Benton County Riparian and Wetlands Project

Inventory Report

DRAFT 12/17/2010

Approved by Benton County with support from the Benton County Riparian and Wetlands Advisory Group

Alsea River Falls

William L. Finley Wildlife Refuge

Jackson Frazier Wetland

Inventory Report, Updates and other Project Materials Available on the Project Website at:

www.co.benton.or.us/cd/riparian

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Background:

This inventory report is a work in progress that will be updated through the remaining stages of the project (see **Recommendations, Next Steps**). A final inventory report will be adopted prior to implementation. Benton County led development of the Riparian and Wetlands Inventory to help county residents and county staff, accomplish community goals for riparian and wetland resources within Benton County. The inventory provides best available information possible during the project period, on the location and type of riparian and wetland resources. These resources help to improve property features, stabilize eroding banks, enhance habitat for fish and many other wildlife species, improve water quality by filtering runoff, and help protect against flood damage to private and public property. Benton County Riparian and Wetlands Advisory Group members and staff will utilize the inventory to assess the current conditions, forecast the effect of land use regulations, provide education and outreach, connect to and provide incentives, and form partnerships to support and improve riparian and wetland resources. The inventory was completed countywide with focus on the unincorporated areas of Benton County.

The inventory is intended to provide the best available information possible during the project period, on the location and quality of riparian and wetland resources.

Under the Oregon Statewide Planning Program, which was initiated with the enactment of Senate Bill 100 in 1973, state statutes and rules require local jurisdictions to plan for natural resources. Among its many components, Statewide Planning Goal 5 (Historic & Natural Resources) directs cities and counties to inventory, evaluate and protect riparian corridors along fish-bearing streams. Goal 6 (Air, Land and Water Quality), requires that land use plans ensure that water quality will be maintained.

Benton County is also required by the federal Clean Water Act to improve water quality. Since 2007, Benton County has been subject to a National Pollution Discharge Elimination System permit, requiring improvements to stormwater quality. Additionally, the County must implement a Total Maximum Daily Load Implementation Plan to reduce inputs of bacteria, mercury and heat to the Willamette River basin. A key element of the County's efforts in both of these areas is to conserve and improve riparian and wetland resources to improve water quality. (See **Guiding Principles**)

The Benton County Riparian and Wetlands Advisory Group was called together to provide diverse perspectives and consensus recommendations to Community Development Staff for completion of the inventory. The inventory includes mapping and evaluation of riparian and wetland resources under State and local Goal 5 and Goal 6 policies, and takes into account overlapping jurisdictional rules.

The Inventory was developed from 2009 to November 2010 by direct support and/or participation from Benton County Landowners, county staff, Benton Soil and Water Conservation District, City of Adair Village, City of Monroe, Marys River Watershed Council, Audubon Society of Corvallis, Oregon Department of Agriculture Oregon Department of Fish and Wildlife, Oregon Department of Land Conservation and Development, Oregon Department of Forestry, and the US Environmental Protection Agency.
Funding was provided through the awarding of a competitive grant from the Wetlands Program Development Program, within US EPA Region 10 to Benton County Community Development Department and in-kind staff and volunteer support. The inventory was requested by county residents during the 2007 Benton County Comprehensive Plan update.

Overview of Current Stream/Riparian and Wetland Resource Issues

Information and issues related to western Oregon riparian areas (and associated stream and wetland resources) were synthesized in *Oregon's Statewide Riparian Restoration and Management Policy* developed by the Governor's Natural Resources Office and the Oregon Plan Core Team during 2000-2002, to guide policy and rulemaking as they relate to riparian areas. These efforts were responses to Executive Order 99-01 and the Independent Multidisciplinary Science Team (IMST) recommendations regarding the need for landscape approaches to watershed management in Oregon. An overview of findings includes:[1]

- Riparian areas make up about fifteen percent of the total area of Oregon;
- Trends in riparian condition along the upper mainstem Willamette River have shown a loss of more than half of the historical channel complexity and reduction of more than 85 percent of the total riparian forest since the 1850s;
- Urbanization and residential development impact a much smaller portion of Oregon's land base—less than ten percent—but reduce riparian functions to a great degree;
- Non-native plants make up more than half of the riparian species along the mainstem Willamette River" (Oregon Progress Board, 2000).
- Benton County contains Endangered Species Act (ESA) listed salmon species, including the Upper Willamette River Coho and Steelhead including habitat utilized for spawning, feeding, and migration (NOAA, 2010). Many impacts have led to the decline of salmon populations (e.g. dams) (NOAA, 2008 Biological Opinion), with documented impacts from development encroachment within the riparian area leading to channelization, degraded water quality, loss of in-stream habitat, increased erosion and other impacts (NOAA, 2008; City of Corvallis Salmon Response Plan, 2004).

Current local stream and riparian/wetland issues have been well documented by watershed councils located in Benton County. Watershed councils are continually working towards implementation of the State of Oregon Plan for Salmon and Watersheds (OWEB, 2010). Through the completion of comprehensive watershed assessments, councils review the historic and current conditions of riparian corridors, vegetation, fish and wildlife habitat and abundance. In general, the assessments in Benton County document that there have been major modifications to riparian corridors including: native vegetation clearing, dams, road crossings, irrigation diversions, straightening stream channels, diked channels and disconnected channels from floodplains, and draining and other impacts to wetland areas (Luckiamute River, Long Tom River, Marys River, watershed assessments). Watershed councils and local, state and federal organizations work towards improving these and other issues across private and public land.

[1]For additional report findings on riparian buffer/area functions in western Oregon, see **Appendix A**.

Overview of Current Water Quality Issues

There are specific water quality problems that the Riparian and Wetlands Project is intended to help address; one of the foremost is the water-quality status of the mainstem Willamette River, and the water quality impacts to streams. Oregon DEQ has mandated that all designated management agencies in the Willamette Basin take steps to:

- Reduce bacteria loading (Benton County TMDL Implementation Plan, 2008,
- Reduce erosion and sedimentation; eroded soil entering waterways is the leading cause of mercury pollution and areas lacking vegetated riparian areas are unable to stabilize streambank soils and filter sediment-laden runoff before it reaches streams in Benton County (Benton County TMDL Implementation Plan, 2008).
- Reduce temperature inputs to the watershed (Benton County TMDL Implementation Plan, 2008). As most of the streams in Benton County drain into the Willamette, Benton County is required to improve water quality and work towards improving and maintaining the riparian buffer between land development/land use activities and the waterways (Benton County Stormwater Management Plan, 2007, Benton County TMDL Implementation Plan, 2008).

As noted in Oregon's Statewide Riparian Management and Restoration Policy document water quality section, the report observed that "…instances of good or excellent water quality occur most often in the forested uplands of Oregon. Both forest practice rules on public and private forest lands and lack of development help explain this result. On the other hand, instances of poor or very poor water quality occur most often in the non-forested lowlands where intensive land uses have occurred" (p. Statewide Riparian Management and Restoration Policy 19-20).

According to the U.S. Environmental Protection Agency, the leading cause of water degradation is from nonpoint sources of pollution (NPS), which includes runoff from lawns, farms, forests, highways, and urban areas, as well as leachate from septic systems and landfills, bacteria from livestock, failing septic systems and other sources (U.S. EPA, 1998). Development can lead to removal of riparian vegetation that can buffer impacts from runoff of pesticides, paint, wood treatment chemicals, fertilizer and other chemicals during rainstorms (Oregon Nonpoint Source Pollution Plan, 2000). An additional water quality issue within several Benton County streams is water quality impairments for temperature during specific times of the year for priority aquatic species such as salmon and other threatened/game fish species (Benton County TMDL, 2007). A major factor of stream temperature impairment is lack of vegetation providing stream shading (NRC 2002; Benton County TMDL, 2007; Moore, 1997; Beschta, 1997). Stream temperature can also be reduced by increased stream flow, stream bank stabilization (leading to narrower stream channels), and other factors (Moore and Miner, 1997; Beschta et al., 1987; and Sinokrot and Stefan, 1993). The location of shading between the headwaters and confluence of the river is also an important influence on stream temperature (Beschta et al., 1987). Once stream temperature is elevated, heat is not dissipated easily even if the water flows through a shaded reach (Beschta et al., 1987).

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Purpose and Overview of Inventory:

This report summarizes the inventory of riparian areas, streams, and wetlands within Benton County, Oregon. The inventory was prepared by Benton County Community Development and Geographic Information Systems staff team, with guidance, review and input provided by the Benton County Riparian and Wetland Advisory Group (RWAG; See **Appendix B** for RWAG volunteer list). The inventory begins with project goals and background, overview of study area characteristics, and inventory methods. Next, the report provides an overview of findings for each resource with a summary of available data sources utilized, and recommendations for meeting goals. The report takes a watershed approach to describe location, quantity, and quality of watershed riparian and wetland resources. Inventory maps show the location of resources and the distribution of riparian corridors, streams, and wetlands within Benton County based on the inventory process developed by Benton County, the advisory group, and reviewed by county commissioners.

The Benton County Riparian and Wetlands Inventory provide a basis for forming policy decisions regarding the type of program appropriate for riparian and wetland resources. Inventory and policy analysis is ongoing through June 2011, supported by an EPA-Region 10 Wetland Program Development Grant, Benton County, project advisory group volunteers and citizens.

Goal, Objectives, and Guiding Principles

Goal

The Riparian and Wetland Advisory Group (RWAG) developed the overarching goal to guide project work over a two year period. The inventory utilizes the best available and most appropriate science from all partners as well as local and regional knowledge streams, riparian areas, and related resources.

Benton County
Riparian and Wetlands Project
GOAL

Create a plan to support and improve natural function of streams, riparian areas and wetlands within the unincorporated areas of Benton County, to comply with State planning rules and Benton County's Comprehensive Plan.

Objectives:

- Prepare and adopt a Statewide Planning Goal 5 inventory for riparian corridors and protection program for 'fish bearing streams, 'fish bearing lakes' in Benton County.
- Prepare a Statewide Planning Goal 6 (water quality) related inventory data for improving water quality.

The Riparian and Wetlands Inventory will compile and create the best available data to meet the citizen developed comprehensive plan goals for riparian, wetland and other natural resources while informing a Benton County Riparian and Wetlands Plan (policy, education, incentives)

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- Encourage land use, development and transportation projects and other private and public work to be designed to minimize incursions and other impacts to floodplains, wetlands, and riparian areas through: policy, outreach, education, and incentives.

Guiding Principles

Benton County Comprehensive Plan (updated 2007)

The Comprehensive Plan is the official policy guide for decisions about growth, development, services, and resource management in Benton County outside of incorporated cities. The policies of the Comprehensive Plan serve as the basis for developing and implementing regulations of the Development Code. The Comprehensive Plan is based on the physical, economic and social characteristics of the county; the desires and needs of county citizens, state laws, and programs and polices of other local, state, and federal governmental agencies. Overall, the Plan is intended to provide a framework for consistent and coordinated public and private land use decisions.

The Riparian and Wetland Inventory and Plan was developed with guidance provided by the Benton County Comprehensive Plan Goal 5 which addresses natural resources, including riparian resources, fish habitat, and wetlands. For example, Comprehensive Plan Policy 5.6.1**,** **"***Benton County shall undertake the Goal 5 process and adopt a protection program for significant riparian areas within 18 months of adoption of the Plan amendments".* In addition Goal 6 policies for water resources were created by citizens to improve and maintain water quality, for example citizen motivated Policy 6.2.4 *"Benton County shall place a high priority on maintaining natural systems and processes as a biological method for maintaining and protecting clean water"* (see **Appendix C** for full list of Benton County Comprehensive Plan Goal 5 and Goal 6 Policies, and State Policy applicable to the Benton County Riparian and Wetlands Project Inventory).

Benton County Stormwater Management Program for the Corvallis Urbanized Area (2007)

Beginning in 1990, the US Environmental Protection Agency (EPA) required large municipalities to obtain National Pollutant Discharge Elimination System (NPDES) permits for their municipal separate storm sewer systems (MS4). An MS4 is a system of conveyances, including roads, ditches, gutters, catch basins, and storm drains that are owned or operated by a public body. In December of 1999, the EPA adopted rules to implement "Phase II" of the stormwater program. Phase II expanded the stormwater permitting program to include smaller communities located in US census defined urban areas. The Corvallis Urbanized Area includes the urban fringe surrounding the cities of Corvallis, Philomath, and Adair Village. Stormwater program implementation goals adopted by Benton

There are many State and Federal water quality and riparian/wetland requirements along with local citizen developed land use goals, which provide the background and need for the Benton County Riparian and Wetlands Project.

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County include "develop and adopt Development Code standards for protection of wetlands and riparian areas to maintain the natural filtration and retention capacity of the ecosystem."

Benton County Total Maximum Daily Load Implementation Plan (2008)

The Willamette River and numerous tributaries do not currently meet several water quality standards that assure beneficial uses of the rivers. When these water quality standards are not met, the federal Clean Water Act (CWA) requires that Total Maximum Daily Loads (TMDLs) be established to determine how much pollution can be added to the river without exceeding the standards. The adopted Benton County TMDL Implementation Plan outlines that the County will implement "better preservation of riparian corridors along waterways will enable better filtering of bacteria and other pollutants before they reach the stream. Increasing dry-season streamflows will reduce the concentration of pollutants. Managing and developing strategies from a watershed perspective will enable better understanding of problems and better ability to formulate solutions." The Water Quality Inventory section builds on the ongoing TMDL Implementation plan and Stormwater Implementation Plan efforts (see **Water Quality**).

Inventory Overview

Benton County project staff completed the following tasks as directed by local and State policies with review and input by the project Advisory Group members, County residents, and other State and Local stakeholders:

1. **Collection of Data** from applicable academic, State, Federal and local scientific research and existing/ongoing inventory methods;

2. **Field Observations** of stream locations, riparian areas, and wetlands;

3. **Mapping** of data relevant to Goal 5 (riparian, wetlands) and Goal 6 (water quality) to meet the goals of the project;

4. **Facilitation of Public Involvement** through the formation of the Riparian and Wetlands Advisory Group, news releases, public meetings, public mailings, website, creation and updates, public review of draft documents, and acknowledgement of the final plan by the Benton County Board of Commissioners;

5. **Analysis and Drafting of the Report** to integrate the results of the planning process provide ample review and integration of committee and public input.

The inventory will adhere to the requirements under Statewide Planning Goal 5 (Riparian, Wetland Resources) and Goal 6 (Water Quality) to meet project goals.

The Inventory Report, will include two series of countywide public meetings and other outreach, with support from the Riparian and Wetlands Advisory Group. The final plan, and associated requirements, will be prepared by June 30, 2011, for the public

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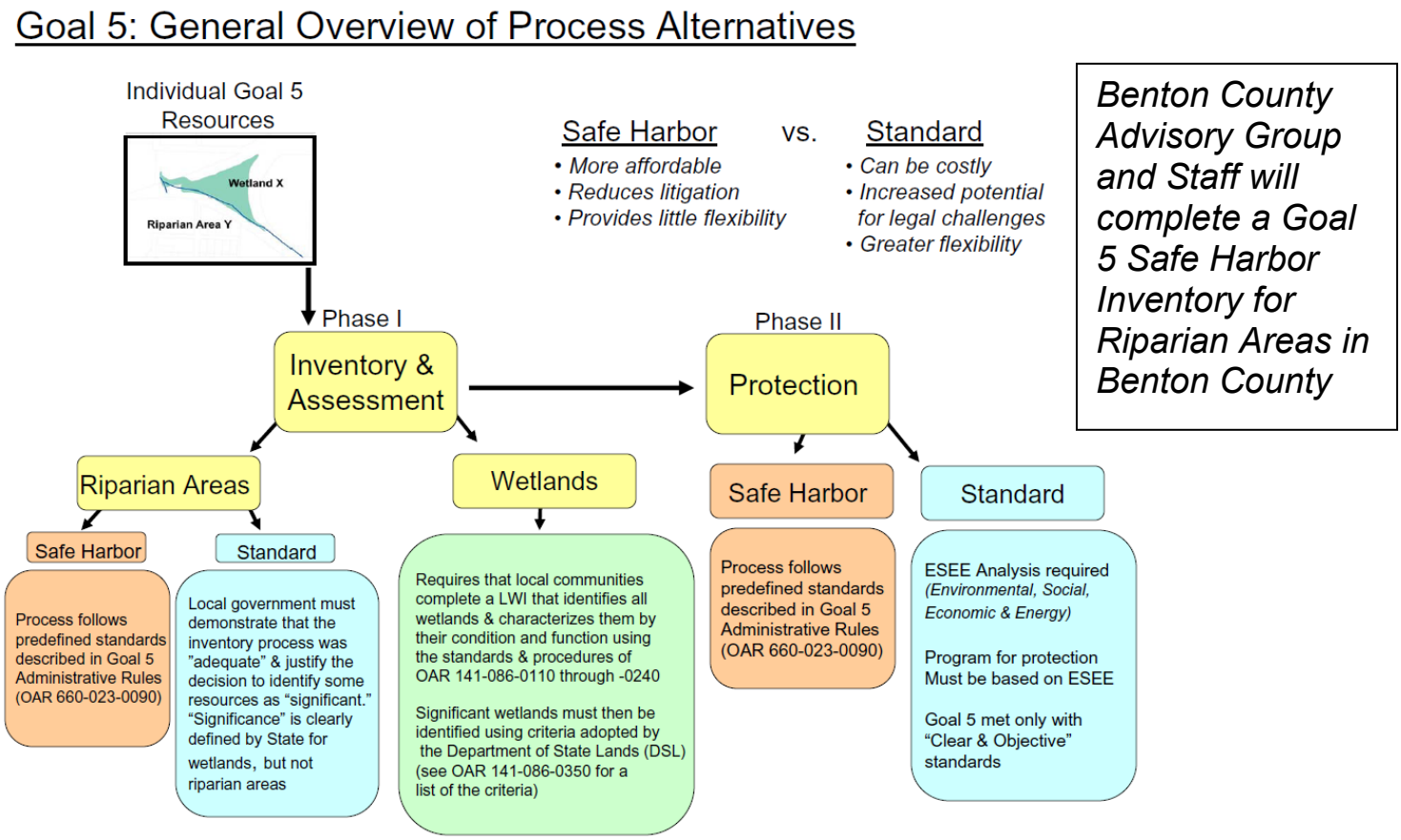
review and adoption process with the Benton County Board of Commissioners **Figure 1**.

Figure 1 Riparian and Wetland Inventory Overview *



State of Oregon Inventory and Policy Options

An overview of the variety of inventory approaches under Statewide Planning Goal 5 is presented in **Figure 1.** This inventory guidance was utilized by staff and participants at advisory group meetings, along with input from community meeting participants to determine an inventory approach. This included a compilation of definitions for riparian and wetland resources as described in State, Federal and local rules (see **Appendix D** for definitions providing guidance).

Oregon Statewide Planning Goal 5 mandates that local governments "adopt programs that will protect natural resources and conserve scenic, historic, and open space resources for present and future generations." Goal 5 requires local governments to maintain current inventories and evaluations of resources, and develop land use ordinances with clear and objective standards to protect the subset of wetland and riparian resources deemed to be significant. Goal 6 seeks to maintain and improve the quality of the air, water and land resources. Unlike Goal 5, Goal 6 does not have Administrative Rules to

set standards for meeting the goal. Instead, it relies entirely on other state and federal regulations for direction and implementation of water quality improvement.

Inventory Method Selected for Benton County

The Benton County Riparian and Wetlands Advisory Group (**Appendix B**), in coordination with the Benton County Riparian and Wetlands Project staff met monthly (with ongoing meetings until June 2011) with Advisory Group volunteers. The result was an understanding of the inventory and protection options available to meet project goals and objectives. Project staff also coordinated closely with the support of the State of Oregon Department of Land Conservation and Development, Oregon Department of Forestry, Oregon Department of State Lands, Oregon Department of Agriculture, and Oregon Department of Environmental Quality providing in-person ideas and support.

During February 2010 the Advisory Group and project staff with public input, finalized an inventory and protection option and process (see description and **Figure 2** below). The proposed inventory approach was reviewed during a Benton County Board of Commissioners meeting, where all Commissioners recommended the "completion of the Riparian and Wetlands Project inventory option and set deliverables, to support "long term County support and improvement of riparian and wetland areas in Benton County".

Adopted Inventory and Protection Method

After several months of Advisory Group review, a series of community meetings, and many conversations with applicable State Agency staff, the Riparian and Wetland Advisory Group (RWAG) adopted the following for Benton County Riparian and Wetlands Inventory approach and Plan creation and implementation:

"Primary protection of riparian resources would fall under Goal 5 "Safe Harbor", with additional program development occurring pursuant to Goal 6 (water quality) (**see schematic below**); Utilizing best available data and the highest resolution (LIDAR) and other riparian and wetlands maps, with select on-site field verification, Benton County will develop outreach materials and Development Code provisions".

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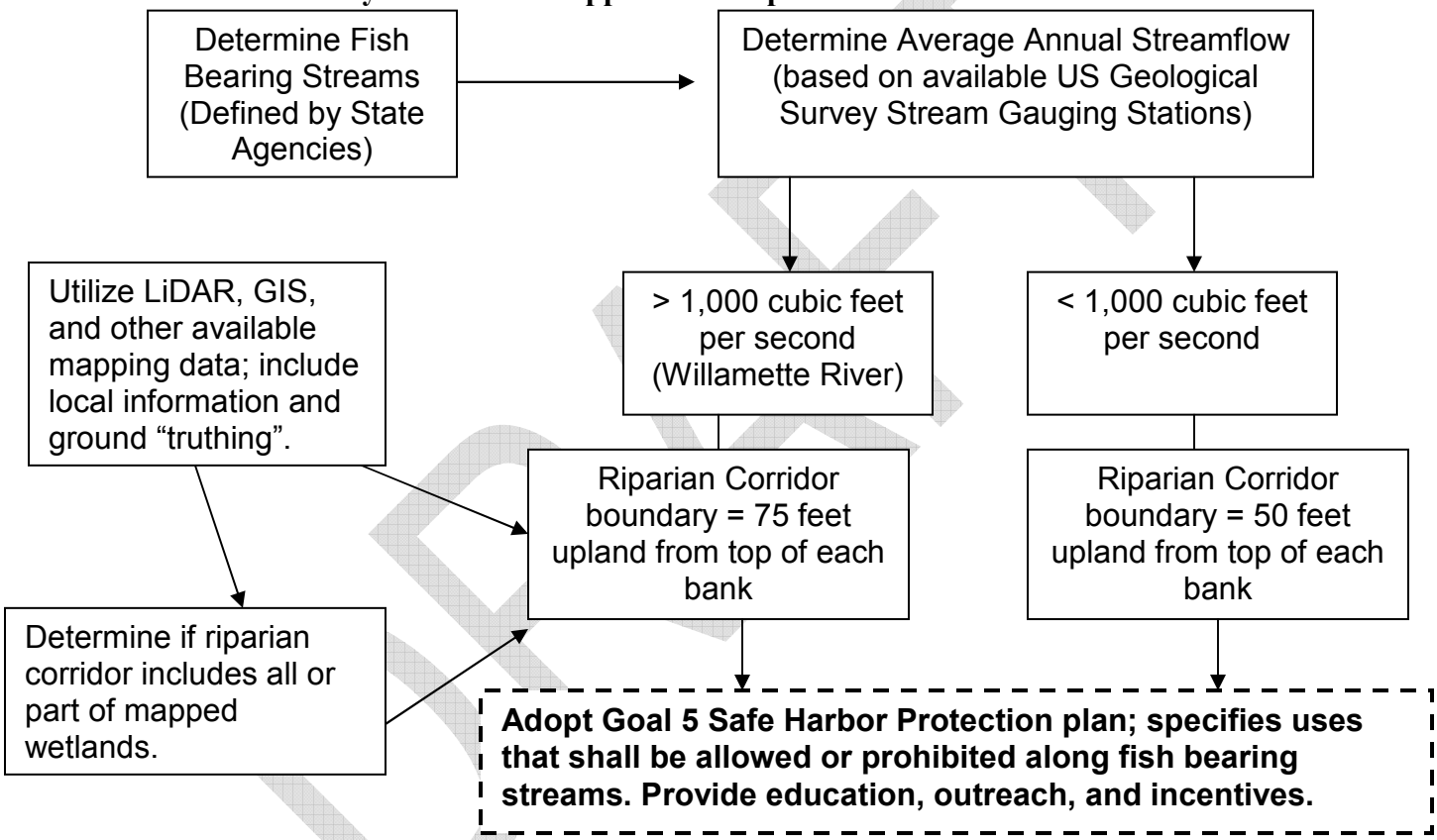
Figure 2

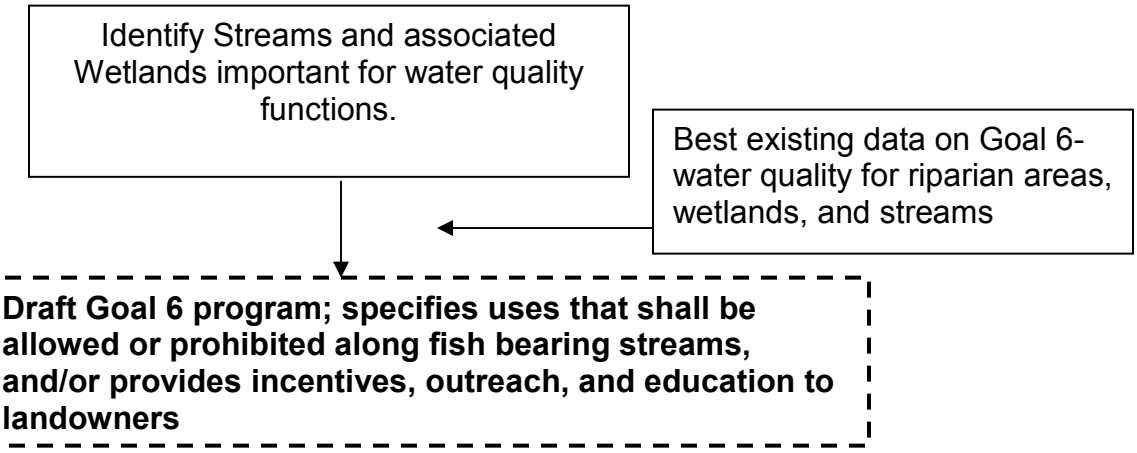
Approved Riparian/Wetlands Inventory Process
Supporting and Improving Natural Functions, Meeting State and Local Goals

Objective: Complete a 'Safe Harbor Inventory' and form a Goal 6 (Water Quality) inventory to inform the development of a Benton County Riparian and Wetland Plan.

Goal 5 Inventory: Focused to Support and Improve Fish and associated Habitats



Goal 6 Inventory: Flexible to Support and Improve Riparian/Wetlands Functions



Inventory Area

The inventory study area is Benton County, Oregon. Benton County encompasses several cities, large areas of agricultural and forest lands, and rural residential areas (see **Figure 3**). In 2007, the US population census for Benton County totaled 85,300. Approximately 80% of the total population was located within the five incorporated cities: Corvallis, North Albany, Philomath, Adair Village, and Monroe, with remaining residents dispersed throughout the unincorporated areas of the county. Inventory work focuses on rural/unincorporated land of Benton County, outside the Urban Growth Boundaries (UGBs) of incorporated cities. Abundant riparian and wetland resources are spread throughout Benton County, with annual precipitation countywide averaging 43 inches per year.

There are eight principal streams in Benton County including the mainstem Willamette River, within Benton County and several hundred tributary streams. All rivers and tributaries flow into the mainstem Willamette River, except for the Alsea River watershed which flows towards the coast. All of the major waterways in the county are known to provide habitat for listed (sensitive, threatened or endangered under State and Federal law) and/or game fish species and fisheries. The Alsea watershed provides important salmon habitat and is a popular fishery. Tributaries to major streams with listed fish species are vital for maintaining fish populations.

Goal 5: Riparian Safe Harbor Inventory

Under the safe harbor provision in State statute, significant riparian corridors are those areas including and adjacent to fish-bearing lakes and streams. The area of significance is determined by using a standard setback distance from all fish-bearing lakes and streams. Inventory information used to make this determination should include, but are not limited to:

a) Oregon Department of Forestry stream classification maps;
b) United States Geological Service 7.5 minute quadrangle maps;
c) National Wetlands Inventory Maps;
d) Oregon Department of Fish and Wildlife maps indicating fish habitat;
e) Federal Emergency Management Agency flood maps; and
f) Aerial photographs.

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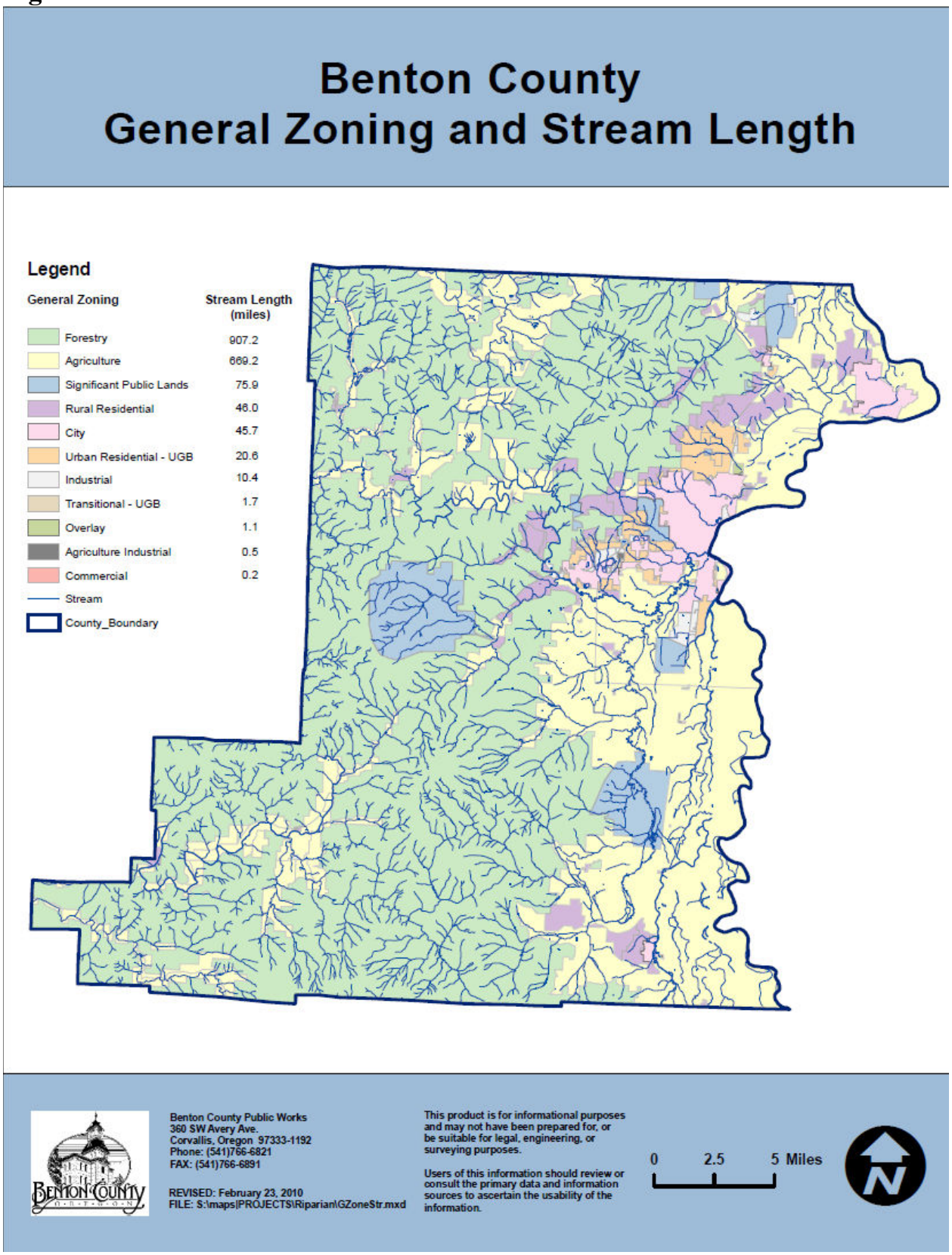
Figure 3


Benton County
General Zoning and Stream Length
Legend
General Zoning
Stream Length (miles)
Forestry 907.2
Agriculture 669.2
Significant Public Lands 75.9
Rural Residential 46.0
City 45.7
Urban Residential - UGB 20.6
Industrial 10.4
Transitional - UGB 1.7
Overlay 1.1
Agriculture Industrial 0.5
Commercial 0.2
Stream
County_Boundary
Benton County Public Works
360 SW Avery Ave.
Corvallis, Oregon 97333-1192
Phone: (541)766-6821
FAX: (541)766-6891
REVISED: February 23, 2010
FILE: S:\maps\PROJECTS\Riparian\GZoneStr.mxd
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Users of this information should review or consult the primary data and information sources to ascertain the usability of the information.
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Safe Harbor Inventory Methods

Two overlapping methods were developed to prepare the Benton County Riparian and Wetlands Project inventory:

1.) A compilation and review of existing information as required under Statewide Planning Goal 5 affiliated Oregon Administrative Rules, and presentation to the Riparian and Wetlands Advisory Group (RWAG), Benton County residents and Benton County project staff. The compiled information includes:

- Oregon Department of Forestry stream classification maps;
- United States Geological Service 7.5 minute quadrangle maps and available stream gauge data;
- Benton County stream delineation maps;
- National Wetlands Inventory Maps ;
- Oregon Wetland Explorer wetlands maps;
- EPA Region 10 wetland geo database (2010);
- Oregon Department of Fish and Wildlife maps indicating fish habitat;
- Federal Emergency Management Agency flood maps; and
- Aerial photographs.

2.) Delineation of stream and riparian area locations using Light Detection and Ranging (LiDAR) remote-sensing, high resolution mapping data.

3.) Select field verification of mapping data as resources allowed, and project staff and advisory group deemed necessary to meet project goals.

Mapping Data

There was a wide range of available Geographic Information Systems (GIS) data available for the project (see overview below). Project staff was required under State statutes and planning rules to compile and review specific types of mapping data, such as stream classification maps from the Oregon Department of Forestry. Benton County staff utilized best existing data (e.g. highest resolution, most current, most accurate) whenever possible, to improve the mapping data available. For an overview of GIS mapping metadata, including references of mapping data, refer to **Appendix E**).

Light Detection and Ranging Data (LiDAR) Map Data

"Light Detection and Ranging" is an optical remote sensing technology that measures properties of scattered light to find range and/or other information of a distant target. The prevalent method to determine distance to an object or surface is to use laser pulses. Benton County was a partner in the Oregon LiDAR Consoritum and will be utilizing LiDAR data for the Riparian and Wetlands project and other County projects**.**

The high resolution LIDAR mapping allowed GIS project staff to:

1. Develop 1 meter squared digital elevation models within current coverage area (**Figure 4**),
2. Prioritize and update stream channel locations within areas documented as "fish bearing streams" with "confirmed fish presence" by Oregon Department of Forestry (**Figure 5**), and
3. Provide outreach and education and other technical assistance to local residents and organizations on the landscape features of properties located within the current coverage area.

For an overview of the LIDAR mapping approach to improve stream location accuracy utilized for the Benton County Riparian and Wetlands Project(see **Appendix F).**

Figure 4 Current LiDAR Mapping Coverage Area

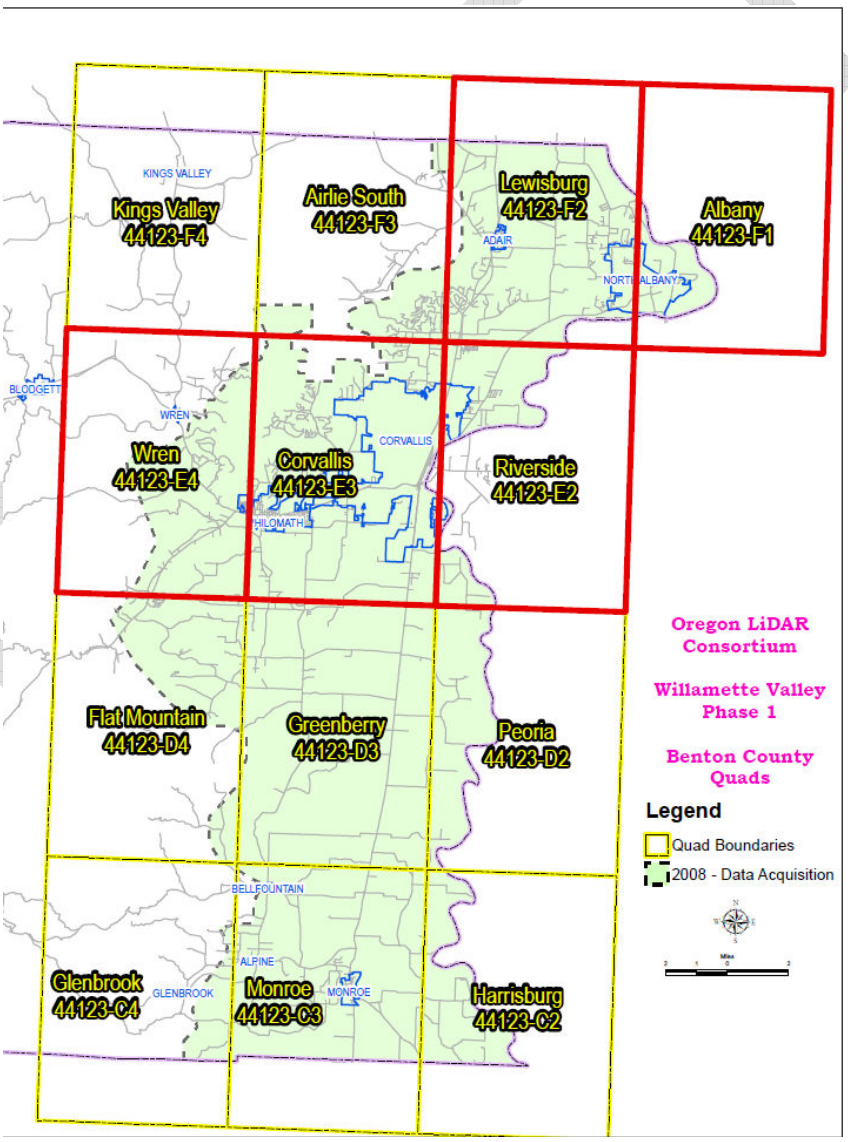
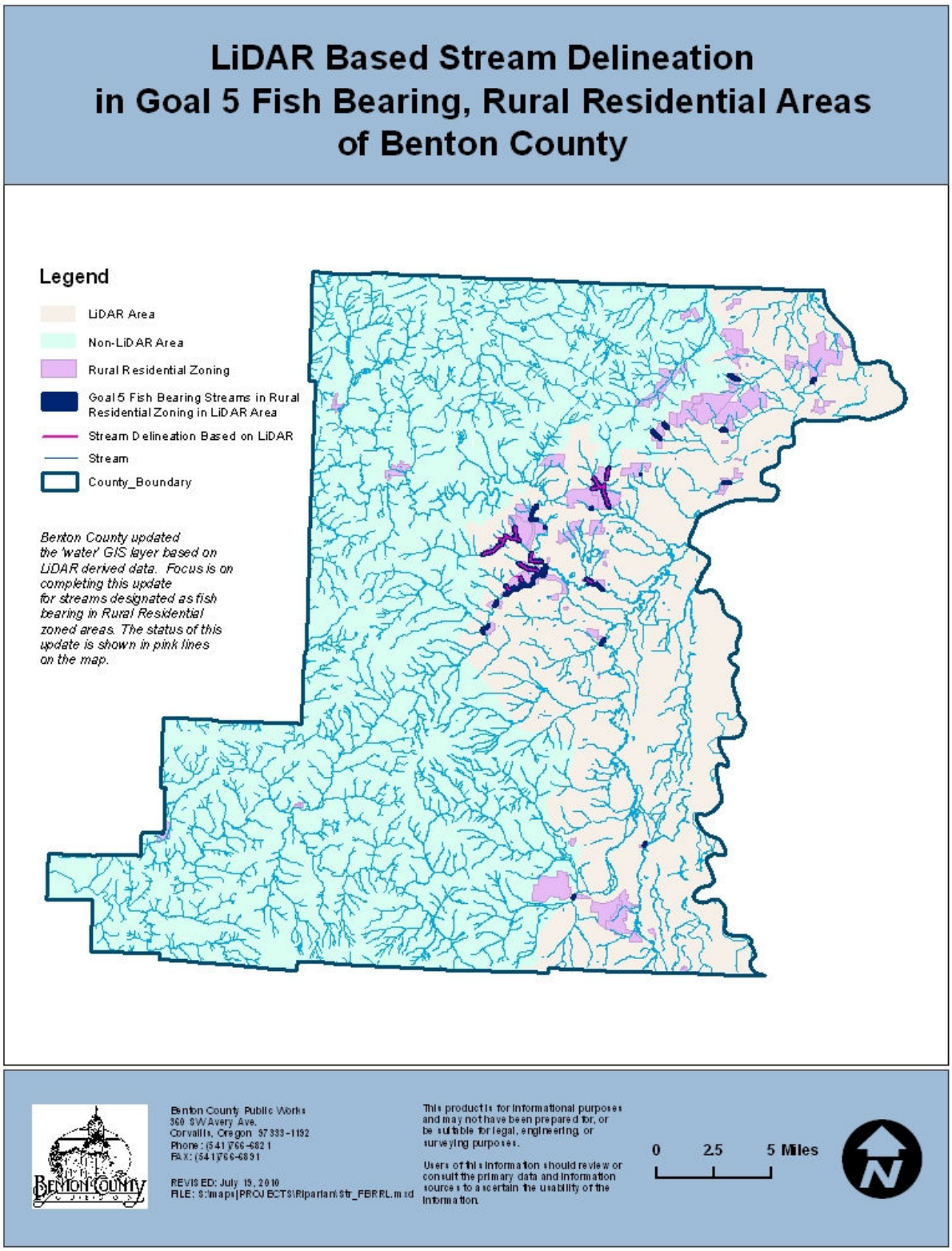


Figure 5 LIDAR Based Stream Delineation Locations



Review of Existing Goal 5 Riparian Inventory Information

Following the steps that project partners approved in the Riparian/Wetland Inventory Process (see **Figure 2**), project staff conducted a review of existing documents, maps, and other materials to identify riparian corridors, fish bearing streams, and other resources as required under the Statewide Planning Goal 5 "safe harbor" inventory requirements as described in the Oregon Administrative Rules (OAR 660-023-0090) (see **Appendix D** for Overview of Oregon Administrative Rules followed to complete Goal 5 Safe Harbor Inventory). This information was utilized to produce maps and information to meet Goal 5 inventory requirements.

United States Geological Survey

United States Geological Survey (USGS) 7.5 minute quadrangle maps, were utilized to determine general locations of streams countywide (Benton County GIS department digitized). Benton County staff also worked to digitize stream locations based on USGS maps. In addition, available USGS stream gauge data was downloaded from the USGS Surface- Water Annual Statistics National Water Information System to determine average annual streamflow over the period of USGS gauge records (**Appendix G**). The Willamette River is the only stream within Benton County that has average annual streamflow greater than 1,000 cubic feet per second (CFS) over the available record.

Oregon Department of Forestry

The Oregon Department of Forestry (ODF) implements the Oregon Forest Practices Rules, which classifies streams based on:

- Average streamflow (small, medium, and large);
- Presence/absence of fish, and
- Location of domestic water rights (e.g. surface drinking water sources).

ODF actively conducts field surveys and maps "Fish Presence" (see **Figure 6**) as required under the Oregon Forest Practice Rules. In addition to the classification system components listed above, ODF GIS staff has compiled modeled fish habitat data (also referred to as "RC 3 data"). In general the data is an artificial stream network created from US Geological Survey (USGS) 10 meter Digital Elevation Model (DEM) to determine stream gradient (see **Figure 7**). The data can be used by ODF district staff for determining fish presence on previously "Unknown" streams if no other allowable method is available for use (pers. comms. Ryan Millar, ODF GIS Coordinator, 7/26/10). Benton County Advisory Group focused on utilizing 'confirmed fish presence' ODF map data to determine 'fish bearing' water bodies during the inventory (see **Figure 6**).

Depending on the riparian and wetland features located on the property using the data provided, various rules and regulations apply when a timber harvest is proposed on public and private lands (see **Existing Riparian, Wetland Rules and Regulations, Appendix H**). Benton County does not currently have any jurisdiction to regulate forest practices.

Figure 6 Streams with Confirmed Fish Presence of Game and Threatened or Endangered Fish Species; Completed by ODFW and ODF

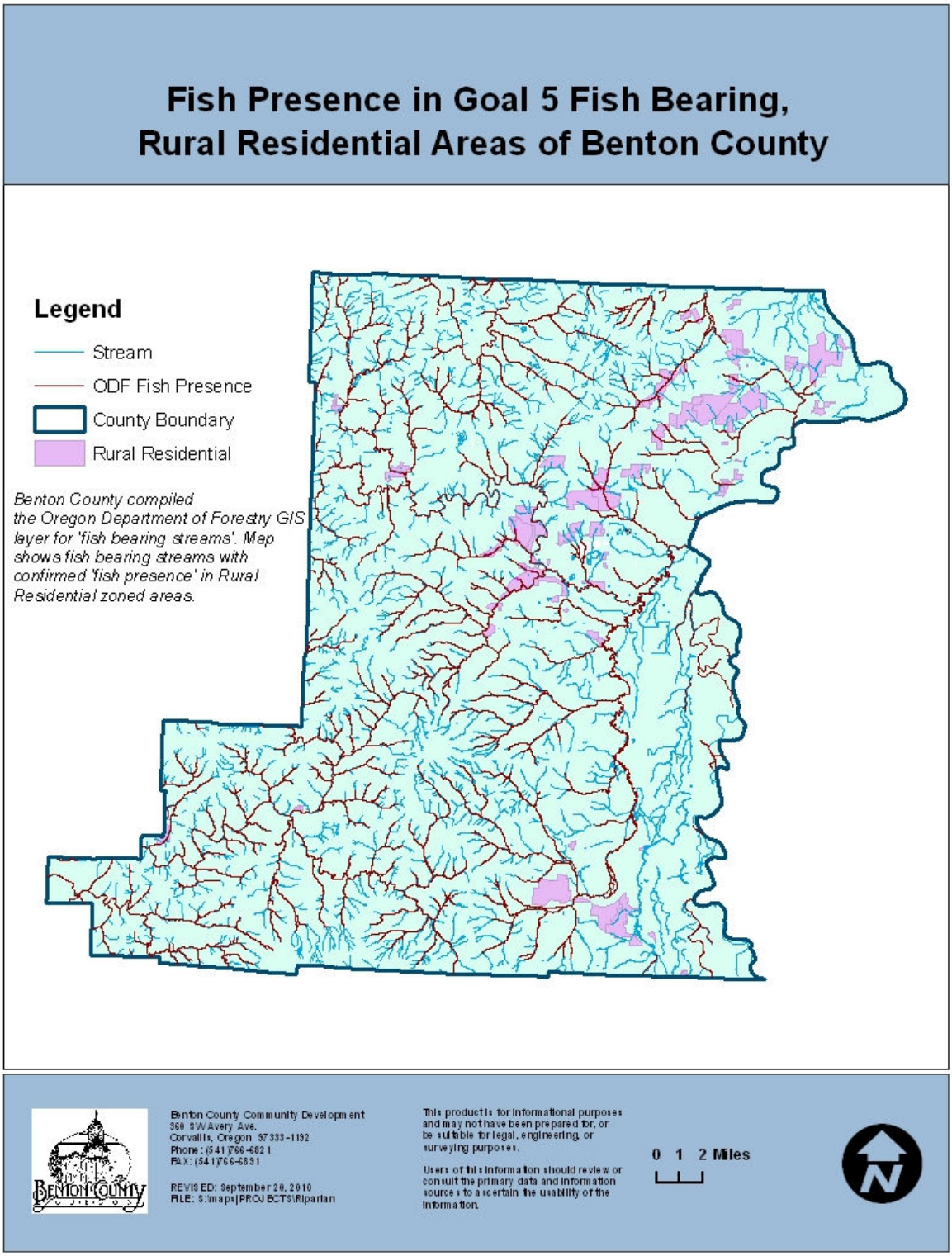
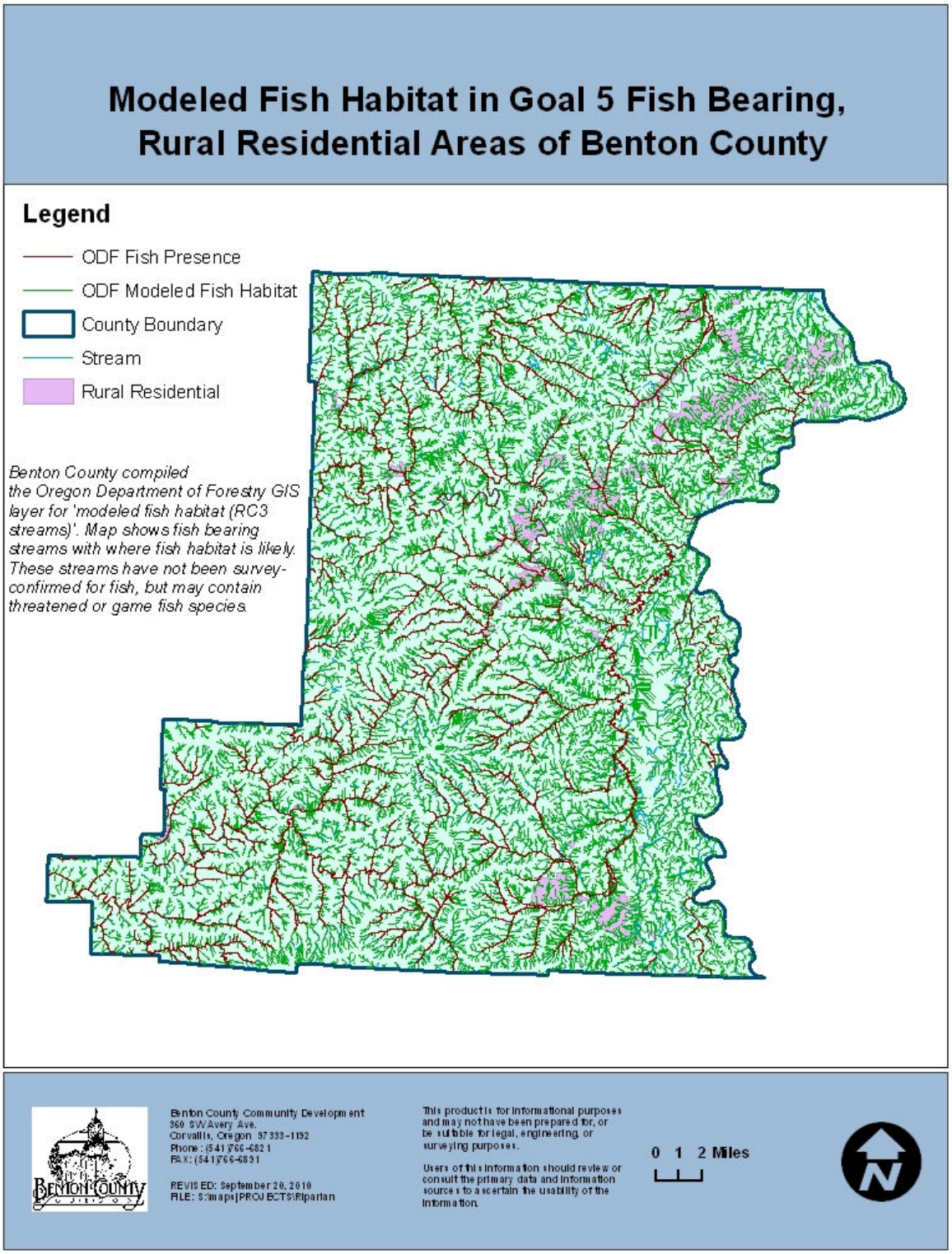


Figure 7 Modeled Fish Habitat Streams within Benton County--Oregon Department of Forestry



Oregon Department of Fish and Wildlife

There are known populations of protected, State and Federal listed fish species throughout the streams and wetlands of Benton County (see **Table 1**). Oregon Department of Fish and Wildlife (ODFW) works with other government agencies and non-profits to provide data and fish habitat survey support, to determine fish presence likelihood within forestland (ODFW Physical Habitat Survey Manual, Draft July 2010). Verification of fish presence data (see **Figure 6**) is also conducted with ODFW in partnership with ODF.

Communications and technical assistance from ODFW fish biologist Karen Hans confirmed the documented presence of cutthroat, other native and nonnative fish species, and associated fish habitat in Benton County streams, wetlands, lakes and ponds that are perennial and seasonal (pers. comms. with Hans at monthly Advisory Group meetings). In addition, Hans noted that many native/nonnative and Federal or State listed and non-listed fish species within Benton County (see below) have been documented by ODFW across various land uses and zoning (e.g. agriculture, forest, residential and other zoning and land uses within Benton County).

Table 1 Listed Fish Species in Benton County Waterways*

Waterway	Listed Species	State Listing	Federal Listing	Distinct Population Segment (DPS)
Willamette R.	Oregon chub	Sensitive, critical	Endangered	N/A
	Chinook salmon	N/A	Threatened	Upper Willamette R.
	Steelhead trout	Sensitive, critical	Threatened	Upper Willamette R.
Long Tom R.	Chinook salmon	N/A	Threatened	Upper Willamette R.
Luckiamute R.	Steelhead trout	Sensitive, critical	Threatened	Upper Willamette R.
Marys R.	Oregon chub	Sensitive, critical	Endangered	N/A
	Chinook salmon	N/A	Threatened	Upper Willamette R.
	Steelhead trout	Sensitive, critical	Threatened	Upper Willamette R.
Rock Cr.	Steelhead trout	Sensitive, critical	Threatened	Upper Willamette R.
Muddy Cr.	Oregon chub	Sensitive, critical	Endangered	N/A
Alsea R.	Coho salmon	N/A	Threatened	Oregon Coast
	Steelhead trout	Critical, vulnerable	N/A	

* Oregon Department of Fish and Wildlife, 2008

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Watershed Councils

Project staff reviewed the Marys River, Luckiamute River, and Long Tom River respective Watershed Assessments (various published dates, see **References**). These plans provide a comprehensive review of federal, state, and local natural resource reports and data. For example, these watershed assessments review the historic and current conditions of riparian corridors, vegetation, fish and wildlife habitat and abundance. In general, the assessments document findings that there have been major modifications to riparian corridors including: native vegetation clearing, dams, road crossings, irrigation diversions, straightening stream channels, diked channels and disconnected channels from floodplains, and draining of adjacent wetland areas (watershed assessments, see **References**). Timber harvesting, farming, and building adjacent or within the floodplain and riparian corridor is cited in all assessments as negatively impacting the function of riparian corridors, and wetland resources.

Inventory work found that there is currently many organizations such as local non-profits and State agencies, that have detailed information and programs in place, that document impacts to the riparian/wetland resources and water quality—while also working to improve function and quality.

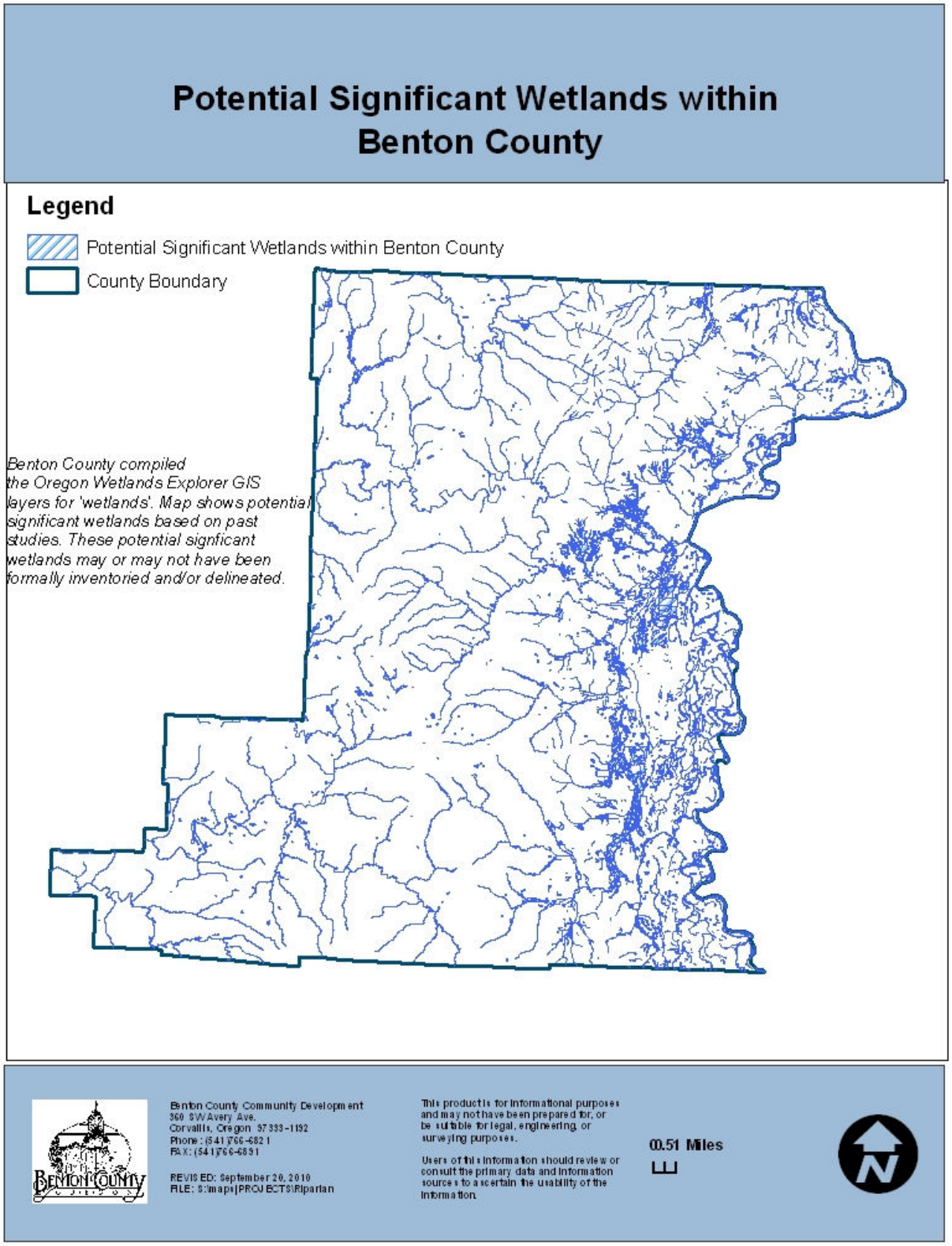
Oregon Department of Agriculture (ODA) and Benton Soil and Water Conservation District

ODA completed a Middle Willamette and Mid Coast Agricultural Water Quality Management Area plans covering Benton County. The plans were developed by a Local Advisory Committee of farmers, ODA staff, and local Soil and Water Conservation Districts. The State adopted plan provides guidance for addressing water quality issues in areas with agricultural practices—regardless of zoning. The purpose of the plan is to identify strategies to enhance water quality and minimize water pollution from agricultural lands. The plan supports meeting state rules that require riparian corridor vegetation and banks to be maintained along with goals and implementation strategies to encourage conservation and improve water quality with optional management practices that landowners may implement to improve water quality (see **Appendix I** for Mid-Willamette and Coast Agriculture Water Quality Management Plan Overview). This includes the requirement of "*Riparian vegetation along perennial streams must provide the water quality functions of shade, streambank stability, and filtration of pollutants. A diverse structure and species mix should provide these functions*".

Wetlands Inventory

Due to the time-intensive State requirements to determine "significant" wetlands by completing a Local Wetlands Inventory (DSL, LWI factsheet **References**) and develop protection measures accordingly, project staff and Advisory Group focused on compiling best available data on existing wetlands locations. In addition, the inventory identified areas where riparian wetlands (wetlands adjacent to/within the riparian area) have been documented or are likely located (see **Findings, Wetlands**). Based on existing wetlands data compiled from Oregon Wetlands Explorer there are 4,956 wetland areas identified in Benton County by various organizations.

Figure 8 Oregon State University Wetlands Explorer Wetland Location Map



Local Wetland Inventories (cities)

The City of Corvallis and City of Philomath have completed Local Wetland Inventories (LWI). The City of Monroe and City of Adair Village are participating in LWIs conducted by Lane Council of Governments and wetland consultants from March-April 2010; data from these LWIs should be available during the project period. An LWI aims to map all wetlands at least 0.5 acres or larger at an accuracy of approximately 25 feet on a parcel-based map. Actual map accuracy varies, and areas that cannot be field verified will be less accurate (The LWI is not a substitute for a detailed delineation of wetland boundaries). The LWI maps and report provide information about the inventory area and the individual wetlands, including:

- Total acreage of wetlands in the inventory area
- Acreage of each wetland type in the inventory area (e.g., 18 acres of forested wetland)
- Location, approximate size, and classification (type) of each wetland mapped
- A description of each mapped wetland
- A functions and condition assessment of all mapped wetlands
- All tax lots containing wetlands

During the project period, the Benton County located City of Monroe and City of Adair will be completing Local Wetland Inventories within their respective Urban Growth Boundaries (UGBs) and in some areas where expansion of the UGB is likely. The data created during the Monroe and Adair wetlands inventory will be reviewed, along with communication/collaboration with project leads to develop mutually beneficial rules, incentives, outreach and education within UGBs and city limits (see **Recommendations**).

Wetland Information compiled from Oregon Wetland Explorer (Oregon State)

The Oregon Wetlands geodatabase is for planning and research purposes only. It is an estimation of the occurrence and extent of wetlands in Oregon, and does not necessarily map all wetlands or represent wetlands that are subject to Federal or State jurisdiction. Benton County has compiled the eleven Federal, State, local, and non-profit Oregon Wetland Explorer data files (see **Figure 8**); the information is useful for assessing and displaying general and location specific wetland indicators for future review. Not all the compiled wetlands data have been field verified. The complete mapping data descriptions and online mapping tool, is located on the Oregon Wetlands Explorer website is: http://oregonexplorer.info/.

Field Verification

Ground-truthing occurred in areas selected by project staff with review by the Benton County Riparian and Wetlands Advisory Group. Selection of ground-truth locations was based on:

- Determination of wetland and riparian and stream location map accuracy,

- Priority areas for riparian and wetland planning and protection based on locations chosen by Benton County staff and Riparian and Wetlands Advisory Group;
- Compare ground truth data with mapping to determine accuracy and future work.

Field work occurred during the wet-season of March-April 2010 and 2011. Some field work utilized the Oregon Wetland Rapid Assessment Protocol methodology where feasible during the project

Riparian Mapping Accuracy Field Assessment

The Benton County Riparian and Wetlands Advisory Group selected locations to complete field assessments to determine accuracy of mapping locations of streams and wetlands. The following locations were selected based on where:

- Photo points could be established within the public right of way along county roads;
- Benton County is a designated management authority;
- Compiled mapping data including LIDAR data could be compared to review on the ground accuracy.

Examples from assessments are provided below. The value of utilizing LIDAR data for current stream locations is also shown in **Figure 10**.

Figure 9 Greasy Creek Sub-basin Photo Point Example

Photo Point Description:

Looking Downstream – standing on Aurora road right of way.

Primary Map Data Source: County Hydro Line, LIDAR

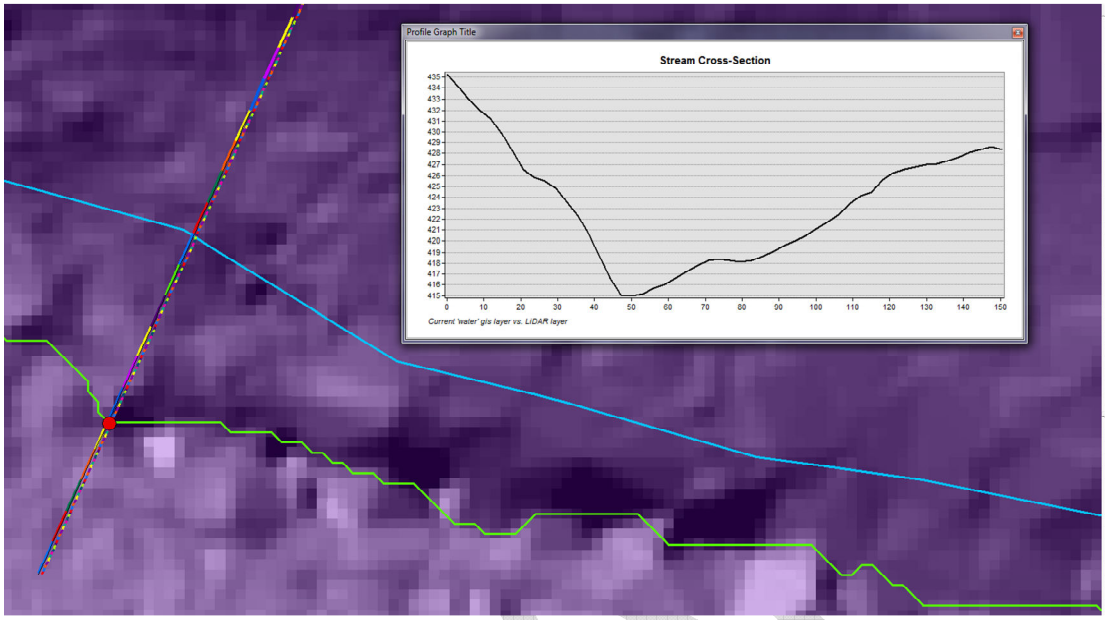
Assessment:

LIDAR mapping data provided accurate location of small, seasonal stream

Figure 10 LIDAR based Stream Delineation for Field Assessment Location
Profile drawn across 'old' and 'new' stream lines for Quality Assurance check

Blue Line ~ stream from County 'water' GIS layer ~ 'old'

Green line ~ stream derived using ArcHydro program and LIDAR data ~ 'new'



* At this location the new ArcHydro TM derived stream utilizing LIDAR data is ***more*** accurate than the currently used Benton County 'water' stream layer by 60 ft.

Figure 11 Oregon Rapid Wetland Assessment completed on Private Property north of Jackson-Frazier Wetland (Benton County Park)

Photo Point Description:

Seasonal Stream running adjacent to wetland assessment boundary, north of Benton County Jackson-Frazier Wetland.

Assessment:

Oregon Wetland Rapid Assessment Protocol determination completed on property.

Goal 5: Riparian Areas, Streams, and Wetland Findings

- Based on available stream maps there are an estimated 50 stream miles within areas currently zoned Rural Residential, 670 stream miles in general Agriculture, 907 stream miles in general Forestry.

- Available stream gauge data in Benton County show that the average annual streamflows for most streams is less than 1,000 CFS average annual streamflow. The Willamette River is the only stream greater than 1,000 CFS average annual streamflow according to the Albany USGS stream gauge.

- Currently most perennial streams in Benton County have confirmed fish presence and are fish bearing streams as defined by State Department of Forestry (for complete list of streams with fish bearing status see **Appendix J**).

- Stream channels delineated using LIDAR data (where available) are more accurate and LIDAR data provides enhanced understanding of a given properties drainage features.

- Compiled wetlands maps are accurate in providing an improved understanding of potential significant wetland locations (based on rapid wetland assessments), however no formal delineations of boundaries could be completed during the project period.

Goal 6: Water Quality Inventory

The Clean Water Act (CWA) was enacted in 1972, and is a "statute that employs a variety of regulatory and non-regulatory tools to sharply reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff". Evolution of CWA programs over the last decade has also included something of a shift from a program-by-program, source-by-source, pollutant-by-pollutant approach to more holistic watershed-based strategies. The project takes this watershed approach, to understand how to best support and improve water quality.

The Water Quality Inventory section takes a "watershed approach" to identify and begin understanding the relationships between the documented causes and sources of water quality impacts in Benton County; building on adopted Benton County water quality plans required by under Federal and State water quality laws.

The water quality inventory work is based on the Benton County Water Quality Implementation Plan and Benton County Storm Water Management Plan (adopted in 2007) water quality pollutant findings, approved implementation goals.

Water Quality Inventory Process

Early in the project, countywide community meetings were held in 2009 and 2010 with rural residents.

Start with Local Knowledge, Ideas, and Issues

Project staff heard from residents on what they believe is the major concerns in the watershed, and began to identify possible causes and sources of these concerns. Anecdotal evidence, such as "There aren't any fish in the stream anymore because the temperature is too warm and there is too much dirt going into the stream since they removed all the trees along the streambank". There was a range of ideas and issues of how to best complete an inventory and structure a plan (see Appendix)

Best Available Data was compiled to the most relevant information to meet project goals by staff, and the volunteer Advisory Group.

Best Available Research and Reports

Compiled peer-reviewed research and reports from the Pacific Northwest (western Oregon and Washington), appropriate for meeting project goals. In addition, State and Federal water quality assessment and improvement manuals were utilized, whenever possible, to provide continuity with water quality related plans and program work including storm water management and total maximum daily loads.

The Public Process

Inventory findings along with recommendations for plans (policy, outreach and education, landowner support, partnerships) were presented to communities through a second round of community meetings during the Fall of 2010. Input at community meetings and other events (County Fair, door-to-door 'listening sessions'), will be presented to the Advisory Group.

A second round of meetings and other outreach to local residents will occur, to inform the Advisory Group development of any policy, outreach and education.

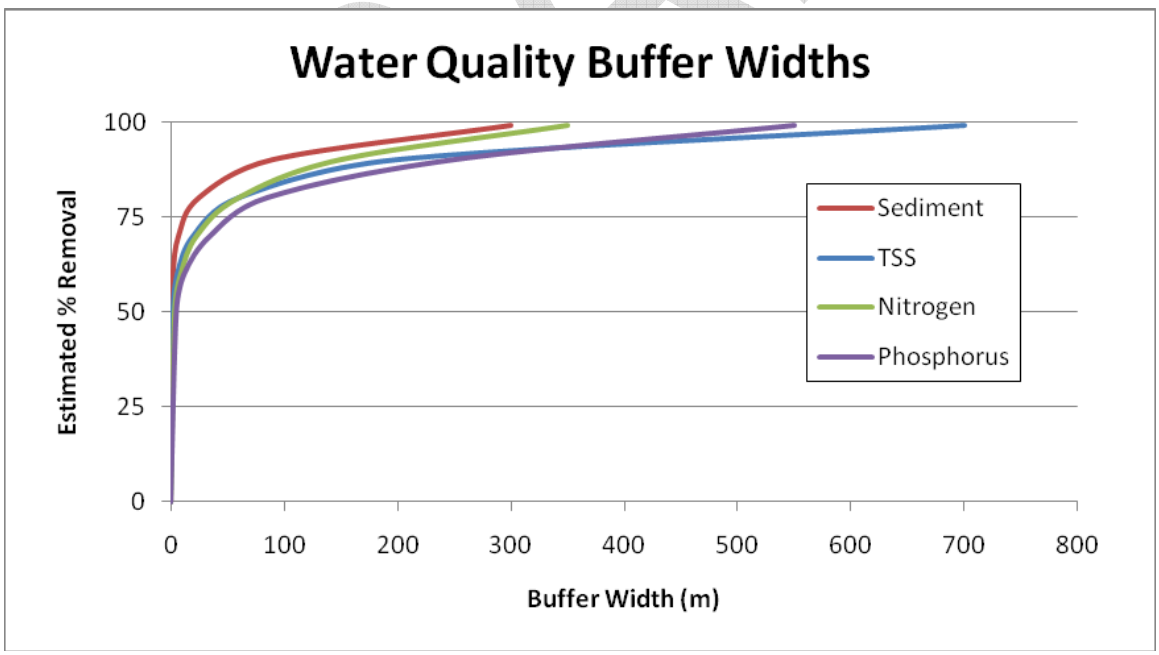
Water Quality Mapping Data

For an overview of GIS water quality related mapping metadata, including references of mapping data, refer to **Appendix E.**

Review of Existing Goal 6 Water Quality Inventory Information

The County is approximately 677 square miles with more than 8,000 households served by septic systems outside the city limits. Many of these properties are located along rivers and streams where riparian buffers (if present) provide water quality benefits (see **Figure 12**). Total Maximum Daily Loads (see overview in section) have been established to help reduce pollution in the water to comply with water quality standards. In this way, designated beneficial uses such as aquatic life, drinking water supplies, and water related recreation will be protected. When implemented successfully, the TMDL will result in a cleaner and healthier Willamette River for current and future generations. Water quality related data to help inform how riparian and wetland resources can improve current water quality.

Figure 12 Contaminant removal effectiveness (adapted from Washington Department of Ecology, 2009)



Oregon Department of Environmental Quality

The Oregon Department of Environmental Quality (ODEQ) Impaired Water Quality Report 2005/2006 was reviewed to determine the status of water quality in Benton County (see **Table 2** summarizes water quality standards that were exceeded for monitored streams). Specific water quality pollutants (parameters) are described by river mile. In addition, the season and when water quality impairments were documented by ODEQ are shown. The water quality pollutants of temperature, bacteria, and mercury are of highest concern in the Mid-Willamette Basin Water Quality Plan. Benton County temperature standards are exceeded on six different streams.

Table 2 Benton County 303d Listed Streams with Listed Water Quality Pollutants

Waterbody Name	Listed River Mile	Parameter	Season	TMDL Written
Long Tom River	0 to 24.2	Fecal Coliform	Winter/Spring/Fall	Yes
Long Tom River	0 to 24.2	Temperature	Summer	Yes
Long Tom River	0 to 24.2	E. Coli.	Fall/Winter/Spring	Yes
Long Tom River	0 to 57.3	Manganese	Year round	No
Long Tom River	0 to 57.3	Iron	Year round	No
Marys River	0 to 13.9	Fecal Coliform	Winter/Spring/Fall	Yes
Marys River	0 to 13.9	Temperature	Summer	Yes
Marys River	0 to 13.9	Dissolved Oxygen	January to May	No
Marys River	0 to 41	Manganese	Year round	No
Marys River	0 to 41	Iron	Year round	No
Muddy Creek	0 to 33	Temperature	Summer	Yes
Soap Creek	0 to 16.8	Dissolved Oxygen	October - May	No
Soap Creek	0 to 16.8	Temperature	Year round	Yes
Willamette River Mainstem	110.5 to 149	Fecal Coliform	Winter/Spring/Fall	Yes
Willamette River Mainstem	110.5 to 158.6	Temperature	Summer	Yes
Willamette River Mainstem	110.5 to 158.6	Mercury	All Year	Yes
Alsea River	15.7 to 27	Dissolved Oxygen	September to June	No
Luckiamute River	0 to 60.1	Temperature	Year round	No

* **Source:** Oregon Department of Environmental Quality, Willamette Basin Total Maximum Daily Loads (TMDLs)

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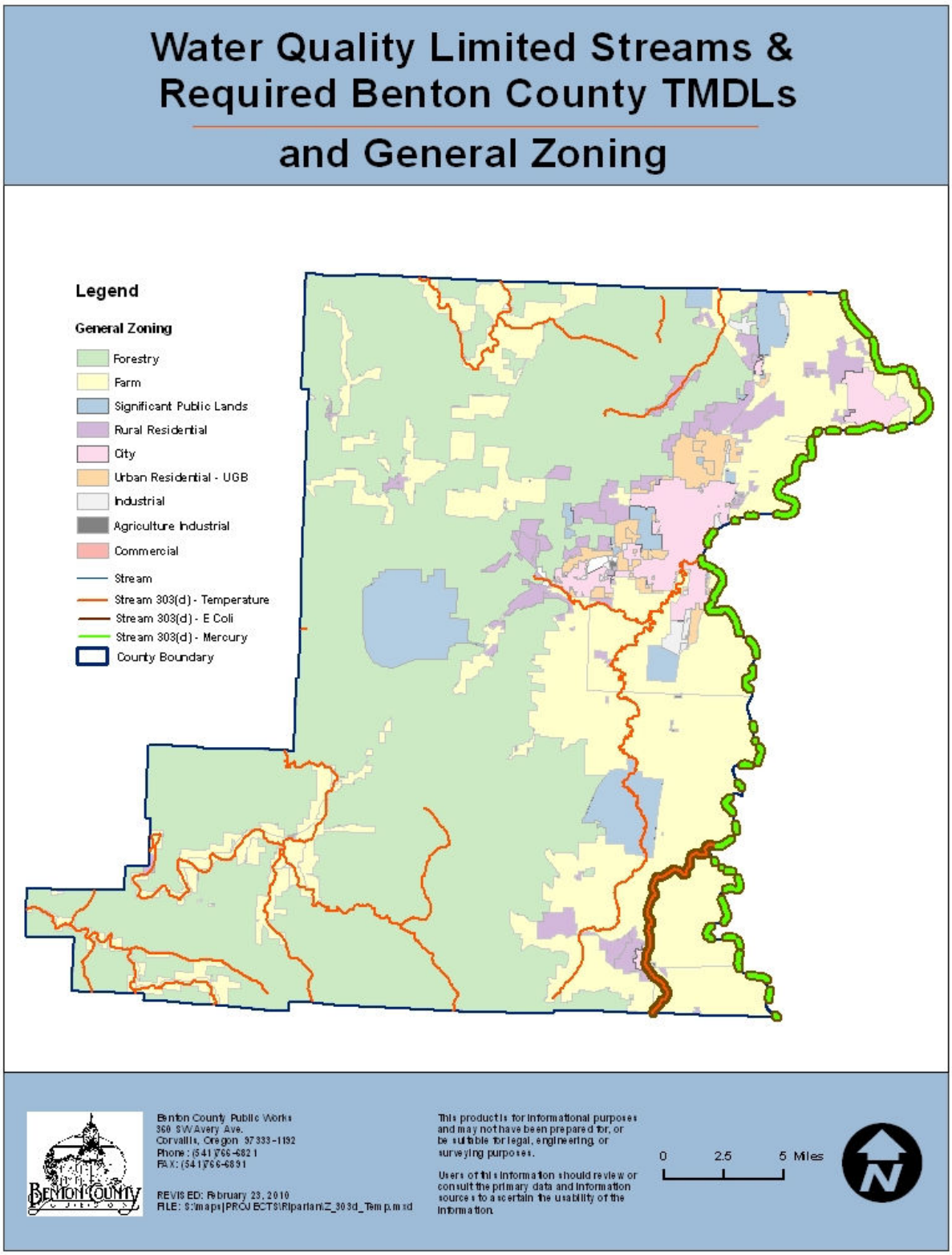
Figure 13 Current Benton County Water Quality Limited Streams



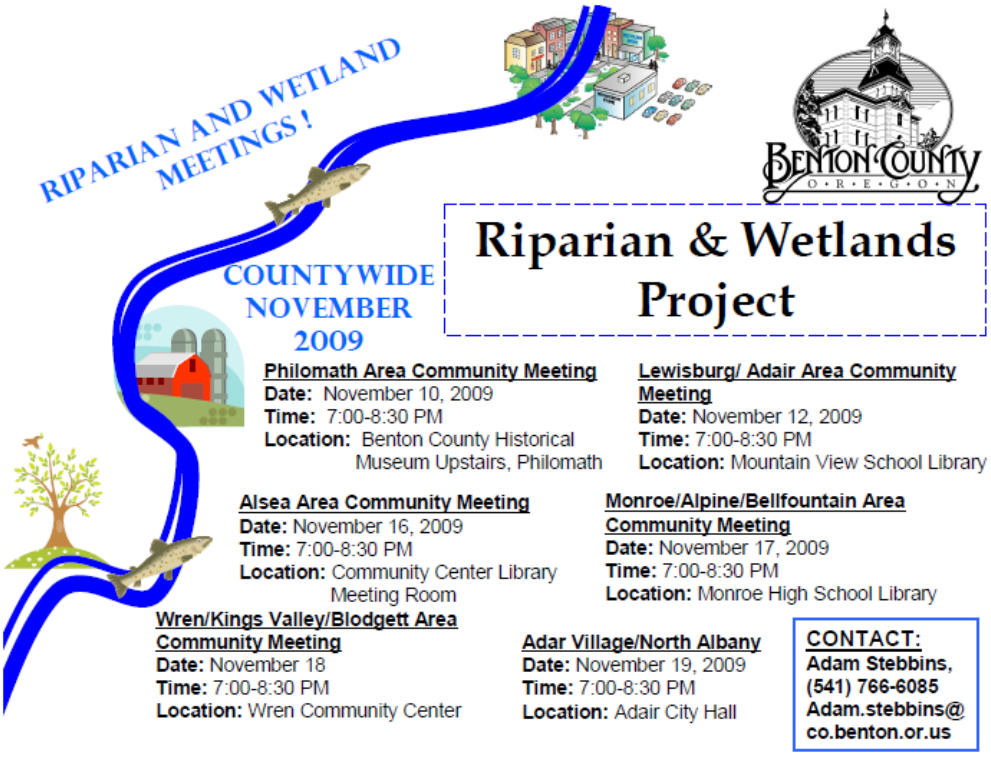
Existing Riparian and Wetland Rules and Regulations

There are many overlapping Federal, State, and Local government plans and policies pertaining to riparian and wetland resources. Overlapping riparian and wetland maps, inventories, outreach, and planning efforts are currently taking place within Benton County. There are six (6) well established government programs associated with riparian corridors, wetlands, and associated natural resources in Oregon (see **Appendix H**). Within Benton County these various local and State Rules apply to protecting streams and wetlands, with various jurisdictions having authority over land use. Benton County will utilize current policy and build on information from these to avoid duplication.

Community Meetings

During 2009 and 2010 countywide community meetings were held with throughout Benton County. 2009 community meetings provided a general overview of the need for the project, goals and timelines. Meeting attendees provided input for staff consideration prior to inventory work beginning. Project mailing list subscribers were emailed a notice of the meeting, with flyers and local news media articles and other media provided.

Figure 14, 15 Flyers disturbed for 2009 and 2010 Community Meeting Dates and Locations



During October and November 2010, a second round of community meetings was held countywide. Direct mailings were sent to property owners within the Benton County GIS database within 100 feet of streams within the five miles of the areas of Alsea, Monroe/Alpine/Bellfountain, Philomath, Lewisburg, and Wren/Kings Valley/Blodgett. In addition, flyers were sent to local libraries and articles were provided by the Benton County Public Information Officer to local news media. All meetings included an overview of inventory work to date, provided by project leads. In addition various policy scenarios and discussion for outreach/education and incentives occurred at all meetings (see **Appendix K** for community meeting slides/policy scenarios). At the request of the Alsea Citizens Advisory Committee chair, an additional public meeting will be held sometime during January 2011.

Comments captured at community meetings (see **Appendix L**) and other correspondence document a wide range of input including but not limited to: inventory findings and methodology, the type and location of potential policy, education and enforcement needs and many other areas. Public input was reviewed by staff and Advisory Group volunteers to determine an effective plan for protecting and improving riparian and wetland resources in Benton County.

Conclusions

Goal 5: Riparian (Safe Harbor) Resources Conclusions

Through the completion of the Safe Harbor inventory, locations of riparian and wetland resources were inventoried. The inventory supported meeting project goals by providing locations for supporting and improving riparian areas, streams and wetlands. Based on best available data, and improved high resolution mapping, priority locations for riparian and wetland protection and improvement were determined. Focus was placed on gaining highest quality inventory data for Rural Residential zoned land, however inventory data and supporting materials such as current program rules for agricultural and forestry activities was compiled.

The inventory documented the diverse characteristics of Safe Harbor inventory resources with a focus on fish bearing streams and other water bodies, within various watersheds across Benton County. Staff and advisory group members determined that resources that were inventoried following the Safe Harbor methodology:

- Fish bearing streams and water bodies are dynamic systems that will change over time— planning and protection of these resources by Benton County should provide flexibility due to the resources' complex nature across the county;

- Fish bearing streams and water bodies have varying protection based on what zone the resources are located, with currently limited requirements for protecting stream and wetland buffers based on current data for rural residential lands;

- There are many resources (e.g. intermittent streams) within Benton County that are vital for maintaining safe harbor inventoried resources, and are located throughout the county.

- Based on reviewed research and recommended buffers for maintaining riparian and wetland functions (**Figure 16** example), Benton County can improve the protection of Goal 5 resources through an update of land use requirements, that will not result in'taking' of private property.

Goal 6: Water Quality Conclusions

The riparian and wetlands inventory has documented water quality impairments in Benton County water bodies. Substantial scientific research demonstrates that intact riparian and wetland areas improve water quality by filtering out pollutants, stabilizing streambanks, shading, and other mechanisms. Watershed assessments and other studies have identified substantial riparian and wetland impairment in Benton County watersheds. Benton County is required by state and federal law to improve water quality conditions, and the Benton County Comprehensive Plan directs the County to take such measures.

The literature review shows removal effectiveness as a function of buffer widths. In general, the larger the buffer, the greater its effectiveness in performing a water quality function. Compiled research shows that water quality contaminant loading can increase over time (depending on the site conditions and type of contaminant), thereby reducing the overall effectiveness of a buffer.

Recommendations, Next Steps

Drafting Policy Options

Based on the reviewed scientific information documenting the connection between land use and water quality, riparian and wetland resources, Benton County recommends developing a policy that would apply a Goal 5 safe harbor setback distance to Goal 5 resources, but possibly extend the setback distance under Goal 6 to further protect water quality.

- This would result in a total setback greater than the safe harbor distances, would not require an "ESEE" (Economic Social Energy Environment) analysis under state statute, and the restrictions within those separate setbacks may be different. Providing for site specific issues and 'flexibility is a goal

To meet Benton County Comprehensive Plan goals and statewide planning goals the Riparian and Wetlands Program should include:

A. Regulatory protections for "fish-bearing" streams and lakes pursuant to the "Safe Harbor" provisions of Statewide Planning Goal 5, for land use activities over which Benton County has regulatory jurisdiction;

B. Regulatory protections for streams and riparian wetlands pursuant to Goal 6 (Water Quality), for land use activities over which Benton County has regulatory jurisdiction.[2] These regulations should be developed to:

- protect headwater stream channels from erosion and pollutant input;
- Preserve vegetation and soil integrity in buffer areas along non-fish-bearing streams;
- Augment, if necessary, the riparian protections established along fish-bearing streams pursuant to the Goal 5 Safe Harbor (see above);
- Preserve wetland vegetation, soils and hydrology for wetlands that are proximal to streams or lakes.

Based on current State rules and Benton County water quality implementation plans (see **Water Quality** section), this inventory has focused on the primary "water quality impairments" identified by Oregon DEQ for the Willamette Basin: temperature, bacteria, and mercury. To improve water quality, riparian and wetland buffer protections should be established by Benton County. To maximize the buffer's effectiveness to remove contaminants, the following actions are recommended in order of priority:

- Retain, restore, or enhance vegetation, particularly native vegetation;
- Manage drainage to ensure that water is moving evenly through the buffer to maximize retention time and infiltration, rather than flowing through pipes, culverts, rills, or other conveyance mechanisms. Avoid routing drainage to adjacent streams that may transect marine riparian areas;
- Avoid the use of pollutants (petroleum, toxics, pesticides, etc) in or near riparian areas;
- Avoid construction of impervious surfaces and septic tank drain fields in riparian areas.

Focus will be on researching buffer effectiveness for water quality and riparian and wetland resource enhancement (see **Appendix M** for overview of buffer effectiveness research

C. Updated wetlands mapping information from Oregon Explorer.

D. Voluntary incentives for landowners. County staff should compile references to the several existing incentive opportunities, and be able to inform interested parties in opportunities. The County should also work with other organizations to promote voluntary improvement of riparian and wetland areas and water quality.

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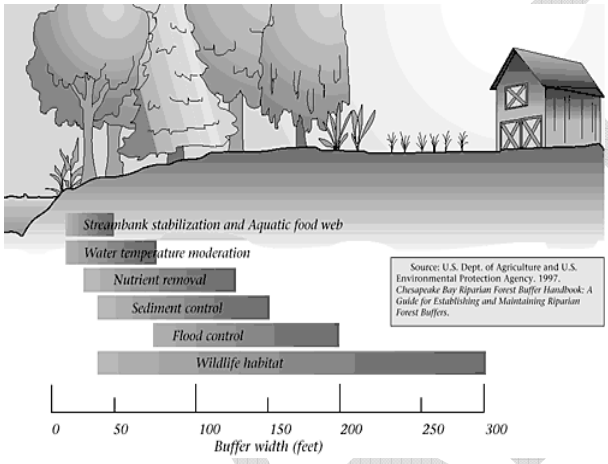
E. Partnerships with local non-profits, agencies, and other local governments and organizations that can provide support for improving and protecting riparian and wetland resources. Such partnerships should be formalized, where possible.

- Additional community outreach with the goal of gaining ideas and input from the public on the completed inventory and draft policy, ideas for education and incentives.

Figure 16 General buffer functions based on buffer size



The Benton County Riparian and Wetlands Project staff has developed draft general policies for review by the stakeholder advisory group, landowners, and any others interested (**Table 3**). Review and input on the draft policy to develop proposed final policy and outreach, education materials will be completed by the following:

- Benton County Riparian and Wetlands Advisory Group;
- General public through community meetings, printed copies available at Benton County Community Development and libraries, email, and other correspondence;
- Local realtors, brokers, and other private organizations through outreach/direct meetings;

Local City Coordination

County staff will need to review City of Adair Village and City of Monroe Local Wetland Inventories; once made available to update existing County wetland maps—focused on areas outside of city limits. City of Monroe and City of Adair Village are currently working to complete Local Wetland Inventories, in partnership with the Lane Council of Governments. Within the urban fringes (the areas outside city limits but inside city Urban Growth Boundaries), the cities have primary responsibility for comprehensive planning (such as Goal 5 inventories) and the County has responsibility for the land use code. Benton County should collaborate with the cities to ensure (a) agreement with inventory and the "program" developed under Goal 5 to protect significant resources, and (b) that the cities agree with the land use code that we would

apply to the significant resources. It would be helpful if the riparian/wetland code adopted inside city limits was similar to the code that Benton County applies county-wide.

In addition, Benton County should continue to participate in the Total Maximum Daily Load Stakeholder Group meetings and work efforts, led by the City of Corvallis. It is a goal to partner, where feasible, to support shared water quality objectives. Benton County Riparian and Wetland Project staff and the Benton County Riparian and Wetlands Advisory Group will continue to support the formation of a Benton County partnership that works to support shared goals with the City of Corvallis Temperature TMDL project (http://www.ci.corvallis.or.us/index.php?option=com_content&task=view&id=3878&Itemid=4429) through possible work that could include:

- Jointly developing incentive programs for private landowners in the rural and urban areas of Benton County to enhance riparian and wetland vegetation;
- Collaboration on riparian and wetland enhancement outreach and education to private and public landowners;
- Utilization and adaptation of Benton County Riparian and Wetlands Inventory data, partnerships, and community outreach.

Outreach, Incentives, and Partnerships

The balance between incentives based programs currently available or that are available in the future will be encouraged to ensure protection of riparian areas and water quality. The following outreach, education and incentives work will be implemented in addition to any land use/code changes.

Agency to Agency Communication

Partnerships with state agencies listed in areas, where county lacks regulatory authority (see **Appendix H**) regarding riparian and wetland resources can be improved through the improved coordination and communication with applicable agencies on a parcel by parcel, landowner by landowner needs basis and enhancement funding.

Voluntary Riparian and Wetland Enhancement Support

An economic analysis titled *The influence of riparian protection measures on residential property values: The case of the Oregon Plan for Salmon and Watersheds* completed in 2001, suggests that individuals owning streamside properties that currently provide the least riparian cover are likely to experience the largest reduction in market value from engaging in voluntary riparian plantings in the study area. It is precisely the cooperation from these property owners that is likely to be the most valuable in efforts to improve water quality and restore fish populations. These are the properties that currently provide the least riparian structure and shade (Mooney and Eisgruber, 2001).

If residents are interested in voluntary actions to improve the functions of wetlands, riparian areas and other water resources, Benton County will be able to provide more informed support and connect those interested in voluntary work with a local organization (e.g. Benton Soil and Water Conservation District, watershed councils). Benton County staff, with Advisory Group support, should produce material helpful property owners with and others interested in riparian and wetland resources, to provide a clear process to understand any rules and other important information to understand importance of riparian and wetland resources and incentives for protection and enhancement.

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Table 3

DRAFT Riparian & Wetland Protection Concepts

Resource	Protect	Identified by:
Fish-bearing streams	Soil and vegetation within 75 ft (Willamette River) or 50 ft (all other fish-bearing streams)	ODF Fish-bearing streams, attributed to our best stream layer[2]
Fish-bearing water bodies[3]	Soil and vegetation within 50 ft	Intersect USGS water polygons with ODF fish-bearing streams.
All other stream channels	Maintain current Benton County setbacks of 25 ft; include protection of soil and vegetation within 25 ft of stream channel.	Streams as they exist on the ground. Create map of best indication of where stream channels are; when reviewing a development proposal; in addition utilize topography/contours, LIDAR, aerial photo, and when necessary a site visit.
Potential Wetlands near streams	Soil and vegetation within 25-ft buffer of mapped location, or delineate	Oregon Wetlands Explorer maps, National Wetland Index maps,
Steep slopes near streams	Soil and vegetation unless geotech report provided to ensure slope stability	If area of >25% slopes occurs within riparian corridor, increase the level of protection for the entire area of steep slopes, even if that extends beyond the riparian buffer]
Erosion potential near streams	Soil and vegetation	Highly erodible soils determined by NRCS
Water Quality Limited Streams	Are these streams affected primarily by the land adjacent or by the water flowing to them from upstream? The former would argue for higher protection on these reaches, the latter would not.	303(d) listed streams layer.
Reservoirs/Ponds (human constructed) that could affect water quality	Outreach and education; provide information on flow impacts during summer/warm weather months	Oregon Water Resources Department point of diversion and storage map; determined through planning consultation, informal discussions
Headwaters, separate from stream channel protection (e.g., drainage area above uppermost scoured channel)	Identify and inform applicants of sensitive nature of these areas.	LIDAR, Wetlands Explorer, topography/contours, aerial photo.
Floodplain	Determine guidance regarding the FEMA/ESA work to determine riparian and wetland protection.	Updated FEMA Floodplain Maps

[2] "Best Stream Layer": Delineated stream locations in RR areas joined with modeled stream layer.
[3] "Water Bodies": Lakes, ponds, sloughs as defined by United States Geological Survey; human constructed reservoirs are not included.

Appendices

Appendix A

Oregon's Statewide Riparian Restoration and Management Policy (2002)
Important Riparian Functions

Important riparian functions are briefly described below; these descriptions are summarized from the Riparian Management Work Group report "Oregon State Programs for Managing Riparian Areas" (Riparian Management Work Group, 2000):

Aquatic shade and water temperatures
Stream temperature is critical to maintaining viable salmonid populations, as well as other aquatic life. Stream temperature conditions are influenced by shade through vegetation and stream channel morphology.

Streambank stability and erosion processes
Well-vegetated riparian areas help maintain the stability of stream banks, reduce bank erosion, and foster the development of complex habitats along channel margins. Riparian plants produce root mass that is distributed throughout the soil column, thereby providing additional resistance to elevated stream velocities. Outside of the channel, healthy stands of riparian vegetation can significantly dampen off-channel floodplain velocities and create backwater conditions. Sediments and nutrients deposited in slack water contribute to water quality and the health and stability of riparian areas.

Floodplain complexity and riparian vegetation
Riparian forests can produce large amounts of wood. This wood plays a critical role in aquatic ecosystems by dissipating the force of water and helping to create complex habitats. When high energy streams enter lowlands and valleys, deposition of sediments causes increased interaction between the channel and floodplain, and results in floodplain complexity such as side channels, sloughs, oxbow lakes and spring fed creeks.

Nutrient and sediment sources
Riparian vegetation provides a nearly constant input of leaves, wood, insects, spores, and other materials, which represent an important part of the aquatic food chain, and contributes to the overall productivity of aquatic systems. Riparian areas may also be a source of sand and gravel for transport and the creation of instream bars, new riparian areas, and channel complexity downstream.

Filtration of sediments, organic material, and toxic substances in surface runoff
All streams, under natural conditions, produce sediment and other inputs at varying levels. Human activities can increase these inputs to a point where they have a negative effect on the health and productivity of the stream. The magnitude of these inputs

depends upon local soil types and substrates, topography, vegetation and precipitation. Healthy riparian vegetation can capture and hold these materials, thus keeping them out of the water.

Wildlife habitat
When compared to most upland areas, riparian areas provide greater habitat diversity, and often support higher species diversity. In healthy riparian ecosystems, structural complexity and habitat diversity result from diverse plant species, multiple canopy layers, and a range of plant age classes.

Appendix B Benton County Riparian and Wetlands Advisory Group Members (RWAG) note that monthly RWAG meeting attendees include the general public and other representatives.

Organization	Applicable Persons	Background/Area of Expertise
Landowners with stream and wetlands	County resident volunteers	Input on process and development, local knowledge
Benton County	Planning Commission member(s)	Volunteers with county and state land use planning and review experience
Benton County Natural Areas & Parks	Director, with staff serving as alternatives	Management and protection of riparian and wetlands resources in County Parks. Assessment of potential conservation areas
Benton County Public Works	Staff and managers as assigned	Road and roadside maintenance along riparian/wetland areas; culvert restoration program
Watershed Councils	Marys River Watershed Council (various staff, volunteers)	Watershed monitoring and restoration projects; provides up to date riparian and wetland information and opportunities for partnerships
Cities	Staff from interested cities; likely planning and development staff	Direct work with Adair, Philomath, and Monroe. Adair and Monroe will be undergoing local wetland inventories during the project period
Audubon Society	John Gaylord, Member	Represents Corvallis Audubon Society; provide project information

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		and ideas, such as work on the Hesthavn Nature Center
US Environmental Protection Agency, Office of Water	Rich Sumner	Wetland and riparian project work management and research
Oregon Dept. of Fish & Wildlife	Karen Hans, fish biologist;	Fish use areas, habitat buffers to improve riparian areas
Benton Soil & Water Conservation District	Donna Schmitz	Diverse experience in streamside fencing and restoration projects across Benton County
Oregon State University	Dr. Paul Adamus (ex. officio), professor and wetland professional	Delineating, monitoring and managing wetlands; author of several books; expert in Oregon/Benton County type wetlands
Dept. of Land Conservation and Development	Amanda Putnam, Natural Resources Specialist (ex officio)	Provides guidance on State Land Use Planning Rules and Statutes; Inter-agency coordination support to understand jurisdictional authority and overlap
Dept. of State Lands Technical Staff	Janet Morlan (ex officio) State Lands Wetlands Division	Wetland specialist
US Fish and Wildlife	Jarod Jebousek (ex officio)	Off-refuge voluntary wetland restoration; discrete lands; Muddy Creek wetlands focus

Available Advisory Group members meet monthly or as necessary to provide input to County Staff to:

- Finalize scope and objectives of project
- Inform the assessment and detailed mapping of current riparian/wetland conditions (GIS, LiDAR, and other data)
- Determine program elements including land use code through an "options analysis" process to meet comprehensive plan goals
- Determine the scope and goals of ground truthing field assessments
- Identify information gaps of importance for future work to enhance the county riparian/wetlands program

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- Inform and review county policy and program details for riparian/wetland planning and protection adoption by Board of Commissioners

http://www.co.benton.or.us/cd/riparian/advisory.php

Appendix C Applicable Benton County Comprehensive Plan Goal 5 and Goal 6 Policies, and applicable Statewide Planning Goal Policy

5.6.1 Benton County shall undertake the Goal 5 process and adopt a protection program for significant riparian areas.

5.6.3 Benton County shall require land development and transportation projects to be designed to minimize incursions and other impacts to floodplains, wetlands, and riparian areas. When no reasonable option exists, roads, bridges, and access ways may be allowed, provided fish passage is assured, channel capacity is maintained, and removal of riparian vegetation is minimized.

5.6.4 Benton County shall use Best Management Practices in County-owned riparian areas and along public rights of way to protect native vegetation and natural functions.

5.6.5 Benton County shall provide educational information regarding the importance and protection of riparian areas and water bodies, the existence of county and state regulations concerning these areas, and where feasible shall develop incentives to encourage preservation and/or restoration of these resources.

5.6.6 Benton County shall encourage landowners to maintain and enhance native vegetation and remove invasive species growing along the banks of surface water areas (streams, creeks, lakes, sloughs, and marshes) with incentives such as the Wildlife Habitat Conservation and Management Program (OAR 635-430).

5.6.7 Benton County's riparian planning process shall place particular emphasis on identifying and protecting headwater areas from adverse impacts of development.

5.6.8 Benton County shall work with the Oregon Department of Fish and Wildlife, and other agencies and nonprofit organizations to promote salmon recovery through non-regulatory approaches such as voluntary incentives, encouraging appropriate species management, coordinated planning, habitat protection.

In addition Goal 6 policies for water resources were created by citizens to improve and maintain water resources:

6.2.5 Benton County shall collaborate with others to promote watershed management practices that protect and enhance water quality and quantity.

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6.2.6 Benton County shall require development to be designed or located in a manner that will result in no net degradation of water quantity and quality.

Statewide Planning Goal 5 and Goal 6 Inventory Overview

The following text was adapted from the **Multi City Wetland Riparian Assessment Project,** Lane Council of Governments (2010) and provides the most current background information on the specifics of Oregon Administrative Rule (OAR) requirements, and other existing requirements/guidance applicable to the Benton County Riparian and Wetlands Inventory and Plan.

Goal 5 Riparian (OAR 660-23-0090)
The Goal 5 rule separates the *identification* of the significant riparian resource, from the process of determining the appropriate *protection* for that identified resource. A jurisdiction may apply the standard or safe harbor option to all phases or may choose to apply the safe harbor approach to one phase and the standard approach to the other phase.

Goal 6 – Air, Water and Land Resources Quality

Although Goal 6 does not have Oregon Administrative Rules to set standards for meeting the goal, for water quality purposes, Goal 6 has the potential for being the most important land use planning goal. The Goal requires that "all waste and process discharges from future development, when combined with such discharges from existing developments shall not threaten to violate, or violate applicable state or federal environmental quality statutes, rules and standards." The Goal includes a series of non-mandatory "guidelines" for developing comprehensive plans such as designating sites for controlling pollution, buffering and separating land uses which lead to impacts upon water resources, and considering the planning area's carrying capacity for water resources.

State definitions for wastewater and pollutants include pollutants carried by stormwater and impacts on habitat that result from stormwater flows. Goal 6 requires jurisdictions to integrate compliance with federal and state water quality regulations with the comprehensive planning process.

Goal 6 can be used as a justification for riparian protection since a link between a healthy riparian area and healthy stream is well established. Although Goal 6 does not require the ESEE process, a similar process will be needed to establish findings that support limiting development in riparian areas. It may also be possible to address wetland and wetland buffer protection under the water quality provisions of Goal 6. It is well established that wetlands serve an important function in preserving the natural hydrology of a watershed. However, a connection must be made between protecting wetland function in a watershed and protecting water quality. Findings to justify protection of wetlands under

Goal 6 would need to be established. DSL's Oregon Freshwater Wetlands Assessment Methodology and the state criteria for determining wetlands significant for water quality (see OAR 146-086-0350) provide guidance for this type of assessment.

Appendix D Existing Riparian and Wetland Rules and Regulations; adapted from State Guidance Document on Managing Riparian Resources

The following definitions will be used to develop a Riparian and Wetlands Project inventory. Definitions are part of the Oregon Statewide Planning Goal 5 Administrative Rule (OAR 660-023-0000); with additional definitions compiled to address Goal 6 water quality related inventory and planning. Administrative Rule Goal 6 (Air, Water and Land Quality) does not contain State Revised Statute definitions.

Term	Goal 5 Administrative Rule (OAR 660-023-0000)	Goal 6 related Definitions (sources cited)
Fish and Wildlife Habitat	An area where fish and wildlife depend in order to meet their requirements for food, water, shelter and reproduction.	
Impaired Water Body		Any waterbody of the United States that does not attain water quality standards due to an individual pollutant, multiple pollutants, pollution, or an unknown cause of impairment. Where a waterbody receives a discharge from one or more point sources, impaired means that the waterbody does not have or maintain a balanced indigenous population of shellfish, fish, and wildlife (US EPA, ODEQ).
Lake		A naturally occurring still-water body. A water area off of a main channel (e.g. a backwater or slough) is considered a stream and not a lake if there is a likely hydrologic connection with the stream during an average year of precipitation (proposed Benton County definition).
Pond		A human created (e.g. through impoundment or diversion) still-water body with outfall to a stream during some portion of the year with average precipitation. Isolated Ponds (i.e. ponds that do not meet this definition) are not subject to the

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		requirements of this section. **NOTE:** USGS maps separate 'ponds' 'lakes' and 'sloughs'.
Riparian Corridor	Goal 5 resource that includes the water areas, fish habitat, adjacent riparian areas, and wetlands within the riparian area boundary.	Pertaining to or located on the bank of a body of water, especially a stream (USGS water basics glossary).
Riparian Corridor Boundary	An imaginary line that is a certain distance upland from the top of bank	Delineated area where riparian functions occur (USGS water glossary).
Term	**Goal 5 Administrative Rule (OAR 660-023-0000)**	**Goal 6 related Definitions (sources cited, other notes)**
Stream	A channel such as a river or creek that carries flowing surface water, including perennial streams and intermittent streams with defined channels, and excluding man-made irrigation and drainage channels (Goal 5).	A scoured channel expected to contain water flow during some portion of a year with average precipitation (current Benton County planning review definition).
Top of Bank	"bankfull stage", defined as the two-year recurrence interval flood elevation (Goal 5).	Identifiable break in slope and/or transition from the riparian to upland environment as defined by the ordinary high water line by the State of Oregon (proposed Benton County definition).
Water Area	Area between the banks of a lake, pond, river, perennial or fish-bearing intermittent stream, excluding man-made farm ponds (Goal 5)	
Water Quality Limited		Any [stream] segment where it is known that water quality does not meet applicable water quality standards, and/or is not expected to meet applicable water quality standards, even after the application of the technology-based effluent limitations (US EPA, ODEQ).

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Wetlands	Area inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soils.	Ecosystems whose soil is saturated for long periods seasonally or continuously, including marshes, swamps, and ephemeral ponds (USGS, National Water-Quality Assessment).

Appendix E GIS Mapping Data Overview

GIS Data	Source(s)
Stream and Wetlands locations	Federal, State, Local government; Oregon State University, Wetlands Explorer
Flow Gauge/Water Quality Monitoring Station(s)	USGS, DEQ
Fish Bearing and other Stream Classification Maps Streams	ODF, ODFW, DEQ Watershed Councils
Listed Riparian/Wetland Species	USFWS, ODFW
High Resolution Satellite Imagery (LiDAR)	Oregon LiDAR Consortium, Benton County GIS Staff
Aerial Photography	National Agriculture Imagery Program (2009), Benton County (2005)
National Wetlands Inventory Maps	USFWS
Floodplain and Floodway Maps	FEMA (currently adopted and proposed flood maps)

Overview of mapping data to complete Goal 6 Safe Harbor Inventory

GIS Data	Source(s)
Flow Gauge/Water Quality Monitoring Station(s)	USGS, DEQ
Water Quality Impaired Streams	Oregon DEQ, US EPA

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Slope	Benton County, NRCS
Erodiblity of Soils	NRCS water erosion potential index (in process, November 20, 2010 ETA)
Wetlands	Oregon Wetlands Exlporer
Potential Headwaters locations	based on LIDAR imagery, BLM stream order classifications where available.

Appendix F Overview of LiDAR Mapping Products evaluated for use in stream delineation (including example map)

Digital elevation models (DEMs) used to generate: Hillshades, 1-ft contours, stream cross-sections, slope, curvature, streamlines, intensity images, and highest hits.

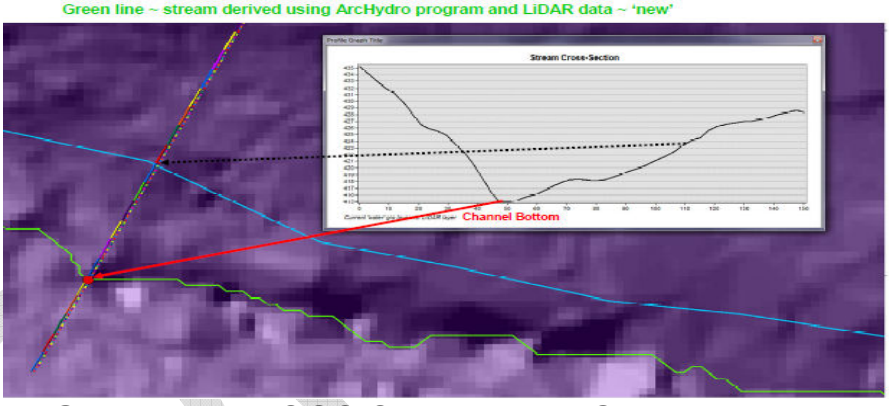
Stream/Riparian Cross-Section: Example 1

At this location the new ArcHydro derived stream is ***more*** accurate than the currently used 'water' stream layer by 60 ft.

Profile drawn across 'old' and 'new' stream lines for Quality Assurance check

Blue Line ~ stream from County 'water' GIS layer ~ 'old'

Green line ~ stream derived using ArcHydro program and LiDAR data ~ 'new'



Appendix G Available USGS Stream Flow Gauge Records applicable to Benton County streams; used to determine Average Annual Streamflow

USGS 14170000 LONG TOM RIVER AT MONROE, OR

Available data for this site Time-series: Annual statistics GO

Benton County, Oregon Hydrologic Unit Code 17090003 Latitude 44°18'47", Longitude 123°17'43" NAD27 Drainage area 391 square miles Gage datum 270.57 feet above sea level NGVD29	**Output formats** HTML table of all data Tab-separated data Reselect output format

Water Years 1922-2008

USGS 14190500 LUCKIAMUTE RIVER NEAR SUVER, OR

Available data for this site Time-series: Annual statistics GO

Polk County, Oregon Hydrologic Unit Code 17090003 Latitude 44°47'00", Longitude 123°14'00" NAD27 Drainage area 240 square miles Gage datum 171.92 feet above sea level NGVD29	**Output formats** HTML table of all data Tab-separated data Reselect output format

Water Years 1906-2008

USGS 14171000 MARYS RIVER NEAR PHILOMATH, OR

Available data for this site Time-series: Annual statistics GO

Benton County, Oregon Hydrologic Unit Code 17090003 Latitude 44°31'35", Longitude 123°20'00" NAD27 Drainage area 159 square miles Gage datum 224.01 feet above sea level NGVD29	**Output formats** HTML table of all data Tab-separated data Reselect output format

Water Years 1941-2008

USGS 14174000 WILLAMETTE RIVER AT ALBANY, OR

Available data for this site Time-series: Annual statistics GO

Linn County, Oregon Hydrologic Unit Code 17090003 Latitude 44°38'20", Longitude 123°06'20" NAD27 Drainage area 4,840 square miles Gage datum 167.18 feet above sea level NGVD29	**Output formats** HTML table of all data Tab-separated data Reselect output format

Water Years 1894-2008

Appendix H Existing Riparian and Wetland Rules and Regulations; adapted from State Guidance Document on Managing Riparian Resources

Agency	Applicable Programs	Applicable Projects	Comments
Counties, Cities	Statewide Comprehensive Planning Program	Local Comprehensive Plan Polices for Goal 5 Riparian and Wetlands; Goal 6 Water Quality	Purpose of County planning goals are to establish land use patterns NOT mitigate effect of land use patterns; County will meet comprehensive plan goals to 1.) Inventory and 2.) Establish a program to plan and protect 'significant' resources; Local plans are implemented primarily through regulations; Riparian restoration partnerships is a priority.

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Oregon Dept. of Agriculture	Agriculture Water Quality Management Program (AgWQM)	Provision for the condition of near stream areas or riparian areas; voluntary driven riparian enhancement; monitoring of 'structural features' such as plant cover, plant community development, streambank stability, or stream channel characteristics can occur.	Area Plan has been developed to address water quality concerns resulting from Ag activities; specific guidelines on how water quality concerns will be addressed; led by ODA, SWCD and local farmers on a voluntary or complaint driven basis.
Oregon Dept. of Forestry	Oregon Forest Practices Act-water protection rules	Resource protection under the Forest Practices Act (FPA) rules for riparian corridors, soil and water quality on defined 'forestland'. This includes erosion control, pesticide and fertilizer application	FPA rules apply to any land used for the growing and harvesting of forest tree species, regardless of how the land is zoned, taxed or how any statutes or local ordinances, rules or regulations are applied; Tree retention varies by stream size and biological criteria and existing beneficial uses.
Oregon Dept. of State Lands	Oregon Wetland Program; Oregon Waterways Program	Wetland delineation review; wetland mitigation	DSL currently reviews delineations prior to development approval by Benton County; DSL uses the National Wetlands Index (circa 1982) Wetlands and deepwater habitats (streams, lakes, estuaries, etc.) are mapped on a USGS quad map base; most are at a scale of 1:24,000. Only those wetlands and other waters that are visible on high altitude aerial photographs are mapped, and most maps date to the mid-1980s.

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Oregon Dept. of Environmental Quality	Water Quality Standards (TMDL); Stormwater (NPDES)	Coordinated watershed enhancement and protection projects, Education to land managers and landowners,	Currently regulates water quality monitoring and planning, and provides technical and financial assistance to restoration activities which improve riparian vegetation and riparian functions that protect water quality. 'Protecting and restoring riparian vegetation is often the best method for controlling and reducing pollution, and thus for protecting water quality'.
Oregon Dept. of Fish and Wildlife	Voluntary Incentive Programs: Riparian Tax Incentive, Wildlife Habitat Conservation, Restoration and Enhancement, and the Access and Habitat Program	Protection and enhancement of fish and wildlife and their habitats including riparian areas	Smaller private landowners with suitable habitat qualify for many incentive programs and can work with ODFW/County to develop a conservation/restoration plan to improve riparian and wetland areas.

Appendix I Oregon Department of Agriculture Middle Willamette and Coast Water Quality Management Plan Overview sheet

What is the plan?

In 2002, the Oregon Department of Agriculture (Department) developed the Middle Willamette Agricultural Water Quality Management Area and Rules in accordance with the Agricultural Water Quality Management Act of 1993. The Polk and Benton Soil and Water Conservation Districts (Districts) and a panel of local landowners helped the Department craft the area plan and rules.

The area plan is a tool that provides agricultural water quality partners and landowners information about:

- The geographic area of the plan and its boundaries. (See map)
- Local water quality concerns in the plan area.
- Goals and implementation strategies to encourage conservation and improve water quality.
- Optional management practices that landowners may implement to improve water quality.

The water quality concerns identified for the Middle Willamette management area are:

- Temperature
- Bacteria
- Dissolved oxygen
- pH
- Mercury

The Districts and the landowners involved in writing the Middle Willamette area plan identified a goal of ensuring water quality goals are met while promoting the flexibility and economic viability of agriculture. They proposed to reach this goal through education, resource management, seeking funding sources, and monitoring and evaluating the plan over time.

The area plan does not tell anyone how to farm, ranch, or otherwise utilize their natural resources. Rather it is a resource for landowners to address water quality issues. In it, they can find contacts for technical and financial assistance that will help them meet their business and conservation goals, and attain water quality standards at the same time.

Are there regulations?

The focus of the Agricultural Water Quality Management Program is on voluntary and cooperative efforts by landowners, the Department, and others to protect water quality. However, the Agricultural Water Quality Management Act also provides for a regulatory backstop to ensure prevention and control of water pollution from agricultural sources in cases where landowners or operators refuse to correct problem conditions.

Agricultural water quality regulations serve as this backstop while allowing landowners flexibility in how they protect water quality. Local area regulations describe characteristics to be achieved on agricultural lands, rather than practices that must be implemented.

The following is a summary of regulations that apply in the Middle Willamette Area:

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1. *Riparian vegetation along perennial streams must provide the water quality functions of shade, streambank stability, and filtration of pollutants. A diverse structure and species mix should provide these functions.*

2. *Landowner actions may not cause pollution to any waters of the state or place any wastes in a location where such wastes are likely to escape or be carried into the waters of the state by any means.*

Do the plan and regulations apply to me?

The area plan and associated regulations apply to all lands, regardless of size, in current agricultural use and those lying idle or on which management has been deferred. It also applies to agricultural operations within incorporated city boundaries within the designated management area boundary.

Communities within the area include Adair Village, Airlie, Blodgett, Corvallis, Dallas, Eola, Independence, Kings Valley, Monmouth, Monroe, north Albany, Philomath, Rickreall, and west Salem. See map.

More information?

If you would like further information, you can contact the Polk Soil and Water Conservation District at (503) 623-9680 or the Benton Soil and Water Conservation District at (541) 753-7208.

OR

Contact the Oregon Department of Agriculture Natural Resources Division at (503) 986-4700 or visit their website at www.oregon.gov/oda/nrd/water_quality_front.shtml

Appendix J Benton County Streams with confirmed fish presence (based on ODF data)

Please note that streams are continually updated as new surveys are completed, and several streams are not named but considered to have confirmed fish presence.

Moss Creek, Ernest Creek, East Fork Marys River, Greasy Creek, East Fork Marys River, Greasy Creek, South Fork Alsea River, Gray Creek, Peak Creek, Hammer Creek, Henderson Creek, Woods Creek, Maxfield Creek, Miller Creek, Silt Creek, Kiser Creek, Dinner Creek, Ervin Creek, Reese Creek, Bummer Creek, Yew creek, Little Lobster Creek, Luckiamute Creek, Williams Creek, Zahn Creek, Tobe Creek, Calloway Creek, Skunk Creek, Cabin Creek, Oliver Labare

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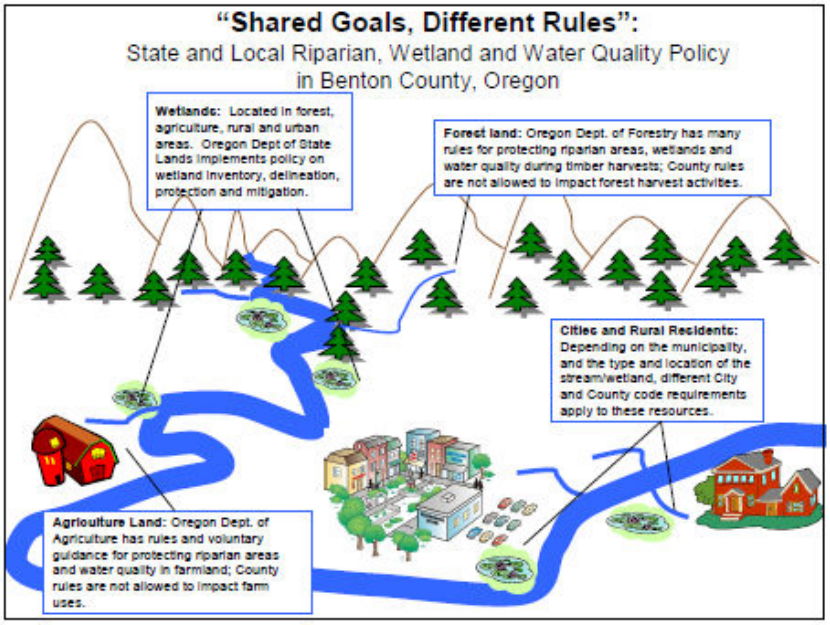
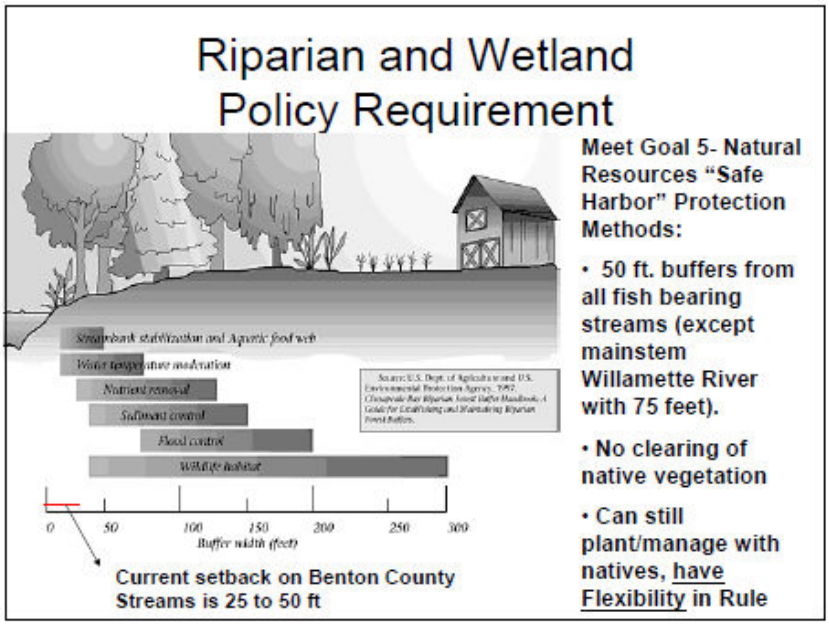
Creek, Meadow Creek, Fall Creek, Willamette River, Crooked Creek, Marys River, Gray Creek, Griffith Creek, Gellatly Creek

Appendix K Policy Scenarios presented to meeting participants during fall 2010 community meetings





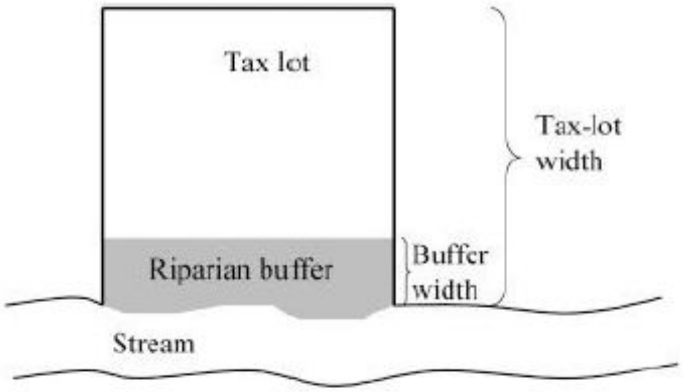
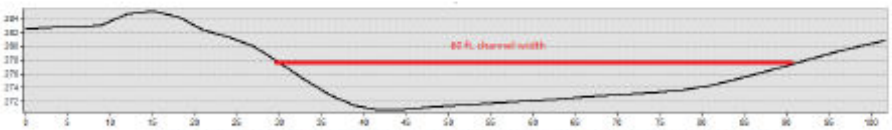
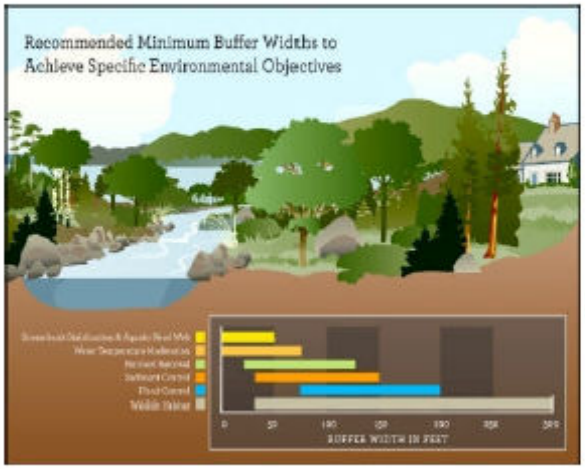


Figure 1. Location of a riparian buffer on a stream-front tax lot and the measurement of riparian buffer width (aerial view).

Top of Bank Delineation Example

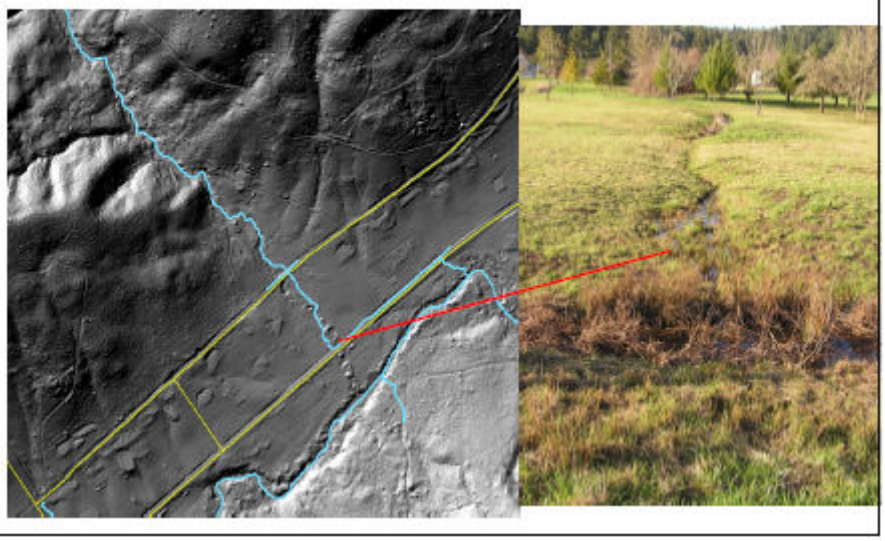


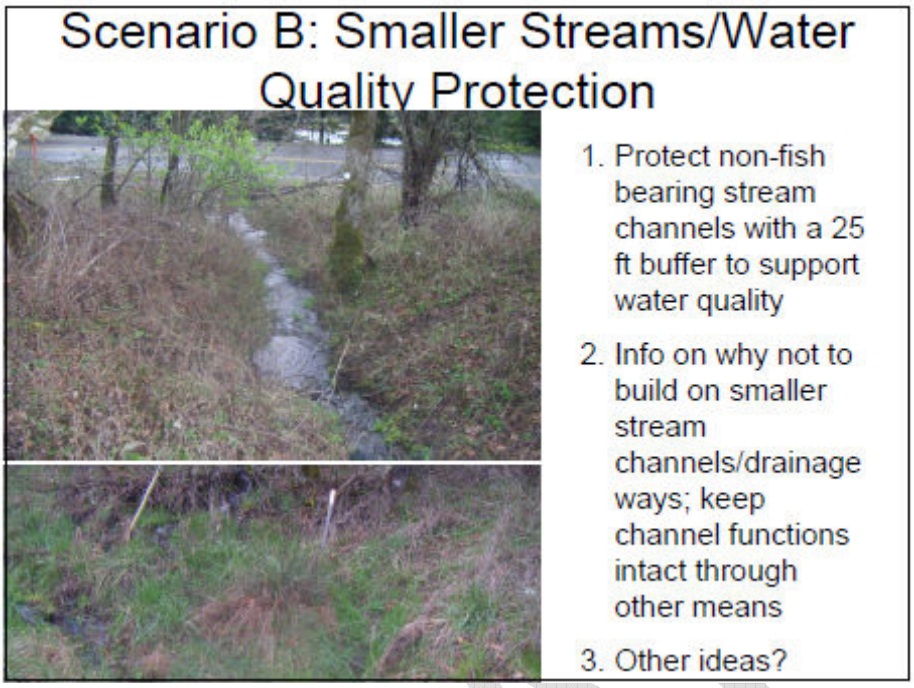
Scenario A: Wetlands Adjacent to/within Riparian Corridor



1. Protect stream and adjacent wetland/fish bearing water body with a 50 foot buffer
2. Allow for a plan to be developed based on site specifics and landowner needs?

Intermittent Streams: Providing Information on importance of these smaller channels





Appendix L Community Meeting participant comments captured during Fall 2010 meetings

Appendix Summary of Land Use Impacts on Riparian Function, need for riparian buffers

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Land use	Riparian function impaired							Specific activities associated with land use category	Impact findings on function	Literature cited
	Water Quality	Shade/Microclimate	LWD	Litter fall	Fine sediment control	Wildlife	Hydrology/slope stability			
Development	X	X	X	X	X	X	X	Clearing and grading/vegetation removal Construction of homes, buildings, roads/Impervious surfaces Shoreline armoring (docks, bulkheads, etc.) Landscaping (non-native plants) Recreational activities (hiking, biking, beachcombing, etc.)	Riparian areas are more highly altered in developed landscapes than in agricultural and forested landscapes	Booth 1991 (*in* Everest and Reeves 2006)
									Direct alteration within the riparian area (vegetation removal/reduction, soil compaction, grading) causes changes in loading of nutrients, organic matter and sediments; reduces capacity of riparian area to filter/absorb pollutants; increases sediment loading	Valiela et al 1992; Wahl et al. 1997; Jones et al. 2000; Jordan et al. 2003 (*in* Hale et al. 2004)
									Creation of impervious surfaces (e.g., parking lots, paved streets, sidewalks, roads), vegetation removal, and soil compaction cause surface water to increase in volume and magnitude. Increased runoff decreases the ability of soils and vegetation to infiltrate and intercept pollutants , increases flooding potential.	Knutson and Naef 1997; Montgomery et al. 2000 (*in* Johannessen and MacLennan 2007); Glasoe and Christy 2005; Hashim and Bresler 2005; Ekness and Randhir 2007; Schiff and Benoit 2007
									Construction of boat landings, docks, and piers creates increased slopes, causing increased and concentrated water flows; construction of domestic, residential and industrial facilities and utilities in and near riparian areas can result in altered topography, removal of vegetation, and rerouting of surface and groundwater flows	Knutson and Naef 1997; NRC 2002; Ekness and Randhir 2007; Schiff and Benoit 2007
									Construction close to the water's edge (bulkheads, docks, etc.) reduce shade as well as species diversity and abundance	Sobocinski et al. 2003; Rice 2006
									Areas with high levels of impervious surface coverage (>50%) correlated with low macrobenthic diversity and abundances	Lerbert et al. 2000
									Vegetation removal causes decreased shade and increased temperatures	Beschta et al. 1987; Macdonald et al. 1994; 1995; Thom et al. 1994; Penttila 1996; Williams and Thom 2001; Bereitschaft 2007
									Removal of vegetation cover also reduces LWD and canopy cover, which serve to dissipate flow energy and control temperature by shading	Booth et al. 2006
									Increases of light levels in the upper intertidal zone results in higher levels of mortality and dessication of insects, invertebrates, and the eggs of intertidal spawning fish like Pacific sand lance and surf smelt.	Pentilla 1996, 2000; Rice 2006
									Low levels of organic litter and LWD have been found on armored beaches	Sobocinski et al. 2003; Dugan and Hubbard 2006; Defeo et al. 2009
									Increased surface runoff of toxins Toxins can affect wildlife through physiological and behavior changes,	Klapproth and Johnson 2000; Krebs and Bums 1977; Krebs and Valiela 1978; Moore et al. 1979

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