natural, etc. – **COMPLETED.** No direct point sources as the water is irrigation owned and therefor solely used for agriculture.

  Measureable objectives, milestones, and timelines were established for the Focus Area. ODA and the LMA will report back to the LAC on the status of land conditions, and outreach and technical assistance efforts in the area, at the 2016 biennial review.

- By the 2016 biennial review, the LMA will report back to the LAC and ODA on information about the number and size of water quality improvement projects status in the focus area since area plan and rules adoption, including where landowners accepted voluntary assistance, as resources allow. – **COMPLETED** (see Board of Agriculture Report)
- By the 2020 biennial review, in conjunction with appropriate partners, the LMA will have offered technical assistance, to landowners in the focus area with lands where agricultural activities appear to be impacting Dry River (Canyon), as resources allow. - **COMPLETED**
- By July 1, 2020, the LMA will complete a follow-up assessment in the area and evaluate land condition changes.
- Measureable Objective: The LAC, ODA and the SWCD will work on developing a Measureable Objective over the next two years.
- Once pre-assessment is completed, the LMA will develop implementation strategies and objectives that decrease agricultures impact on water quality.

The above measureable objectives are subject to change based on Assessment and available resources.

Current flow conditions in the Focus Area:

Current Conditions (From Pre-Assessment)
Current conditions (yearly average CFS for 2015):
CFS at each location:

- Powell Butte Spill: 2.2 cfs
- L Lateral: .49 cfs
- Dry Canyon Waste Flume: 3.41 cfs

Focus Area Milestone for 2015-2017

- By June 30, 2017, the Crook SWCD and other partners will work to reduce the cfs flow by 5%.

Location	2011 Pre-Assessment Results in CFS (yearly average)	2012 Assessment Results in CFS (yearly average)	2013 Assessment Results in CFS (yearly average)	2014 Assessment Results in CFS (yearly average)	2015 Assessment Results in CFS (yearly average)	2017 Post-Assessment (or Interim-Assessment) Results in CFS (yearly average)	Percent Change During 2011-2017 in CFS (yearly average)
Powell Butte Spill	5.39	1.9	.98	1.5	2.22		
L Lateral	No Data	No Data	.74	.35	.49		
Dry Canyon Waste Flume	7.97	5.04	4.1	2.69	3.41		
TOTAL	**6.68**	**3.47**	**1.94**	**1.51**	**2.04**		

As of this Biennial Review, no projects have been implemented thus far to reduce stream flow. The Crooked River SWCD continues to work with landowners and apply for grant funding to implement projects within the Focus Area.

4.2 Activities and Accomplishments

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

Basin-wide Actions/Implementation Summary:
Outreach and Education:

- Crook County SWCD holds an annual landowner workshop every February in Paulina, Oregon. Average attendance is 75 to 80 with presentations on a variety of subjects. The last two years included presentations on sage-grouse CCAA program, riparian grazing, noxious weeds, improving soil, and water quality management plan. Other workshops included a 2014 workshop in Powell Butte and 2015 workshop in Prineville. In September 2015, there was a

workshop and tour on treating juniper with herbicide and new bacteria developed to fight annual grasses with 75 in attendance.

- In 2015 the county, school district, and natural resource agencies partnered to hold a 3-day educational event for all Crook County elementary students called River Keepers.
- Each year Crook County SWCD supports the Crooked River Weed management at the Crook County fair with time and information at the weed wagon.
- In 2015, Crook County SWCD launched their website providing information to landowners on programs, events, and projects.
- In June 2015, BLM held a Riparian Grazing Management class in which 74 attended the 3-day event.

Planning and Projects:

- Over the past two years, 106 landowners were provided with technical assistance, with 116 site visits, and 23 restoration grants applied for.
- 34 water quality projects were implemented affecting over 3,000 acres.
- Since June 2013 landowners have enrolled over 2,500 acres into the CREP, fenced more than 22,000 feet of critical riparian areas, and planted over 13,000 trees within those riparian corridors.

Monitoring:

- Pre/Post monitoring completed for all OWEB small and restoration grants.

Funding and Grants:

- Local Government Support $ 35,000
- Small Grant Funding $ 119,680
- Large OWEB Restoration Grants $ 664,120
- ODA Technical Support $ 100,000
- OWEB TA Grants $ 50,000
- Federal Grant Funding $ 20,000
- PGE Pelton Fund $ 98,000

The Crook County SWCD, ODA, and the LAC are responsible for determining whether the goals will be met within the timeframes identified in the Area Plan. Progress and success of implementation efforts will be assessed through compliance with Area Rules and State standards and the measurement of water quality improvement over time. Monitoring of land conditions related to water quality is the responsibility of ODA.

The Accomplishments Table showing basin-wide projects was be developed using data submited to ODA and OWEB since 2004.

ACCOMPLISHMENTS TABLE FOR THE CROOKED RIVER AGRICULTURAL WATER QUALITY MANAGEMENT PLAN – SWCD OR COUNTYWIDE TASKS – Funded by OWEB

	FY2006	**FY2007**	**FY2008**	**FY2009**	**FY2010**	**FY2011**	**FY2012**	**FY2013**	**FY2014**	**FY2015**
Miles of riparian fence installed – *reported to OWEB, Crook County Only*	2	.85	1.14	.6	N/A	1.51	N/A	2.4	15.25	TBD
Acres of noxious weed treatments – upland and riparian – *reported to OWEB, Crook County Only*	N/A	N/A	2030	331.1	N/A	2.5	446	113	1664	TBD
Acres of riparian plantings - *reported to OWEB, Crook County Only*	50.3	9.23	3	13.1	20.2	2.5	117	20	3.15	TBD
Number of Educational Activities and Outreach: Workshops, meetings, tours, displays, site visits, demonstrations, and articles – *SWCD SOW Tasks Only*	40	56	37	51	148	22	67	34	12	TBD
Number of Landowners provided Technical Assistance – *SWCD SOW Tasks Only*	5	12	17	34	41	43	47	69	70	TBD
Number of off-channel livestock or wildlife watering - *reported to OWEB, Crook County Only*	2	12	N/A	6	2	45	8	11	37	TBD

4.3 Water Quality Monitoring—Status and Trends

Data relevant to agricultural water quality are being collected through two main programs: DEQ and the Crooked River Watershed Council. The below information is a preliminary assessment of conditions due to lack of resources to do a thorough evaluation of all the data that has been collected. A more thorough review will be done before the next biennial review.

DEQ has collected data since the 1990s from two sites that represent agricultural water quality: Crooked River at Lone Pine (near the mouth) and Crooked River at Conant Road (above Prineville Reservoir). The Water Quality Index has consistently rated both sites as poor since 2001, although the data shows a "significant improving trend" at Lone Pine for several years. There is no discernable trend at the Conant Basin site. In 2014, there were improvements in nitrogen and phosphorus; improvements over the years have been seen in temperature, pH, dissolved oxygen, total solids, nitrogen, phosphorus.

ODA evaluated data from the Crooked River Watershed Council that included five sites upstream of Prineville with agricultural influence: Beaver Creek at Highway 380, Pine Creek at Shotgun Road, Newsome Creek at Shotgun Road, Crooked River below Newsome Creek, and McKay Creek at Highway 26. ODA evaluated data from 2010; parameters consisted of temperature, dissoloved oxygen, pH, conductivity, nutrients, and *E. coli*. The Beaver Creek data showed three low dissolved oxygen values samples (to 4.8 mg/l). No problems were apparent at Pine Creek. Newsome Creek had high total phosphorus (to 0.34 mg/l), and most samples had excessive *E. coli* counts (>2420 colonies/100 mL). The Crooked River downstream of Newsome Creek also had high *E. coli* counts, indicating contributions from Newsome Creek. McKay Creek had high nitrate (to 3.85 mg/l) and some high *E. coli* (to 579 colonies/100 mL).

4.4 Biennial Reviews and Adaptive Management

The LAC met two times for the 2016 Biennial Review (04/4/2016, 5/11/16). The biennial review meetings consisted of updating language throughout the Area Plan, as well as discussing the New Chapter Format and Measurable Objectives.

ODA presented the program updates from the past two years. This included Demonstration Area/Focus Areas, Strategic Implementation Areas, and the new Chapter Format for the Area Plans. ODA presented the major edits of the Area Plan to the LAC.

In the last biennium, ODA investigated two properties regarding cattle grazing along the Crooked River. One landowner has received a letter of compliance after providing off stream water and building riparian fencing. The other landowner was a previous enforcement case that was reopened due to lack of riparian vegetation along Horse Heaven Creek. A follow-up site visit will occur in Fall 2016.

Appendices

A. Noxious Weed List

A. Noxious Weed Lists

1. CROOK COUNTY

LIST A

These weeds occur in small enough infestations to make eradication/containment possible, or are not known to occur but their presence in neighboring counties make future occurrence in the county seem imminent. List A also includes weeds that are actively managed by neighboring counties due to agricultural concerns (e.g. Jefferson County produces carrots, and wild carrot poses a threat to agricultural carrot crops). List A weeds are high priority sites for treatment.

Management Goal: Eradicate or contain populations; prevent List A weeds from becoming more abundant and moving onto List B.

Aegilops cylindricaa	jointed goatgrass
Carduus nutans	musk thistle
Centaurea solstitialis	yellow starthistle
C. virgata	squarrose knapweed
Chondrilla juncea	rush skeletonweed
Daucus carota	wild carrot
Euphorbia esula	leafy spurge*
Lepidium latifolium	perennial pepperweed
Linaria dalmatica	Dalmatian toadflax
Lythrum salicaria	purple loosestrife
Onopordum acanthium	Scotch thistle
Peganum harmala	African rue
Salvia aethiopis	Mediterranean sage
Senecio jacobaea	tansy ragwort
Myriophyllum spicatum	**Eurasian watermilfoil**

* All areas except Mill Creek drainage and within 50 feet of the high water mark on the Crooked River

LIST B

These weeds are abundant in the county and of great concern because they cause economic and ecological losses. Eradication of List B weeds in the county may not be realistic; however, they are still high priority species for strategic treatment and control to prevent further spread.

Management Goal: Control List B weeds to prevent their spread into new areas. Management strategies should focus on outlying populations to protect native ecosystems, as well as high public use areas.

Cardaria spp.	Whitetop
Centaurea diffusa	diffuse knapweed
C. maculosa	spotted knapweed
C. repens	Russian knapweed
Cirsium arvense	Canada thistle
Conium maculatum	poison hemlock
Cynoglossum officinale	common houndstongue
Cytisus scoparius	Scotch broom
Hypericum perforatum	St. Johnswort
Iris pseudacorus	yellow flag iris
Senecio vulgaris	common groundsel
Sonchus asper	spiny sowthistle
Taeniatherum caput-medusae	medusahead rye
Tribulus terrestris	puncturevine
Euphorbia myrsinites	Myrtle Spurge

LIST C

These weeds are abundant. They are not high priority species to control. However, it may be desirable to treat localized populations to prevent their spread into new areas, and/or to protect from economic and ecological losses.

Management Goal: Treat List C species as "incidental" and control on a case-by-case basis.

Cicuta maculata	western waterhemlock
Cirsium vulgare	bull thistle
Convolvulus arvensis	field bindweed
Dipsacus fullonum	common teasel
Kochia scoparia	kochia
Melilotus officinalis	yellow sweetclover
Ranunculus testiculatus	bur buttercup
Salsola iberica (= S. kali)	Russian thistle
Verbascum thapsis	common mullein
Stellaria	Chickweed

2. MANAGEMENT AREA PRIORITY WEEDS

The Management Area contains portions of 6 counties, in addition to almost all of Crook County. The following weeds are found on the lists of at least six of the seven counties:

Acropitlon repens	Russian knapweed
Cardaria spp.	whitetop
Centaurea diffusa	diffuse knapweed
Centaurea maculosa	spotted knapweed
Centaurea solstitialis	yellow starthistle
Centaurea virgata	squarrose knapweed
Chondrilla juncea	rush skeletonweed
Cirsium arvense	Canada thistle
Convolvulus arvensis	field bindweed/morning glory
Euphorbia esula	leafy spurge
Hypericum perforatum	St. Johnswort/Klamath weed
Kochia scoparia	kochia
Lepidium latifolium	perennial pepperweed
Linaria dalmatica	Dalmatian toadflax
Lythrum salicaria	purple loosestrife
Onopordum acanthium	Scotch thistle
Salvia aethiopis	Mediterranean sage
Senecio jacobaea	tansy ragwort
Taeniatherum caput-medusae	medusahead rye
Tribulus terrestris	puncturevine