

MIDDLE JOHN DAY RIVER

Agricultural Water Quality Management Area Plan

Guidance Document

developed by

**The Middle John Day
Local Advisory Committee**

with assistance from

**Oregon Department of Agriculture
and
Wheeler Soil and Water Conservation District**

April 22, 2003

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Table of Contents

<i>I. Foreword</i>	5
<i>II. Introduction</i>	6
<i>III. Geographic Area and Physical Setting</i>	7
A. Geology	7
B. Land Cover and Land Use	8
C. Land Ownership	8
Special Uses	8
D. Water Resources	8
Water use	9
E. Fisheries and Wildlife Resources	9
F. Agriculture	10
<i>IV. Water Quality Issues</i>	10
A. Beneficial Uses	10
B. Water Quality Parameters of Concern	10
Temperature.....	10
Biological Criteria	11
Sediment.....	11
C. Water Quality Limited (303-d) Listings	12
1998 Water Quality Limited Streams - 303(d) List	12
D. Sources of Impairment and Conditions Affecting Water Quality	12
<i>V. Goals and Objectives</i>	14
Goal	14
Objectives.....	14
<i>VI. Strategies for Achieving Plan Goals</i>	14
A. Prevention and Control Measures	14
Waste Management	14
Uplands Management and Soil Erosion	15
Effective Water Quality Management Practices for soil erosion and sediment control:	17
Riparian Area Management	17
Effective Water Quality Management Practices for prevention and control of impacts to riparian areas: .	18
Irrigation Management	18
Effective Water Quality Management Practices for prevention and control of impacts from irrigation....	19
Livestock Management	19
Effective Water Quality Management Practices for prevention and control of impacts from livestock	20

B. Implementation Strategies	20
Education Programs	20
Water Quality Management Practices	21
Farm/Rural Conservation Plans.....	21
Technical & Financial Assistance	22
Monitoring and Evaluation.....	23
Biennial Review	24
VII. Administrative Roles and Responsibilities	25
A. Designated Management Agency	25
B. Resolution of Complaints and Enforcement Action	25
C. Total Maximum Daily Loads.....	26
ATTACHMENT 1:.....	27
Oregon Administrative Rules	27
Oregon Department of Agriculture	27
Middle John Day River Subbasin	27
ATTACHMENT 2:.....	29
References to information used in the development of the Area Plan.....	29
NRCS Field Office Technical Guide, NRCS	29
Oregon Revised Statutes, 468B.....	29
Oregon Revised Statutes, 568.900 through 568.933	29
Questions and Answers About DEQ’s Temperature Standards, DEQ, February 1998	29
Water Quality Monitoring: Technical Guide Book, OWEB, July 1999	30
ATTACHMENT 3: Map	31

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Middle John Day Agricultural Water Quality Management Area Plan

I. Foreword

This Agricultural Water Quality Management (AgWQM) Area Plan provides guidance for addressing agricultural water quality issues in the Middle John Day AgWQM Area. The purpose of this Area Plan is to identify strategies to reduce water pollution from agricultural lands through a combination of educational programs, monitoring, suggested land treatments and management activities. This Area Plan will be used by landowners to enhance their awareness and understanding of water quality issues and to provide guidance to solutions for water quality problems. Local management agencies will use this plan to guide implementation, outreach, and assistance efforts for landowners.

This Area Plan does not establish legal requirements or prohibitions for landowners. Implementation of this Area Plan will be through formally adopted Area Rules, as provided in Oregon Revised Statutes (ORS) 568.912. When voluntary approaches do not adequately protect water quality, the Oregon Department of Agriculture (ODA) will use regulatory measures as a last resort to achieve desired results. ODA will exercise its enforcement authority for the prevention and control of water pollution from agricultural activities under Area Rules for the Middle John Day AgWQM Area (Oregon Administrative Rules (OAR) 603-095-2500 through 603-095-2560) and statewide enforcement procedures provided in OAR 603-090-0060 through 603-090-0120. The Area Rules are listed in **Attachment 1** of this plan.

This Area Plan and the rules are required because currently available, limited, water quality data, gathered by various agencies and organizations, indicates that there are some streams in the basin that do not meet standards established by the DEQ under the federal Clean Water Act. While only a few streams have been reported to be water quality impaired, the rules apply to all streams within the basin. It is recognized that the sources of pollution are not present in all locations and that landowners activities may or may not be contributing to the problem. Lands that meet the conditions described in this plan are deemed to have met the rule requirements, however, all landowners should be aware of the rules and operate accordingly.

II. Introduction

The Agricultural Water Quality Program in the ODA's Natural Resources Division is responsible for addressing water pollution associated with agricultural lands and activities. The water quality program has evolved in response to requirements given to Oregon as a result of the federal Clean Water Act.

In 1993, the Oregon Legislature passed Senate Bill 1010 (ORS 568.900 – 568.933) that directs the ODA to be the lead state agency working with agriculture to address water pollution. Through SB 1010, ODA is authorized to develop and carry out a water quality management plan for agricultural or rural lands, whenever a water quality management plan is required by state or federal law. In 1995, the Oregon Legislature passed SB 502 (ORS 561.191) that stipulates that the ODA shall develop and implement any program or rules that directly regulate farming practices that are for the purpose of protecting water quality and that are applicable to areas of the state designated as exclusive farm use zones or other agricultural lands. The implications of the legislation are that in Oregon, the ODA is the agency solely responsible for regulating agricultural activities that affect water quality. Passed by the Oregon legislature in 2001, SB 208 amends 568.900-933 to clarify that only the Area Rules associated with a water quality management plan are enforceable, not the plan itself. Also passed in the 2001 legislative session, **SB 51 clarified that ODA entry onto private property must be consistent with section 9, Article I of the Oregon Constitution, and the Fourth Amendment of the United States Constitution**; that ODA may not impose a civil penalty on a landowner for a first violation of any water quality rules unless certain conditions are met; and that any new fees proposed by ODA are subject to legislative approval.

Area Plans help identify and control water pollution caused by activities on agricultural and rural lands. These plans recognize that the best way to prevent or control pollution from agricultural and rural land is to work to reduce the conditions on that land that cause pollution.

This Area Plan was developed by volunteer members of the Middle John Day AgWQM Area Local Advisory Committee (LAC) with assistance from the ODA and the Wheeler Soil and Water Conservation District (SWCD). The LAC utilized the resources referenced in **Attachment 2**, which are available from the SWCD upon request.

Nothing in this Area Plan should be interpreted as an attempt to intrude on, or usurp, private property rights. Instead, it is the best efforts of the LAC to develop a plan that gives landowners guidelines to address water quality as it may be affected by conditions on agricultural and rural land in the management area and for meeting applicable statutes and administrative rules related to water pollution control.

III. Geographic Area and Physical Setting

The John Day River Basin is an 8100 square mile drainage area, the 4th largest basin in the state. The flows originate in the Blue Mountains and flow generally westward and then northward for approximately 284 miles, discharging into the Columbia River east of Rufus, at River Mile (RM) 218. The John Day River is one of the longest undammed rivers in the United States. The climate is continental, characterized by low winter and high summer temperatures, low average annual precipitation and dry summers. Precipitation ranges from 10 to 12 inches at low elevations and up to 30 inches in the mountains. Most precipitation falls between November and March. Less than 10% of the annual precipitation falls as rain during July and August, usually from sporadic thunderstorms. Throughout the subbasin, actual temperatures vary from sub-zero during winter months to over 100 °F during the summer. Inflows of moist Pacific air moderate extreme winter temperatures. The average frost-free period is 50 days in the upper basin and 200 days in the lower basin.

The Middle John Day subbasin is an area of 1894 square miles or 1,212,219 acres. It includes a 110-mile reach of the John Day River from the Gilliam-Wheeler county line (River Mile 95) to the upstream end of Picture Gorge (RM 205). The elevation ranges from 1300 feet near Clarno to over 6000 feet in the Ochoco Mountains. The climate varies from semi-arid to relatively moist at higher elevations. The average annual temperature at Mitchell is 49° F, with the average low of 33° F and average high of 68° F.

The subbasin includes parts of Wheeler, Grant, Gilliam, Jefferson, Wasco, and Crook Counties. The cities of Fossil, Mitchell and Spray are the incorporated cities in the subbasin. A map of the Middle John Day AgWQM Area is included as **Attachment 3**.

A. Geology

The Middle John Day River region is underlain by basalt and andesite lava flows that cap several thousand feet of weakly structured mudstones, clayey sediments and other soft rocks composed of volcanic debris. The effect of relatively brittle lava flow rocks perched on easily erodible sediments results in the classic landslide terrain that comprises the region. Examples of acre and mountain-size tilted slump blocks with perched basalt flows are common (e.g. Sheep Rock) and represent the aggressive nature of mass-wasting processes that are continually taking place. The result of these processes has produced the dramatic incised terrain of the Middle John Day: up to 3500 ft. of downcutting of the wide, uplifted central Oregon plateau.

Sediment loading of the Middle John Day River and various tributaries is of concern to the LAC. It is recognized that sudden weather events, such as summer flash floods (water spouts), coupled with the region's geological setting are responsible for the creation of the valley. Periodic, often isolated, weather events cause severe sedimentation in the drainage systems, including non-settleable clayey sediment. Single events can release thousands of cubic yards of sediment and scour the steep wall canyons. These are naturally occurring events to which the ecosystem is adjusted. Sediment loading from man-made developments, including ranch roads, cropland, and building sites, tends to be insignificant in comparison.

B. Land Cover and Land Use

Range and shrublands cover 61% of the subbasin, forest covers 36% and the remainder is urban, roads, open water or barren. Western juniper has encroached into many areas and all areas, especially along transportation corridors, have increasing threats for noxious weeds. These invasive species replace the native vegetation with less desirable vegetation.

Nearly all of the land is grazed and only 2% is used for farming activities such as pasture, hay and small grains.

C. Land Ownership

The 1.2 million acres in the management area is 78% privately owned. The 22% owned by the public is managed by the Bureau of Land Management (BLM), the U.S. Forest Service (USFS), the National Parks Service (NPS) and the State of Oregon.

Special Uses

There are numerous special use areas designated in the management area. The John Day River is federally designated as Wild and Scenic from the mouth to Service Creek and state designated as a Scenic Waterway from the mouth to Parrish Creek. The John Day Fossil Beds National Monuments includes three units -- Clarno, Painted Hills, and Sheep Rock – managed by the NPS. The Bridge Creek Wilderness Area is located in Ochoco National Forest and the BLM manages the Research Natural Area and three Wilderness Study Areas – Sutton Mountain, Pat’s Cabin, and Spring Basin.

The Middle John Day management area is within the ceded lands of the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWSRO). The tribes have reserved certain treaty rights to the use of the land and its resources, and this area is still used for ceremonial and subsistence purposes. The Tribes also manage the Pine Creek ranch, a 35,000-acre wildlife habitat project near Clarno.

D. Water Resources

Peak flows in the John Day River occur from late March to early June and can account for as much as 70% of the annual discharge. Low flows occur from July through November. The Middle John Day subbasin is characterized by fairly dry conditions. Flows are determined more by input from the upper basin tributaries than by inputs from the lower basin tributaries. Smaller streams in the subbasin are likely to stop flowing in the late summer and fall. Main tributaries are Bridge Creek and Butte Creek.

Outflow of the management area is not measured since there is no recording station at Clarno. The nearest gauge is at McDonalds Ferry, near the mouth of the John Day Basin. Major inflow from upstream subbasins is measured by gauges at Picture Gorge on the Upper Mainstem and at Monument on the North Fork. The gauge at Service Creek, which is roughly the midpoint of the subbasin, provides a good record of water production for the subbasin above that point. Flow data indicate that the subbasin above

the gauge produces about 100,000 acre-feet of water per year, or roughly 120 acre-feet of water per square mile.

Water quality in the John Day River generally exhibits satisfactory chemical, physical, and biological quality except during water flow extremes. Turbidity, erosion, and sedimentation problems occur during high flows, and higher temperatures occur with concurrent lower dissolved oxygen during the low-flow periods.

Tributaries in the subbasin also exhibit high temperatures during the summer months. High water temperatures create the most serious threat to beneficial uses of the water. These tributaries carry high sediment loads during heavy rainstorms and snowmelt. Portions of the basin contain soils of the fossil formations. When heavy rains occur, stream turbidity increases because these are very fine soils that remain in suspension, giving the appearance of a more serious sediment-loading problem.

Water use

Over 85 percent of the appropriated water volume is used for irrigation. Another nine percent is for mining with all mining rights dating from before 1940 and probably are not used. There also are rights for about 4 cfs for municipal use, the majority of which takes place in Spray.

Instream water rights are approved by WRD for fish protection, minimizing the effects of pollution or maintaining recreational uses. Instream water rights have a priority date and are regulated in the same way as other water rights. An instream water right cannot affect a use with a senior priority date. Instream Water Rights were established for the mainstem John Day River at Service Creek in 1962, lower Bridge Creek in 1983, upper Bridge Creek, Rock Creek, and Bear Creek in 1990.

E. Fisheries and Wildlife Resources

The John Day River supports some of the healthiest populations of anadromous fish in the Columbia Basin, and an estimated 17 native and 10 non-native species. The John Day River supports runs of spring and fall Chinook salmon, summer steelhead, and Pacific lamprey; and resident populations of westslope cutthroat, interior redband, and bull trout. The current management policy is designed to maintain native, wild stocks of salmon and steelhead, and to preserve the genetic diversity of these native stocks for maximum habitat use and fish production. Smallmouth bass, an introduced warm-water game fish, provide an economically important fishery in the mainstem of the John Day River.

A variety of wildlife species, including large and small mammals, waterfowl, songbirds, raptors, reptiles, and amphibians, are associated with the John Day subbasin riparian and upland habitats. Wildlife species associated with shrub-steppe habitat have declined regionally as their habitat has decreased.

F. Agriculture

Agriculture is the primary economic activity in the management area. Total gross sales for Wheeler County, in 2000, were reported as \$9,140,000. Cattle were by far the leading commodity (\$6.3 M) and farm forest products were second (\$1.5 M). Hay and forage, field crops, recreation and fee hunting, and other livestock and animal products contribute to the agricultural economy.

IV. Water Quality Issues

The Federal Clean Water Act (CWA) requires each state to determine water quality by: 1) identifying beneficial uses for each water body; 2) designating parameters to monitor for each beneficial use; and 3) establishing a standard for each parameter. The state is also required to report findings to Congress every two years, and to correct water quality problems.

A. Beneficial Uses

Water quality in the Middle John Day AgWQM Area is managed to protect recognized beneficial uses. Beneficial uses of water in the John Day Basin are: public and private water supply, industrial water supply, irrigation, livestock watering, anadromous fish passage, salmonid fish rearing and spawning, resident fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation and aesthetic quality. (OAR 340-41-602, Table 10)

B. Water Quality Parameters of Concern

Of the beneficial uses of water in the John Day Basin, the most sensitive use for most waters and parameters of concern is spawning and rearing of cold-water fisheries. The following discussion of water quality parameters of concern in the watershed addresses the Clean Water Act (CWA) requirements that require standards be established for the most sensitive beneficial use.

Temperature

Temperature is primarily a summer concern for rearing of anadromous fish species and resident trout. Water temperatures above 70°F can be immediately lethal to salmonids due to a breakdown in their respiration and circulation systems. Sub-lethal temperatures between the mid 60's°F to 70°F are stressful to salmonids, and reduce survival by increasing susceptibility to other agents. The sub-lethal effects associated with higher than optimum temperatures are disease, reduced metabolic energy for feeding, and reduced growth or reproductive behavior due to avoidance of areas with high temperatures. High water temperatures can also create barriers to migration and prevents normal movement of both juvenile and adult fish. This information represents the current understanding of fisheries biologists, based upon research in both laboratory and natural conditions.

Current DEQ standards (OAR 340-41-605(b)) state that no measurable surface water temperature increase resulting from anthropogenic (man-caused) activities is allowed:

- in a basin for which salmonid fish rearing is a designated beneficial use, and in which surface water temperatures exceed 64.0° F.
- in waters and periods of the year supporting native salmonid spawning, egg incubation, and fry emergence from the egg and from gravels, which exceeds 55.0° F.
- in waters supporting native bull trout, when surface water temperatures exceed 50.0°F.

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 will NOT be considered a violation of the standard. When stream flow is exceptionally low or air temperature is exceptionally high the temperature criteria are waived (an example is when the flow is less than the expected ten year low flow or the air temperature is above the 90th percentile of a seven day average).

The temperature standard is designed to protect cold-water aquatic species such as trout and salmon throughout their lifecycles. These needs are the same regardless of where the fish live. However, some streams in Oregon likely always reached a summer maximum temperature greater than the temperature criteria. The standard recognizes that not all streams will be able to comply. It says that if all feasible efforts to improve the temperature have been taken, then the temperature achieved can become the criteria for that specific stream as long as beneficial uses are protected. (*Questions and Answers About DEQ's Temperature Standard, DEQ, February 1998*)

Biological Criteria

Biological criteria refer to the support of plants and animals that live at least part of the life cycle in water. Factors that affect biological criteria are stream disturbances, excessive heat inputs and excessive sediment. "Waters of the state shall be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities." (OAR 340-41-027)

Sediment

Sediment includes fine silt and organic particles suspended in the water column, settled particles, and larger gravel and boulders that move at high flows. Sediment movement and deposition is a natural occurrence but high levels of sediment can degrade fish habitat by filling pools, creating a wider and shallower channel and covering spawning gravels. Suspended sediment or turbidity in the water can cause physical damage to fish and other aquatic life, modify behavior and increase temperature by absorbing incoming sunlight. Large quantities of suspended sediment occur naturally after weather events, however, erosion from roads, range, cropland and developed areas also contribute sediment to streams.

C. Water Quality Limited (303-d) Listings

Section 303(d) of the CWA requires each state to develop a list of water bodies that do not meet the standards designed to protect the most sensitive beneficial use. Water bodies that do not meet standards are placed on the 303(d) water quality limited list.

Nine river segments in the Middle John Day River subbasin were declared “water quality limited”, under section 303(d) of the CWA when the Oregon Department of Environmental Quality (DEQ) last updated the listing in 2002. The list will next be updated in 2004. Water quality standards violations occur for temperature on eight segments and biological criteria on one stream.

2002 Water Quality Limited Streams - 303(d) List

NAME	SEGMENT	PARAMETER
Bear Creek	Mouth to RM 4.6	Temperature
Bridge Creek	Mouth to RM 28.7	Temperature
Gable Creek	Mouth to RM 7.7	Temperature
Henry Creek	Mouth to RM 7.1	Temperature
John Day River	RM 182 to 265	Fecal coliform
John Day River	RM 182 to 265	Dissolved Oxygen
John Day River	Tumwater Falls to North Fork	Temperature
Mountain Creek	Mouth to RM 21.7	Temperature
Nelson Creek	Mouth to RM 5.7	Temperature
Pine Creek	Mouth to RM 15.8	Biological Criteria
Rock Creek	Mouth to RM 24.7	Temperature
Sorefoot Creek	Mouth to RM 7.5	Temperature

The CWA also directs states to develop Total Maximum Daily Loads (TMDL) for 303(d) listed streams. These TMDLs will result in allocations of pollutant loads (e.g. degrees of temperature or milligrams/liter of sediment) to different sources such as private agriculture, urban areas, and federal lands. Because there is no TMDL yet for the John Day Basin, this Area Plan will address water quality issues, as they are currently understood. The TMDL for this portion of the John Day Basin is expected to be completed in 2005. Once an allocation is given, this Area Plan will be modified, if necessary, to meet the allocation.

D. Sources of Impairment and Conditions Affecting Water Quality

Both point and nonpoint sources contribute to water pollution. The accumulation of point and nonpoint source pollution results in water quality impairment. Point sources discharge pollutants into the water through a pipe or conveyance. In contrast, nonpoint source pollution is pollution emanating from landscape scale sources and typically cannot be tracked to a single point of discharge. Nonpoint sources of pollution in the area can include the effects of weather events causing runoff and erosion from agricultural and forest lands, leaching of pollutants to groundwater, eroding stream banks, and runoff from roads and urban areas. Pollutants from nonpoint sources can be carried to the surface water or groundwater through the actions of rainfall, snowmelt, irrigation, and leaching. Increased heat input due to vegetation removal, seasonal flow reduction, changes in channel shape, and floodplain alteration are major sources of water quality impairment. Channelization and

bank instability may alter gradient, width/depth ratio, and sinuosity, thereby causing undesirable changes in sediment transport regime, erosional and depositional characteristics, and elevated temperature.

The high stream temperatures and low summer streamflows are the main water quality problems in the Middle John Day River subbasin. Stream temperatures can increase from various types of land management activities and natural disturbances, that cause the removal of riparian vegetation or changes in channel morphology, from hydrological factors such as groundwater recharge and discharge and from other factors such as high sediment loads.

Protection of riparian and streamside areas for moderation of stream temperatures will be the subject of rules created from this Area Plan. Low summer streamflows often result from channel loss and water withdrawals for beneficial uses, primarily irrigation, along with normal seasonal reductions of streamflow. Water withdrawals are regulated by the Oregon Water Resources Department (WRD) and will not be addressed by rule or in this Area Plan.

V. Goals and Objectives

Goal

Develop strategies that are practical and economically feasible in order to aid the prevention of water pollution from agricultural and rural activities and the control of water pollution if such problems exist.

Objectives

- Promote voluntary land stewardship practices that enhance water quality
- Increase public awareness and understanding of agriculture's contributions to improving water quality
- Ensure technical and financial assistance for implementing effective water quality improvement projects
- Promote a monitoring program that provides scientifically credible data

VI. Strategies for Achieving Plan Goals

The Department and the District strategy to reduce amounts of pollution and soil erosion in runoff from agricultural and rural lands, where such problems exist, include both voluntary and regulatory strategies. Voluntary strategies to reduce pollution include a combination of 1) educational programs, 2) implementation of sound management practices, and 3) monitoring of implementation effectiveness. A secondary strategy, when necessary to supplement voluntary efforts, is the adoption and compliance with Prevention and Control Measures directly related to water quality.

A. Prevention and Control Measures

A landowner or operator's responsibility under this Area Plan is to implement measures that prevent and control the possible sources of water pollution that may be associated with agricultural and rural lands and activities. The sections that follow provide 1) more detailed information related to potential agricultural water quality concerns, 2) definitions of commonly used terms, 3) dates when rules are effective, and 4) some exemptions to the rules. Criteria to determine measures to be implemented will be applied with consideration of agricultural and economic impacts. These Prevention and Control Measures are formalized in Oregon Administrative Rules (OAR 603-095-2540) and provided in Attachment 1 of this Area Plan.

Waste Management

A landowner's or operators responsibility under this Area Plan is to prevent the introduction of waste materials, both by direct or indirect means, into nearby bodies of water. Applicable statutes and rules (ORS 468B.005 through 468B.220) are presently in effect and are enforceable by designated management agencies.

Current Oregon Law, **ORS 468B.025** states:

(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.

ORS 468B.050 identifies the conditions when a permit is required. A permit is required for certain livestock confinement areas, defined as confined animal feeding operations (CAFO) that meet minimum criteria for confinement periods and have large animal numbers or have waste water facilities. OAR 603-074-0005 through 0080, contains the rules that apply to CAFO.

ORS 468B.005 provides the following definitions:

“Wastes,” means sewage, industrial wastes, and all other liquid, gaseous, solid, radioactive or other substances that will or may cause pollution or tend to cause pollution of any waters of the state. Additionally, OAR 603-095-0010(53) includes commercial fertilizers, soil amendments, composts, animal wastes, and vegetative materials as 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, creek, estuaries, marshes, inlets, canals, the Pacific Ocean within the territorial limits of the State of Oregon and all other bodies of surface or underground waters, natural or artificial, inland or coastal, fresh or salt, public or private (except those private waters which do not combine or effect a junction with natural surface or underground waters), which are wholly or partially within or bordering the state or within its jurisdiction.

Uplands Management and Soil Erosion

Landowners and operators should manage their resources to prevent and control water pollution from upland soil erosion and runoff of pollutants. This includes agricultural and rural lands that may not be in close proximity to water bodies but have the potential to contribute to water quality degradation through runoff of sediment or animal wastes.

Uplands areas are the range, forest and croplands, upslope from the riparian areas to the ridge tops. Vegetation on upland areas is dependent on physical characteristics including

geology, landform, soils, water and other climate factors. Healthy uplands maintain productivity over time and are resilient to stress caused by variations in physical conditions.

Healthy upland areas provide several important ecological functions. They are:

- Capture, store and safely release precipitation in balance with climate and landform
- Provide plant health and diversity that supports habitat (cover and forage) for wildlife and livestock
- Filter sediment and thus reduce polluted runoff
- Provide root masses that utilize nutrients and stabilize soil against erosion

Indicators of healthy conditions may include:

- Ongoing recruitment of beneficial vegetation
- Adequate ground cover to limit runoff of nutrients and sediment
- Cropland condition sufficient to limit runoff of nutrients, sediment, and pesticides
- Roads and related structures designed, constructed and maintained to limit sediment delivery to streams
- Noxious weeds controlled or contained

Factors to evaluate upland area condition may include:

- Stubble height as a tool to measure plant utilization
- Species composition to measure plant health and diversity
- Ground cover (plants, litter) to measure potential for erosion
- Presence of patterns of erosion caused by overland flows
- Domestic livestock and/or wildlife carrying capacity
- Soil loss prediction models available at local NRCS Field Office

This Area Plan does not prescribe specific practices to landowners for management of upland areas to reduce runoff of sediment and other wastes. Site specific recommendations for management to protect water quality, including grazing management systems, desirable vegetation types and road construction and maintenance, can be obtained from sources listed in the Implementation Strategies section of this Area Plan.

The Area Waste Management Rule OAR 603-095-2540(2) acknowledges ORS 468B.025, which predates this Area Plan, and could apply to problematic runoff of sediment and animal waste from upland areas.

The following practices and many others may be considered in the development of a management system that is appropriate for prevention and control of pollution caused by agricultural activities on an individual parcel of land. Management practices and land management changes are most effective when selected and installed as integral parts of a comprehensive resource management plan based on natural resource inventories and assessment of management practices. The result is a system using management practices and land management changes which are designed to be complementary, and when used in combination, are more technically sound than each practice separately.

Effective Water Quality Management Practices for soil erosion and sediment control:

- Range plantings of desirable perennial species
- Livestock distribution systems
 - Fencing
 - Water development
 - Salting
 - Herding
- Grazing management plans that balance available forage and utilization
- Prescribed burning to control undesirable species and invigorate desirable species
- Weed control to reduce plant competition
- Thinning or removal of overstocked stands or trees and brush
- Road design and maintenance to reduce runoff of sediment
- Sediment retention basins and runoff control structures
- Irrigation scheduling to maximize the efficient use of available water

Riparian Area Management

Landowners and operators should manage their resources to prevent and control impacts to streams. Areas near water bodies are especially important to water quality and sensitive to management activities because of the natural ecological functions they perform such as water infiltration, waste filtration, erosion control, water storage and moderation of temperature.

The riparian area, as defined in OAR 141-110-0020(28), is a zone of transition from an aquatic to a terrestrial system, dependent upon surface or subsurface water, that reveals through the zone's existing or potential soil-vegetation complex the influence of such surface or subsurface water. A riparian area may be located adjacent to a lake, reservoir, estuary, pothole, spring, bog, wet meadow, muskeg, slough, or ephemeral, intermittent or perennial stream.

Water is the distinguishing characteristic of riparian areas but soil, vegetation and landform also exert strong influence on these systems. In a healthy riparian ecosystem, these four components interact to produce a wide variety of conditions.

Healthy riparian areas provide several important ecological functions. These include:

- Dissipation of stream energy associated with high flows and thus influencing the transport of sediment
- Capturing suspended sediment and bedload that builds streambanks and develops floodplain function
- Retaining flood-water and recharging ground-water
- Stabilizing streambanks through plant root mass
- Developing diverse channel characteristics providing pool depth, cover, and variations in water velocity necessary for fish production
- Supporting biodiversity
- Shading for moderation of solar heat input
- Recruitment of large woody debris for aquatic habitat

Indicators to determine improvement of this condition include:

- Recruitment of desirable riparian plant species

- Maintenance of established beneficial vegetation.
- Maintenance or recruitment of woody vegetation -- both trees and shrubs.
- Streambank integrity capable of withstanding 25-year flood events.

Factors available to evaluate improvement of the riparian area condition could include:

- Expansion of riparian area as evidenced by development of riparian vegetation and plant vigor
- Reduction in actively eroding streambank length beyond that expected of a dynamic stream system
- Community composition changes reflecting an upward trend in riparian condition. (Increases in grass-sedge-rush, shrubs, and litter and decreases in bare ground)
- Plant community composition reflecting an upward trend as indicated by decreases in noxious plant species
- Stream channel characteristics show upward trend consistent with landscape position (i.e. a decrease of width to depth ratio of the channel)
- Shade patterns consistent with site capability
- Stubble height of herbaceous species and leader growth of shrubs and trees

Effective Water Quality Management Practices for prevention and control of impacts to riparian areas:

- Critical Area planting to stabilize erodable areas
- Vegetative buffer strips to stabilize streambanks, filter sediment and wastes, and provide shade
- Livestock Management including riparian pastures, seasonal grazing, temporary or permanent fencing
- Water developments including off-stream watering, water gaps and spring development
- Weed control to reduce competition with desired species
- Nutrient and chemical application scheduling to avoid drift or runoff
- Road, culvert, bridge, and crossing maintenance

Irrigation Management

A landowner or operator's responsibility under this Area Plan is to implement measures that prevent and control water pollution from irrigation activities. Irrigated lands include riparian areas, floodplains or uplands upon which water is applied for the purpose of growing crops or pasture. Application of water for this purpose is a recognized beneficial use of water. Proper management of diversions, for irrigation or other uses such as livestock watering, and overland return flows of excess water to the stream should be designed and managed to prevent water quality problems.

Irrigation water use is regulated by the Oregon Water Resources Department (WRD) in the form of water rights, which specify the rate, duty and season that water can be applied to a particular parcel of land. Refer to WRD Rules (OAR 690-250 and ORS 536 through 543) for more details.

Irrigation in this basin is typically done by either flooding or sprinkler application. Water usually is diverted from a surface source (stream or pond) but may also be from groundwater sources. Irrigation management in this basin recognizes the positive benefits which occur from irrigation application - including flow augmentation for late

season as water returns back to the stream, cooling and filtering of water through underground percolation, and the recharge of shallow wells and springs due to the connectivity of surface water to ground water sources. Irrigation water may be used more than once as it returns to the stream and is available for instream uses or by other irrigators. Ultimately, streamflows will be enhanced by upland and riparian management practices promoting natural upstream storage and properly functioning floodplains that catch, store, and safely release precipitation for beneficial uses during summer months.

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

- Efficient delivery of water to the land within legal water rights
- Minimal overland return flows
- Return flow routing that provides for settling, filtering and infiltration
- Minimal effect on stability of streambanks and minimal soil erosion.
- Appropriate scheduling of water application to the site including consideration of soil conditions, crop needs, climate and topography
- Diversion structures that are installed and managed to control erosion and sediment delivery, and protect the stability of streambanks. If funding becomes available, temporary diversions, which must be reinstalled every year, should be replaced with suitable permanent diversions (i.e. pumping stations, infiltration galleries, dams)
- Diversions that are adequately screened and which provide for fish passage (Refer to ORS 498.268)

Effective Water Quality Management Practices for prevention and control of impacts from irrigation

- Irrigation scheduling based on crop needs, soil type, climate, topography, and infiltration rates
- Irrigation system efficiency and uniformity monitoring
- Diversion maintenance including push-up dam management, screens and fish passage
- Return flow management to prevent pollution from entering streams
- Backflow devices to prevent well contamination
- Flow measuring devices to assure legal and efficient water usage
- Cover crops to reduce soil erosion

Livestock Management

Landowners or operators should manage their land to prevent and control water pollution from livestock enterprises. Management of areas used for grazing, feeding and handling are critical to the success of livestock operations and has potential to affect water quality by the runoff of sediment and animal wastes. Livestock management can be done in a manner that limits soil erosion and minimizes the delivery of sediment and animal wastes to nearby streams. A grazing management system should promote and maintain adequate vegetative cover, for protection of water quality, by consideration of intensity, frequency, duration and season of grazing.

Managed grazing near streams should prevent negative impacts to streambank stability, allow for recovery of plants, and leave adequate vegetative cover to ensure protection of riparian functions including shade and habitat. Offstream watering systems, upland water developments, feed, salt and mineral placement are examples of methods to be considered as ways to reduce impacts of livestock to streamside areas.

Effective Water Quality Management Practices for prevention and control of impacts from livestock

- Grazing management or scheduling based on intensity, duration, frequency and season of use
- Pasture rotation including resting or deferred grazing
- Vegetation management including grass seeding, weed control, clipping, fertilization, and controlled burning
- Fencing to protect sensitive areas and aid in distribution
- Watering facilities including spring developments, water gaps, off-stream water (may require water rights, refer to ORS 537.141)
- Salt and mineral placement to aid livestock distribution
- Waste management systems for waste collection, storage, and utilization; facilities operation and maintenance
- Routing clean water around confinement areas

B. Implementation Strategies

The following guidelines will apply for public participation in implementation and review of the Area Plan. ODA and the SWCD intend to encourage participation in this water quality improvement program by:

- Providing educational programs to raise public awareness and understanding of water quality issues and solutions.
- Providing incentives for the development and implementation of effective agricultural management practices for prevention and control of agricultural pollution.
- Offering technical assistance for the development and implementation of farm/rural conservation plans.
- Developing a monitoring program to identify current and potential water quality problems.
- Following up on any water quality complaints and provide assistance in solving identified problems.

Education Programs

As resources allow, the SWCD, watershed councils, and OSU Extension Service (Extension), in partnership with other agencies and local organizations, will develop an educational plan to improve the awareness and understanding of water quality and quantity issues. They will strive to provide the most current information in a manner, which avoids conflict and encourages cooperative efforts to solve problems. The following is a list of action items that will be considered in developing educational programs.

- Showcase successful practices and systems and conduct annual tours for landowners and media.
- Recognize successful projects and practices through appropriate media and newsletters.
- Promote cooperative on-the-ground projects to solve critical problems identified by landowners/operators and in cooperation with partner organizations.
- Conduct educational outreach to promote public awareness of water quality and quantity.
- Evaluate current research and scientifically valid monitoring results and conduct such monitoring as may be necessary to better quantify current conditions and objectives contained in this plan in preparation for biennial plan reviews.

Implementation of this Area Plan is a priority element in the Wheeler Soil and Water Conservation District Annual Work Plan and Long Range Plan and the Mid John Day Watershed Councils Action Plans. These organizations hold regular monthly public meetings, publish newsletters and sponsor special events that will often focus on water issues. Community meetings will continue to be encouraged as needed to provide a forum for current water issues.

Water Quality Management Practices

Effective water quality management practices for water pollution control are those management practices and structural measures that are determined to be the most beneficial, practical means of controlling and preventing pollution from agricultural activities.

Appropriate management practices for individual farms may vary with the specific cropping, topographical, environmental, and economic conditions existing at a given site. Due to these variables, it is difficult to recommend any uniform set of management practices to improve water quality relative to agricultural practices.

Management practices and land management changes are most effective when selected and installed as integral parts of a comprehensive resource management plan based on natural resource inventories and assessment of management practices. The result is a system using the management practices and land management changes which are designed to be complementary, and when used in combination, is more technically sound than each practice separately.

A detailed listing of a number of specific practices and management measures, which can be employed to control or reduce the risk of agricultural pollution, are contained in other documents such as the Field Office Technical Guide available for reference at the local the NRCS office. While not exhaustive or all-inclusive, each prevention and control measure contains a list of practices that may typically be used for effective prevention and control of water pollution from agricultural activities.

Farm/Rural Conservation Plans

This plan recognizes that planning for water quality is only part of a successful plan for overall management of agricultural and rural land, and that other personal and public objectives must also be considered in total farm or resource management planning.

Landowners and operators have flexibility in choosing management approaches and practices to address water quality issues on their lands. They may implement management systems on their own without a plan or may develop a plan that suits the needs of their operation. The local management agencies recommend that voluntary water quality plans be developed to assist the landowners and operators to assess the conditions on their lands. These plans will identify problems or potential problems on their land, describe measures and resources needed to address those problems and identify expected outcomes.

Farm/rural conservation plans describe the management systems and schedule of conservation practices that the landowner will use to conserve soil, water, and related plant and animal resources on all or part of a farm or ranch unit. Voluntary water quality plans may be developed by landowners or operators, or with the assistance of consultants or technicians available through the SWCD or NRCS. An effective water quality plan will outline specific measures necessary to prevent or control water pollution and soil erosion from agricultural activities and to address the "Prevention and Control Measures" outlined in this Area Plan.

Technical & Financial Assistance

It is not the intent of this plan to impose a financial hardship on any individual. It is the responsibility of the landowner or operator to request technical and/or financial assistance, if needed, and to develop a reasonable timeframe for addressing potential water quality problems. It is the state's responsibility, through involved agencies, to provide incentives to private landowners to achieve water quality benefits for the public unless the landowner has conducted activities in a flagrant, neglectful and willful manner.

As resources allow, the SWCD, NRCS and other natural resource agency staff are available to assist landowners in evaluating effective practices for protecting and improving water quality on their land, and incorporating these practices into voluntary water quality plans. Personnel in these offices can also design and assist with implementation of practices, and assist in identifying sources of cost-sharing or grant funds for the construction and use of some of these practices.

Farm planning assistance is available from these and other sources:

Technical Assistance

NRCS, Soil Conservationist –planning, design, implementation
SWCD, Technical Watershed Specialist – planning, implementation, grant writing
Mid John Day and Bridge Creek Watershed Council – planning, implementation, grant writing

Publications

Voluntary Conservation On Your Land, NRCS/OACD
Oregon Small Acreages Conservation Toolbox, NRCS/OACD
WESt Program Workbook, OCA/Extension
Ranch Water Quality Planning Workbook, Extension
Oregon Plan Toolbox, OWEB

Programs

Farm*A*Syst Program, Extension
Stream*A*Syst Program, Extension
Home*A*Syst Program, Extension

Financial and cost-sharing assistance, for installation of certain management practices, may be available through current USDA conservation programs such as the Environmental Quality Incentives Program (EQIP), Conservation Reserve Program (CRP), Conservation Reserve Enhancement Program (CREP), Continuous CRP, EPA's non-point source implementation grants, Bonneville Power Administration (BPA) fisheries and wildlife mitigation funds or state programs such as the Oregon Watershed Enhancement Board (OWEB) and OWEB Small Grant Program. The local watershed councils and several federal and state agencies are also available to provide technical assistance or financial assistance to private landowners.

Monitoring and Evaluation

The progress and success of implementation efforts will be assessed through determination of changes in land management systems and the measurement of water quality improvement over time. Monitoring activities are integral components of Area Plans. When effectively used, monitoring activities can provide valuable information on how much effect a plan is having, how extensively it is being implemented, and where more efforts are needed in a basin. For the purposes of Area Plans, three main types of monitoring are appropriate. These are:

Baseline condition monitoring - Baseline condition monitoring information provides a starting point for assessing water quality trends. In order to evaluate the impact of Area Plan efforts, a picture of conditions prior to implementation of the Area Plan is needed. Baseline condition monitoring will identify all previously existing data applicable to the area. Landowners are encouraged to collect water quality data on their land. Watershed councils and the SWCD are available to assist their efforts.

Water quality trend monitoring - This type of monitoring is performed to give feedback on the long-term changes in water quality in a basin. When combined with compliance monitoring, it can indicate how much improvement in water quality conditions can be attributed to changes in land use practices. In general, trend monitoring activities will be a continuation of your baseline monitoring.

Effectiveness monitoring - In the context of Area Plans, effectiveness monitoring involves evaluation of changes in land use, and in monitoring the net effect of Area Plan rules on water quality. Water Quality Management Practices are evaluated to make sure that they produce the desired outcomes, in terms of protecting water quality.

A complete monitoring program should involve all of these types of monitoring. The Oregon Plan for Salmon and Watersheds *Water Quality Monitoring Technical Guide Book (Monitoring Guide)* is available to provide guidance in developing monitoring programs. Since resources are limited, a monitoring program must be a cooperative effort between

involved agencies and organizations to obtain the necessary information for making management recommendations.

Biennial Review

This Area Plan and the associated Area Rules are subject to a biennial review process. Two years after adoption, ODA, in cooperation with the Wheeler SWCD, the LAC, and DEQ will assess the progress of Area Plan implementation toward achievement of Area Plan goals and objectives. These assessments will include:

1. An accounting of the numbers and acreage of operations with Voluntary Water Quality Plans and the calculated amount of soil erosion and pollution prevented.
2. Identification of additional sources of sediment, heat inputs and other contributors to non-attainment of all applicable water quality standards.
3. An evaluation of available current water quality monitoring data.
4. An evaluation of outreach and education programs designed to provide public awareness and understanding of water quality issues.
5. A review of projects, demonstrations, and tours used to showcase successful management practices and systems.
6. An evaluation of the effectiveness of technical and financial assistance sources available to the agricultural community.
7. Review of load allocations as found in the Middle John Day Basin TMDL and effectiveness of this plan in meeting load allocations as described in the TMDL.

Based on these assessments, the ODA, the SWCD, the LAC and the State Board of Agriculture will consider making appropriate modifications to the plan and the associated Oregon Administrative Rules. Any future amendments to the administrative rules will be subject to public participation process as defined in Oregon law.

VII. Administrative Roles and Responsibilities

A. Designated Management Agency

The Oregon Department of Agriculture is the Designated Management Agency for water pollution control activities on agricultural and rural lands in the Middle John Day AgWQM Area. The department is authorized to develop and carry out a water quality management plan for any agricultural or rural lands where such a plan is required by state or federal law.

The Wheeler Soil and Water Conservation District is the Local Management Agency (LMA) designated by ODA for development and implementation of the Area Plan and projects in the Management Area. Grant, Gilliam, and Wasco, and Jefferson SWCDs will assume responsibility for the implementation of the Area Plan and related projects within those districts under agreement with the LMA. The Mid John Day Watershed Councils will assist the LMA in implementation and review of the Area Plan and related projects. Implementation priorities will be established on a periodic basis through annual work plans developed jointly by the SWCDs and ODA with input from partner agencies.

The director of ODA appointed a Local Advisory Committee representing local agricultural producers, and owners, agencies, tribes, environmental organizations and the SWCD for the purpose of assisting with the development of this Area Plan and the associated Oregon Administrative Rules to implement core elements of the Area Plan.

B. Resolution of Complaints and Enforcement Action

ODA will investigate complaints against landowners or operators who are alleged to be out of compliance with the Rules associated with this Area Plan. If the landowner is in non-compliance, ODA will consult with the SWCD and relevant landowners, using the NRCS Field Office Technical Guide to develop solutions and timelines. The authority and procedures for complaint investigation rests with ODA under provisions of OAR 603-095-2560.

ODA will use enforcement mechanisms where appropriate and necessary to gain compliance with the prevention and control measures. Any enforcement action will be pursued only when reasonable attempts at voluntary solutions have failed. Authority for any enforcement action rests with the Department under provisions in OAR 603-90-0060 through 603-90-0120.

In that regard, ODA's authority is subject to all provisions of the Oregon Constitution and the 4th Amendment of the US Constitution that protect citizens against unreasonable searches. The Department may not enter private land to collect information without landowner consent or a warrant when consent is not received.

C. Total Maximum Daily Loads

The Oregon Department of Environmental Quality is required by federal law to establish formal "Total Maximum Daily Loads" (TMDLs) for pollutants in waters designated as "water quality limited." The TMDL will set maximum limits on the amount of pollutants allowed to enter in the AgWQM Area waters. This loading capacity is calculated to achieve water quality standards.

Each jurisdiction in the John Day River basin will be allotted a portion of the TMDLs, representing the maximum amount of pollutant, which may be discharged daily from the lands managed by the respective jurisdiction to the John Day River's waters. This amount is the jurisdiction's "Load Allocation" (LA). The DEQ has requested the appropriate Designated Management Agencies in the basin to develop pollution control plans and programs designed to achieve the load allocations. Oregon Administrative Rules Chapter 340, Division 41, paragraph 026,120 and 642 requires these Water Quality Management Plans and sets the water quality standards.

Consistent with this Area Plan and the memorandum of understanding between DEQ and ODA, an objective of this plan is to meet John Day basin load allocations. At the time of publication of this Area Plan, these loads are not available. The biennial review for this Area Plan will enable modifications as needed to implement management that reduces pollutants related to load allocations.

ATTACHMENT 1:

Oregon Administrative Rules Oregon Department of Agriculture Middle John Day River Subbasin

603-095-2500

Purpose

(1) These rules have been developed to implement a water quality management area plan for the subbasin pursuant to authorities vested in the department through ORS 568.900-568.933. The area plan is known as the Middle John Day Agricultural Water Quality Management Area Plan.

(2) The purpose of these rules is to outline requirements for landowners in the Middle John Day Agricultural Water Quality Management Area for the prevention and control of water pollution from agricultural activities and soil erosion. Compliance with Division 95 rules is expected to aid in the achievement of applicable water quality standards.

603-095-2520

Geographic and Programmatic Scope

(1) The Middle John Day Agricultural Water Quality Management Area Management Area includes the area that drains into the John Day River between the Wheeler-Gilliam county line and the upstream end of Picture Gorge. The physical boundaries of the Middle John Day Agricultural Water Quality Management Area Management Area are indicated on the map included as an attachment to these rules.

(2) Operational boundaries for the land base under the purview of these rules include all agricultural and rural lands within the Middle John Day Agricultural Water Quality Management Area Management Area with the exception of public lands managed by federal agencies and activities that are subject to the Oregon Forest Practices Act.

(3) The provisions of these rules apply to all agricultural and rural land whether or not in current productive agricultural use.

(4) For lands in agricultural use within other Designated Management Agencies' or state agency jurisdictions, the Department and the appropriate Local Management Agency shall work with these Designated Management Agencies to assure that provisions of these rules apply, and to assure that duplication of any services provided or fees assessed does not occur.

603-095-2540

Prevention and Control Measures

(1) Limitations: All landowners or operators conducting activities on agricultural and rural lands are provided the following exemptions from the requirements of OAR 603-095-2540 (Prevention and Control Measures).

(a) A landowner or operator shall be responsible for only those conditions caused by activities conducted on land managed by the landowner or operator.

(b) Rules do not apply to conditions resulting from unusual weather events or other circumstances not within the reasonable control of the landowner or operator. Within the reasonable control of the landowner means that technically sound and economically feasible measures must be available to address conditions described in Prevention and Control Measures.

- (c) The Department may allow temporary exceptions when a specific integrated pest management plan is in place to deal with certain weed or pest problems.
- (2) Waste Management: Effective on rule adoption, no person subject to these rules shall violate any provision of ORS 468B.025 or 468B.050.
- (3) Effective January 1, 2008, riparian management must allow the establishment, growth, and active recruitment of vegetation, consistent with the vegetative capability of the site, for protection of water quality by filtering sediment, stabilizing streambanks and providing shade.
- (4) Effective January 1, 2008, irrigation must be done in a manner that limits the amount of pollutants entering waters of the state in the runoff from the irrigated area.
- (5) Effective January 1, 2008, areas used to control livestock, with a demonstrated impact on water quality, will be managed to control runoff of sediment or animal waste.

603-095-2560

Complaints and Investigations

- (1) When the Department receives notice of an alleged occurrence of agricultural pollution it may conduct an investigation. The Department will coordinate inspection activities with the appropriate Local Management Agency.
- (2) Each notice of an alleged occurrence of agricultural pollution shall 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 603-095-2560(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 603-095-2560(4), "person does not include any local, state or federal agency.
- (6) Notwithstanding OAR 603-095-2560(4), 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 OAR 603-090-0060 through 603-090-0120.

ATTACHMENT 2:

References to information used in the development of the Area Plan

Agricultural Commodity Sales – Wheeler County, Extension Economic Information Office, OSU, January 2000

Effective Cattle Management in Riparian Zones: A Field Survey and Literature Review, Montana BLM, 1997.

Influences of Human Activity on Stream Temperatures and Existence of Cold-Water Fish in Streams with Elevated Temperature: Report of a Workshop, Interagency Multidisciplinary Science Team, November 8, 2000.

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John Day River Basin Report, Oregon Water Resources Dept., November 1986

John Day River Management Plan and Environmental Impact Statement, BLM & OSPRD, October 1993

North/Middle Forks John Day River Agricultural Water Quality Management Area Plan and Rules, ODA, 2002

NRCS Field Office Technical Guide, NRCS

Oregon Administrative Rules, Chapter 340, Division 41, DEQ, March 1996

Oregon Administrative Rules, Chapter 603, Divisions 90 and 95, ODA

Oregon Final 2002 Water Quality Limited Streams - 303(d) List, DEQ, Nov. 2002

Oregon Revised Statutes, 468B

Oregon Revised Statutes, 561.191

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Oregon Small Acreages Conservation Toolbox, NRCS /OACD, 1999

Questions and Answers About DEQ's Temperature Standards, DEQ, February 1998

Ranch Water Quality Planning Workbook, OSU Extension,

Relationship Between Agriculture Water Quality Management Area Plan Conditions and Water Quality Standards, ODA, Sept. 2000

Restoring Water Quality Throughout Oregon, DEQ, February 1998

Riparian Area Management; A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas, BLM/USFS/NRCS, 1998

Riparian Area Management; Process for Assessing Proper Functioning Condition, BLM, 1995

Riparian Area Responses to Changes in Management, BLM/OSU, 1999

Successful Strategies for Grazing Cattle in Riparian Zones, Montana BLM, 1998

The Ecological Provinces of Oregon, Oregon Agricultural Experiment Station, May 1998

The Oregon Plan Toolbox, Oregon Watershed Enhancement Board

Water Quality Monitoring: Technical Guide Book, OWEB, July 1999

WESt Program Workbook, Oregon Cattleman's Association, 1998

ATTACHMENT 3: Map

