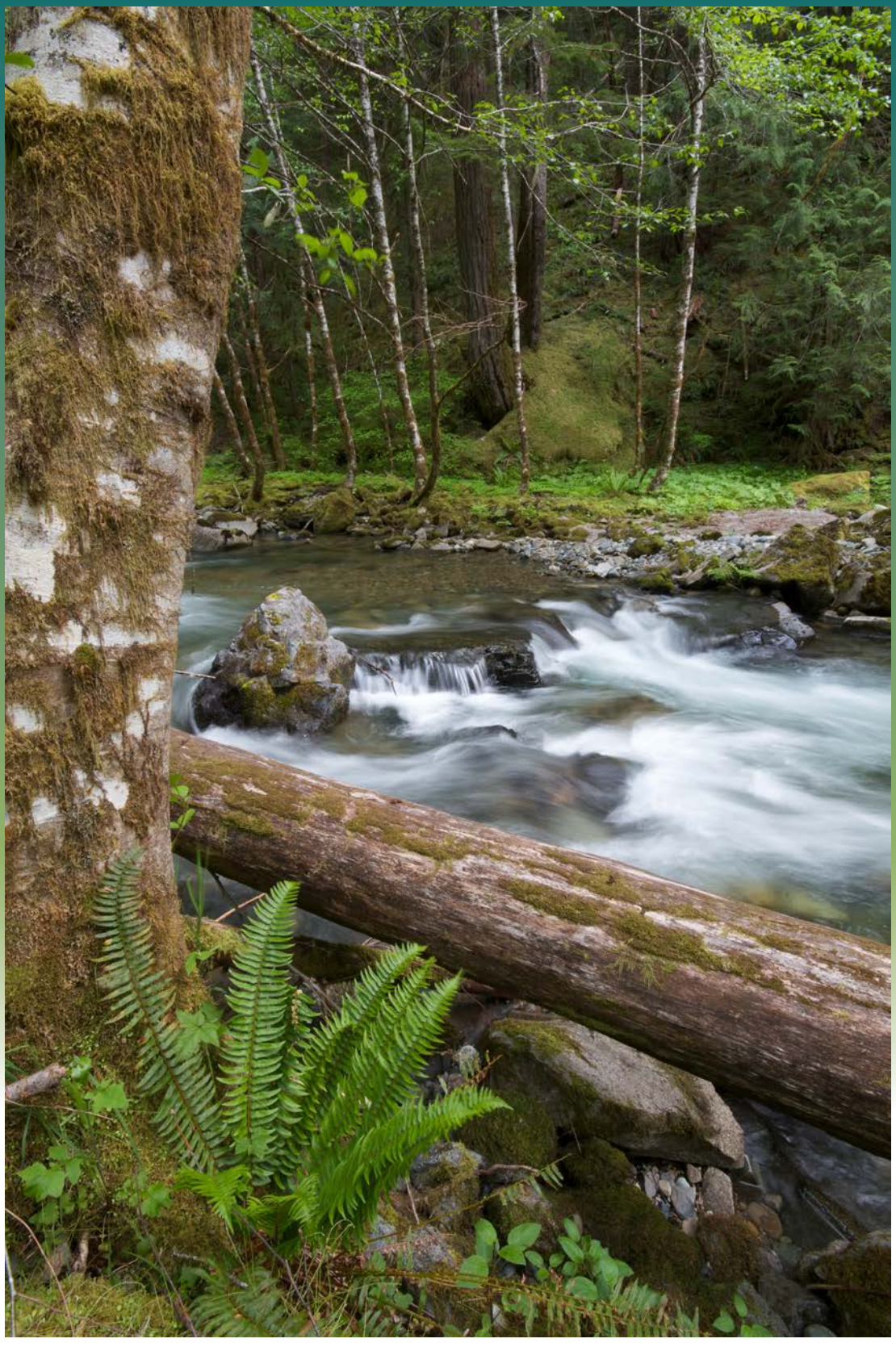
Action Plan

Middle Fork Willamette Watershed

Headwaters to Confluence

10-Year Action Plan



2012

Middle Fork Willamette
WATERSHED
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Middle Fork Willamette Watershed
Headwaters to Confluence
10-Year Action Plan
2012

Acknowledgements

This Action Plan is the result of a significant amount of input, guidance and review by many individuals, particularly Johan Hogervorst and the specialists of the Middle Fork Ranger District of the US Forest Service. This Action Plan was funded by the Oregon Watershed Enhancement Board and National Forest Foundation. It was also made possible by hundreds of volunteer hours. The Middle Fork Willamette Watershed Council wishes to thank the funding agencies that made this Plan possible as well as the dedicated specialists listed below.

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MFWWC Board of Directors
Tom Whitford, National Resource Manager, USFS

The Technical Advisory Committee established the goals and objectives of this project and provided invaluable guidance for this Action Plan. Committee members include Eve Montanaro, Elise Ferrarese and Nicole Czarnomski of Middle Fork Willamette Watershed Council, Johan Hogervorst of USFS, Kat Beal of USACE, Cary Hart of Guistina Land & Timber, and Chris Orsinger of Friends of Buford Park

Lead authorship and GIS map production by Elise Ferrarese, MFWWC
Co-authorship and project management by Eve Montanaro, MFWWC
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Table of Contents

Chapter 1. Introduction

BACKGROUND ON THE WATERSHED

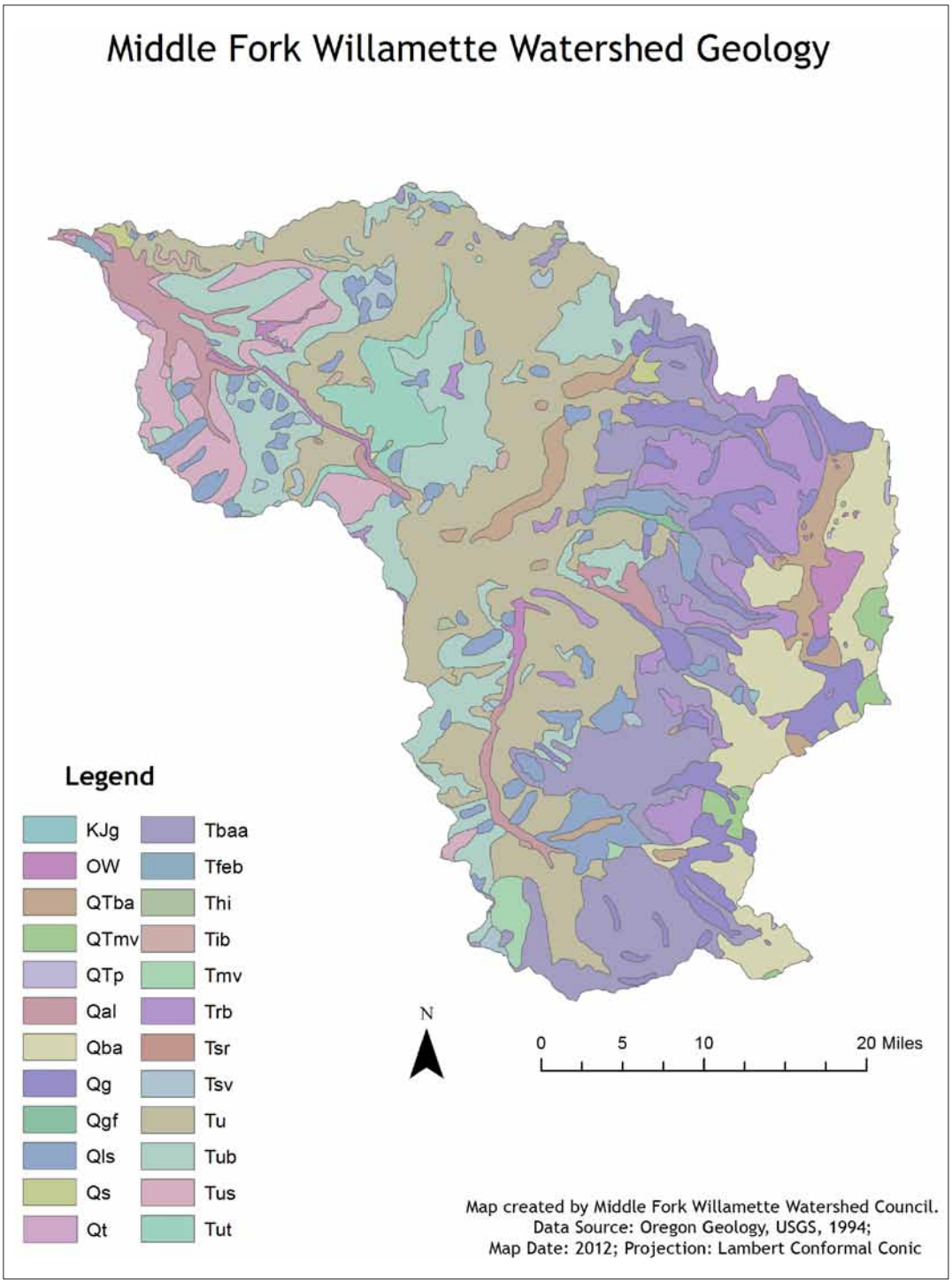
The Middle Fork Willamette Watershed (MFWW) is approximately 865,920 acres with 72% of the land managed as National Forest. Land use in the watershed consists of agriculture, industry, timber production, conservation, public water supply, rural/residential and recreation. The population within the watershed is close to 24,000 and includes the rural communities of Oakridge, Westfir, Dexter, Lowell, Springfield, Jasper, Pleasant Hill, Lost Creek, Fall Creek and Little Fall Creek.

The Middle Fork Willamette River (MFWR) forms the headwaters of the Willamette River, which has the 13th largest stream flow in the United States. The MFWR has its origins in the volcanic rocks in the west Cascades and at the base of this mountain range is Waldo Lake, which has some of the purest water anywhere in the world. Heavy precipitation in the form of rain and snow seep into the Cascades aquifer and deliver high quality water in steady quantities to dozens of stream networks that flow to the MFWR and support multiple beneficial uses such as drinking water and habitat for salmonids and bull trout.

The MFWW is a biologically rich watershed that supports healthy populations of aquatic, terrestrial and avian species. Species of concern, such as, bull trout, Oregon chub, spring Chinook, brook lamprey, western pond turtles, northern red-legged frogs, bald eagles, spotted-owl and migratory birds utilize the rich habitats and corridors in the watershed. In recognition of the rich habitat and potential for ecological uplift through habitat enhancement, biologists from State, Federal and private organizations have considerable interest and commitment in coordinating restoration efforts with the MFWWC and stakeholders in the MFWW.

Overview and purpose of the plan

This Middle Fork Willamette Watershed 10-Year Headwaters to Confluence Action Plan (Action Plan) provides an overview of current watershed conditions and a strategic plan for implementation of habitat conservation and enhancement projects across ownership boundaries. This Action Plan takes into account ecological, social, and economic factors and prioritizes actions needed to address these factors. The Council worked together with key MFWW stakeholders to identify factors that are currently or have historically limited the quality of watershed conditions, identify challenges and opportunities within each subwatershed, and to strategically define priority actions for conservation, protection, enhancement, and restoration.


Middle Fork Willamette Watershed Geology
Legend
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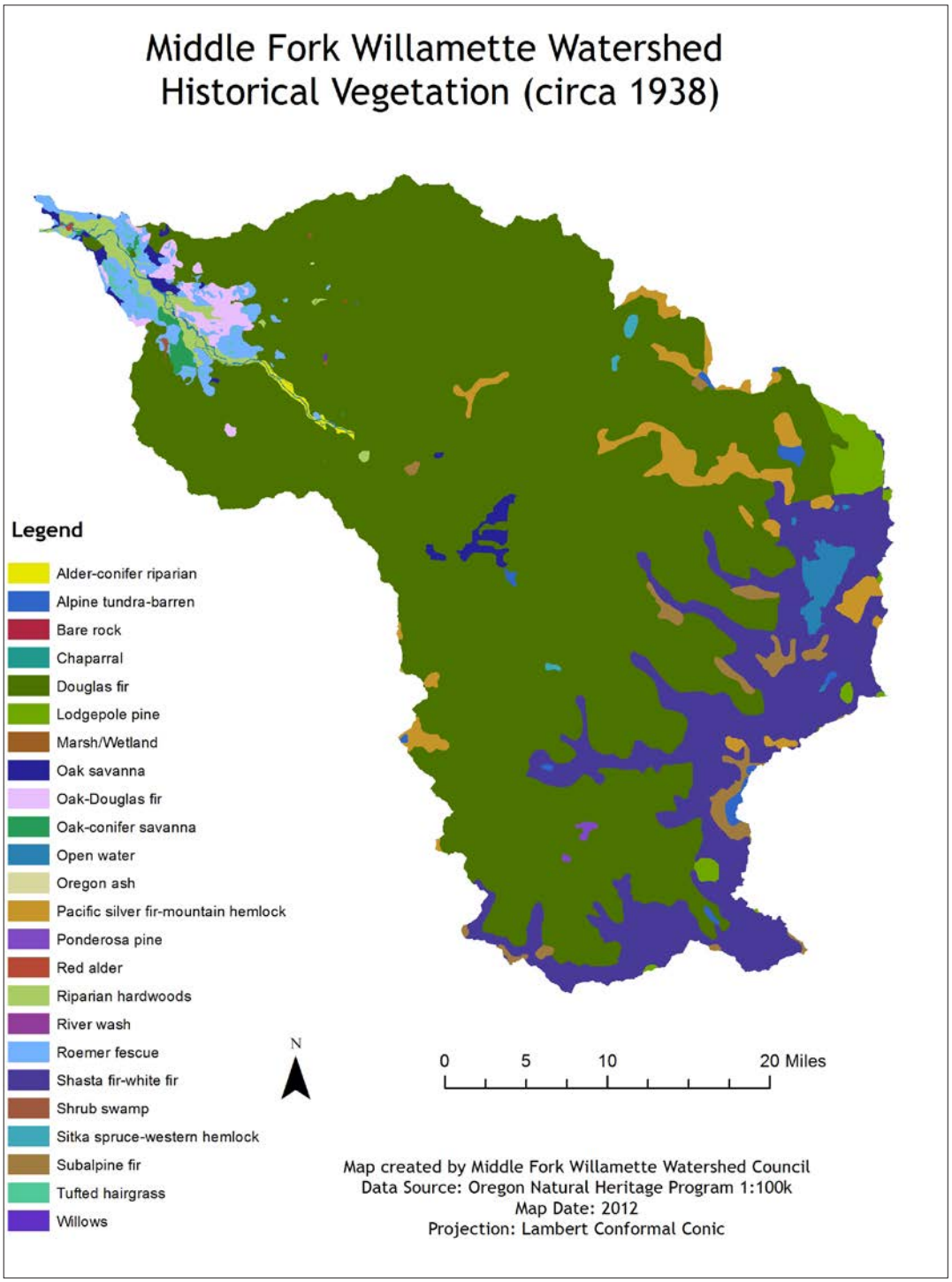
Map created by Middle Fork Willamette Watershed Council.
Data Source: Oregon Geology, USGS, 1994;
Map Date: 2012; Projection: Lambert Conformal Conic


Middle Fork Willamette Watershed
Historical Vegetation (circa 1938)
Legend
Alder-conifer riparian
Alpine tundra-barren
Bare rock
Chaparral
Douglas fir
Lodgepole pine
Marsh/Wetland
Oak savanna
Oak-Douglas fir
Oak-conifer savanna
Open water
Oregon ash
Pacific silver fir-mountain hemlock
Ponderosa pine
Red alder
Riparian hardwoods
River wash
Roemer fescue
Shasta fir-white fir
Shrub swamp
Sitka spruce-western hemlock
Subalpine fir
Tufted hairgrass
Willows
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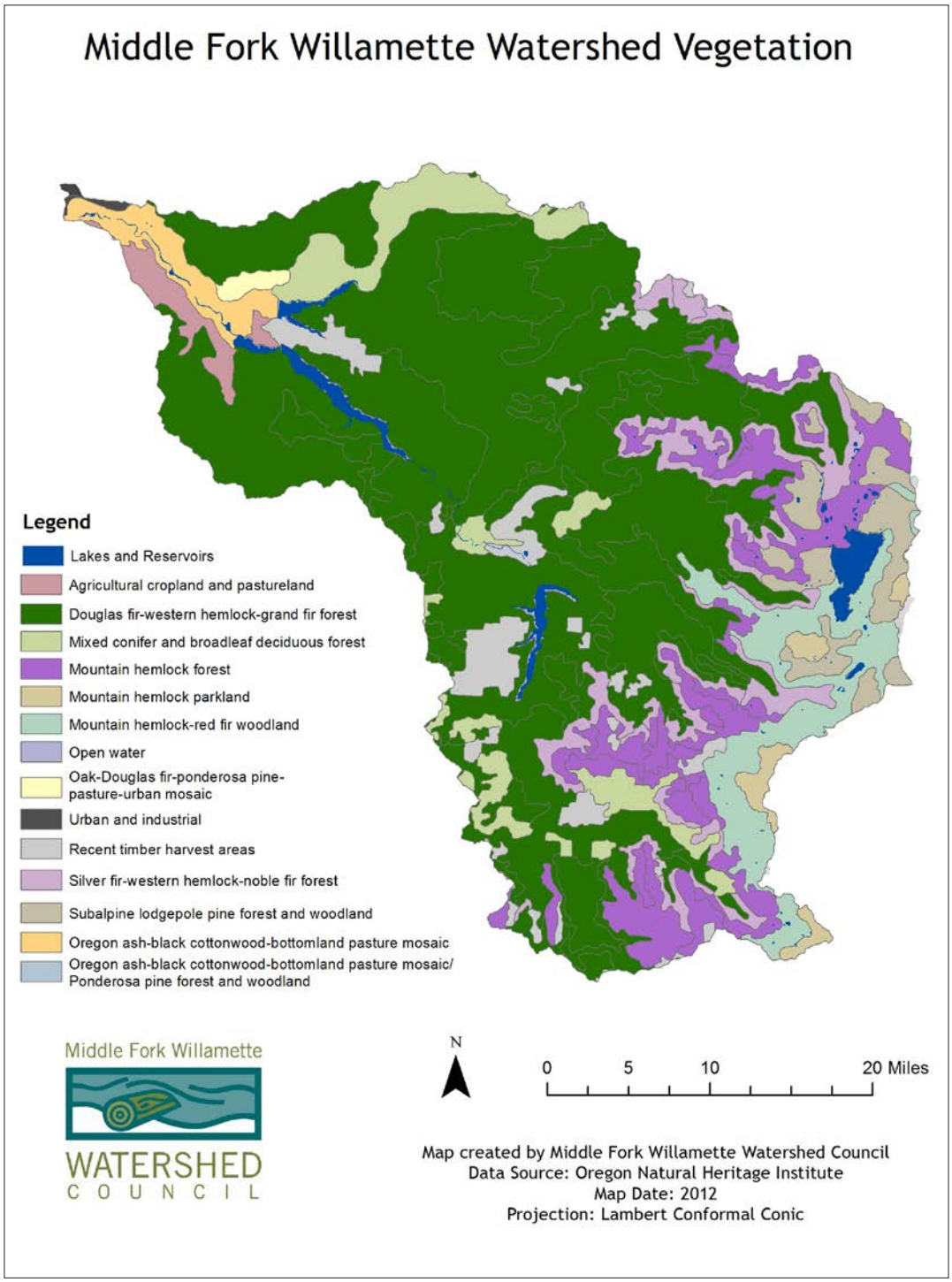
0 5 10 20 Miles
Map created by Middle Fork Willamette Watershed Council
Data Source: Oregon Natural Heritage Program 1:100k
Map Date: 2012
Projection: Lambert Conformal Conic


Middle Fork Willamette Watershed Vegetation
Legend
Lakes and Reservoirs
Agricultural cropland and pastureland
Douglas fir-western hemlock-grand fir forest
Mixed conifer and broadleaf deciduous forest
Mountain hemlock forest
Mountain hemlock parkland
Mountain hemlock-red fir woodland
Open water
Oak-Douglas fir-ponderosa pine-pasture-urban mosaic
Urban and industrial
Recent timber harvest areas
Silver fir-western hemlock-noble fir forest
Subalpine lodgepole pine forest and woodland
Oregon ash-black cottonwood-bottomland pasture mosaic
Oregon ash-black cottonwood-bottomland pasture mosaic/ Ponderosa pine forest and woodland
Middle Fork Willamette
WATERSHED
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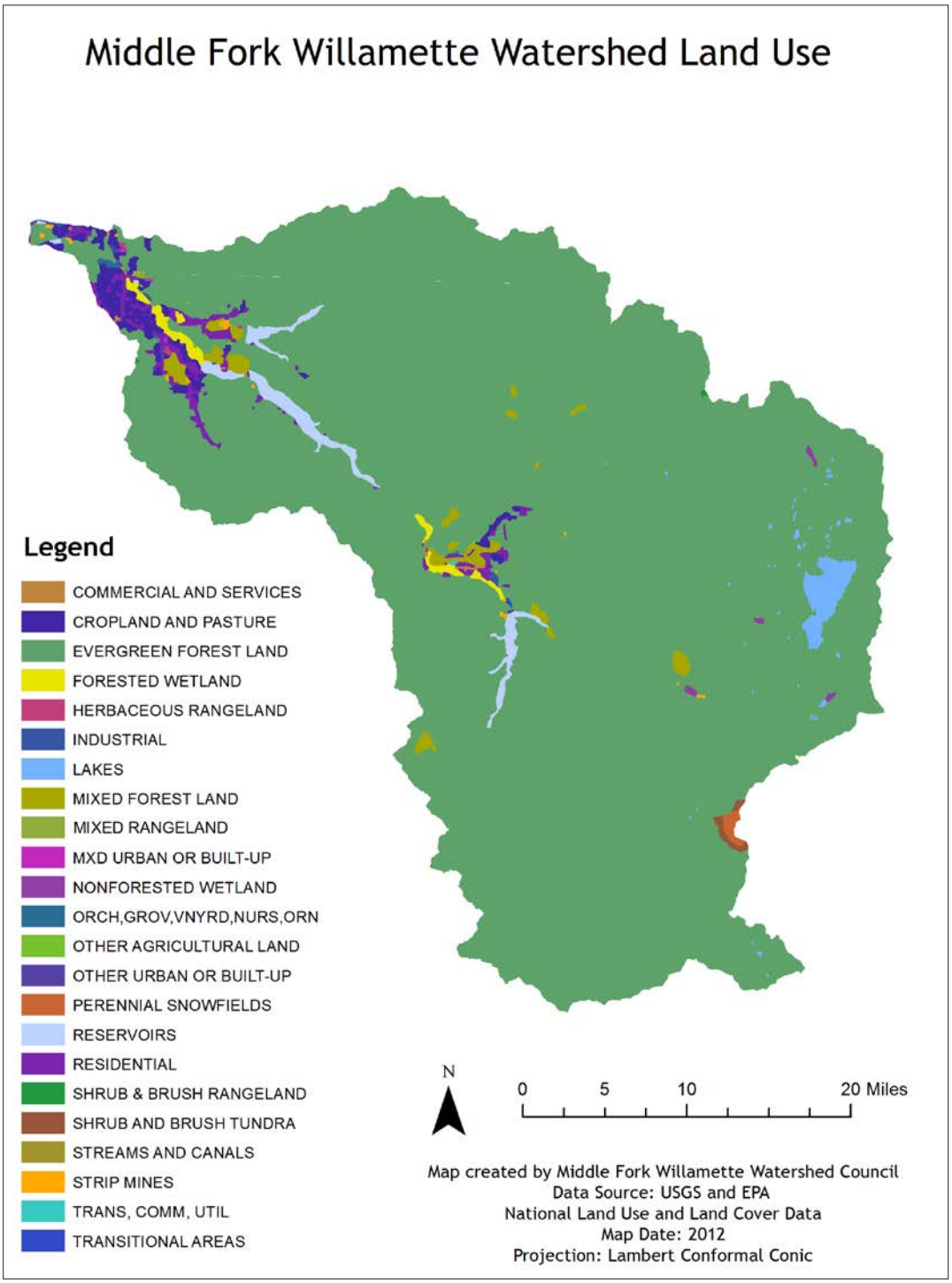
Map created by Middle Fork Willamette Watershed Council
Data Source: Oregon Natural Heritage Institute
Map Date: 2012
Projection: Lambert Conformal Conic


Middle Fork Willamette Watershed Land Use
Legend
COMMERCIAL AND SERVICES
CROPLAND AND PASTURE
EVERGREEN FOREST LAND
FORESTED WETLAND
HERBACEOUS RANGELAND
INDUSTRIAL
LAKES
MIXED FOREST LAND
MIXED RANGELAND
MXD URBAN OR BUILT-UP
NONFORESTED WETLAND
ORCH,GROV,VNYRD,NURS,ORN
OTHER AGRICULTURAL LAND
OTHER URBAN OR BUILT-UP
PERENNIAL SNOWFIELDS
RESERVOIRS
RESIDENTIAL
SHRUB & BRUSH RANGELAND
SHRUB AND BRUSH TUNDRA
STREAMS AND CANALS
STRIP MINES
TRANS, COMM, UTIL
TRANSITIONAL AREAS
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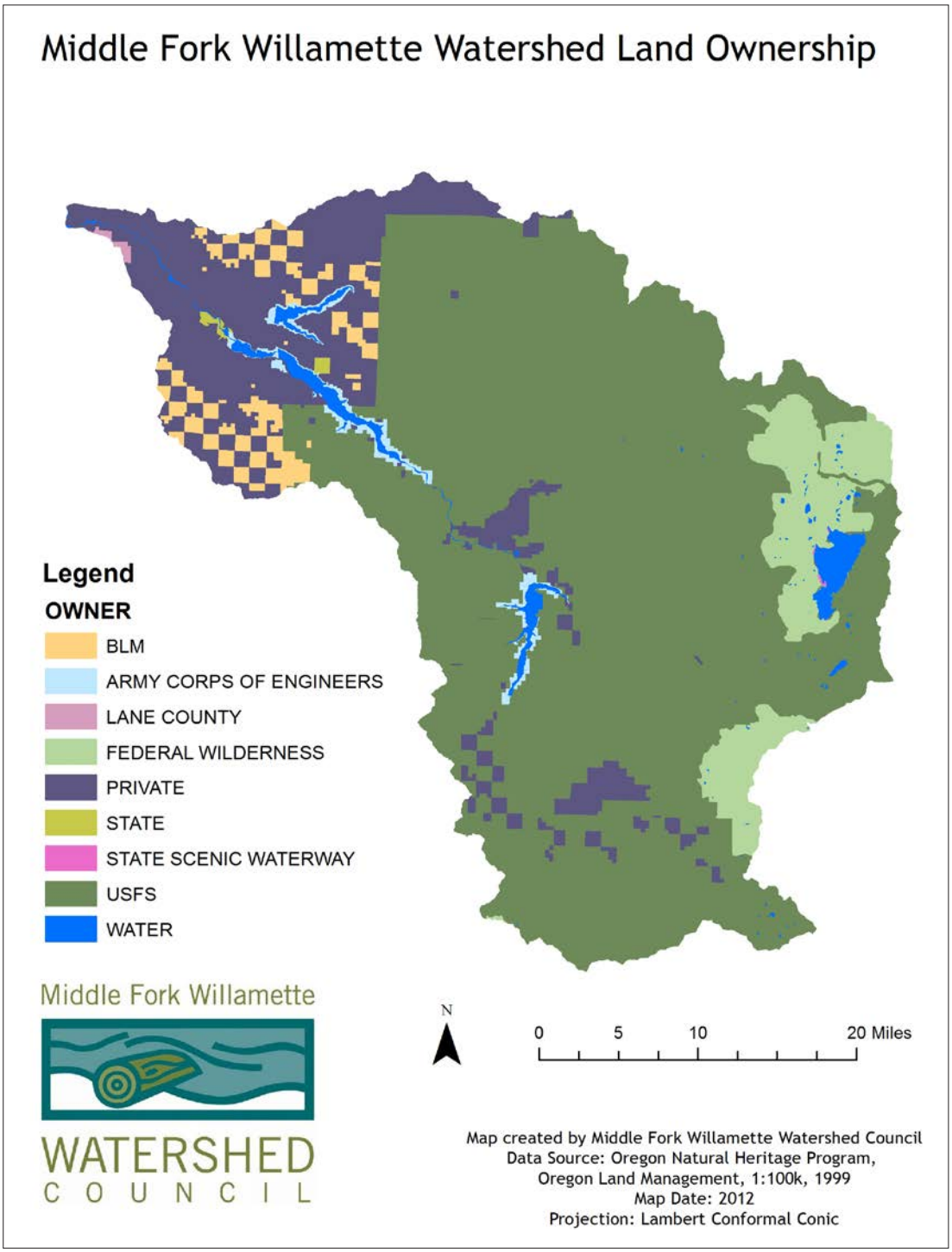
Map created by Middle Fork Willamette Watershed Council
Data Source: USGS and EPA
National Land Use and Land Cover Data
Map Date: 2012
Projection: Lambert Conformal Conic


Middle Fork Willamette Watershed Land Ownership
Legend
OWNER
BLM
ARMY CORPS OF ENGINEERS
LANE COUNTY
FEDERAL WILDERNESS
PRIVATE
STATE
STATE SCENIC WATERWAY
USFS
WATER
Middle Fork Willamette
WATERSHED
COUNCIL
N
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10
20 Miles
Map created by Middle Fork Willamette Watershed Council
Data Source: Oregon Natural Heritage Program,
Oregon Land Management, 1:100k, 1999
Map Date: 2012
Projection: Lambert Conformal Conic

The Action Plan was developed by the Middle Fork Willamette Watershed Council (MFWWC), whose mission is to work together as a community to restore, enhance and sustain the ecological integrity and economic viability of the watershed. The MFWWC is a 501c3 non-profit organization with a volunteer-based partnership of diverse watershed stakeholders that focus on promoting sustainability and making the Middle Fork Willamette Watershed (MFWW) a better place to live, work, and visit; for current and future generations. The MFWW supports a diversity of ecosystems and species: natural assets that define the character of the region, deliver ecosystem services, and provide value as working landscapes and recreational hotspots.

This Action Plan builds on the previous work of the MFWWC and its partners. The Middle Fork Willamette Watershed Council developed a five-year action plan for the lowest three subwatersheds in 2002. Over the past several years, the MFWWC and other agencies have conducted focused studies on attributes within the watershed, making available information on current conditions for water quality, fish passage, riparian corridors, invasive plant species and in-depth assessments for the lower three subwatersheds in 2010. Given the acquisition of current information and the fact that the five-year plan was due for renewal, the MFWWC and the USFS identified the need to develop a current, watershed-wide action plan to guide our efforts in the MFWW for the next 10 years. An Oregon Watershed Enhancement Board (OWEB) technical assistance grant was awarded to the MFWWC for completion of this action plan.

The purpose of this Action Plan is to identify and prioritize habitat protection, enhancement, and restoration opportunities using an integrated, watershed-wide approach. The MFWWC and USFS Middle Fork Ranger District and other agency partners will use this plan for selecting high priority activities and projects for implementation. The plan is not intended to capture every project that might take place over the next ten years, but rather to lay out broad objectives and provide recommendations for projects that meet them. Given the size of the watershed and multiple jurisdictions and land ownerships, this approach allows the MFWWC and partners the flexibility to coordinate efforts throughout the entire 865,920-acre watershed to enhance and sustain the ecological integrity and economic viability of the MFWW.

Action Plan Goals

General goals of this Plan are to:

- Identify ecological attributes, current conditions, desired future conditions, factors limiting viability of conditions and actions for addressing limiting factors within each subwatershed
- Establish priorities for addressing limiting factors to promote the viability of ecological attributes within each subwatershed
- Focus on habitat needs for Federal and State-listed threatened and endangered species
- Capture knowledge and experience of local experts to revise status of current conditions and priority actions for each subwatershed within the Middle Fork Willamette watershed
- Review subwatershed assessments and recent studies to provide current status of conditions
- Use the established priorities to implement actions in a strategic, cost-effective manner
- Develop an Action Plan among strong partnerships and with significant stakeholders to provide a comprehensive, watershed-wide guide for addressing limiting factors
- Identify data gaps to determine data collection and analysis needs
- Identify education and outreach needs to provide the public with information to enhance awareness of threats to key attributes and opportunities for protection and enhancement
- Identify opportunities for stakeholders to work together across ownership boundaries

Action Planning Process and Timeline

The first step in the planning process consisted of an in-depth review of existing subwatershed analyses and planning documents. Information from previous studies was synthesized for each of the 11 subwatersheds within the watershed. This information provided us with an overview of the current condition of ecological attributes along with key assets and challenges, providing a baseline for workshop discussions and an assessment of ecological targets within subwatersheds. The watershed condition synthesis also allowed us to determine where data gaps exist.

A series of workshops were organized to gather input from all of the major stakeholders within the watershed. Scientists and planners were invited to attend and offer their expertise and perspectives as a part of the Action Plan process. The stakeholder workshops were instrumental in the development of the planning effort and in identification of assets, challenges, and opportunities within each subwatershed.

The first stakeholder workshop was held in October 2008. The goals of the workshop were to identify data gaps and collect subwatershed information, to agree on an approach for assessing subwatersheds, and to develop evaluation criteria for assessing subwatersheds.

The Nature Conservancy's Conservation Action Planning process was adapted for use as a part of the Middle Fork Willamette Headwaters to Confluence 10-Year Action Plan. This process enabled us to establish priorities within each of the subwatersheds based on an assessment of ecological attributes and limiting factors.

Partners and Stakeholders

A number of partners and stakeholders covering a suite of fields were involved in developing and reviewing this project:

- Oregon Department of Fish and Wildlife
- Oregon Department of Environmental Quality
- Bureau of Land Management
- US Forest Service
- Friends of Buford Park
- Native Plant Society
- US Army Corps of Engineers
- Weyerhaeuser Corporation
- Oregon Parks and Recreation Department
- The Nature Conservancy
- Springfield Utility Board
- Guistina Land and Timber
- EcoNorthwest
- University of Oregon
- MFWWC Board of Directors

Previous Studies and Reports

This Action Plan is based on information gathered from previous studies and reports developed by the MFWWC and a variety of partners and agencies. Key studies reviewed as a part of the Action Planning process are:

- 2008 Willamette Project Biological Opinions (NMFS 2008, USFWS 2008)
- Willamette River Floodplain Restoration Study Preliminary Draft Integrated Feasibility Report/Environmental Assessment: Coast and Middle Forks Willamette River Watersheds (Tetra Tech 2008)
- Status and Trends of the Middle and Coast Forks Willamette River and Their Floodplain Habitat Using Geomorphic Indicators (Dykaar 2005)
- Upper Willamette Floodplain Feasibility Study (Tetra Tech, MFWWC, CFWWC 2009)
- MFWWC Fish Passage Database and Prioritization (Reed 2006)
- Lost Creek and Little Fall Creek Restoration Priorities (Montanaro, Czarnomski, MFWWC, 2009) (Appendix A)
- Middle Fork Willamette Watershed False-brome Implementation Plan (Getty 2009)
- TMDL Plans for Lowell, Oakridge, Westfir (Polkowski, Montanaro, 2007)
- Water Quality Results for the Middle and Coast Fork Willamette Watersheds and Eight Small Cities in the Upper Willamette Sub-basin: 2008–2010 (MFWWC et al. 2011)
- Lower Middle Fork Willamette River Watershed Assessment (Runyon et al. 2002)
- Oregon Conservation Strategy (ODFW 2006)
- Little Fall Creek and Lost Creek Stream Survey Reports (Ecosystems Northwest 2002)
- USFS Individual Subwatershed Analyses (1995–1998)

Climate Change

Planning for a future that will be characterized by a changing climate must incorporate strategies that focus on ecological resiliency. Exactly how global climate change will impact the Middle Fork Willamette watershed is unclear, but we must move forward in the face of uncertainty. Climate models agree that the Pacific Northwest will experience an increase in temperatures, a shift in seasonal patterns of precipitation, and increased frequency and severity of extreme weather events (Battin et al. 2007; Doppelt et al. 2009).

Despite uncertainty in climate change models, projected impacts on salmon habitat and productivity have been negative across-the-board (Battin et al. 2007). Higher water temperatures are projected to seriously impact native aquatic species that are sensitive to high temperature, such as salmon, trout, and amphibians, as the duration of thermal stress periods will increase (Mantua et al. 2009). Increased temperatures will result in a significantly declining snowpack in the Pacific Northwest (Salthe et al. 2009; Doppelt et al. 2009), which will produce lower summer and fall flows that will reduce spawning habitat and exacerbate water temperature issues (Battin et al. 2007). Changes in seasonal precipitation patterns will alter the timing and magnitude of peak flows (Doppelt et al. 2009). Native species and populations that are most at risk from climate change are those at high elevations, dependent on old-growth, associated with maritime evergreen communities, are moisture dependent (waterbirds, snails, amphibians, etc.), and species that are already rare or declining (Doppelt et al. 2009). In addition to negative impacts to native species, climate change will also likely find new conditions favorable. For instance, increases in water temperature will favor exotic warmwater fish species such as bass, while on land, increased temperatures may benefit insect pests, invasive plants, and diseases.

All of the issues raised in the preceding paragraphs will influence our ecological restoration activities in the Middle Fork Willamette watershed. Many of the issues will also be exacerbated by an increased demand on natural resources as human population increases. Historical reference conditions that are sometimes used as target conditions for restoration activities may no longer be applicable under a different climate regime (see Seavy et al. 2009). Instead, restoration targets should focus on enhancing ecological resilience by enhancing habitat connectivity, promoting redundancy and buffers, maintaining a mix of successional stages, protecting refugia, and lessening the impacts of low flows and peak flows (Battin et al. 2007; Millar et al. 2007).

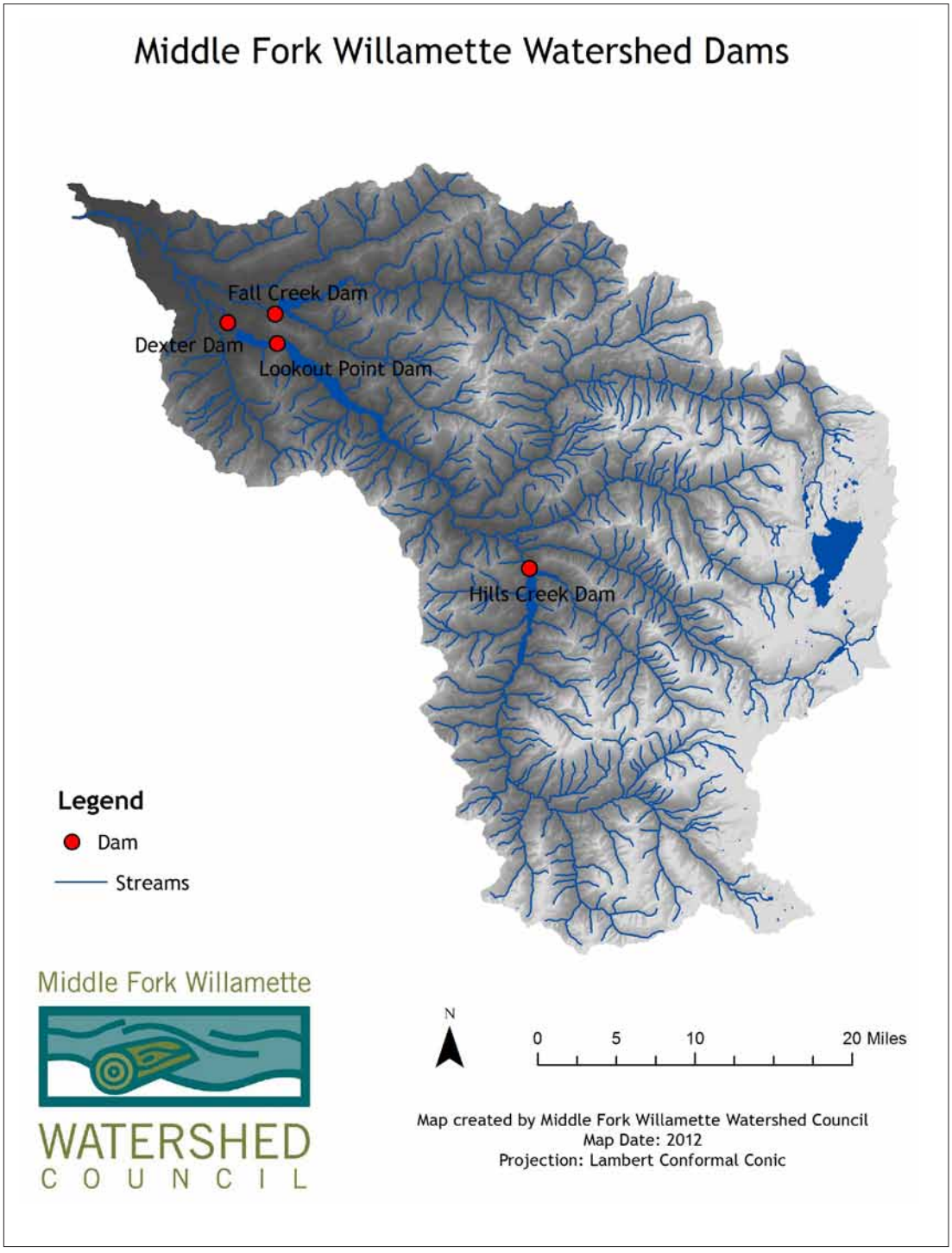
Chapter 2. Conservation Strategy

MFWWC HABITAT ENHANCEMENT AND RESTORATION PROGRAM

Assessment of current watershed conditions is an integral component of the MFWWC Habitat Enhancement and Restoration Program. Our Restoration Program is built around three core concepts: strategic planning and implementation, effectiveness monitoring, and adaptive management. Knowledge of current conditions allows us to be strategic in our approach to protecting areas that are in good condition, enhancing areas of medium and high-quality habitat, and restoring habitats that are currently degraded but have the potential to reestablish. Current conditions assessments also enable us to identify education and outreach projects to inform the public about watershed issues and recommend areas where more data are needed. We prioritize ecological attributes and habitats for protection, enhancement, and restoration based on our current understanding of ecological conditions and the factors that have led to those conditions. We attempt to address high priorities first but occasionally circumstances dictate the completion of medium priority project types over higher priority projects. Cirumstances may include: timing, landowner interest, funding, etc. Our habitat protection, enhancement, and restoration efforts benefit ecological attributes and species habitats across ownership boundaries.

USFS Watershed Condition Framework

The United States Forest Service (USFS) has a framework for assessing and tracking changes to watershed conditions that is a comprehensive approach for implementing restoration on national forests and grasslands. The Watershed Condition Framework (WCF) consists of assessments completed by the individual national forests, implementation of integrated improvement activities within priority watersheds, validation and monitoring of watershed condition class changes, and aggregation of program performance data for national reporting. Watersheds (6th Field) are classified according to watershed condition in terms of geomorphic, hydrologic, and biotic integrity and functionality relative to potential natural condition. Individual attributes are rated and indicators are averaged to determine the condition score for each watershed: Condition Class 1 = functioning; Condition Class 2 = functioning at risk; and Condition Class 3 = not functioning. Technical staff from the Willamette National Forest have completed the WCF process for all watersheds within the WNF. The results from the WCF have been integrated into this Action Plan using The Nature Conservancy's Conservation Action Planning (CAP) prioritization process that was adapted by the MFWWC (see below). Technical staff from the WNF participated in a series of workshops to assist with the CAP prioritization scoring process on USFS lands. While the WCF and CAP process differ in their approaches to watershed prioritization, there were considerable areas of overlap. For more information on the USFS WCF, visit http://www.fs.fed.us/publications/watershed/.


Middle Fork Willamette Watershed Dams
Fall Creek Dam
Dexter Dam
Lookout Point Dam
Hills Creek Dam
Legend
Dam
Streams
Middle Fork Willamette
WATERSHED
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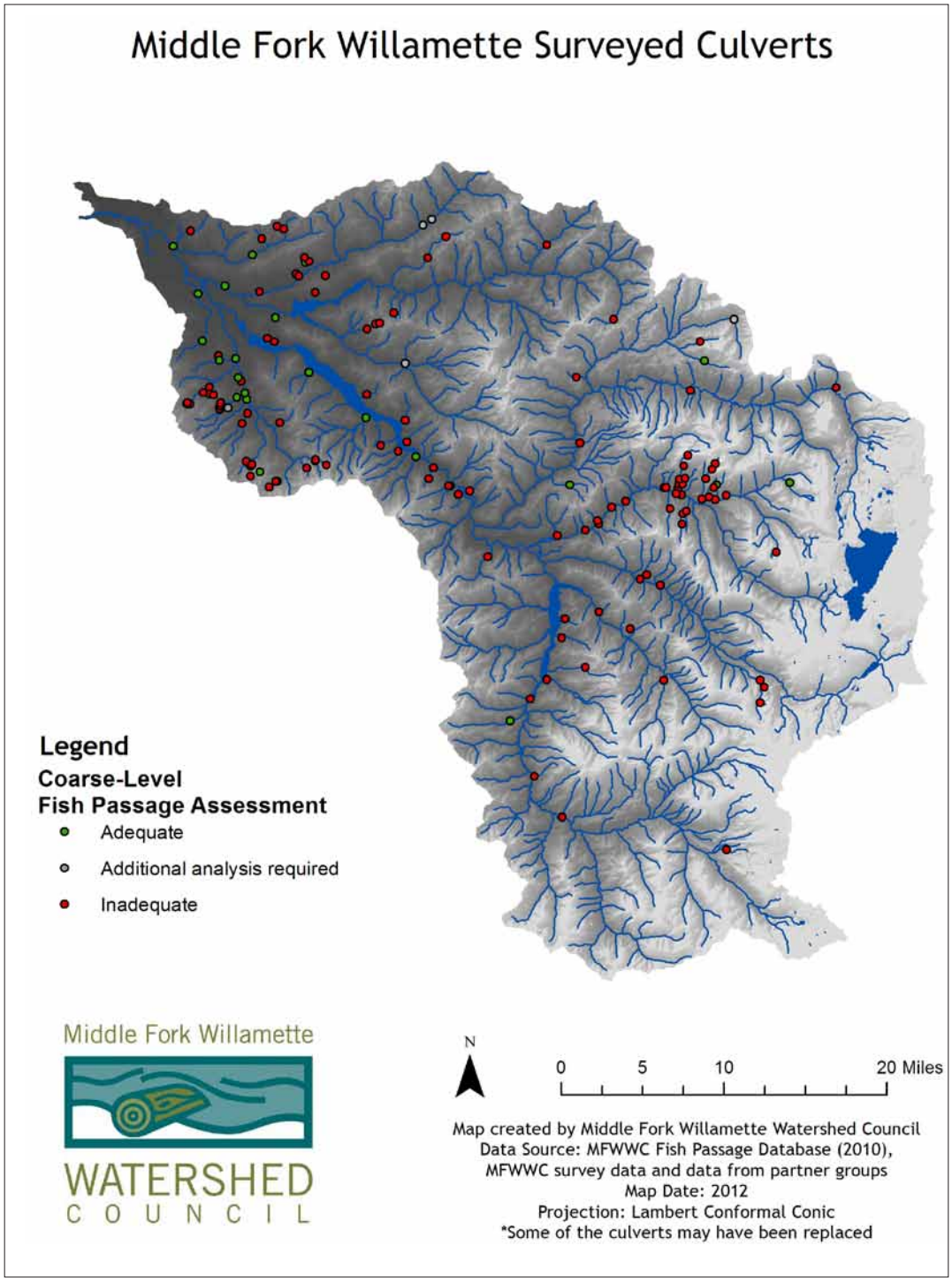
Map created by Middle Fork Willamette Watershed Council
Map Date: 2012
Projection: Lambert Conformal Conic


Middle Fork Willamette Surveyed Culverts
Legend
Coarse-Level
Fish Passage Assessment
Adequate
Additional analysis required
Inadequate
Middle Fork Willamette
WATERSHED
COUNCIL
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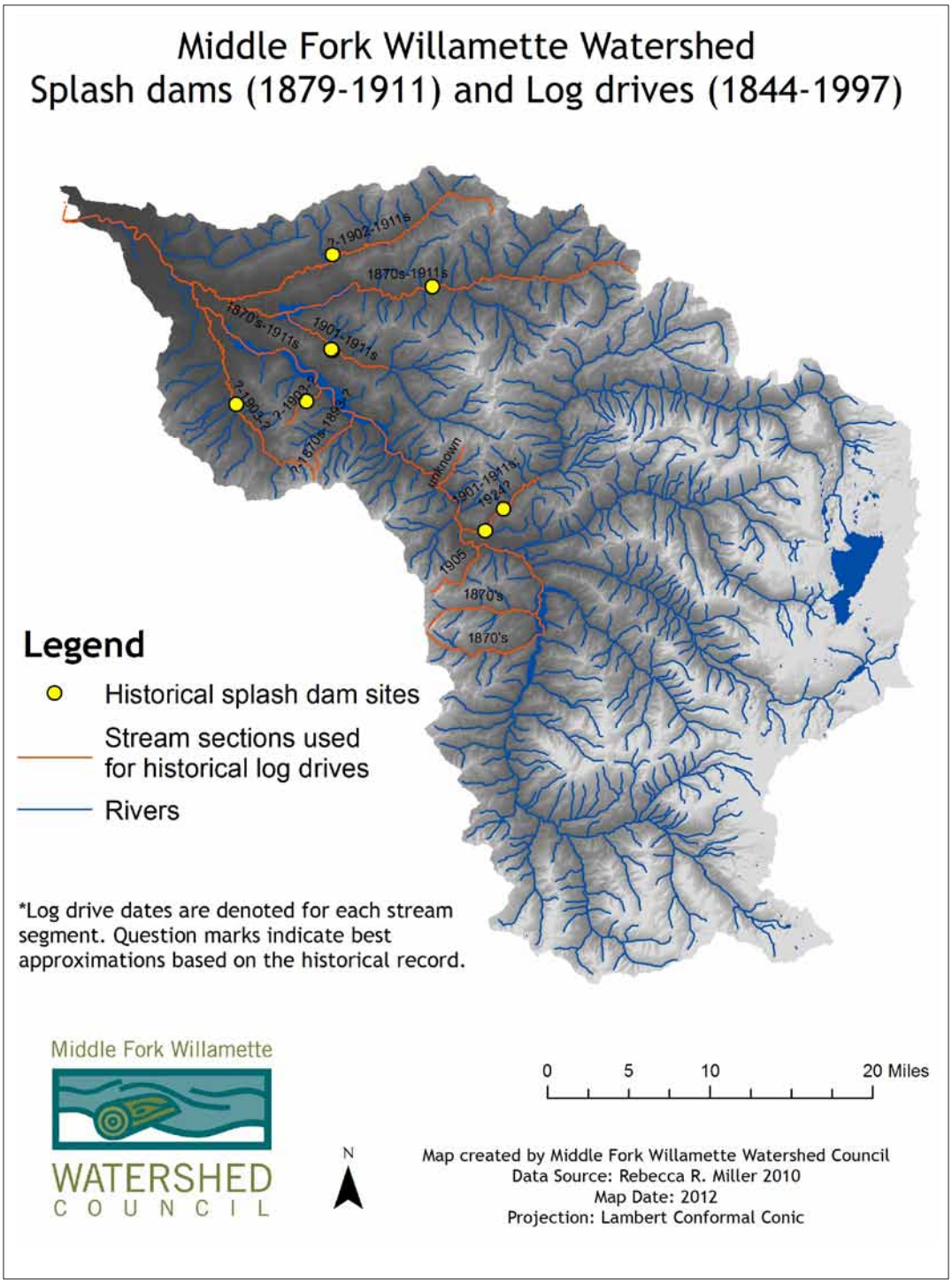
Map created by Middle Fork Willamette Watershed Council
Data Source: MFWWC Fish Passage Database (2010),
MFWWC survey data and data from partner groups
Map Date: 2012
Projection: Lambert Conformal Conic
*Some of the culverts may have been replaced


Middle Fork Willamette Watershed
Splash dams (1879-1911) and Log drives (1844-1997)
1902-1911s
1870s-1911s
1870s-1911s
1901-1911s
1905-2
1903-2
1870s-1892-2
unknown
1901-1911s
1924?
1905
1870's
1870's
Legend
Historical splash dam sites
Stream sections used for historical log drives
Rivers
*Log drive dates are denoted for each stream segment. Question marks indicate best approximations based on the historical record.
Middle Fork Willamette
WATERSHED COUNCIL
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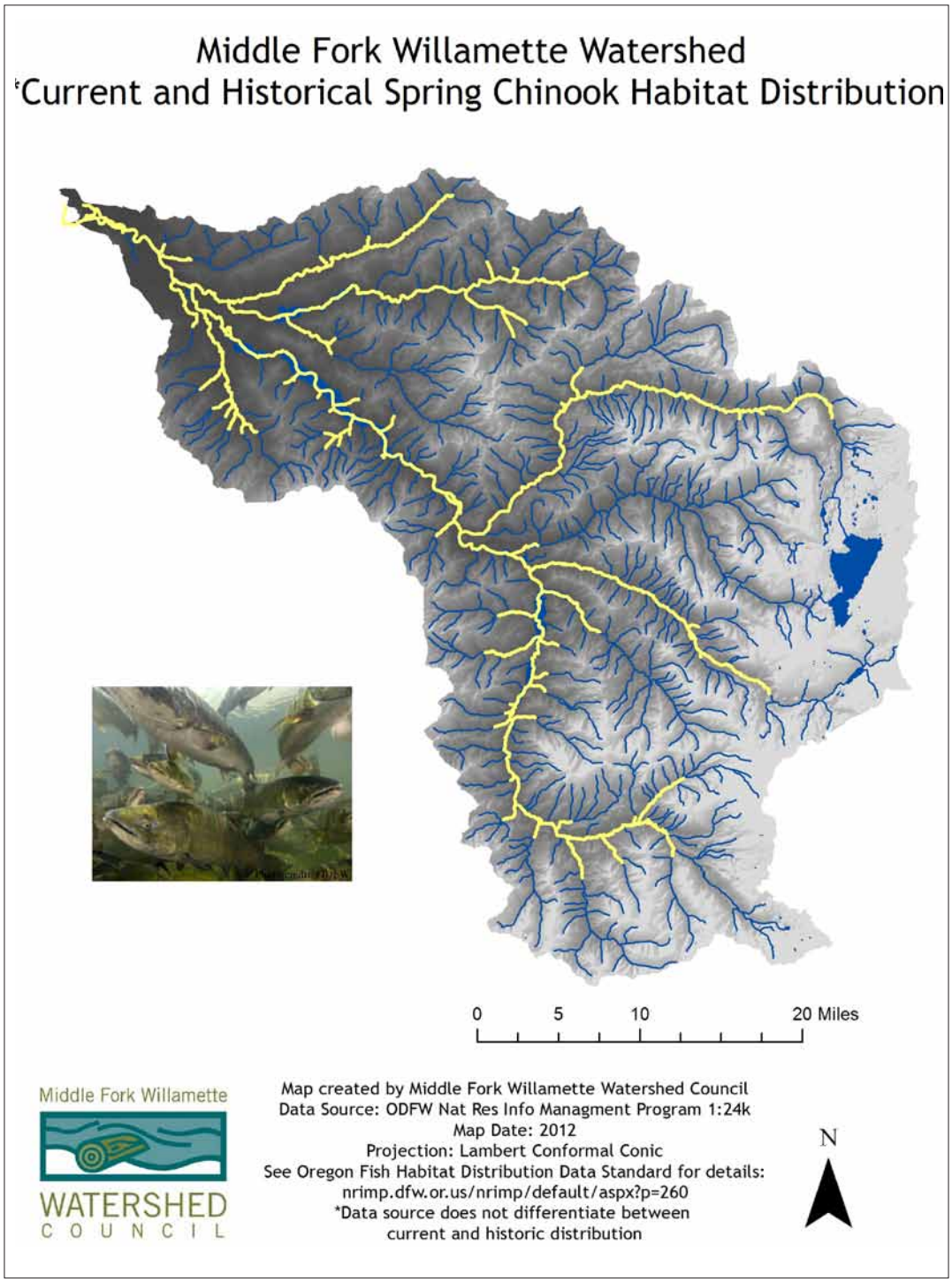
Map created by Middle Fork Willamette Watershed Council
Data Source: Rebecca R. Miller 2010
Map Date: 2012
Projection: Lambert Conformal Conic


Middle Fork Willamette Watershed
*Current and Historical Spring Chinook Habitat Distribution
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WATERSHED
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Map created by Middle Fork Willamette Watershed Council
Data Source: ODFW Nat Res Info Managment Program 1:24k
Map Date: 2012
Projection: Lambert Conformal Conic
See Oregon Fish Habitat Distribution Data Standard for details:
nrimp.dfw.or.us/nrimp/default/aspx?p=260
*Data source does not differentiate between
current and historic distribution
N

Middle Fork Willamette Watershed
Current* and Historical Bull Trout Habitat Distribution

Middle Fork Willamette
WATERSHED COUNCIL

Map created by Middle Fork Willamette Watershed Council
Data Source: ODFW Nat Res Info Managment Program 1:24k
Map Date: 2012
Projection: Lambert Conformal Conic
See the Oregon Fish Habitat Distribution Data Standard for details:
nrimp.dfw.state.or.us/nrimp/default.aspx?p=260
*Bull Trout were extirpated from the MFWW with dam construction but have been reintroduced in the Upper Middle Fork.

N

Assessment of Current Conditions

To assess current conditions for each subwatershed, we established a ratings matrix based on the TNC CAP process. The matrix is a planning tool that allows a land manager to assess the relationships between components within a complex system and to use this information in a stepwise manner to plan desired conditions and measurements for evaluating results. For the purpose of assessing conditions and actions necessary to achieve ecological uplift within each subwatershed of the Middle Fork Willamette, we used the matrix as a tool to identify and rate: Ecotype, Ecological Attributes, Indicators, Limiting Factors, Current Conditions, Desired Future Conditions, Project Actions, and Short and Long-term Benchmarks for evaluating progress. Information from stakeholder workshops, subwatershed analyses, focused studies for fish passage, water quality monitoring, invasive plant surveys, stream surveys for Little Fall Creek and Lost Creek and GIS analyses of the lower three subwatersheds provided the information needed for scoring the matrices. Desired future conditions and project actions necessary to achieve those actions have been identified so the MFWWC and its partners can address actions in a strategic, cost-effective manner within the next ten years.

Prioritization Framework

The following outlines a process for prioritizing ecological attributes and the limiting factors that impede the quality of ecological attributes important to the Middle Fork Willamette watershed. Identifying the priority for each of the limiting factors within a subwatershed will provide the MFWWC and its partners guidance for pursuing protection, enhancement or restoration actions. Based on the information developed through subwatershed planning workshops and personal communication with key specialists, we use both quantitative and qualitative rating and prioritization schemes to rank top priority actions for each subwatershed with the MFWW. The quantitative process is based on The Nature Conservancy's Conservation Action Planning process. For each Ecotype, we have identified Key Ecological Attributes. Key Ecological Attributes are aspects of the ecotype that define a healthy target, and if altered or absent lead to degradation or loss of the ecotype over time. Because Key Ecological Attributes tend to be broad and difficult to assess, specific measureable characteristics of the attributes, or Indicators, are selected for assessment. For each indicator, a rating scale based on the natural range of variability of the indicator is determined. Available data are then used to determine the condition of each indicator. If no data are available for a given indicator, the indicator is not rated, and the data gap is noted. Data gaps can be addressed overtime through collaborative stakeholder efforts and the information used to assess important indicators.

Each indicator will also be ranked by assessing a series of qualitative questions. Qualitative metrics are necessary because there is a lack of data for many of the rating or prioritization variables needed to conduct a quantitative ranking. Additionally, the rating scales have not yet been developed for every indicator and the process of developing them will take considerable time and research. Given the Plan is a living document and MFWW stakeholders will continue to work toward gathering data, the quantitative ranking can occur over time. In the meantime, the qualitative ranking system will allow us to assess ecological attributes.

The second tier of prioritization is for limiting factors. Limiting factors are stresses that negatively impact indicator condition. For each limiting factor, project types that can be implemented are provided.

Prioritization Process

Current ecological attributes, indicators and limiting factors were established for each subwatershed through a series of workshops and studies and based on the TNC CAP model. To establish conditions for each subwatershed, MFWWC staff worked with over 40 specialists to develop the matrices. Taking into consideration environmental, social and economic factors, MFWWC staff developed criteria for prioritizing the actions identified in the matrices. Stakeholders were provided the criteria for review and comment and MFWWC staff incorporated comments into a final prioritization criteria. MFWWC staff and key project partners scored each matrix using the prioritization criteria. Ecological Attributes and Limiting Factors were assessed using the prioritization method outlined on the next page.

Prioritization Method

There were two major steps to the prioritization process – evaluation of ecological components and evaluation of socio-economic components. The goal for evaluating ecological components was to identify ecological attributes and limiting factors in need of protection and enhancement; and to identify where more data is needed to make a determination. Evaluation of social-economic components is necessary to determine where there is interest and momentum for addressing problems; and to identify where more outreach and education is desirable to enhance community understanding of ecological issues in the area.

Ecological Components

Ecological prioritization consists of two prioritization tiers:

- Ecological Attributes
- Limiting Factors

Ecological Attributes: Quantitative Rating System

Ecological Attributes are aspects of an ecotype's structure and function. Key Ecological Attributes were selected for inclusion in the matrix and indicators were described for each attribute. Indicators are specific measurable characteristics of the Ecological Attribute. For each Indicator, a rating scale will be built based on professional opinion about the acceptable range of variation for that indicator. This will be an iterative process involving local experts. Each rating scale will be classified into four groups:

1) Poor–Restoration is increasingly difficult; occurrences are ubiquitous, chronic, and/or permanent.
2) Fair–Outside acceptable range of variation, requires human intervention; occurrences are widespread, or uncontrolled, or multiple.
3) Good–Indicator is within the acceptable range of variation, some intervention is required for maintenance; occurrences are isolated, limited, singular.
4) Very Good–Ecologically desirable status, requires little intervention for maintenance; no occurrences.

Indicators will be rated to determine the condition of an Ecological Attribute using available data. If no appropriate data are available to rate the Indicator then the value of Insufficient Data (IND) will be assigned. The goal of this prioritization is to assess which attributes are of concern. **At the time of this report, rating scales had not been built for the indicators. This process will require a lot of data, take considerable time, and necessitate input from specialists so the quantitative rating system will be implemented at a later date and added as an addendum to this report.*

Ecological Attributes: Qualitative Rating System

Qualitative prioritization is necessary for several reasons: 1) Determining indicator rating scales will be an ongoing process that will take considerable time, information, and consultation with experts and we need to have a system in place for evaluating indicators in the meantime; 2) Data are not available for many of the indicators, so an alternative method of assessment is necessary until data are acquired. Qualitative prioritization of the condition of indicators of Ecological Attributes is based on the best professional judgment by MFWWC staff and regional experts assessing the following criteria:

1. Rate the current suspected condition of this indicator (1=not degraded, 2=somewhat degraded, 3= degraded)
2. Indicate the spatial scale at which you have observed the condition to be degraded (1=isolated, 2=moderate, 3=widespread)
3. Does the current suspected condition of this Attribute negatively impact the structure of the Ecotype? (0=no, 1=yes)
4. Does the current suspected condition of this Attribute negatively impact ecological processes (e.g. energy flux, nutrient cycling, foodweb interactions) of the Ecotype? (0=no, 1=yes)

5. Does the current suspected condition of this Attribute negatively impact the biodiversity of the Ecotype? (0=no, 1=yes)
6. In your opinion, what is the potential for recovery of this indicator if human intervention is initiated? (1=low, 2=moderate, 3=high)

Limiting Factors

Limiting factors are factors that control a process. Factors of concern for a given attribute were selected based on stakeholder interviews and meetings. The goal of this prioritization is to assess which limiting factors are the most ecologically significant, tangible and manageable to address within the period of the 10-year Action Plan.

We prioritized Limiting Factors based on the following criteria:

Ecological Components

1. Does this limiting factor cause impairment of indicator condition? (0=not contributing, 1=contributing, U=unknown)
2. If the limiting factor is contributing to impairment of indicator condition, is this limiting factor the dominant mechanism of failure or secondary? (1=secondary, 2=dominant, N/A=not applicable)
3. Will addressing this limiting factor benefit additional ecological attributes? (0=no, 1=yes)

Socio-Economic Components

Limiting factors are also scored according to socio-economic factors. Socio-economic issues are scored by answering the following questions:

1) Are partners especially interested in or concerned about this limiting factor? (2=great interest, 1=some interest, 0=no interest)
2) Are landowners or user groups particularly interested in addressing this limiting factor? (2=great interest, 1=some interest, 0=no interest)
3) Has a targeted outreach campaign been conducted for this limiting factor? (1=yes, 0=no)
4) Is addressing this limiting factor socially and politically feasible? (1=yes, 0=no)
5) Is obtaining funding for addressing this limiting factor likely? (1=yes, 0=no)

Chapter 3. Current Conditions and Priority Summaries

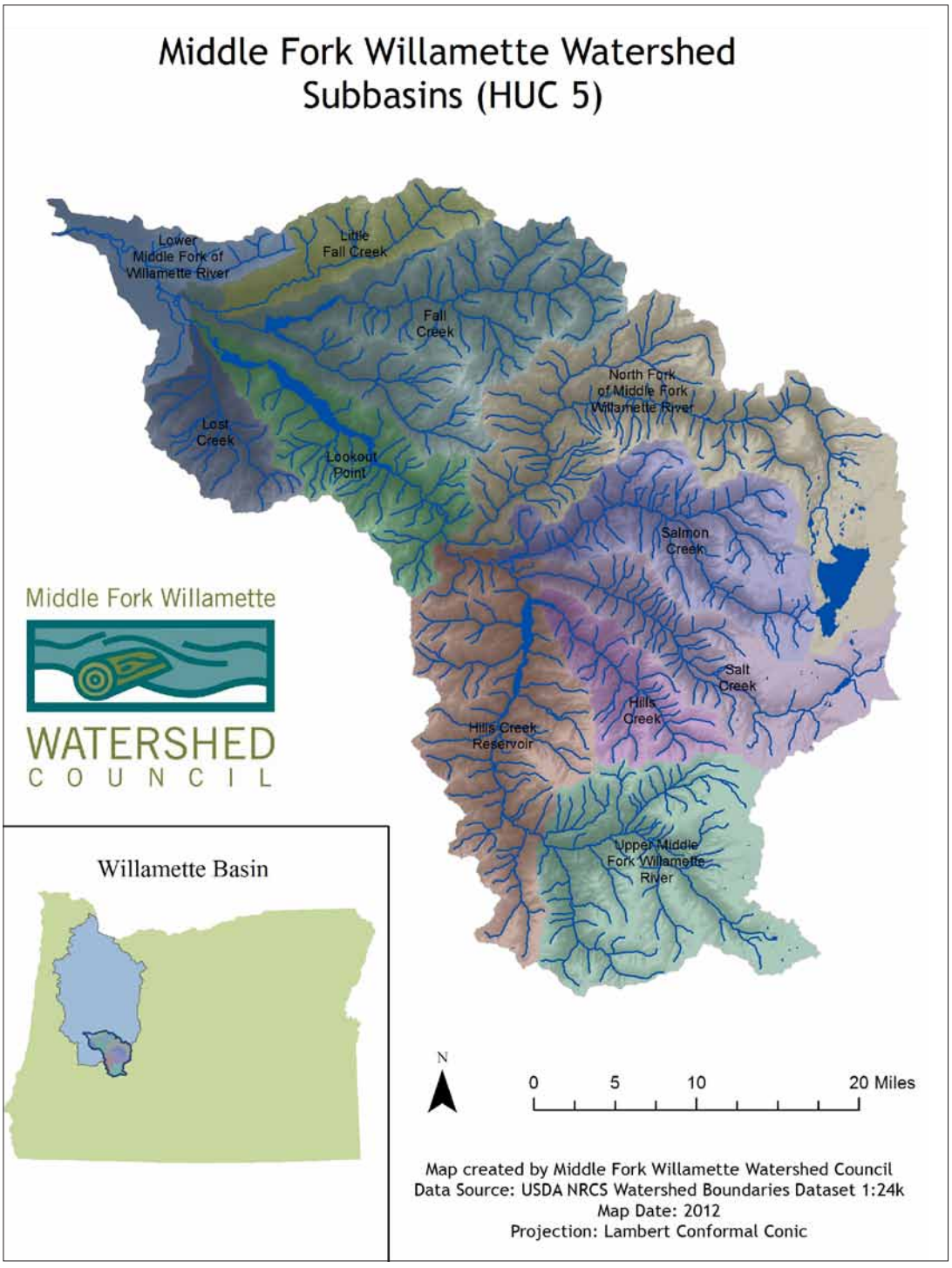
The CAP process was instituted for each of the 5th-field subwatersheds within the Middle Fork Watershed. Each of the subwatersheds differs in size, landscape characteristics, geology, land use, population, and other factors that influence watershed condition. Therefore, each subwatershed has unique current conditions and threats to watershed integrity and different protection, enhancement, and restoration needs. Current conditions, priorities and needed actions are described for each of the subwatersheds in the following chapters. There are 11 recognized 5th-field subwatersheds within the Middle Fork Watershed: Lower Middle Fork, Little Fall Creek, Lost Creek, Fall Creek, Salmon Creek, Salt Creek, Hills Creek, Hills Creek Reservoir, Middle Fork-Lookout Point, North Fork of the Middle Fork, and Upper Middle Fork.

Model Watershed Program

The Middle Fork Willamette Watershed Council is participating in the Model Watershed Program, a program of the Bonneville Environmental Foundation, with significant funding provided by the Meyer Memorial Trust. The BEF Model Watershed Program supports science-based watershed restoration initiatives that demonstrate strong community engagement and strive to implement a long-term and adaptive restoration approach. The MFWWC has enrolled two subwatersheds in this program from 2010–2020: Little Fall Creek and Lost Creek. The MWP will provide long-term support of strategic planning, project implementation, organizational capacity, and restoration effectiveness monitoring. Medium priority projects within model subwatersheds will potentially be implemented prior to high priority projects within other subwatersheds. A separate prioritization process was implemented for the Model Watersheds prior to completing the prioritization process used for this Action Plan. Those results can be found in Appendix A. Information from the MWP GIS-based prioritization process was used within this Action Plan prioritization framework.

Project Implementation and Effectiveness Monitoring

This document lists the highest priority limiting factors for each of the high priority ecological attributes within all of the subwatersheds in the MFWW. Projects that address each of the high priority limiting factors are indicated in the summary tables in the following chapters. We recognize that sometimes opportunities arise to implement projects that may not be high priorities. When those circumstances arise, we ask that higher priority projects be considered instead, especially given the limited funding available for habitat conservation, enhancement and restoration.


Middle Fork Willamette Watershed
Subbasins (HUC 5)
Lower Middle Fork of Willamette River
Little Fall Creek
Fall Creek
North Fork of Middle Fork Willamette River
Lost Creek
Lookout Point
Salmon Creek
Salt Creek
Hills Creek
Hills Creek Reservoir
Upper Middle Fork Willamette River
Middle Fork Willamette
WATERSHED
COUNCIL
Willamette Basin
N
0
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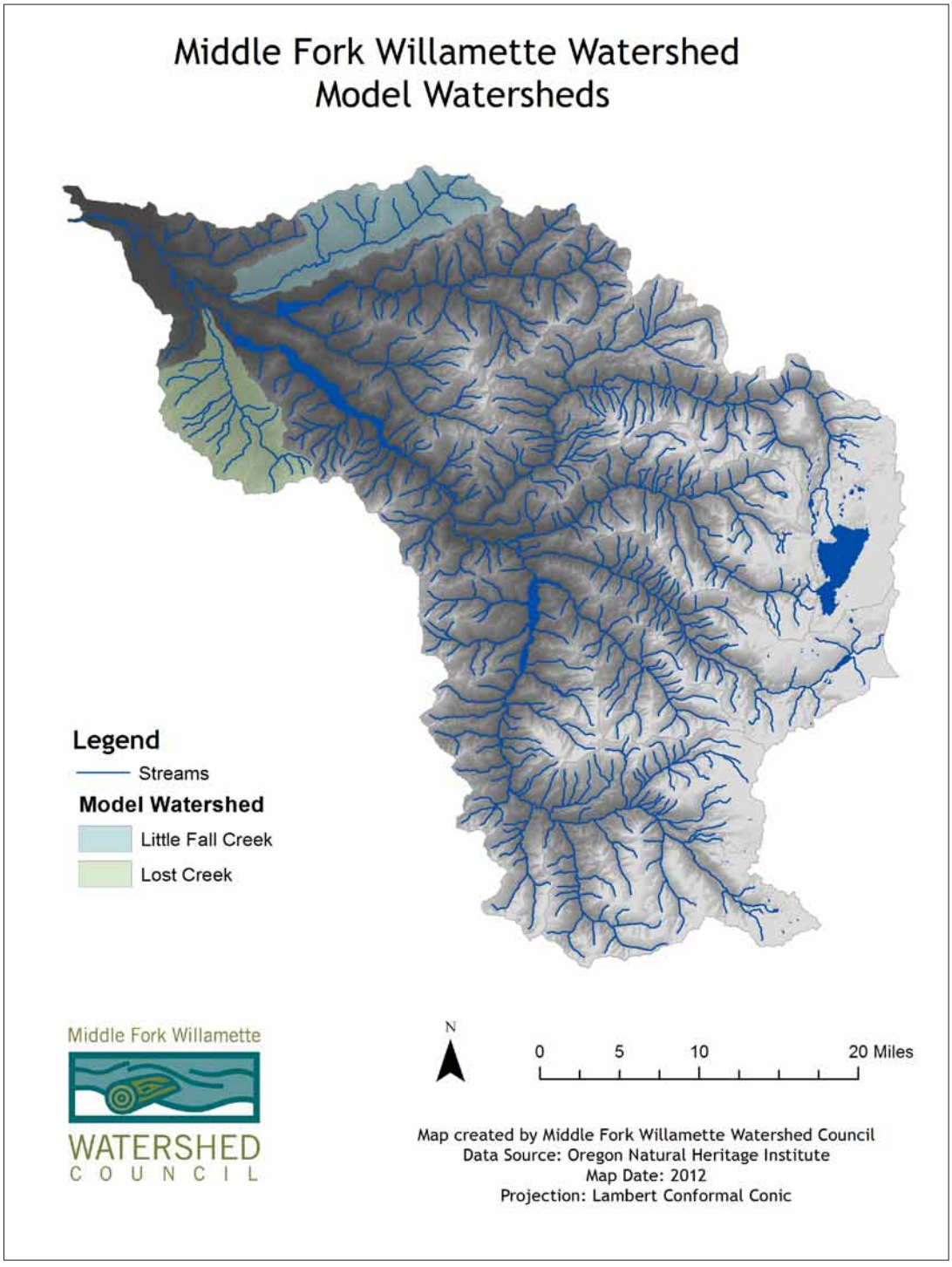
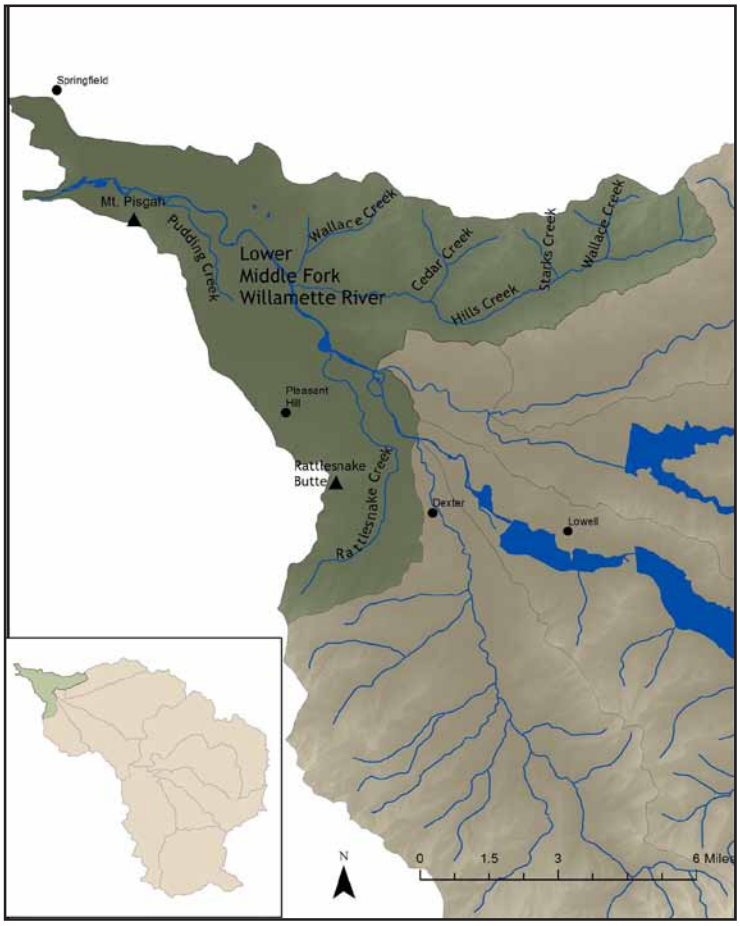
Map created by Middle Fork Willamette Watershed Council
Data Source: USDA NRCS Watershed Boundaries Dataset 1:24k
Map Date: 2012
Projection: Lambert Conformal Conic


Middle Fork Willamette Watershed
Model Watersheds
Legend
Streams
Model Watershed
Little Fall Creek
Lost Creek
Middle Fork Willamette
WATERSHED
COUNCIL
N
0
5
10
20 Miles
Map created by Middle Fork Willamette Watershed Council
Data Source: Oregon Natural Heritage Institute
Map Date: 2012
Projection: Lambert Conformal Conic

LOWER MIDDLE FORK



THE LOWER MIDDLE FORK SUBWATERSHED includes significant urban areas as it reaches the confluence with the mainstem of the Willamette River. Impacts from the urban areas, agriculture, and high road density are significant, however, water quality remains in relatively good condition.

WATERSHED CHARACTERISTICS

36,000 total acres

Land Ownership
- 13% Bureau of Land Management
- 24% Private industry; 61% Other private land
- 2% State of Oregon
- Includes significant urban areas

Riparian Function
- Lack of seasonal flooding has caused a reduction in complex riparian and floodplain habitat

Large Wood Potential
- Considered insufficient for fish habitat in 46% of total stream miles

Special Habitats
- Significant remnant oak woodlands and prairies

Roads
- High number of roads near streams (riparian zone)

Water Quantity & Quality
- Summer temps sometimes exceed DEQ standards

The Lower Middle Fork subwatershed is transitioning from hardwood to conifer forest due to lack of seasonal flooding resulting from dams.

PRIORITY INDICATORS

1. Flow regime frequency and duration of natural hydrograph
2. Quantity of large wood in stream; Pool-to-riffle ratio; Standard deviation of thalweg profile
3. Floodplain inundation frequency / groundwater elevation
4. Riparian corridor continuity and buffer width; Riparian plant community diversity and structural diversity; Invasive species cover
5. Abundance of riparian / floodplain habitat features (large wood, snags, side channels, wetlands)
6. Hydrological regime - maintenance of natural hydroperiod
7. Wetland native plant community
8. Quality and quantity of mosaic patch sizes
9. Beaver abundance and distribution
10. Native plant community
11. Frequency of disturbance by fire
12. Frequency of disturbance by fire, herbivory, windthrow

PRIORITY LIMITING FACTORS

1. Dam operations; Road in riparian areas route water directly to stream, altering peak discharge
2. Large wood removed from channel; Reduced riparian vegetation limits recruitment of large wood; Channel straightened, confined, simplified, armored
3. Presence of levees and riprap reduces connectivity; Lack of natural floodplain storage due to development and other activities in floodplain
4. Habitat loss; Invasive species; Spread of invasives into riparian area due to disturbance
5. Development in the floodplain and installation of riprap and levees
6. Hydrology altered to facilitate draining: ditches and tiles
7. Presence of invasive species
8. Loss of critical wetland and prairie habitat due to land use change and hydrological modification
9. Lack of riparian forest understory
10. Invasive species cover; Urban development
11. Fire suppression
12. Fire suppression; Forest management practices have reduced impacts of disturbance on habitat complexity

SUBWATERSHED ATTRIBUTES 1 River and stream hydrology 2 Channel habitat complexity 3 Floodplain connectivity 4 Riparian vegetation 5 Riparian / floodplain habitat complexity 6 Wetland hydrology 7 Wetland vegetation 8 Wetland habitat complexity 9 Wetland biological composition 10 Grassland, prairie, oak savanna vegetation 11 Grassland, prairie, oak savanna habitat complexity 12 Forest and oak woodland habitat complexity

Chapter 4. Lower Middle Fork Subwatershed

SUBWATERSHED SUMMARY

The Lower Middle Fork is the farthest downstream and closest subwatershed to major population centers. The Lower Middle Fork subwatershed lies between the mouth of Lost Creek and the confluence with the Coast Fork of the Willamette River. It is below all four dams, and has a high percentage of private land (84%) as compared with most other Middle Fork River in the watershed (Runyon et al. 2002). It totals just over 36,000 acres. About 65% of the land within the subwatershed is used for forestry of which 36% is in private ownership (Runyon et al. 2002). The BLM manages about 13% of the land within the subwatershed, while the USACE and Oregon State Parks also own large parcels.

About 31% of the total area is used for agriculture, and 3% is urban, including the towns of Pleasant Hill, Jasper, Lowell, and the City of Springfield (Runyon et al. 2002). Highway 58 bisects the subwatershed northwest to southeast. Several important local recreation areas include: Jasper State Park, Dorris Ranch (Willamalane Park and Recreation District), and Howard Buford Park (Lane County). There are significant areas with remnant prairie and oak ecosystems; both high priorities state wide for conservation and restoration. The remaining lowland riparian habitats, particularly those associated with the Willamette Greenway and the TNC Willamette Confluence Project, are also important areas. Within the lower portion of this subwatershed near and within Springfield, the river has large wetlands with complex and braided stream channels and gravel bars. There are also large areas with hydric soils, indicating that wetlands may have once been much more extensive.

Upstream dams have had significant impacts on river and riparian habitats as well as water quality. The dams are operated primarily for flood control, but power is also generated from the Hills Creek, Lookout Point and Dexter dam complex when appropriate water levels and power needs align. Dams alter all aspects of the natural hydrological regime, including timing of discharge, flow magnitude, periodicity, and duration (Lytle and Poff 2004). Dam operations have decreased the magnitude of winter floods and increased summer flows by 2–3 times (Gregory et al. 2007). Lack of seasonal flooding and past stream bank engineering has caused a reduction in complex stream and riparian habitats in large part because bankfull flows, which redistribute sediments and shape channels, have been greatly reduced. The amount of large wood necessary for providing adequate fish habitat is considered insufficient. Livestock grazing and unpaved roads are believed to be contributors of sediment to streams. Water quality is good in comparison with much of the greater Willamette River basin, but summer temperatures sometimes exceed DEQ standards. Dam operations have more than likely resulted in increased late summer and autumn river temperatures and decreased spring and early summer temperatures (Gregory et al. 2007).

The Lower Middle Fork provides important habitat for spring Chinook, winter steelhead, Brook lamprey, and Oregon chub. Bull trout have been extirpated from the lower Middle Fork. There are many non-native fish species present which compete with native species for limited habitat.

Invasive plant species are widespread throughout this subwatershed. These include common species like blackberry, scotch broom, and English ivy, but also less widespread knotweed and false brome, as well as aquatic weeds like Eurasian watermilfoil.

Due to its close proximity to population centers and position below the dams, the Lower Middle Fork subwatershed has been the focus of conservation and enhancement work in recent years. This work includes invasive plant surveys and management, prairie and oak woodland inventories and restoration, and riparian planting. The Army Corps of Engineers (USACE), MFWWC and CFWWC recently completed a study of floodplain restoration opportunities in the Lower Middle Fork that identified three key reaches with high restoration potential; the Coast Fork/Middle Fork confluence area, Jasper to Mount Pisgah, and the Fall Creek confluence (Tetra Tech 2008). All three areas have concentrations of public land, few structures in the floodplain, naturally braided channels, and lateral room for floods. The USACE is studying the potential for modifying dam operations to include seasonal "pulse" releases of water to simulate historic flood conditions. Further recommendations from multiple studies include: riparian woodland restoration, dike and revetment removal or partial breaching, wetland restoration, large wood placement along mainstem banks and within tributaries, and reconnection of side channel habitats and oxbows. A recent biological opinion by the National Marine Fisheries Service will require the USACE to improve flow and hatchery management. It also requires funding and implementation of unspecified off-site habitat enhancement projects beginning in 2010.

Recent conservation and enhancement projects have included: riparian planting and ivy removal at Jasper State Park, mapping and control of invasive species, fish passage improvements, and pond habitat enhancement. There have also been recent floodplain acquisitions in the confluence area, including the purchase of a large former gravel mining operation site by The Nature Conservancy. A 2005 fish passage report identified two high priority culverts that block fish passage in the Lower Middle Fork, one at Wallace Creek and the other on Rattlesnake Creek.

Lower Middle Fork Prioritization Results

The highest priority Indicators for Key Ecological Attributes in the Lower Middle Fork subwatershed can be found in the table below.

For stream and river habitats and surrounding riparian areas, the indicators should be priorities to address with restoration and enhancement actions:

- Flow-regime frequency and duration of natural hydrograph
- quantity of large wood in the stream
- pool to riffle ratio
- floodplain inundation frequency and groundwater elevations
- riparian corridor continuity and buffer width
- riparian plant community diversity and structural diversity
- invasive species cover
- abundance of riparian/floodplain habitat features
- amphibian and reptile communities

For wetlands, ponds and lakes, priority should be given to:

- wetland hydrological regime
- wetland native plant community
- quality and quantity of wetland mosaic patch sizes
- beaver abundance and distribution

For grassland, prairie and oak savanna habitats, focus should be on:

- native plant community
- frequency of disturbance by fire

In oak woodland and forest environments, priority should be given to

- frequency of disturbance by fire, herbivory, and windthrow

The prioritization process identified specific limiting factors for each of the high-priority indicators listed above. Limiting factors for each indicator were assessed through the lens of ecological and socio-economic considerations.

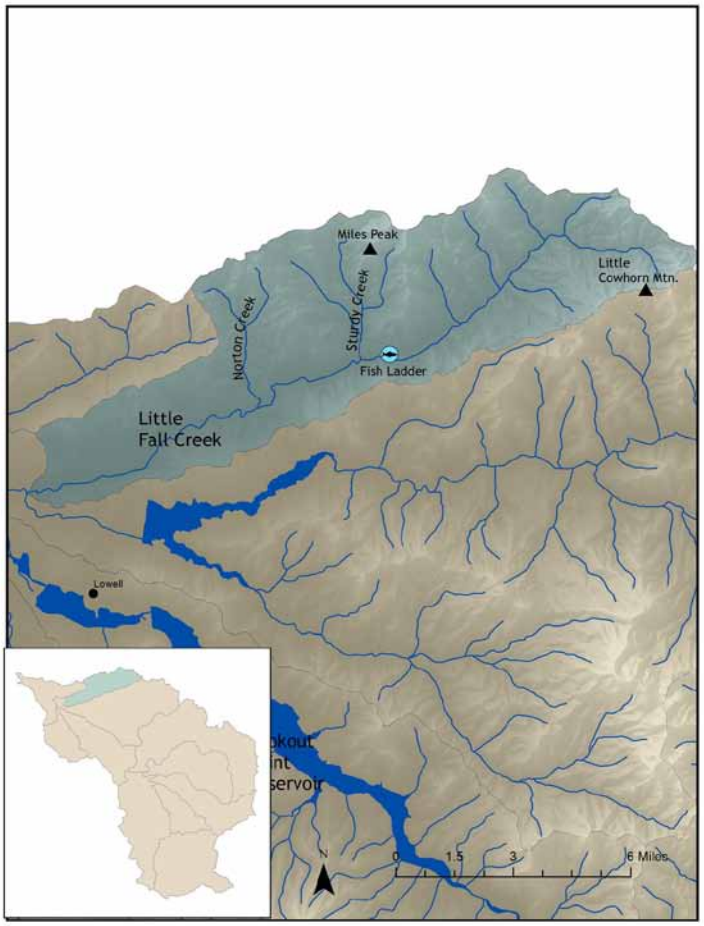
A separate prioritization process was implemented for the Model Watersheds prior to completing the prioritization process used for this Action Plan. Those results can be found in Appendix A.

Lower Middle Fork priorities based on qualitative scoring of Indicators and Limiting Factors

Attribute	Indicator(s)	Limiting Factors(s)	Projects that Address Limiting Factors
River and stream hydrology	Flow regime-frequency and duration of natural hydrograph	Dam operations	Dam operation flow modifications to mimic natural hydrograph and cold water releases
		Roads in riparian areas route water directly to stream, altering peak discharge	Promote stormwater detention basins and comprehensive stormwater management planning
Channel habitat complexity	Quantity of large wood in stream	Large wood removed from channel	Large wood placement along mainstem banks and within tributaries. The need for wood placement at the Coast Fork/Middle Fork Confluence and at RM 189, 1919, 192, 193, 197, and 203 was identified in USACE Willamette Floodplain Feasibility Study.
		Reduced riparian vegetation limits recruitment of large wood	Riparian planting projects
	Pool:riffle ratio	Channel straightened, confined, simplified, armored	Reconnect side channel and alcove habitats in mainstem and its tributaries to benefit Oregon chub and provide slow-water refuges
	Standard deviation of thalweg profile		Remove key hard structures or retrofit using bioengineering methods
Floodplain connectivity	Floodplain inundation frequency and groundwater elevations	Presence of levees and riprap reduces connectivity	Remove key hard structures at RM 190, 192, 194, 198, 202 or retrofit using bioengineering methods
		Lack of natural floodplain storage due to development & other activities in floodplain	Reconfigure/restore gravel ponds near MF/CF confluence
			Floodplain enhancement projects
			Priority should be given to projects identified as part of the USACE Willamette Floodplain Feasibility Study

Attribute	Indicator(s)	Limiting Factors(s)	Projects that Address Limiting Factors
Riparian vegetation	Riparian corridor continuity and buffer width	Habitat loss	Riparian planting projects at Jasper State Park, Confluence, Springfield Mill Race, and RM 192-193.
	Riparian plant community diversity and structural diversity	Habitat loss	Installation of livestock fencing
		Invasive species	Early Detection and Rapid Response for new invaders
	Invasive species cover	Spread of invasives into riparian area due to disturbance	Work with FBP to control and contain invasive species along trails
Riparian/ floodplain habitat complexity	Abundance of riparian/ floodplain habitat features (large wood, snags, side channels, wetlands)	Development in the floodplain and installation of riprap and levees	Remove structures
			Large wood placement and turtle nesting habitat enhancement and creation
Wetland hydrology	Hydrological regime-maintenance of natural hydroperiod	Hydrology altered to facilitate draining:ditches and tiles	Restoration of wetland hydrology at confluence of Coast and Middle Forks and in lower reaches of MFW near Springfield. Focus on high-priority areas for green heron, wood ducks, red-legged frogs, and western pond turtles.
			Preservation of intact wetlands
Wetland vegetation	Wetland native plant community	Presence of invasive species	Removal of invasive species and replacement with natives
Wetland habitat complexity	Quality and quantity of mosaic patch sizes	Loss of critical wetland and prairie habitat due to land use change and hydrological modification	Preservation of intact wetlands and wet prairie and restoration and enhancement of degraded wetlands and wet prairie. Support FBP in wetland and wet prairie restoration efforts at HBRA
Wetland biological composition	Beaver abundance and distribution	Lack of riparian forest understory	Riparian planting projects in slackwater and side channel areas
			Beaver habitat enhancement through riparian fencing, connecting flow to historic channels, and floodplain restoration activities
Grassland, prairie, oak savanna vegetation	Native plant community	Invasive species cover	Weed removal, prescribed burns, and native species planting
		Urban development	Identify grassland, prairie, and oak savanna resources and work with landowners on conservation and habitat enhancement measures including thinning and oak release, planting of understory shrubs and native grasses
Grassland, prairie, oak savanna habitat complexity	Frequency of disturbance by fire	Fire suppression	Prescribed burns
			Thinning and oak release, planting of understory shrubs and native grasses
Forest and oak woodland habitat complexity	Frequency of disturbance by fire, herbivory, windthrow	Fire suppression	Prescribed burns, promote integrated approach to wildfire management that considers historic conditions, wildlife conservation, natural fire intervals, and silviculture
		Forest management practices have reduced impacts of disturbance on habitat complexity	Selective thinning to promote species diversity and structural diversity

Little Fall Creek



THE LITTLE FALL CREEK SUBWATERSHED is majority owned by private entities. Riparian habitat is in relatively good condition. The stream is undammed and provides some of the best pontential for enhancing spring Chinook habitat.

Watershed Characteristics

37,400 total acres

Land Ownership
- 70% private industry
- 17% Forest Service
- 7% BLM and other public lands
- 6% other private land

Stream Conditions
- Loss of complexity resulting from historic splash-damming
- Pools not abundant, but deep
- Low amounts of wood except in upper reaches
- 75% shade cover

Aquatic Species:
- Spring Chinook
- Winter and summer steelhead

Water Quantity & Quality
- Limited data on flows
- Only 1 stream gage, 1936-48

Impacts:
- 838 stream crossings
- Multiple roads along streams
- High sediment potential from roads

Priority Indicators

1. Water temperature
2. Quantity of large wood in stream; Pool:riffle ratio and thalweg profile
3. Fish communities
4. Floodplain inundation frequency and groundwater elevation
5. Riparian plant community diversity and structural diversity
6. Abundance of habitat features (large wood, snags, side channels, wetlands)

Priority Limiting Factors

1. Lack of channel complexity
2. Reduced conifers in riparian corridor result in lack of large wood recruitment to stream; Channel straightened, confined, banks armored
3. Access to off-channel habitat is limited
4. Lack of natural floodplain storage due to development of roads adjacent to stream
5. Reduced structural complexity due to historical splash-damming practices
6. Reduced floodplain forest extent and condition reduces wood available for habitat

SUBWATERSHED ATTRIBUTES 1 Water Quality 2 Channel habitat complexity 3 Biological interactions, composition and structure 4 Floodplain connectivity to watercourse 5 Riparian vegetation 6 Riparian/floodplain habitat complexity

Chapter 5. Little Fall Creek Subwatershed

SUBWATERSHED SUMMARY

Little Fall Creek flows into Fall Creek and then into the Lower Middle Fork from the Northeast. It is one of only three subwatersheds in the Middle Fork Watershed that is free flowing. It totals over 37,000 acres, with 70% in private, industrial forest ownership (Weyerhaeuser Corporation). Twenty-three percent is in federal ownership, split between the US Forest Service and Bureau of Land Management. Only 2% of the total land area is used for agriculture. Elevations range from a low of 600 feet to over 4000 feet at Little Cowhorn Mountain. There are private residences in the lower subwatershed, but no incorporated towns.

Riparian cover along tributary streams and much of the mainstem is adequate for shade, but this is less the case along the lower mainstem where private residences occur. Most riparian forests are in less than a mature condition for coniferous species, resulting in a low large wood recruitment potential in over 61% of the area (Runyon et al. 2002).

Because Little Fall Creek is not dammed, conservation and enhancement of salmon habitat is considered very important for regional salmon population improvement efforts. The stream conditions we observe today are legacies of past management and use. Like many streams in western Oregon, Little Fall Creek was "splash-dammed" in the early 1900s. Splash-dams spanned the entire stream and created reservoirs that were used to backup water and store logs. During log drives, the spillway on the splash-dam was opened to create a flood event that would transport the logs downstream to the mill. Another common practice during this period was to remove instream obstacles that could hinder log transport, including large boulders and log jams. Splash-damming resulted in stream channels being scoured down to bedrock and a loss of channel habitat complexity, including structures that would trap gravel and maintain channel-floodplain connectivity. A fish ladder was constructed in 1986 around a natural waterfall, which has allowed spring Chinook to access high quality upstream habitat in recent years. Hatchery stocks have most likely interbred with native fish, possibly diminishing the value of Little Fall Creek as refugia for the native salmon gene pool. Observations indicate increased use by salmon over the past number of years in the upper watershed. Winter and summer steelhead are also present, and there was a single sighting of a Brook lamprey in 1993 (ODFW personal communication). Large wood and boulders, important features of quality salmon habitat, are lacking in streams except for in the upper watershed.

Sediment delivery from roads within the subwatershed may be significant. Nearly all of the 838 stream crossings are unpaved roads (Runyon et al. 2002). Major timber haul roads parallel Little Fall Creek but most sediment delivery originates from midslope roads (Weyerhaeuser 1997). There have been a number of mapped landslides attributed to roads and timber harvest, however, most soils within the subwatershed exhibit low erosion potential (Runyon et al. 2002). Overall, water quality in Little Fall Creek is good, although temperature standards were not met in LFC during most days in the summer in 2009 (MFWWC et al. 2011). Several periodical DO measurements taken monthly during 2008–2010 were lower than the State Standard, which is based on a moving average.

Populations of false-brome (*Brachypodium sylvaticum*) have been mapped, including 186 populations on 20 separate private properties. The subwatershed includes a large BLM meadow complex with a fringe of Oregon white oak near Cedar and Wallace Creeks.

Little Fall Creek Prioritization Results

High priority indicators and their corresponding ecological attributes for Little Fall Creek can be found in the table below. Attributes related to stream channels and riparian areas that are in greatest need of attention include:

- water temperature
- water quality parameters
- quantity of large wood or boulders in stream
- pool to riffle ratio
- off-channel habitat connectivity
- fish passage barriers
- fish communities
- floodplain inundation frequency/groundwater elevation
- riparian plant community diversity and structural diversity
- invasive species cover
- abundance of riparian/floodplain habitat features

In forested environments within the Little Fall Creek watershed, priority restoration activities will address

- forest soil structural integrity
- forest native plant community
- frequency of disturbance necessary to maintain healthy forest condition.

Each of these high priority indicators has at least one driver or limiting factor. Limiting factors were prioritized based on a qualitative assessment of ecological and socio-economic factors. The high ecological priority limiting factors identified in the table on the next page are the most likely to be the main drivers of the reduced condition of the attributes identified as high priorities.

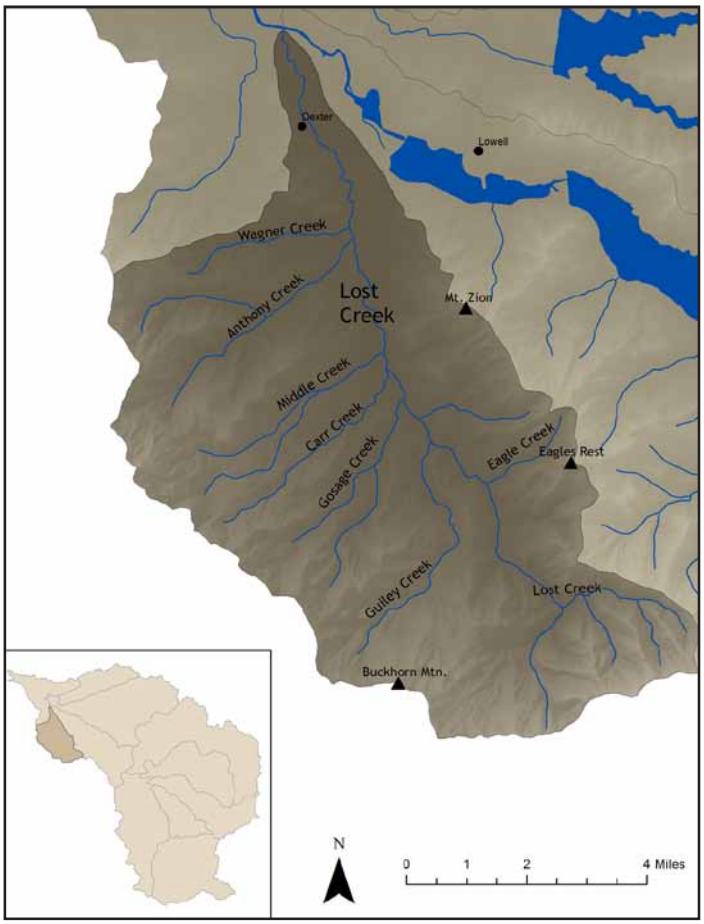
At the time of this report, we were unable to rank indicators for key ecological attributes of wetland, grassland, prairie and oak savanna resources within the Little Fall Creek subwatershed due to a lack of information. The National Wetlands Inventory map indicates that there are not significant wetland resources within the subwatershed. Currently, land managers do not have an oak coverage map, so it is unclear how prevalent oak resources are, or what kind of condition they are in within the lower basin. The Nature Conservancy recently completed a project in which they mapped properties containing significant oak resources that occur within Willamette Valley Synthesis Project Conservation Opportunity Areas. The resulting map indicates that there are important oak resources on privately owned land in the lower Little Fall Creek subwatershed (Ed Alverson, personal communication, 2011). At this time, there is no information on the condition of those resources so indicators for these attributes were not prioritized. Because oak habitat is a high priority for conservation within the Oregon Conservation Strategy, oak habitats should be given a high priority for action within the subwatershed.

A separate prioritization process was implemented for the Model Watersheds prior to completing the prioritization process used for this Action Plan. Results are tied to specific geographic areas. Additional information on the prioritization process and results can be found in Appendix A.

Little Fall Creek priorities based on qualitative scoring of Indicators and Limiting Factors

Attribute	Indicator(s)	Limiting Factor(s)	Projects that Address Limiting Factors
Water Quality	Temperature	Lack of channel complexity limits cold water habitats	Large wood and boulder placement
Channel habitat complexity	Quantity of large wood in stream	Reduced riparian vegetation condition causes lack of large wood recruitment to stream	Restore and preserve existing riparian forests
			Large wood and boulder placement
			Side channel reconnection projects
	Pool:riffle ratio and thalweg profile	Channel straightened, confined, banks armored	Restore stream reaches that have been straightened, channelized, or dewatered to add complexity and habitat features
Biological interactions, composition and structure	Fish communities	Access to off-channel habitat is limited	Restore and enhance side channel and alcove habitats.
Floodplain connectivity to watercourse	Floodplain inundation frequency and groundwater elevation	Lack of natural floodplain storage due to development of roads adjacent to stream	Look for opportunities to enhance floodplain connections while maintaining access to timberlands
Riparian vegetation	Riparian plant community diversity and structural diversity	Reduced structural complexity due to historical logging and forest management practices	Conifer interplanting
Riparian and floodplain habitat complexity	Abundance of habitat features (large wood, snags, side channels, wetlands)	Reduced floodplain forest extent and condition reduces wood available for habitat	Floodplain forest restoration: removal of invasives and planting native conifer species

LOST CREEK



THE LOST CREEK SUBWATERSHED includes the town of Dexter. Lost Creek is an undammed tributary to the Middle Fork Willamette and home to spring Chinook salmon and steelhead. High stream temperatures and loss of channel complexity are issues in this subwatershed.

WATERSHED CHARACTERISTICS

34,618 total acres

Land Ownership
- 42% Private timber industry
- 33% Bureau of Land Management
- 25% private residential

Upland Conditions
- Mostly fragmented Douglas fir forest
- Oak woodlands, prairies, and savannas

Riparian Conditions
- Riparian cover generally good in the upper reaches
- Mainstem reaches have lower quality riparian buffers
- Low large wood recruitment in many areas

Aquatic Habitat
- Decline in quantity of deep pools
- Lack of large wood and complex structure

Water Quantity & Quality
- Increased stream temperatures
- Low dissolved oxygen levels in some areas
- Water withdrawls may be impacting aquatic life

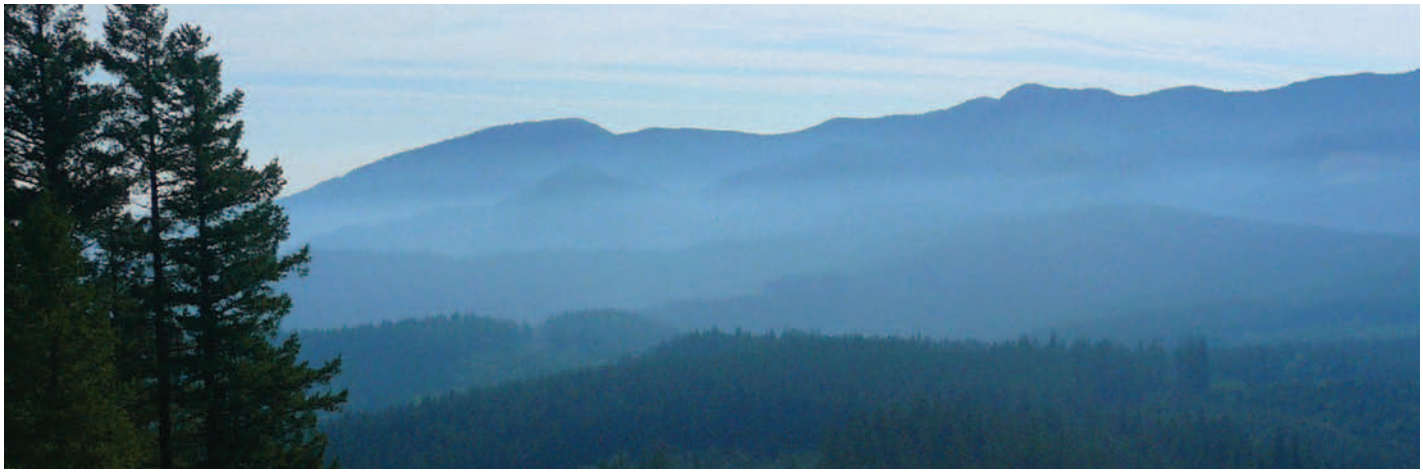
PRIORITY INDICATORS

1. Water quantity
2. Water temperature
3. Quantity of large wood in stream; Pool-to-riffle ratio; Standard deviation of thalweg profile
4. Fish passage barriers
5. Floodplain inundation frequency / groundwater elevation
6. Riparian corridor continuity and buffer width; Riparian plant community diversity and structural diversity; Invasive species cover
7. Abundance of riparian / floodplain habitat features (large wood, snags, side channels, wetlands)
8. Native plant community
9. Frequency of disturbance by fire and herbivory
10. Forest area with natural hydroperiod and drainage pattern
11. Native plant community

PRIORITY LIMITING FACTORS

1. Water allocations - summer flows too low
2. Lack of shade
3. Large wood was removed from stream channel; Reduced riparian vegetation limits recruitment of large wood
4. Inadequate culverts or stream crossings
5. Presence of levees or riprap; Development in the floodplain
6. Habitat loss and land use conversion; Spread of invasives into riparian area due to disturbance
7. Reduced extant of floodplain forests reduces wood available for recruitment, bank stabilization, and shade
8. Invasive species encroachment; Habitat loss; Altered hydrology
9. Fire suppression
10. Forest management practices; Roads
11. Logging has altered vegetation structure and composition

SUBWATERSHED ATTRIBUTES 1 Stream hydrology 2 Water quality 3 Channel habitat complexity 4 Connectivity/fish passage 5 Floodplain connectivity to watercourse 6 Riparian vegetation 7 Riparian/floodplain habitat complexity 8 Grassland, prairie, oak savanna vegetation 9 Grassland, prairie, oak savanna habitat complexity 10 Forest hydrology 11 Forest and oak woodland vegetation



Chapter 6. Lost Creek Subwatershed

SUBWATERSHED SUMMARY

Lost Creek enters into the Lower Middle Fork north of Dexter. It is one of only three subwatersheds not impacted by dams in the Middle Fork Willamette watershed. It contains over 34,000 acres, of which about 60% is privately owned. The remaining ownership is public (including BLM, USFS, and State of Oregon). About 8% is in agricultural use, the majority of land use is commercial forestry (Runyon et al. 2002). Elevations range from 600 to 4600 feet at Mount June. Dexter is an unincorporated, semi-rural settlement, and there are rural residences scattered across the lower subwatershed. About half the subwatershed is located within the Willamette Valley ecoregion, while the remainder is in the Western Cascades ecoregion.

Lost Creek was splash-dammed in the late 1800s and early 1900s. In 1921, a 7.5-mile-long lumber flume was erected from Mt. Zion near Anthony Creek, across the Willamette River to the mill at Pengra. The flume operated until a flood destroyed it and the mill in 1942 (BLM 1997). The practice of splash damming alters the geomorphic characteristics of a stream, in addition to reducing channel complexity through a reduction of instream wood and boulders.

Riparian cover is generally good, with over 82% identified as high shade levels (Runyon et al. 2002). Nearly 50% of riparian stands have high large wood recruitment potential, mostly on tributaries such as Carr and Gosage Creeks, while 35% has low large wood recruitment potential (Runyon et al. 2002). The mainstem has lower quality riparian vegetation due to the location of housing and agriculture. Invasive plants are present throughout much of the riparian area in the lower reaches of Lost Creek. The MFWWC has worked with partners to address knotweeds (*Fallopia* species) and false brome (*Brachypodium sylvaticum*) across many private properties within this basin.

Upland areas are fragmented and mostly comprised of uniform-aged timber stands with only 2% old growth remaining (BLM 1997). Oak and prairie habitats are found in the lower subwatershed near Dexter. At the time of this report, location and condition of significant oak savanna and oak woodlands were unknown for the Lost Creek subwatershed. Most of the oak resources within this subwatershed are likely in private ownership. Dry upland meadows and rocky outcrop habitats are found in the upper subwatershed.

Road density is relatively high, with over 200 miles and 515 stream crossings. Gravel midslope roads probably constitute a sediment source in the upper basin. A major road along most of the mainstem stream corridor contributes to channel confinement. Fish passage may be an issue in some areas within this subwatershed.

Lost Creek is a relatively low-gradient system. The lower reaches flow through Quaternary alluvial deposits and the upper reach flow through sedimentary and volcanic substrates. Fish habitat quality varies throughout the basin. Generally, lower reaches lack large wood, boulders, deep pools, and complex structure (Ecosystems Northwest 2002). Evidence suggests recent downcutting of lower portions of Lost Creek (Ecosystems Northwest 2002). Lower reaches have significant areas of bank erosion and many attempts at bank hardening using riprap, tires, and other household items. A significant portion of the creek has no side-channel and little floodplain connectivity. Upper reaches have sufficient amounts large wood. Pool frequency and depth have declined over time (BLM 1997). Dace and red shiners are abundant in the lower subwatershed,

while cutthroat trout, rainbows, and steelhead can be found in the upper reaches (Ecosystems Northwest 2002). Spring Chinook are reported in Lost Creek despite the historical impacts to fish habitat from the flume, lumber mill water diversions, and splash-damming (Ecosystems Northwest 2002).

Water temperatures exceed state standards in the lower subwatershed (MFWWC et al. 2011). Tributaries to Lost Creek also periodically exceed temperature standards, including Anthony, Middle, and Gosage Creeks. Anthony Creek and Lost Creek mainstem are both 303(d) listed for dissolved oxygen and high temperatures are covered by the Willamette Basin TMDL. Summer flows in Lost Creek are low and reports from long-time landowners within the basin indicate that this is not the natural flow regime of the creek. Potential causes of diminishing water quantity include surface flow withdrawals, groundwater withdrawals, and shifting periodicity of the snowpack in the upper basin. A hydrological analysis has not been undertaken to determine the cause(s).

Recent conservation and enhancement projects have included: Lost Creek confluence riparian habitat enhancement, oak woodland and prairie restoration at Elijah Bristow State Park, knotweed eradication along Lost Creek, and assessment of fish passage barriers. About 4.3 acres of outlier populations of false-brome have been identified and treated on ten separate private properties within the subwatershed. There are also scattered populations of false-brome along BLM and Weyerhaeuser roads. A meadow on Mt. Zion has a fringe of oak trees, but has not been field surveyed (land ownership shared by BLM and Giustina Resources). A midslope, rocky meadow with an oak fringe is located near Anthony Creek, with another at the top of Mount Kloster. These sites are within BLM ownership. They have not been studied in detail for current condition or restoration potential.

Lost Creek Prioritization Results

High priority indicators and their corresponding ecological attributes for Lost Creek can be found in the table below. Attributes that are in greatest need of attention include:

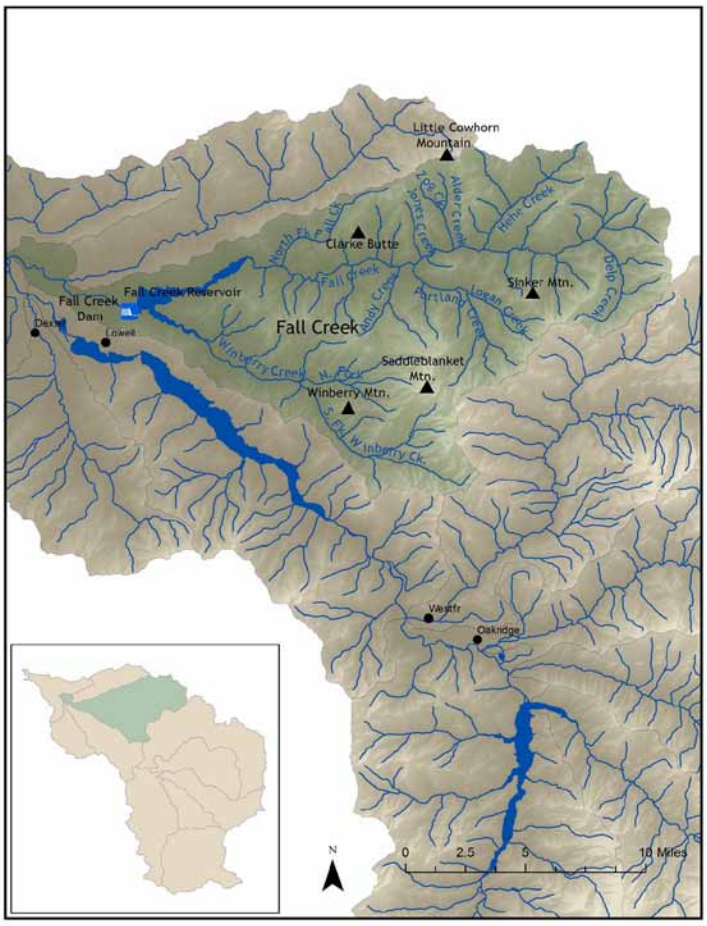
- stream hydrology
- water quality and quantity
- channel habitat complexity
- connectivity and fish passage
- floodplain connectivity
- riparian vegetation
- riparian and floodplain habitat complexity
- grassland, prairie, and oak savanna vegetation and habitat complexity
- forest hydrology
- forest and oak woodland vegetation.

Each of these high priority indicators has at least one driver or limiting factor. Limiting factors were prioritized based on a qualitative assessment of ecological and socio-economic factors. The high ecological priority limiting factors are the most likely to be the main drivers of the reduced condition of the attributes identified as high priorities. Lost Creek is currently a part of the Willamette Model Watershed Program (MWP), an initiative of the Meyer Memorial Trust with the purpose of increasing the pace and scope of stream restoration within the Willamette River Watershed. The MWP will provide the MFWWC with some of the resources necessary to implement restoration projects and monitoring in partnership with landowners in Lost Creek. Therefore, medium priority projects within Lost Creek may be implemented prior to high priority projects within other subwatersheds.

Lost Creek priorities based on qualitative scoring of Indicators and Limiting Factors

Attribute	Indicator(s)	Limiting Factor(s)	Projects that Address Limiting Factors
Stream hydrology	Water quantity	Water allocations:summer flows too low	Transfers or leases of water rights
Water quality	Water temperature	Lack of shade	Riparian planting projects along Lost Creek and its tributaries
Channel habitat complexity	Quantity of large wood in stream	Large wood was removed from stream channel	Large wood placement in upper watershed and tributaries
	Pool:riffle ratio	Reduced riparian vegetation limits recruitment of large wood	Identify young coniferous forests in the riparian area for maintenance and conservation
	Standard deviation of thalweg profile		Riparian planting projects along Lost Creek and its tributaries
Connectivity/fish passage	Fish passage barriers	Inadequate culverts or stream crossings	Culvert replacement projects
Floodplain connectivity to watercourse	Floodplain inundation frequency/groundwater elevation	Presence of levees or riprap	Streambank bioengineering projects that replace riprap while still achieving landowner goals
		Development in the floodplain	
Riparian vegetation	Riparian corridor continuity and buffer width	Habitat loss and land use conversion	Riparian planting projects along Lost Creek and its tributaries
	Riparian plant community diversity and structural diversity		
	Invasive species cover	Spread of invasives into riparian area due to disturbance	Early Detection and Rapid Response to new invaders. Knotweed control project.
Riparian/ floodplain habitat complexity	Abundance of riparian/ floodplain habitat features (large wood, snags, sidechannels, wetlands)	Reduced extant of floodplain forests reduces wood available for recruitment, bank stabilization, and shade	Riparian planting projects along Lost Creek and its tributaries
			Channel complexity and side channel reconnection projects at the mouth of the mainstem upstream to Elijah Bristow SP bridge.
Grassland, prairie, oak savanna vegetation	Native plant community	Invasive species encroachment	Invasive weed treatment, native planting projects, and prescribed burns
		Habitat loss	Identify significant grasslands, prairies and oak savannas for conservation
		Altered hydrology	Restore natural hydrological regime
Grassland, prairie, oak savanna habitat complexity	Frequency of disturbance by fire and herbivory	Fire suppression	Prescribed burns
Forest hydrology	Forest area with natural hydroperiod and drainage pattern	Forest management practices	Selective harvest
		Roads	Decommission and/or weatherproof road systems
Forest and oak woodland vegetation	Native plant community	Logging has altered vegetation structure and composition	Selective harvest to promote more species and structural diversity

Fall Creek



THE FALL CREEK SUBWATERSHED encompasses Fall Creek Reservoir. Fall Creek is 303(d) listed due to high summer water temperatures. Special habitat such as meadows can be found at Saddle Blanket Mountain, Mt. Salem, and Sourgrass Mountain.

Watershed Characteristics

120,594 total acres

Land Ownership
- 52% Forest Service
- 24% Private Industry
- 15% Army Corps of Engineers & BLM
- 9% Other Private Land

Forest Conditions
- Conifers no longer dominant
- Dominant conifer species: Western Hemlock
- Low winter foraging levels
- Isolation of mature forest blocks

Riparian Conditions
- 21,000 acres riparian reserve

Aquatic Habitat
- Low complexity due to lack of wood
- Loss of connectivity

Water Quantity & Quality
- High summer water temperatures
- 65% reduction in peak flows due to dam

Priority Indicators

1. Quantity of large wood in stream; Pool:riffle ratio; Standard deviation of thalweg profile
2. Presence of fish passage barriers
3. Riparian plant community diversity and structural diversity

Priority Limiting Factors

1. Large wood was removed from stream channel; Channel straightened, armored, confined
2. Dam restricts upstream and downstream fish migration; Inadequate culverts
3. Lack of frequency and abundance of important habitat features (large wood, snags, side channels, wetlands)

SUBWATERSHED ATTRIBUTES 1 Channel habitat complexity 2 Connectivity/Fish passage 3 Riparian Vegetation

Chapter 7. Fall Creek Subwatershed

SUBWATERSHED SUMMARY

The 123,600-acre Fall Creek subwatershed is located above the Fall Creek dam, of which 68% is in federal ownership (mostly US Forest Service). Most of the remainder is in private timber industry ownership, with a small amount of private land, including rural housing and farms above the reservoir. The landscape is a patchwork of recent clearcuts, tree plantations, and mature forest, including old growth. Remnant mature and old growth forest habitat is fragmented by clearcuts. About one-third of the forest is in late successional stage (Willamette National Forest 1995). Nearly 50% of the subwatershed forest has been logged over the past 60 years (Willamette National Forest 1995). Wet and dry meadows, and rock outcrops with oak fringes are located at Tire Mountain, Saddle Blanket Mountain, Sourgrass Mountain, Mount Salem, and at Nelson Creek

There are nearly 500 miles of roads within the subwatershed, the vast majority of which are not paved. Most of the roads were built between 1950–1980 and many roads exhibit edge-cracking and slumping (Willamette National Forest 1995). There have been numerous landslides attributed to roads. Riparian areas are impacted by roads that parallel streams. A 2005 fish passage study identified six culverts that block access to high quality fish habitat at Zog, Bedrock, Logan, Nelson, Puma, and Clark Creeks (Reed 2006). Several additional culverts on Fall, Winberry, and Portland Creeks may be impassable, but there is insufficient data to make a determination at this time.

Spring Chinook, collected and transported around the dam, spawn in the upper subwatershed. Hatchery steelhead and trout also use the area, along with numerous non-native fish that live in and around the reservoir. A wide array of native wildlife, including peregrine falcons, northern goshawks, Northern spotted owls, bats, cougars, bears, and possibly even wolverine inhabit this subwatershed.

There are core false-brome infestations in the lower subwatershed with 19.5 acres on 15 private properties and additional infestations on land managed by the USACE, the BLM, and State Parks at Winberry State Park, Cascara Campground, Fisherman's Point, and along the County Road right-of-way. Upper Fall Creek has scattered outlier brome populations on USFS land, with populations concentrated in recreational use areas.

Conservation and restoration activities in recent years have included: road decommissioning, prescribed fire, false-brome mapping and control, forest thinning in uplands and riparian areas, and continued transport of salmon around the dam. Mount Salem is currently being evaluated for inclusion in the Willamette Valley fringe oak-pine prairies Area of Critical Environmental Concern. Most of this area is under BLM management, with some belonging to Weyerhaeuser. This area is in good to excellent condition and is a high priority for conservation and enhancement.

Fall Creek Prioritization Results

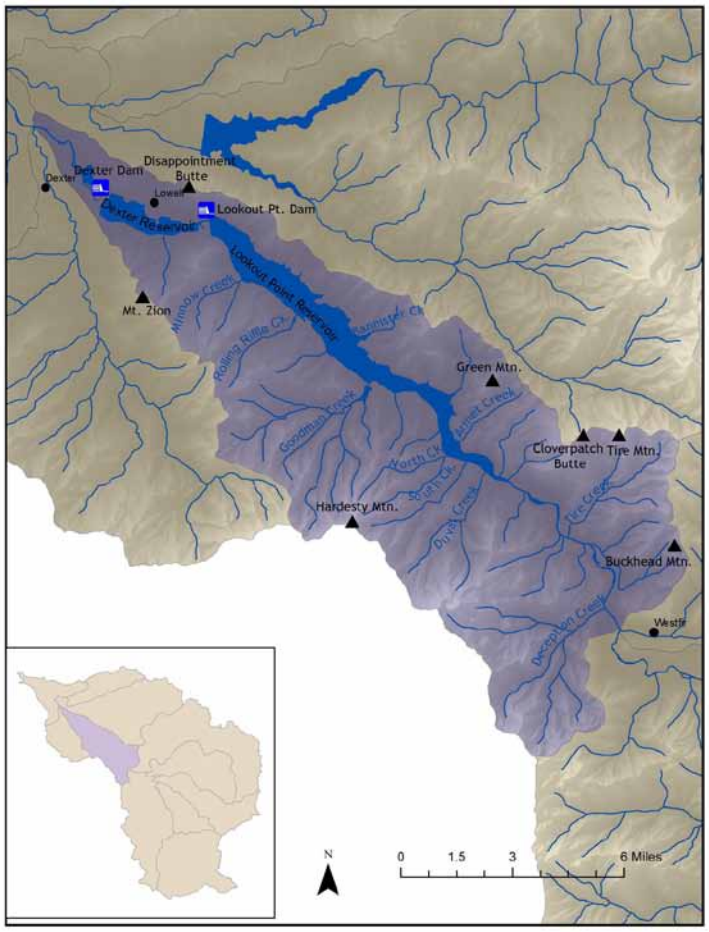
High priority indicators and their corresponding ecological attributes for Fall Creek can be found in the table below. Attributes that are in greatest need of intervention include:

- channel habitat complexity
- connectivity and fish passage
- riparian vegetation

Fall Creek priorities based on qualitative scoring of Indicators and Limiting Factors

Attribute	Indicator(s)	Limiting Factor(s)	Projects that Address Limiting Factors
Channel habitat complexity	Quantity of large wood in stream	Large wood was removed from stream channel	Restore riparian buffers along mainstem
			Large wood placement along mainstem and within tributaries
	Pool:riffle ratio	Channel straightened, armored, confined	Recreate or restore side channel habitats, alcoves, back water sloughs, and oxbows
	Standard deviation of thalweg profile		
			Identify revetments for removal and facilitate restoration of natural floodplain processes
Connectivity/ Fish passage	Presence of fish passage barriers	Dam restricts upstream and downstream fish migration	Provide adequate downstream passage through Fall Creek Reservoir and dam (through operations or structural modifications)
		Inadequate culverts	Replace fish blocking culverts
Riparian Vegetation	Riparian plant community diversity and structural diversity	Lack of frequency and abundance of important habitat features (large wood, snags, side channels, wetlands)	Restore riparian buffers along mainstem
			Weed treatment and native planting projects

LOOKOUT POINT



THE LOOKOUT POINT SUBWATERSHED includes the town of Lowell, as well as Dexter and Lookout Point Lakes. Dexter and Lookout Point Dams have a significant impact on fish passage and water quality in this subwatershed. Sedimentation and loss of channel complexity are issues in this subwatershed.

WATERSHED CHARACTERISTICS

49,000 total acres

Land Ownership
- 94% Forest Service
- 4% Corps of Engineers
- 2% Private
- Includes the town of Lowell

Upland Conditions
- Oak woodlands, prairies and savannas
- Mostly western hemlock zone, some dry douglas fir
- Some ponderosa and sugar pine
- Decrease in upland meadows due to lack of fire
- Quaking aspen (rare habitat)

Aquatic Habitat & Riparian Conditions
- Impacted by loss of peak flows (dams)
- Lack of large wood and complex structure
- Loss of channel complexity from multiple causes
- Lack of shade along mainstem

Roads
- 515 stream crossings
- High amount of road sediment
- High amount of streamside roads

PRIORITY INDICATORS

1. Quantity of large wood in stream; Pool:riffle ratio; Thalweg profile
2. Fish passage barriers
3. Fish communities
4. Reduced extant of floodplain forests reduces wood available for recruitment, bank stabilization, and shade

PRIORITY LIMITING FACTORS

1. Reduced riparian vegetation limits recruitment of large wood; Channel straightened, confined, simplified, armored banks
2. Dam operations
3. Culverts are barriers to fish passage; Development limits access to off-channel habitat
4. Development in the floodplain and installation of revetments and levees have reduced floodplain connectivity; The frequency of flows is not of sufficient magnitude to create and maintain channel complexity and provide nutrients, organic matter, and sediment inputs from floodplain areas.

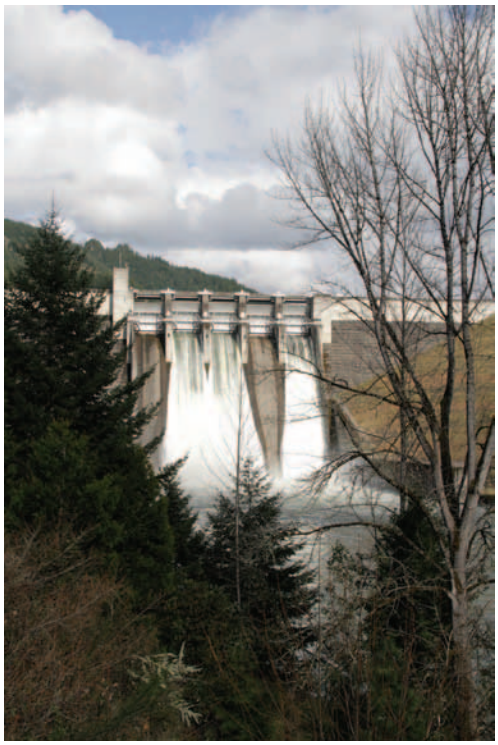
SUBWATERSHED ATTRIBUTES 1 Channel habitat complexity 2 Connectivity/fish passage 3 Biotic interactions, composition, and structure 4 Riparian/floodplain habitat complexity

Chapter 8. Lookout Point Subwatershed

SUBWATERSHED SUMMARY

This is a 102,000 acre subwatershed located along the mainstem of the Middle Fork Willamette River, and encompasses areas behind Dexter and Lookout Point dams. Over 90% of the land area is in federal ownership, including BLM, USFS, COE (Willamette National Forest 1997a). The town of Lowell and Dexter State Park are within this subwatershed. Due to its close proximity to the Eugene-Springfield metro area and the high percentage of federal lands, this subwatershed is a destination for recreation. Camping, hiking, boating, fishing, hunting, hiking are all popular activities. The lower part of the subwatershed is within the Willamette Valley ecoregion, and contains oak savannas and grasslands. Most of this subwatershed is within the Western Cascades ecoregion, and is dominated by Douglas-fir/Western hemlock forests. Thirty percent of the forest is old growth or late-successional reserve. There are areas of ponderosa and sugar pine, a quaking aspen grove, and several upland meadows and outcrops. Northwest pond turtles, Oregon chub, Northern spotted owls, Townsend's big-eared bats, and Roosevelt elk are all found within this subwatershed.

Fire suppression, timber harvest, and road construction have had wide-ranging impacts. Harvest of riparian trees has resulted in a shift from large-conifer-dominated to hardwood-dominated riparian areas. This has, in turn, reduced the large wood recruitment potential for streams. Upland forests are fragmented; age, complexity, species diversity, and stand size have all been reduced. Fire suppression has led to reduction in size and alteration of condition of oak savannas and meadows, including those on the north shore of Lookout Point Reservoir, Patterson Mountain, Hardesty Mountain, Tire Mountain, and the Cloverpatch Special Wildlife Habitat Area.



There are 250 miles of roads in the Middle Fork-Lookout Point subwatershed, including State Highway 58. Approximately 86% of the roads are paved or aggregate and considered relatively high quality (Willamette National Forest 1997a). Fine sediment produced by roads is not a great concern within this subwatershed. A 2006 study identified seven culverts that block fish passage at Goodman, School, Minnow, and Banister Creeks.

Dexter and Lookout Point dams were erected in the early 1950s as part of an Army Corps of Engineers flood control project. The Middle Fork Willamette River flood control dams reduce flow extremes (both high and low), and have resulted in streambed downcutting, channel confinement, and connection to the floodplain. Stream surveys indicate that between

Lookout Point and Hills Creek, the number of pools decreased from 13.4 in 1938 to 6.9 in 1996 (Willamette National Forest 1997a). Erosion from reservoir drawdown and wave action along the shoreline of Lookout Point Reservoir is a problem. The dams block the migration of salmon and steelhead to historical spawning areas in the upper watershed. Spring Chinook, summer and winter steelhead are now collected at Dexter dam and spawned at the Oakridge fish hatchery. Winter steelhead runs didn't occur in this subwatershed until they were introduced after dam construction (PNWHSRG 2009).

There are records of historical splash-dams in Black Canyon and Rolling Riffle Creek. Splash-damming reduces stream channel complexity. The main channel is fairly low-gradient from Hills Creek Dam down to Lookout Point Reservoir. Aerial photo interpretation indicates that the stream complexity of the Middle Fork Willamette River in the Buckhead area has been significantly confined since the 1940s. Tributaries that drain into this reach of the river are mostly steep-gradient, sediment transport reaches, with habitat for cutthroat trout but not spring Chinook salmon.

The lower reaches of Buckhead Creek and a Goodman Creek tributary are water quality limited and covered by the Willamette Basin TMDL for temperature. The Middle Fork is considered water quality limited due to flow modifications from river mile 18.7–44.2.

Western pond turtles use habitat at Lookout Point Reservoir, as well as at the Buckhead Creek Natural Wildlife Area. The presence of bullfrogs and impacts to nesting and juvenile rearing areas continue to present problems for turtle recovery. Oregon chub can be found in some ponds and slackwater areas within the subwatershed.

The NOAA Biological Opinion on the Army Corps of Engineers' dams concluded that fish collection and passage improvements are needed at both the Dexter and Lookout Point Dams. It is also recommended that large wood be collected behind the dams and placed in other areas for fish habitat improvement.

Lookout Point Reservior Prioritization Results

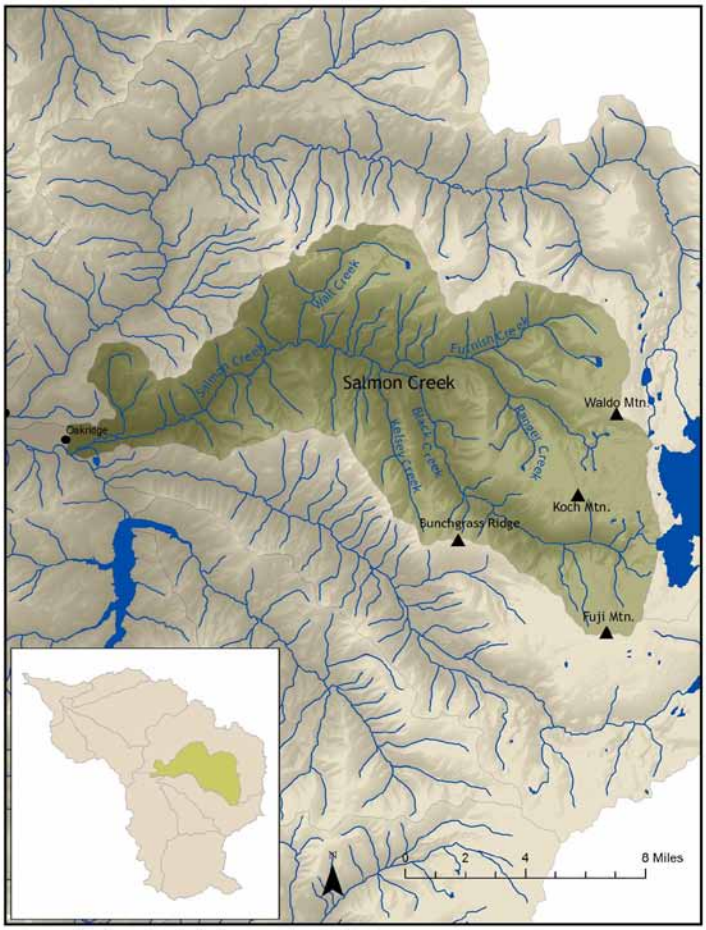
High priority indicators and their corresponding ecological attributes for Lookout Point Creek can be found in the table below. Attributes that are in greatest need of attention include:

- Channel habitat complexity
- Connectivity and fish passage
- Aquatic biological interactions, composition, and structure
- Riparian and floodplain habitat complexity
- Forests, oak woodlands, and coniferous forests biological interactions, composition and structure

Lookout Point priorities based on qualitative scoring of Indicators and Limiting Factors

Attribute	Indicator(s)	Limiting Factor(s)	Projects that Address Limiting Factors
Channel habitat complexity	Quantity of large wood in stream	Reduced riparian vegetation limits recruitment of large wood	Invasive plant removal and native plantings in riparian areas
	Pool:riffle ratio	Channel straightened, confined, simplified, armored banks	Implement channel reconnection, large wood placement and other projects cites in the USACE Floodplain Feasibility Study
	Thalweg profile		
Connectivity and fish passage	Fish passage barriers	Dam operations	Institute operational and structural modifications to dams to enhance fish passage, reduce predation in reservoirs, and improve water quality
Biotic interactions, composition, and structure	Fish communities	Culverts are barriers to fish passage	Culvert removal or upgrade projects. Consider priorities at Goodman, School, Minnow, and Bannister Creeks
		Development limits access to off-channel habitat	Implement channel reconnection, large wood placement and other projects cites in the USACE Floodplain Feasibility Study
			Enhance spring Chinook habitat below the dam
Riparian and floodplain habitat complexity	Reduced extant of floodplain forests reduces wood available for recruitment, bank stabilization, and shade	Development in the floodplain and installation of revetments and levees have reduced floodplain connectivities	Implement channel reconnection, large wood placement and other projects cites in the USACE Floodplain Feasibility Study
		The frequency of flows is not of sufficient magnitude to create and maintain channel complexity and provide nutrients, organic matter, and sediment inputs from floodplain areas.	Implement channel reconnection, large wood placement and other projects cites in the USACE Floodplain Feasibility Study
Forests, oak woodlands, coniferous forests biotic interactions, composition, structure	Large mammal use	Loss of habitat has been continues to be among the most important factors that limit terrestrial animal populations	Manage and restore native meadow habitat by controlling conifer encroachment and introducing prescribed fire where appropriate
			Maintain and expand ongoing efforts to provide meadow, early seral and open forest habitat along BPA Powerline Right-of-way and Buckhead Wildlife Area.
			Enhance oak habitat at Ivan Oaks and Landex Parks and Disappointment Butte

SALMON CREEK



THE SALMON CREEK SUBWATERSHED is largely protected (70%) forest land, with significant wilderness areas. Rare, high quality habitats exist throughout this area. Surface waters and groundwater are important sources of drinking water for the residential community in this subwatershed.

WATERSHED CHARACTERISTICS

82,432 total acres

Land Ownership
- 98% Forest Service (13% Wilderness, 31% riparian reserve)
- 2% private

Forest Conditions
- Mostly westside lowlands forest
- 94% conifer forest
- 51% late successional reserve (protected)
- Small areas of special/rare habitat: yellow cedar, whitebark pine and quaking aspen
- Decrease in upland meadows due to lack of fire

Riparian Conditions
- 24,000 acres riparian reserve
- 270 road miles; 12 bridges; 576 culverts

Aquatic Habitat
- General lack of large wood
- Mainstrem has no fish barriers

Water Quantity & Quality
- Elevated stream temperatures at Salmon Creek mouth
- Most tributaries have cool temperatures
- Water source for Willamette Fish Hatchery

PRIORITY INDICATORS

1. Quantity of large wood in stream; Pool:riffle ratio; Standard deviation of thalweg profile
2. Fish community

PRIORITY LIMITING FACTORS

1. Large wood was removed from the channel; Reduced riparian vegetation causes lack of large wood recruitment; Channel straightened, confined, simplified, armored
2. Culvert size and placement are barriers to fish passage; Lack of off-channel habitat

SUBWATERSHED ATTRIBUTES 1 Channel habitat complexity 2 Biotic interactions, composition and structure

Chapter 9. Salmon Creek Subwatershed

SUBWATERSHED SUMMARY

Salmon Creek includes over 82,000 acres in the central Middle Fork Willamette watershed. Ninety-eight percent is managed by the Forest Service. Elevations within the subwatershed range from about 1,300 to 7,200 feet above sea level. The majority of the subwatershed forest has never been altered, and about 34% is in late-seral condition (Willamette National Forest 1996). Most of the forest is Western lowland mixed conifer type (Douglas-fir/Western hemlock); rare habitats within the subwatershed include rocky outcrops, sub-alpine forests, and meadows. Some areas support rare species, including Alaskan yellow cedar, quaking aspen, whitebark pine, and rabbit bush.

The City of Oakridge is located at the mouth of Salmon Creek. The primary source for municipal water is a series of wells located near the mouth of Salmon Creek that are influenced by surface water. The city also can withdraw surface water from Salmon Creek as a secondary water source. Oakridge and Westfir have strategies in place to better manage stormwater runoff and restore riparian areas within city limits. A small diversion dam routes some water from Salmon Creek to the ODFW Willamette Fish Hatchery, located near the mouth of Salmon Creek. Salmon Creek is constrained by flood-control levees in Oakridge erected in 1958. The Salmon Creek subwatershed is a popular destination for mountain biking, hiking, fishing, and camping.

Resident fish include cutthroat trout and rainbow trout. The construction of the Lookout and Dexter dams blocked fish migration. Spring Chinook are transported around the dams and can be found in the lower Salmon Creek subwatershed. Brook trout, rainbow trout, and cutthroat trout have been introduced to many of the lakes in the upper basin. Sensitive amphibian species found in the subwatershed include the tailed frog, the red-legged frog, the cascade frog, the Oregon slender salamander, and the western toad (Willamette National Forest 1996).

There are 270 miles of roads and nearly 600 stream crossings. No culverts were identified as high priority for replacement in the 2006 fish passage study.

Water quality within the subwatershed is generally good. Stream temperatures above the state standard have been recorded near the mouth of Salmon Creek (Willamette National Forest 1996), but it is not 303(d) listed. Data indicate that tributaries have cool temperatures. The state standard for dissolved oxygen based on a moving average was not met during numerous periodic sampling periods from 2008–2010 (MFWWC et al. 2011).

Timber management has resulted in fragmentation of late successional forests across the landscape and impacts to riparian forests and soil compaction have probably impacted hydrological processes within the subwatershed (Willamette National Forest 1996). Stream cleaning projects and salvage timber harvest have reduced the amount of large wood in most streams and the potential for future recruitment. This has resulted in reduced channel complexity.

Fire suppression has reduced meadow habitat quantity and quality within the subwatershed, homogenized forest age classes across the landscape, and impacted biodiversity (Willamette National Forest 1996).

Several restoration projects are being planned, including instream habitat enhancement near Road 2408 Bridge, and thinning and fuels reduction projects near Oakridge and Westfir.

Salmon Creek Prioritization Results

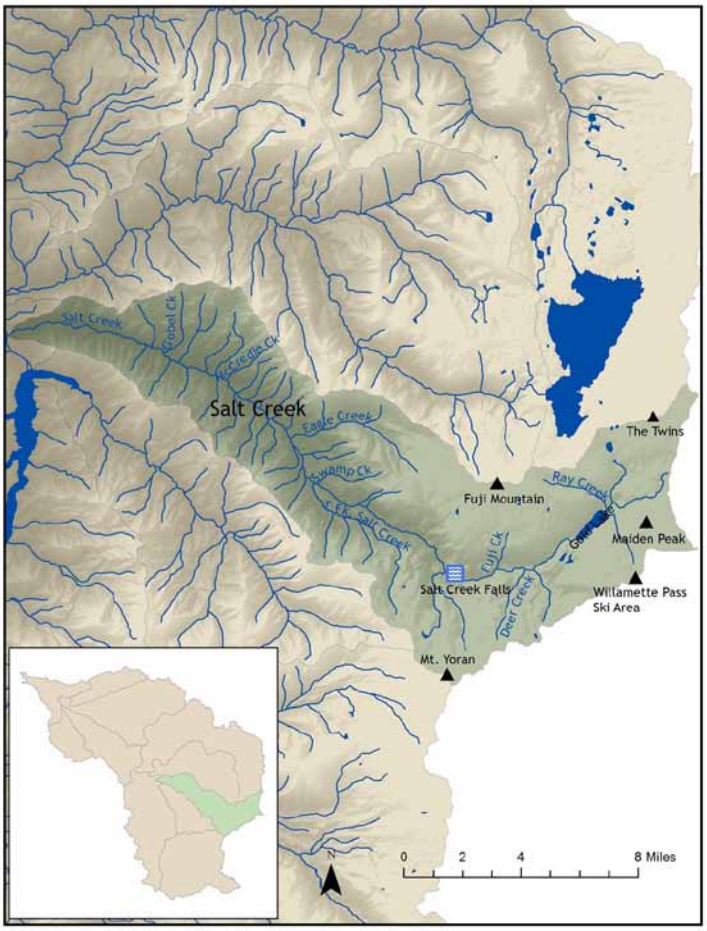
High priority indicators and their corresponding ecological attributes for Salmon Creek can be found in the table below. Attributes that are in greatest need of intervention include:

- channel habitat complexity
- stream biotic interactions, composition, and structure

Salmon Creek priorities based on qualitative scoring of Indicators and Limiting Factors

Attribute	Indicator(s)	Limiting Factor(s)	Projects that Address Limiting Factors
Stream channel habitat complexity	Quantity of large wood in stream	Large wood was removed from the channel	Large wood placement projects, including Lower Salmon Creek in partnership with City of Oakridge
		Reduced riparian vegetation causes lack of large wood recruitment	Riparian planting projects
	Pool:riffle ratio	Channel straightened, confined, simplified, armored	Decommissioning roads adjacent to streams
			Mill Site reclamation
	Standard deviation of thalweg profile		
Biotic interactions, composition and structure	Fish community	Culvert size and placement are barriers to fish passage	Culvert replacement projects including Willamette Hatchery intake partial fish barrier
			Bull trout reintroduction feasibility studies at Furnish and Black Creeks
		Lack of off-channel habitat	Side channel reconnection projects

Salt Creek



THE SALT CREEK SUBWATERSHED is heavily forested, and includes significant high quality habitat for aquatic and terrestrial species. Salt Creek Falls, the 2nd largest waterfall in Oregon, Willamette Pass ski area and Waldo Sno-Park are all located in this subwatershed.

Watershed Characteristics

71,000 total acres

Land Ownership
- 99.8% Forest Service
- Willamette Pass ski area

Upland Conditions
- 93% forested
- 5% special habitats
- Oak woodlands on south facing slopes
- 7,000 acres late successional reserve
- Significant fire history: 64% burned over 200 years

Riparian Conditions
- 23,000 acres riparian reserve

Aquatic Habitat
- 25 miles of spring Chinook habitat
- Cutthroat and rainbow trout present
- 301 stream miles
- Lack of large wood and complex structure

Water Quantity & Quality
- High summer water temps near mouth

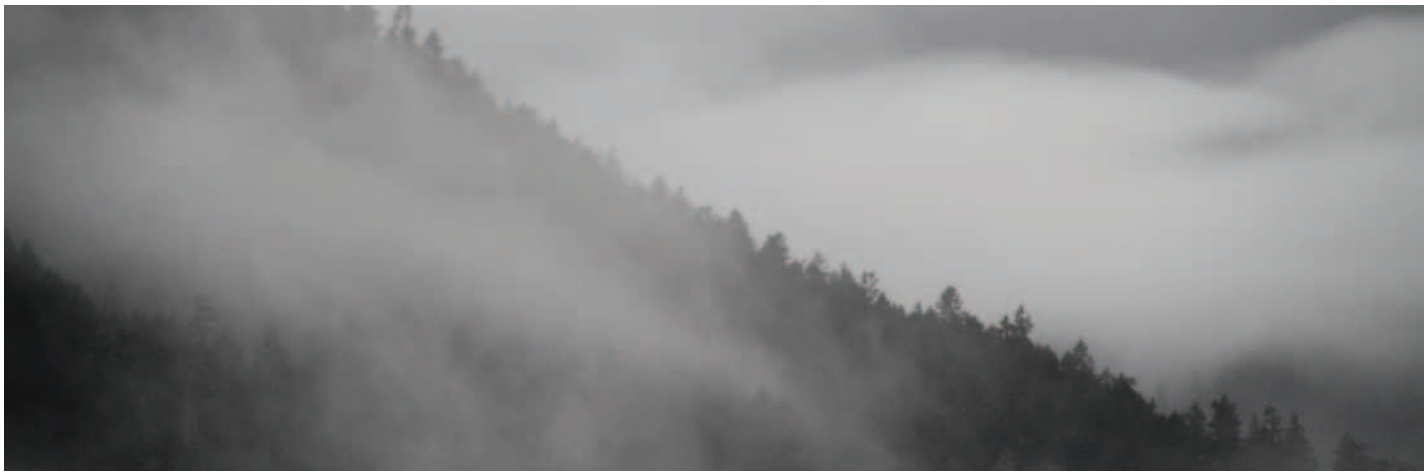
Priority Indicators

1. Quantity of large wood in stream; Pool:riffle ratio; Standard deviation of thalweg profile
2. Fish community

Priority Limiting Factors

1. Large wood was removed from the channel; Reduced riparian vegetation causes lack of large wood recruitment; Channel straightened, confined, simplified, armored
2. Culvert size and placement are barriers to fish passage; Lack of off-channel habitat

SUBWATERSHED ATTRIBUTES 1 Channel habitat complexity 2 Biotic interactions, composition and structure



Chapter 10. Salt Creek Subwatershed

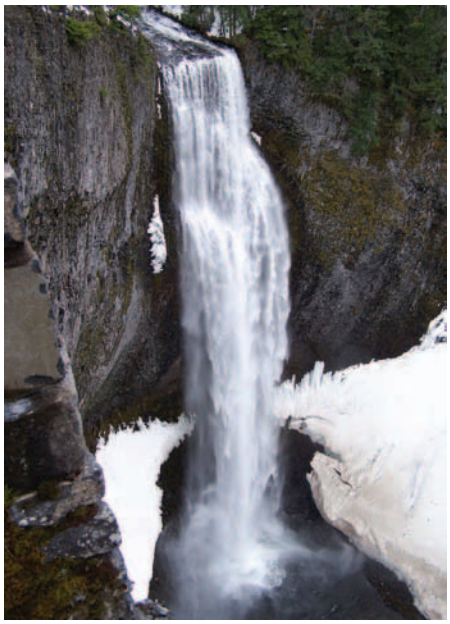
SUBWATERSHED SUMMARY

Salt Creek is located in the southeastern part of the Middle Fork Watershed Willamette watershed above Dexter and Lookout Point dams. Its confluence with the Middle Fork is just outside of Oakridge, about 1.5 miles downstream from the Hills Creek dam. The Salt Creek subwatershed includes 71,000 acres of land, of which nearly all (99.8%) is managed by the Forest Service.

The Salt Creek subwatershed is a popular destination for recreation; Salt Creek Falls, McCredie hot springs, Willamette Pass Ski Area, Big Bunchgrass Meadows, Blue Pool and Gold Lake campgrounds are all recreational hotspots within the watershed. Hiking, fishing, hunting, and winter skiing are popular activities. The subwatershed includes significant amounts of designated wilderness and an extensive system of trails.

Most of this subwatershed is characterized by coniferous forests, but there are also pockets of wetlands, subalpine forest parks, rocky outcrops, and Oregon white oak. Approximately 75% of the subwatershed has never been harvested (Willamette National Forest 1997). Over 64% of the forest areas have experienced stand replacement burns over the past 200 years (Willamette National Forest 1997).

There are about 300 stream miles within the subwatershed. Fifty-nine percent of the subwatershed is within the transient snow zone and high-flows are caused by rain-on-snow events (Willamette National Forest 1997). High elevation snowmelt contributes to summer base flows in many of the streams in the subwatershed. Streams were systematically cleared of wood under past forest management practices, causing a reduction in stream channel complexity. The 1964 floods destroyed several bridges within the watershed, and subsequently, stream channelization and levee projects were installed to protect Highway 58. Water temperatures above the state standard for salmonid fish rearing have been recorded at the mouth (Willamette National Forest 1997), low periodic measurements of dissolved oxygen have been recorded (MFWWC et al. 2011) Salt Creek is listed as water quality limited for temperature up to mile 13.6 and is covered by the Willamette Basin TMDL. Total suspended solids reached levels exceeding "fair" quality on several summer sampling periods (MFWWC et al. 2011). Sediment from roads is a major factor adding sediment to streams (Willamette National Forest 1997). A USGS stream gage was in place from 1913–1915 and from 1932–1950. Ponds and lakes in the upper subwatershed are classified as oligotrophic to ultraoligotrophic.



Road density within the subwatershed is high, with over three miles per square mile and 575 stream crossings. Highway 58 and a railroad corridor interrupt habitat connectivity and constrain the channel in some locations. Two culverts along Warner Creek have been identified as high priority fish passage barriers. Additional culverts in Diamond, Basin, and Fin Roberts Creeks have been identified as being at risk of blowout due to inadequate size (Reed 2006).

Prior to dam construction, spring Chinook and bull trout were supported in approximately 30 miles of habitat within this subwatershed. Cutthroat trout, rainbow trout, mountain whitefish, sculpin, lamprey, speckled dace, largescale suckers, squawfish and redsided shiners are now present within the subwatershed. Brook trout have been stocked in many lakes and ponds throughout the subwatershed and have escaped into mainstem Salt Creek, Deer Creek, Diamond Creek and Fall Creek. Fish passage is blocked by the 286-foot Salt Creek Falls.

Sensitive amphibian species present within the subwatershed include the tailed frog, red-legged frog, Oregon spotted frog, Cascade frog, Oregon slender salamander, and the western toad.

Salt Creek Prioritization Results

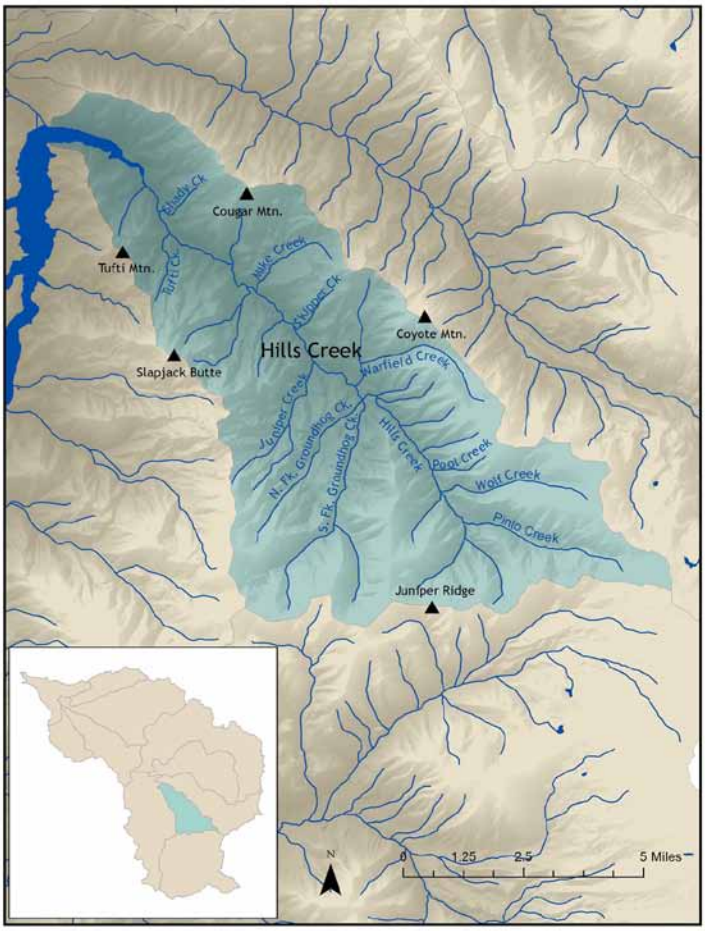
High priority indicators and their corresponding ecological attributes for Salt Creek can be found in the table below. Attributes that are in greatest need of attention include:

- channel habitat complexity
- stream biotic interactions, composition, and structure

Salt Creek priorities based on qualitative scoring of Indicators and Limiting Factors

Attribute	Indicator(s)	Limiting Factor(s)	Projects that Address Limiting Factors
Stream channel habitat complexity	Quantity of large wood in stream	Large wood was removed from the channel	Large wood placement projects, including side channels
		Reduced riparian vegetation causes lack of large wood recruitment	Riparian planting projects, especially along Highway 58 corridor
	Pool:riffle ratio	Channel straightened, confined, simplified, armored	Decommissioning roads adjacent to streams
	Standard deviation of thalweg profile		Salt Creek Road Drainage Improvement Project (Legacy Roads funding)
Biotic interactions, composition and structure	Fish community	Culvert size and placement are barriers to fish passage	Culvert replacement projects
			Trap and haul of spring Chinook salmon and release in Salt Creek (priority #3 location for MFW)
			Address unscreened diversion of surface water out of Salt Creek (USFS and City of Oakridge diversion canal with wood culverts)
		Lack of off-channel habitat	Side channel reconnection projects, large wood placement in side channels
			Initiate partnership to restore the mill property near the mouth, including industrial cleanup, riparian revegetation and flow restoration to gravel ponds
			Investigate opportunities for Heather Wetland and Wicopee Ponds wetland and riparian habitat enhancement to benefit Oregon chub, Western pond turtles, and waterfowl.

HILLS CREEK



THE HILLS CREEK SUBWATERSHED contains significant stands of old growth and mature forest. However, a relatively high proportion of the subwatershed forests have been harvested or impacted by roads, causing sedimentation issues. High water temperatures and low stream flows in tributary creeks may also be negatively impacting aquatic habitat.

WATERSHED CHARACTERISTICS

38,000 total acres

Land Ownership
- 98% Forest Service
- 2% private

Forest Conditions
- Westside lowlands ecotype
- 26% mature/old growth
- 47% very young/recent clearcuts
- High elevation meadows and outcrops

Riparian Conditions
- 38% mature/old growth

Aquatic Habitat
- Lack of large wood and complex structure
- Historic good spring Chinook habitat

Water Quantity & Quality
- Flows affected by harvest and roads
- 38 year flow record at mouth
- High summer temps at mouth

PRIORITY INDICATORS

1. Quantity of large wood in the stream
2. Riparian corridor continuity and buffer width; % cover of invasive species; Riparian plant community diversity and structural diversity
3. Abundance and distribution of beaver and other keystone species
4. Frequency of disturbance by fire and/or herbivory and/or snowpack to maintain condition

PRIORITY LIMITING FACTORS

1. Large wood was removed from the channel; Reduced riparian vegetation causes lack of large wood recruitment
2. Habitat loss; Spread of invasive species into the riparian area, degrading native habitat; Grazing of domestic animals reduces native plant cover; Reduced structural complexity due to logging and forest management practices
3. Trend towards mature forests in riparian areas with little understory or structural diversity; lack of food resources for beaver
4. Fire suppression activities

SUBWATERSHED ATTRIBUTES 1 Channel habitat 2 Riparian vegetation 3 Wetland biological interactions, composition, and structure 4 Grassland, prairie, oak savanna habitat complexity

Chapter 11. Hills Creek Subwatershed

SUBWATERSHED SUMMARY

Hills Creek subwatershed includes 38,000 acres, of which 98% is managed by the Forest Service. Twenty-six percent of the upland forest is in a mature or old growth condition (Willamette National Forest 1998). High elevations are dominated by Western hemlock/Pacific silver fir/noble fir forests, while the lower and mid-elevations within the subwatershed are dominated by Western hemlock/Douglas-fir forests. There are rocky outcrops and upland meadows in the upper subwatershed.

Timber harvest has resulted in an increase in young and early-seral forests and an increase in habitat fragmentation. Upland meadows within this subwatershed have declined in size and quality due to fire suppression. Fire suppression has also resulted in increased fuel loading and dense understories. Over one-third of the total riparian forest is in a mature or old growth condition, while a nearly equal amount is immature or young forest (Willamette National Forest 1998). Prior to 1946, riparian vegetation consisted primarily of large conifers; harvesting within riparian areas was a standard management practice from the 40s through the 1980s (Willamette National Forest 1998). Today there are large numbers of hardwood trees in riparian areas. Roads cover about six percent of the total riparian area. A 2005 survey found only one culvert was a priority for replacement at South Fork Groundhog Creek.

Stream flow and temperature data were collected at a USGS gaging station at the mouth of Hills Creek from 1958–1981, with some periodic gaps. The gage began operating again in June 2010. Water quality and flows have been affected by the dense road network and timber harvest activities. Hills Creek is listed as water quality impaired for temperature from mile 1.7 to 8.2 and is covered by the Willamette Basin TMDL. Streams generally lack large woody debris and deep pools. Sediment input from bank erosion accelerated following riparian vegetation removal (Willamette National Forest 1998). Removal of large wood has probably reduced sediment storage capacity within the subwatershed.

Much of the subwatershed supported spring Chinook in the past. The segment of Hills Creek between Mike and Juniper Creeks was historically the best reach for spring Chinook spawning within the Hills Creek subwatershed. It is still an important area for native cutthroat. Warfield and Groundhog Creeks also contain quality fish habitat. Some tributaries, including Shady, Crabapple, and Landes have natural bedrock barriers to fish migration.

Hills Creek Prioritization Results

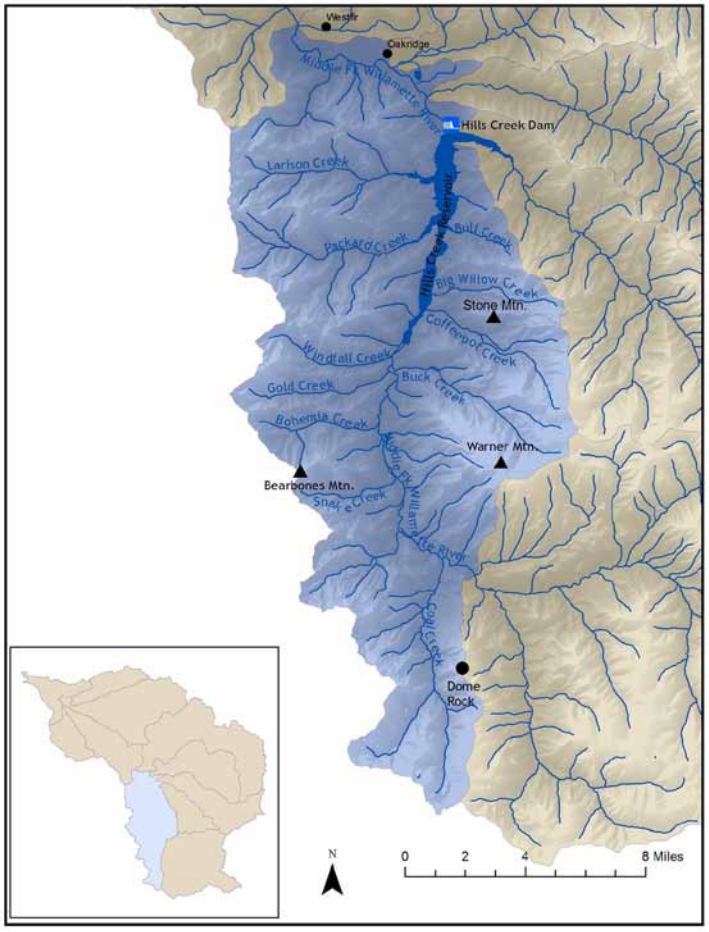
Priority actions for habitat enhancement and restoration are listed in the table below and will address:

- channel habitat complexity
- riparian vegetation
- wetland biological interactions, composition and structure
- grassland, prairie, and oak savanna habitat complexity

Hills Creek priorities based on qualitative scoring of Indicators and Limiting Factors

Attribute	Indicators	Limiting Factors	Projects that Address Limiting Factors
Channel habitat complexity	Quantity of large wood in the stream	Large wood was removed from the channel	Large wood placement
		Reduced riparian vegetation causes lack of large wood recruitment	Enhance riparian areas by removing invasive species and planting native conifers and other species
			Rehabilitate dispersed campsites in riparian areas
Riparian vegetation	Riparian corridor continuity and buffer width	No listed LFs in matrix	
	Riparian plant community diversity and structural diversity	No listed LFs in matrix	
Wetland biological interactions, composition, and structure	Abundance and distribution of beaver and other keystone species	Trend towards mature forests in riparian areas with little understory or structural diversity; lack of food resources for beaver	Remove invasive species and restore native vegetation
			Encourage growth of young trees and shoots that are preferred by beaver
			Investigate potential for beaver reintroduction
			Determine need for placement of wood structures in ponds for basking structures and hiding cover for native turtles
Grassland, prairie, oak savanna habitat complexity	Frequency of disturbance by fire and/or herbivory and/or snowpack to maintain condition	Fire suppression activities	Restore and enhance meadow habitat associated with USFS Calapooya I (283 acres) and Calapooya II (325 acres), and at Crabapple prairie, Pinto Mtn, Wolf Mtn, Hills Creek Complex, Packard Creek, Buck Creek and Little Willow Creek
			Prescribed burns
			Oak savanna, grassland and prairie treatments using whip falling, mowing, thinning

Hills Creek Reservoir



THE HILLS CREEK RESESERVOIR SUBWATERSHED has the only successful bull trout reintroduction program in the country. A high number of forest service road closures will occur between 2009-2013. Spring Chinook are known to spawn above the Hills Creek Reservoir. Fire exclusion has contributed to a reduction in abundance and structure of oak forests.

Watershed Characteristics

Over 100,000 total acres

Land Ownership
- 84% Forest Service
- 15% Private industry
- 1% Hills Creek Reservoir

Forest Conditions
- 51% Late successional reserve
- 2,274 acres closed canopy, mid-development young forest
- 7,648 acres closed canopy late succession
- 1/3 of total montane forests mixed conifer habitat type, unique to watershed
- Loss of meadows due to fire suppression and dam placement
- Mature old-growth ponderosa and sugar pine show stress and increased insect infestation
- Some Oregon white oak

Aquatic Habitat
- Lack of large wood in channels
- Successful Bull trout recovery
- Spring Chinook spawn above reservoir

Priority Indicators

1. Quantity of large wood in stream; Pool:riffle ratio
2. Riparian plant community diversity and structural diversity
3. Abundance of habitat features (large wood, snags, side channels, wetlands)
4. Native plant community structure, extant, species composition; Frequency of disturbance by fire and/or herbivory, and/or snowpack

Priority Limiting Factors

1. Reduced riparian vegetation condition causes lack of large wood recruitment to stream; Channel straightened, confined, banks armored
2. Reduced structural complexity due to historical logging and forest management practices; Spread of invasive species into the riparian, degrading native habitat
3. Development in the floodplain and installation of revetments and levees; Reduced floodplain forest extent and condition reduces wood available for habitat
4. Invasive species encroachment; Encroachment of native trees and shrubs; Fire suppression

SUBWATERSHED ATTRIBUTES 1 Channel habitat complexity 2 Riparian vegetation 3 Riparian/floodplain habitat complexity 4 Grassland, prairie, oak savanna and alpine meadow habitat complexity

Chapter 12. Hills Creek Reservoir Subwatershed

SUBWATERSHED SUMMARY

The Hills Creek Reservoir subwatershed is located above Hills Creek Dam in the southwestern part of the Middle Fork watershed. It includes about 110,000 acres, of which 84% is managed by the Forest Service. The remaining area is in privately held forest-land. There has never been a detailed subwatershed assessment for this subwatershed. A 2008 update to a 1996 subwatershed assessment for the Upper Middle Fork watershed also covered this subwatershed but information pertaining exclusively to this subwatershed is limited.

Hills Creek Reservoir experiences significant algae blooms during the summer and fall months of most years, necessitating health advisories issued by the Oregon Harmful Algae Bloom Surveillance program. These algae blooms affect aquatic health and exclude recreation during health advisories.

Fire suppression and timber harvest have both had a big impact on this area, with over 9000 acres of forest having been identified as overly dense. The Hills Creek Reservoir subwatershed has over one-third of the total mixed conifer habitat type within the Middle Fork watershed. There are remnant oak woodlands that have been encroached on by fir, particularly at Jim's Creek Oak Patch in lower Coal Creek. The upland meadows at Calapooya Divide are declining in size and quality due to fire suppression. There are unique ponderosa pine stands in lower Young's Creek, Deadwood, Pine, Cone, and Coal Creek drainages. Upland forests within the subwatershed are fragmented due to timber harvest.

Most of the subwatershed has not yet been surveyed for sensitive or invasive species. The Hills Creek dam is not passable to fish, but bull trout have been successfully reintroduced above the dam. Artificial propagation and transportation around the dam are currently used to provide a prey-base for the bull trout. McKenzie River bull trout will continue to be imported to ensure genetic diversity. There is ongoing work to improve bull trout habitat, including a passage project on road 2100 at Indigo Springs and Buck Creek. There is a proposal to build an outdoor education/viewing area where the public can see and learn about bull trout. Further analysis on road-related risks to bull trout is also ongoing.

A number of culverts that block fish passage have been identified Upper and Lower Coal Roads, Windfall Creek, Indian Creek, Coffeepot Creek, Bull Creek, Snow Creek, Simpson Creek, and Gold Creek Road.

Hills Creek Reservoir Prioritization Results

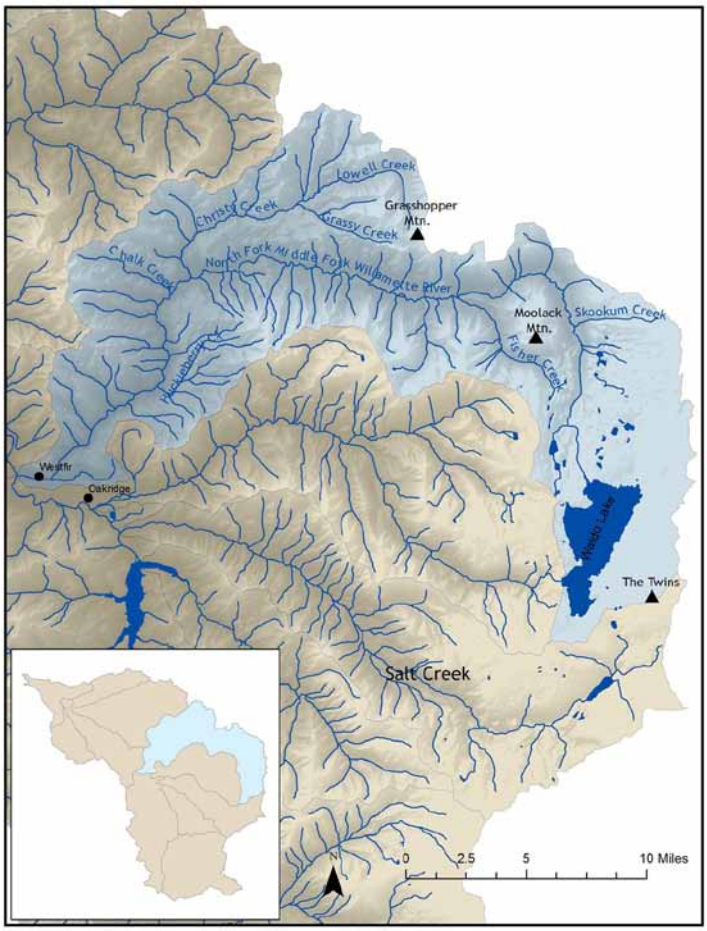
High priority indicators and their corresponding ecological attributes for Hills Creek Reservoir can be found in the table below. Attributes that are in greatest need of attention include:

- Channel habitat complexity
- Riparian vegetation
- Riparian and floodplain habitat complexity
- Grasslands, prairie, oak savanna, and alpine meadow vegetation

Hills Creek Reservoir priorities based on qualitative scoring of Indicators and Limiting Factors

Attribute	Indicator(s)	Limiting Factor(s)	Projects that Address Limiting Factors
Channel habitat complexity	Quantity of large wood in stream	Reduced riparian vegetation condition causes lack of large wood recruitment to stream	Restore and preserve existing riparian forests
			Upper Middle Fork Willamette and Buck Creek large wood placement
			Instream large wood restoration project phase 1 & II (UMFW Action Plan)
			Headwater stream restoration project phases I-III (UMFW Action Plan)
	Pool:riffle ratio	Channel straightened, confined, banks armored	Restore stream reaches that have been straightened, channelized, or dewatered to add complexity and habitat features
			Legacy roads projects: Buck Creek 6th field (26.2 miles), Larison and Packard Creek 6th fields (25.1 miles)
Riparian vegetation	Riparian plant community diversity and structural diversity	Reduced structural complexity due to historical logging and forest management practices	Remove invasive species and restore native vegetation
		Spread of invasive species into the riparian, degrading native habitat	Lower Middle Fork riparian restoration project phase 1 & 2 (UMFW Action Plan)
			Utilize the Respect the River funding to restore riparian habitat
Riparian and floodplain habitat complexity	Abundance of habitat features (large wood, snags, side channels, wetlands)	Development in the floodplain and installation of revetments and levees	Remove levees and restore stream reaches that have been straightened, channelized, or dewatered to add complexity and habitat features
		Reduced floodplain forest extent and condition reduces wood available for habitat	Floodplain forest restoration: removal of invasives and planting natives
			Continue NW pond turtle habitat restoration efforts around Hills Creek Reservoir
Grasslands, prairie, oak savanna, and alpine meadow vegetation	Native plant community structure, extant, species composition	Invasive species encroachment	Prescribed burning and weed treatment
		Encroachment of native trees and shrubs	Oak savanna, grassland, and prairie treatments using whip falling, mowing, thinning and prescribed fire at Holland Meadows (59 acres), Grass Mountain (10 acres), Gertrude Lake (21 acres), Johnson Meadows (188 acres), Bristow Prairie (62 acres), Joe's Prairie (38 acres), North Goundhog Complex (35 acres), Little Groundhog (78 acres), Jim's Oak Patch (21 acres).
	Frequency of disturbance by fire and/or herbivory, and/or snowpack	Fire suppression	

North Fork of the Middle Fork



THE NORTH FORK OF THE MIDDLE FORK SUBWATERSHED includes the town of Westfir, and the Aufderheide scenic route. There are many high-altitude lakes including Waldo Lake which has some of the purest water in the world. Impacts from roads and culverts are of particular concern in this subwatershed.

Watershed Characteristics

158,000 total acres

Land Ownership
- 94% Forest Service
- 6% Private
- Includes the town of Westfir

Upland Conditions
- 68% mature or old growth
- Multiple meadows decreasing in size due to fire exclusion
- Some white oak in south facing rocky openings

Roads
- 570 mi of road; 15 bridges; 2600 culverts
- Over 800 partially blocked culverts
- Over 400 problem culverts

Aquatic & Riparian Habitat
- Lack of large wood and complex structure
- Chinook salmon reintroduced
- Reduced habitat complexity
- No barriers on mainstream

Water Quantity & Quality
- High water temps; High turbidity; High peak flows
- Waldo Lake among purest water in the world

Priority Indicators

1. Quantity of large wood in stream; Pool:riffle ratio; Standard deviation of thalweg profile
2. Fish passage barriers
3. Fish communities
4. Large mammal use

Priority Limiting Factors

1. Large wood was removed from the channel; Reduced riparian vegetation causes lack of recruitment of large wood; Channel straightened confined, simplified, armored
2. Inadequate culverts or crossings
3. Culvert size and placement are barriers to fish passage; Off-channel habitat is limited
4. Loss of habitat

SUBWATERSHED ATTRIBUTES 1 Channel habitat complexity 2 Connectivity 3 Biological interactions, composition, and structure 4 Forests, oak woodlands, coniferous forests: biological interactions, composition and structure

Chapter 13. North Fork of the Middle Fork Subwatershed

SUBWATERSHED SUMMARY

The North Fork Middle Fork subwatershed includes over 158,000 acres, ranging from a low of 1000 feet in elevation at the confluence with the Middle Fork Willamette River to a high of over 7300 feet at The Twins Mountain. Most of the land is forested and managed by the Forest Service (98%). The unincorporated settlement of High Prairie is located in the lower subwatershed outside of Oakridge. Portions of two wilderness areas (Waldo Lake Wilderness and Three Sisters Wilderness) make up 23% of the North Fork watershed. The North Fork Middle Fork was designated a Wild and Scenic River from Waldo Lake to the National Forest boundary in 1988 (8.8 miles designated "wild"; 6.5 miles designated "scenic"; 27.0 miles designated "recreational").

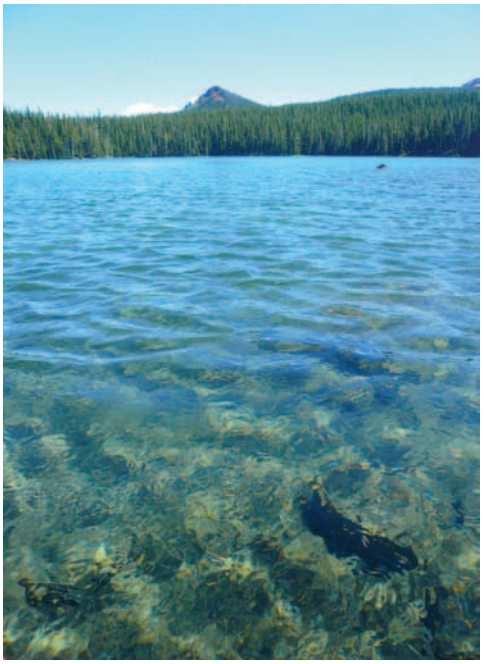
Waldo Lake forms the headwaters of the North Fork at about 5,000 feet in elevation. Waldo Lake has a surface area of 6,298 acres and is 420 feet deep. It is ultraoligotrophic and contains some of the purest, cleanest water anywhere in the world. The lake is fed by direct precipitation and snowmelt. Waldo Lake receives a high amount of non-motorized recreational use during summer months. Most of the lakes within the upper watershed are nutrient poor and did not contain fish prior to Euro-American stocking programs. The introduction of fish has most likely seriously impacted lake food-webs. Waldo Lake was stocked with kokanee, brook trout and rainbow trout until 1991 (Ziller and Wade 2000). The fish have naturally reproduced but the lake is not capable of supporting large fish populations because it is ultraoligotrophic.

The North Fork had some of the best anadramous fish habitat within the Middle Fork Willamette River watershed prior to 1930 (WNF 1995b). Wild cutthroat and rainbow trout and Chinook salmon spawned in the cold clear streams. Chinook salmon were extirpated due to the downstream dams, but have since been reintroduced. No splash-damming is known to have occurred within this basin, although a dam associated with the Westfir sawmill was built across the North Fork in 1923. Salvage timber harvest and stream cleanout projects reduced the amount of large wood found in streams throughout the watershed. The reduction in large wood caused a reduction in stream habitat complexity.

Most of the subwatershed is comprised of conifer forest. Timber harvest was initiated within this subwatershed in the early 1920s. Timber harvest has resulted in forest fragmentation and homogenization. Fire suppression and the build-up of fuels have dramatically increased the risk of large, stand-replacing fires. There was a large amount of harvest of riparian forest in the lower parts of North Fork subwatershed from the 1960s to late 1980s. Harvest of riparian trees has reduced the amount of large wood currently available to streams, and has reduced future recruitment potential. Riparian areas in the upper watershed were mostly not harvested and are in generally good condition (WNF 1995b).

Upland meadows are being impacted by encroaching forest due to fire-suppression activities. Some meadows within the subwatershed were grazed for many years and have experienced erosion and establishment of invasive species. Aspen groves, which typically are not found on the west side of the Cascades, are present within this subwatershed. Other locally rare trees found within this watershed are whitebark pine, Alaska yellow cedar, and sub-alpine fir.

There are over 570 miles of road in this subwatershed. Only one culvert (Major Creek) was identified as a priority for fish passage (Reed 2006). Culverts at Fifth, Cedar, and Captain's Creeks also block fish passage, but are lower priority due to their location in the subwatershed. Other culverts are undersized and could blow out in large storms, including those at Fisher, Parker, and Martie Creeks.



Water quality issues within this subwatershed include nonpoint sources of sediment and increased temperatures. The mainstem of the North Fork is considered water quality limited for temperature along much of its length, from mile 0 to mile 28 and it is covered by the Willamette Basin TMDL. Chalk Creek, Christy Creek, and McKinley Creek also have high temperatures. Occasional low dissolved oxygen levels have been recorded in the North Fork of the Middle Fork (MFWWC et al. 2011).

The North Fork subwatershed is a popular destination for recreation. The wilderness areas provide numerous opportunities for hiking, swimming, and camping. Expert kayakers float the North Fork. Non-motorized boating, mountain biking, hiking, and camping are all popular activities at Waldo Lake. The Aufderheide Scenic Byway, parallel to the lower 30 miles of the North Fork, attracts scores of motorists, swimmers, bikers, and campers. There are 160 miles of maintained trails and 5 developed campgrounds within the subwatershed.

North Fork of the Middle Fork Prioritization Results

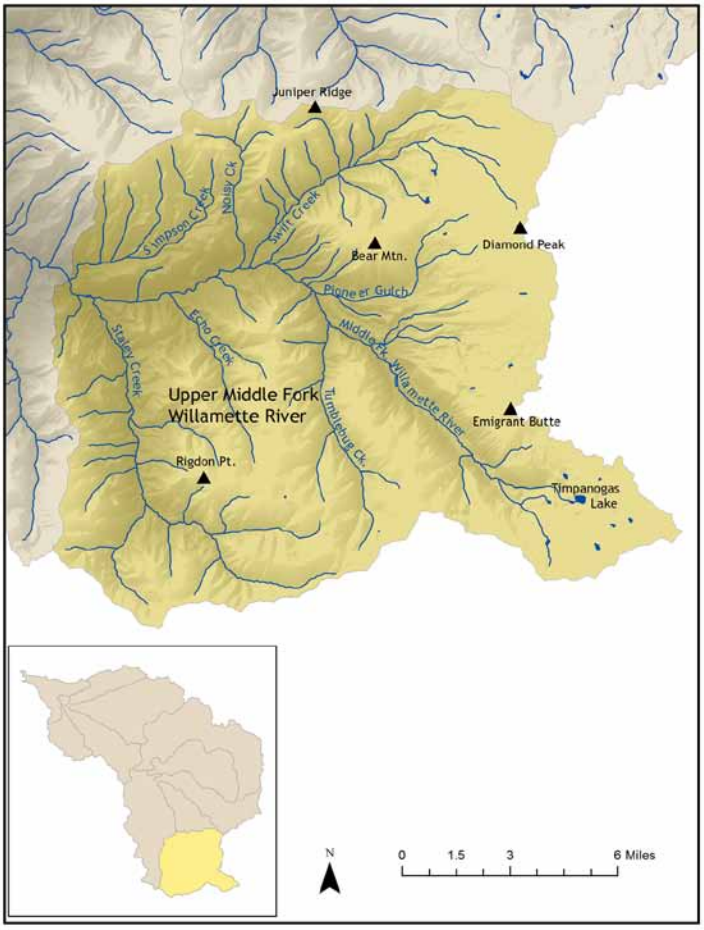
High priority indicators and their corresponding ecological attributes for North Fork can be found in the table below. Attributes that are in greatest need of attention include:

- Channel habitat complexity
- Connectivity and fish passage
- Aquatic biological interactions, composition, and structure
- Forest biological interactions, composition, and structure

North Fork of the Middle Fork priorities based on qualitative scoring of Indicators and Limiting Factors

Attribute	Indicator(s)	Limiting Factor(s)	Projects that Address Limiting Factors
Channel Habitat Complexity	Quantity of large wood in stream	Large wood was removed from the channel	Placement of large wood in stream channels
		Reduced riparian vegetation causes lack of recruitment of large wood	Restore and preserve existing riparian forests
	Pool:riffle ratio	Channel straightened confined, simplified, armored	Road closure/decommissioning, especially those adjacent to streams (Chalk Parker road treatments: 94 miles; Major Prairie Road)
	Standard deviation of thalweg profile		
Connectivity	Fish passage barriers	Inadequate culverts or crossings	Remove or upgrade culverts, specifically along FR 19
Biological interactions, composition, and structure	Fish communities	Culvert size and placement are barriers to fish passage	Remove or upgrade culverts
			Trap and haul spring Chinook and release in North Fork (priority #2 location for Middle Fork Willamette) ODFW and USACE
			Bull trout reintroduction feasibility studies
		Off-channel habitat is limited	Side channel reconnections
Forests, oak woodlands, coniferous forests: biological interactions, composition and structure	Large mammal use	Loss of habitat	Oak woodlands: thin firs and release oaks, remove invasives, plant native understory shrubs
			OWTFR meadow restoration (70 acres); vegetation cut back, pile burning, broadcast burning
			Specific opportunities for meadow and special habitat treatments occur at locations along the NF valley bottom between Grasshopper and Chucksney Mountains, along Mule Mountain and Alpine Ridge. Cutting and prescribed burning to enhance early seral meadow conditions at Glade Creek, Brock Meadows, Major Prairie, Camp Five, Elk Camp Shelter, and Scout Lake
			Coniferous forests: thinning to promote structural complexity

Upper Middle Fork Willamette River



THE UPPER MIDDLE FORK WILLAMETTE RIVER SUBWATERSHED is located at a relatively high elevation. It includes high quality aquatic habitat and several areas of high elevation special habitat. Significant restoration and mitigation work has been occurring in this area. Cold springs offer ideal stream temperatures for bull trout.

Watershed Characteristics

Over 100,000 total acres

Land Ownership
- 92% Forest Service
- 8% private

Forest Conditions
- High ecodiversity
- 94% conifer forest, 49% never harvested
- Small areas of high elevation special habitats: yellow cedar, whitebark pine
- Quaking aspen (rare habitat)
- Ponderosa pine and Oregon white oak

Riparian Conditions
- Large areas of hardwoods
- 672 stream crossings
- Many culverts have been replaced

Aquatic Habitat
- Bull Trout recovery program successful
- Multiple large woody debris projects in recent years
- No barriers on main channel and many tributaries

Water Quantity & Quality
- High due to snowmelt and cold water springs

Priority Indicators

1. Quantity of large wood per stream segment; Pool:riffle ratio; Thalweg profile
2. Riparian corridor continuity and buffer width; Riparian plant community diversity and structural diversity
3. Frequency of disturbance by fire, herbivory, or snowpack to maintain condition
4. Frequency of disturbance by fire, herbivory, windthrow to maintain forest condition

Priority Limiting Factors

1. Large wood was removed from channel; Reduced riparian vegetation causes lack of large wood
2. Habitat loss; Reduced structural complexity due to historical logging practices
3. Fire suppression
4. Fire suppression; Forest management practices have reduced the recruitment of habitat features

SUBWATERSHED ATTRIBUTES 1 Channel habitat complexity 2 Riparian vegetation 3 Grassland, prairie, oak savanna habitat complexity 4 Forests, oak woodlands, coniferous forests, aspen forests

Chapter 14. Upper Middle Fork Subwatershed

SUBWATERSHED SUMMARY

The Upper Middle Fork subwatershed occupies the southeastern portion of the basin. It includes 113,000 acres, of which 95% is managed by the Forest Service, the remainder, mostly along Simpson Creek, is owned by Seneca Jones Timber. Elevation within this subwatershed ranges from 2,000 to 8,744 feet at Diamond Peak. Habitat types include high-elevation upland forests dominated by mountain hemlock, Pacific silver fir, and noble fir; low and mid-elevation upland forests dominated by Western hemlock and Douglas-fir; mixed conifer and hardwood riparian forests; and rare and non-forested habitats such as rocky outcrops, tallus slopes, and high-alpine meadows. Mature or old-growth forest is found on about 35% of the landscape.

The Calapooya Ridge, one of the largest east-west ridges in the Cascade Range, forms the southern boundary of this subwatershed. The ridge causes a rain-shadow effect in the southern two-thirds of the watershed, providing environmental conditions that are ideal for ponderosa and sugar pine forests. Small but important patches of Oregon white oak and upland meadows are found scattered within the Upper Middle Fork. These systems have declined in extant and quality due to suppression of the frequent, low intensity fires that typified the historical fire regime.

Riparian forests make up approximately 15% of total subwatershed area (Willamette National Forest 1996b). Riparian vegetation is dominated by hardwood trees with few large conifers, a legacy of past timber management practices and fires. This shift to deciduous vegetation and younger/smaller trees has impacted bank stability, side channel maintenance and large wood recruitment to stream channels. Stream cleanout projects have also decreased the amount of large wood present in streams and decreased the frequency of deep pools.

Fire suppression has led to increased fuel loading and an increased risk of high-intensity fires. Forests that would have had an open understory under the natural fire regime now have dense understories and increased cover of fire-intolerant species. Fire suppression has reduced the size and condition of meadows and Oregon white oak inclusions.

There are 471 miles of road and 672 stream crossings within the basin. Roads contribute to a flashier hydrologic regime. Roads also fragment the landscape and act as vectors for invasive weeds. Historically there were a high number of slope failures attributed to road construction and undersized culverts. Many roads within this subwatershed were built before the 1980s using sidecast methods or on steep, erosive soils, which makes them prone to failure (Willamette National Forest 1996b). A detailed road and culvert inventory was done as part of the 2002 Watershed Supplement by the Forest Service. It identified the highest risk roads for failure, as well as culverts needing up-grading or replacement. In a 2006 fish passage study, only one culvert (on the south fork of Simpson Creek) was ranked as a high priority for replacement. A culvert on Beaver Creek was identified as high risk of failure due to its small size and unstable topography.

Water quality within this subwatershed is generally good. The headwater streams originating from glacially formed valleys are predominantly spring-fed and often have sections that are subterranean due to highly porous volcanic

material. Water from the Timpanogas Watershed has warmer temperatures due to solar input to high-elevation headwater lakes, but temperatures decrease downstream inputs from springs. While water is generally very cold (temperatures in headwater streams are typically 45–55°F), temperatures in some parts of the subwatershed have warmed and may be contributing to downstream warming.

The Upper Middle Fork historically had a robust population of spring Chinook that migrated from the mainstem to spawn in the headwaters prior to dam construction. The cold streams in this subwatershed also used to support bull trout, before they were extirpated due to stream cleanouts, and the 1960 rotenone poisoning effort above Hills Creek dam. A catch and transport program run by the Oregon Department of Fish and Wildlife has moved salmon back into this subwatershed since 1993. Successful spawning has been observed since 1999. The best spawning habitat is in the mainstem and lower tributary reaches, particularly in Paddy's Valley, where there are high concentrations of large wood. Adequate conditions exist for spring Chinook in Echo, Swift, Tumblebug, and Staley Creeks. Bull trout reintroduction has been successful, and associated habitat enhancement projects are ongoing and include road decommissioning and stormproofing, recovery of Chinook as an essential prey base, and reduction of recreation-related impacts. Dam operation and the need to improve up and downstream passage are believed to be the most important factors in success of bull trout recovery (USFS personal communication).

Non-native sport fish, including cutthroat trout, rainbow trout, and steelhead, have naturalized in many areas and some are potentially diluting the gene pool of wild fish. Eastern brook trout were stocked into alpine lakes in the 1930s and 40s and have since escaped into headwater tributaries of the Middle Fork (Willamette National Forest 1996b).

Recreation within this subwatershed is concentrated around the Middle Fork River, Diamond Peak Wilderness, and the Timpanogas Basin. Boating, fishing, hiking, hunting, and mountain biking are all popular activities.

Upper Middle Fork Prioritization Results

High priority indicators and their corresponding ecological attributes for Upper Middle Fork can be found in the table below. Attributes that are in greatest need of attention include:

- Channel habitat complexity
- Riparian vegetation
- Grassland, prairie, and oak savanna habitat complexity
- Forests and oak woodlands condition

Upper Middle Fork priorities based on qualitative scoring of Indicators and Limiting Factors

Attribute	Indicator(s)	Limiting Factor(s)	Projects that Address Limiting Factors
Channel habitat complexity	Quantity of large wood per stream segment	Large wood was removed from channel	Large wood placement in Upper Middle Fork, Echo, Staley, Swift Creeks, Paddy's Valley and Pioneer Gulch
	Pool:riffle ratio	Reduced riparian vegetation causes lack of large wood	Riparian planting and restoration
	Thalweg profile		Side channel reconnections
Riparian vegetation	Riparian corridor continuity and buffer width	Habitat loss	Riparian planting and restoration
			Respect the River riparian social campground rehabilitation
			Legacy roads projects: Swift and Echo Creek 6th fields (32.7 miles), Staley and Coal Creek 6th fields (39.0 miles), Pioneer Gulch, Paddy's Valley, and Tumblebug 6th fields (15.1 miles)
	Riparian plant community diversity and structural diversity	Reduced structural complexity due to historical logging practices	
Grassland, prairie, oak savanna habitat complexity	Frequency of disturbance by fire, herbivory, or snowpack to maintain condition	Fire suppression	Presecribed fire and meadow restoration at Grassy Glade (13 acres), Mutton Meadow (15 acres), Big Pine Opening (22 acres), Rigdon Meadow (19 acres)
			Manage and restore native meadow habitat by controlling conifer encroachment wherever appropriate
Forests, oak woodlands, coniferous forests, aspen forests	Frequency of disturbance by fire, herbivory, windthrow to maintain forest condition	Fire suppression	Prescribed fire projects
		Forest management practices have reduced the recruitment of habitat features	Prescribed fire Thinning/whip felling Plant understory shrubs to enhance white oak habitat
			Institute measures to protect long-term integrity of northern spotted owls
			Maintenance and recovery of LSR habitat and early seral habitat (for large mammals) within the Tumblebug Fire perimeter

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MFWWC Model Watershed 10-Year Priority Actions and Maps

GIS Layer Development Methods and Criteria

Below is a description of 1) the criteria used to select locations for the Opportunities GIS layer; and 2) how the locations of 10-year Priority Actions were chosen for the GIS layer.

Riparian plantings for shade

- Opportunity:
  - Assessment of areas within 50 ft. of the mainstem and major tributaries (also having TMDL data) based on:
  1) TMDL shade differential information suggesting shade <70% (this modeled data was incorrect roughly 30% of the time)
  2) Ocular assessment of aerial imagery
- 10-Year Proposed Action:
  1) Due to the relatively reasonable number of sites identified for the "Opportunity", all sites were selected for action in 10 years.
  2) Stream reaches with a density of >5 acres/mi of riparian planting need were determined to be highest priority.

Riparian fencing

- Opportunity:
  1) All stream miles on right bank and left bank that flow along taxlots identified as pasture or agricultural. Surveys should be conducted to determine whether fence currently exists.
- 10-Year Proposed Action:
  1) Lengths of stream selected for priority fencing based on proximity to bank stabilization projects and riparian shade planting projects

Streambank stabilization

- Opportunity:
  1) Locations identified during 2001 Stream Surveys
  2) Locations identified by landowners interested in assistance with bank erosion
- 10-Year Proposed Action:
  1) Fish bearing channel
  2) Upstream and downstream conditions are such that recovery is feasible and action is likely to be successful (e.g. stream power at erosion location, directionality of flow, bank materials, downstream obstructions)
  3) Proximity to riparian planting projects
  4) Landowner interest

Water quantity

- **Opportunity same as 10-yr Priority Action**
  - Identify water rights and in LFC and LC

LWD

- Opportunity:
  1) Identified # pieces /100 m needed per reach based on 2001 stream surveys and ODFW benchmarks of a desirable number of 20 per 100 m stream length
  2) Calculated # pieces needed per reach and totaled for entire length of 2001 stream survey
- 10-Year Proposed Action:
  - The top 2-3 reaches for each sub-basin were selected for wood additions based on:
  1) Highest potential for suitable fish habitat
  2) Landowner willingness
  3) High amount of % gravel area (desirable is ≥35%)
  4) % shade (desirable is >70%)

Lateral connectivity

- Opportunity:
    1) Locations identified during 2001 Stream Surveys
    2) Locations identified during ocular assessments of aerial imagery (only possible when canopy cover was low)
- 10-Year Proposed Action:
    1) Fish bearing channel and high potential for suitability
    2) Conditions are such side channel reconnection is feasible and action is likely to be successful (e.g. gradient, elevation of side channel, erodibility of side channel materials, shade over side channel)
    3) Landowner interest

Invasives removal

- Opportunity:
    1) False brome projects identified during false brome surveys 2007-2009
- 10-Year Proposed Action:
    1) Determined based on Middle Fork Willamette Watershed False-brome Implementation Plan 2009-2013 prioritization criteria:
        i. Outlying populations
        ii. Vector corridors (roads, waterways, trails) and high use recreation sites
        iii. Areas where false-brome threatens threatened species or habitat

    Those populations that fit within the above criteria will be targeted more aggressively for eradication wherever possible, with efforts focused on containment where eradication seems unlikely.

Roads

- Opportunity:
    1) Roads within 50 ft. of the stream were identified and selected.
    2) Gravel roads within this category were selected for possible action.
- 10-year Priority Action – not yet determined. See Proposed Actions table.

Culvert replacement

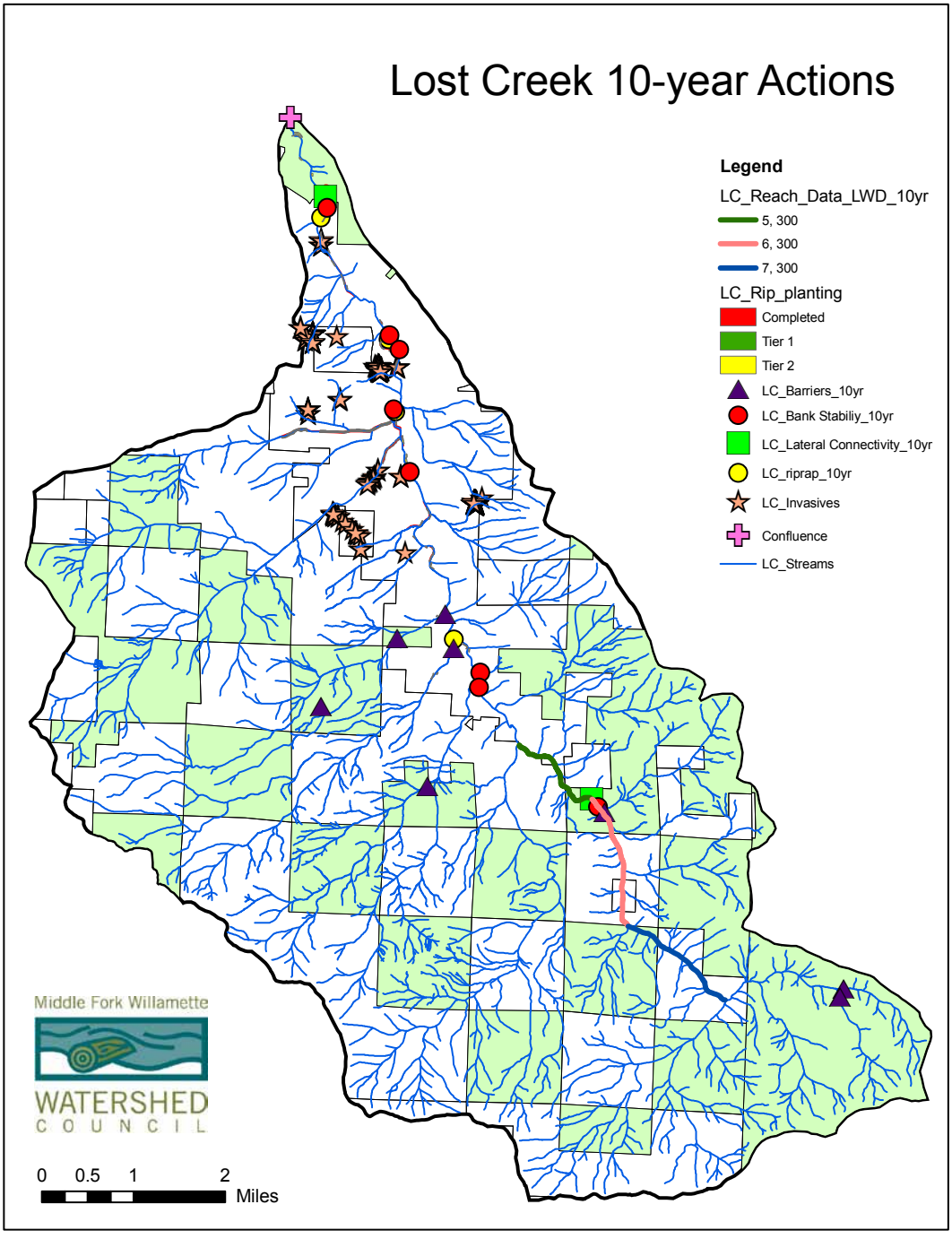
- Opportunity
    1) 2005 GIS prioritized culverts: Fish Passage and Database Project Final Report
    2) Suitable fish habitat
- 10-Year Proposed Action: (based on suitability of fish habitat)
    1) 2005 GIS prioritized culverts: Fish Passage and Database Project Final Report (see LC_barriers_ALL and LFC_barriers_ALL)
    2) Suitable fish habitat
    3) Start with lowest culverts in system, especially on the mainstem or at confluence with major tributaries, then move further upstream on the tributaries
    4) Ownership

Riprap

- Opportunity:
    1) Locations identified during 2001 Stream Surveys
- 10-Year Proposed Action:
    1) Fish bearing channel
    2) Elevation of adjacent terrace/floodplain
    3) Purpose of riprap (e.g. protecting structures)
    4) Landowner interest
    5) Upstream and downstream conditions are such that recovery is feasible and action is likely to be successful (e.g. stream power at riprap location, directionality of flow, bank materials, downstream obstructions)

Confluence

- Confluence areas are considered high priority for project implementation as a result of the ability to support multiple habitats and species through a single or few projects.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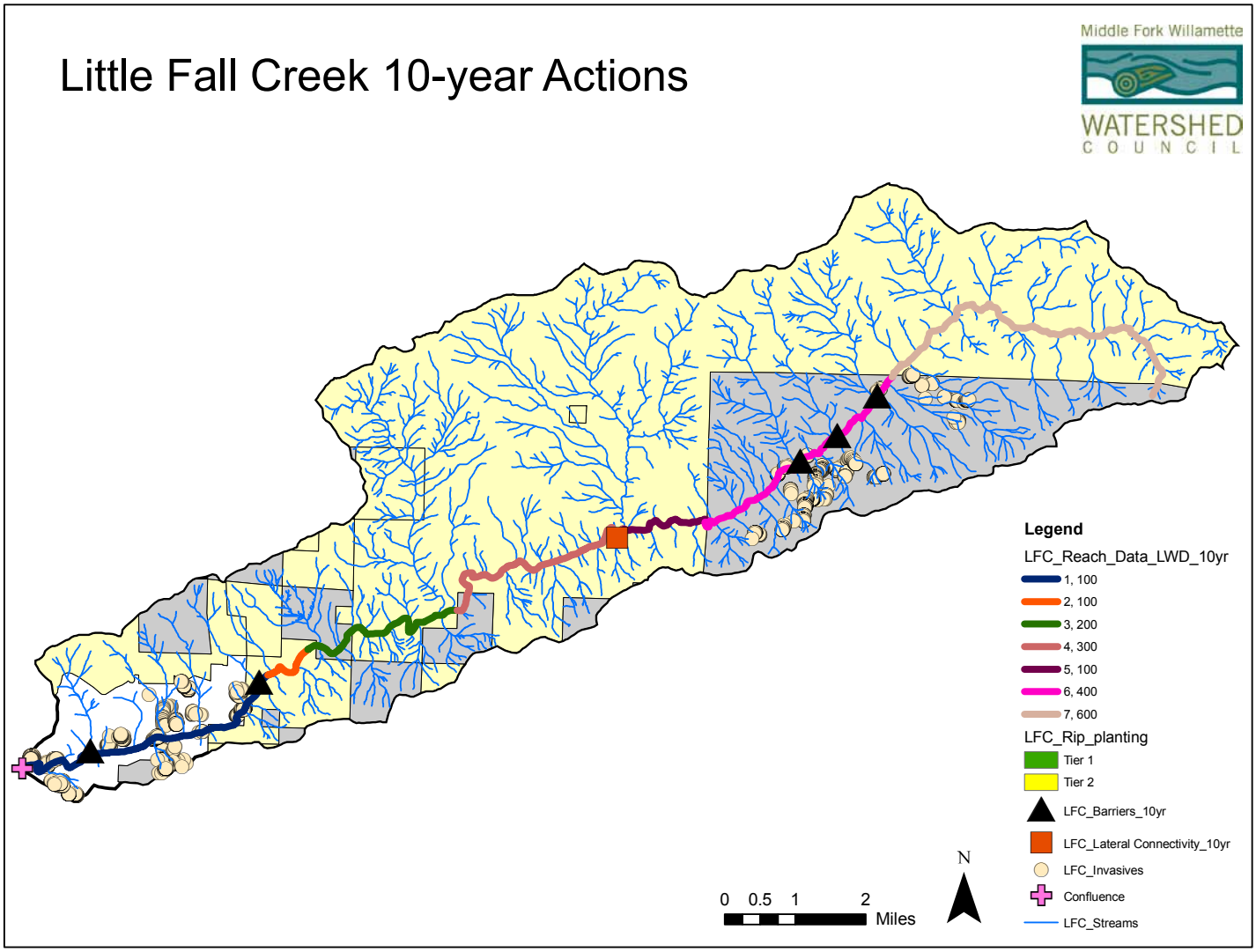
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Tier 2
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