1.0 INTRODUCTION

The Middle McKenzie Landscape Area (MMLA) is within the Central Cascades Adaptive Management Area (CCAMA). This land use allocation encourages development and evaluation of new approaches for integrating ecological and social objectives. This landscape design is an alternative approach to meeting the objectives of the Northwest Forest Plan (NFP). The central concept of this project is to approximate key aspects of historical fire regimes through forest management practices while sustaining native habitats and species, maintaining ecological processes within historical ranges, and providing a sustained flow of timber.

Project objectives are to:

- Utilize some components of fire history information collected from the MMLA to assist in crafting a Landscape Design (Weisberg, 1997).

- Integrate some components of the Blue River Landscape Plan to provide consistency across Middle McKenzie and Blue River landscapes.

- Contribute substantially to the achievement of Eugene District Record of Decision and Resource Management Plan 1995 (EIS/ROD) objectives including:

  - Provision of well-distributed late-successional habitats outside reserve;
  - Retention of key structural elements of late-successional forests on lands subject to regeneration harvest
  - Restoration and protection of riparian zones
  - Provision for a stable timber supply.

- Sustain and restore native habitats, species, ecological processes, and water quality

- Retain the existing character of the landscape in the McKenzie River Special Recreation Management Area and McKenzie River

- Maintain and enhance the McKenzie River's Outstandingly Remarkable Values (scenic, fish, wildlife, recreation) in compliance with the Wild and Scenic River Act

- Maintain or enhance the primary values of the Potential Area of Critical Environmental Concern (ACEC)

This document is consistent with the Northwest Forest Plan (USDI and USDA 1994). This document does not make formal decisions resulting in activities affecting the environment. Decisions that commit resources to management actions will be made at the project-scale. Prior to commencement of any activity potentially affecting the environment, a formal National Environmental Policy Act (NEPA) document will be prepared.

2.0 BASIC INFORMATION

General Information – The Middle McKenzie landscape lies within the McKenzie River subbasin (approximately 873,000 acres), which is a major tributary to the Willamette River in western Oregon. The MMLA is 16,550 acres. The land use allocation for the MMLA is adaptive

management. However, there are some underlying land use designations that are listed in table S-1:

Table S-1 – Land Designations

Underlying designations	BLM Acres
Tier - 1 Key watershed	8,282
Low Elevation Headwaters of the McKenzie River Potential ACEC	7,650
Unmapped LSRs	517
Bald Eagle Habitat Areas	2,037

Landscape Disturbance History and Landscape Units – The Bear-Marten watershed fire history was reconstructed for the period between 1574 to 1997. The information from 1574-1849 was used to determine the following elements of the plan:

- rate of rotation
- number and location of landscape areas
- the pattern for leaving green trees, snags, and down wood

Information such as cruise data from old timber sales, old photos, and data sets from other assessments were also used in determining the number of green trees, snags, and down wood to leave in the harvest units.

The MMLA is divided into two landscape areas based on fire history information. Geology and topography information was used where fire history information was lacking.

The landscape areas are further divided into landscape regions and landscape blocks. The landscape regions were delineated for analysis purposes. The landscape blocks were delineated for planning purposes associated with stand modeling and harvest scheduling. The primary goal for landscape blocks was to emulate the size and distribution of disturbance patches that might be found within the MMLA.

3.0 LANDSCAPE MANAGEMENT STRATEGY

This section describes the components of the Middle McKenzie Landscape Design (MMLD). The MMLA is divided into two main management categories: Non-reserves and Reserves. The Reserves are subdivided into Riparian Reserve Corridors, Small Basin Reserves, and other reserves. Non-reserve lands are where the transition and the general timber harvest prescriptions apply. For the Reserves category, timber harvest could occur but would be for an objective related to the type of reserve.

Table S-2 – Acres by Categories

Categories	Landscape Design	
	Acres	Percent
Non-Reserve	8,195	49%
Inclusions		
Riparian Reserve Corridors	4,016	24%
Small Basin Reserves	2,581	16%
Other Reserves	1,858	11%

3.1 Landscape Areas

Based on the fire history information, the MMLA is divided into two landscape areas and each landscape area is assigned a rotation age and corresponding prescriptions.

Landscape Area 1 is 6,459 acres with a 100 year rotation age. **Landscape Area 2** is 10,194 acres with a 180 year rotation age. Table S-3 describes the age class distribution in the MMLA.

Table S-3 -- Acres by Age Class

Age class	Landscape Area 1	Landscape Area 2
0	346	517
10 - 39	974	1,558
40 - 79	2,233	1,083
80 - 109	805	1,451
110 - 180	2,049	5,044
190+	34	394
nonforest	18	144
Total	6,459	10,194

3.2 Prescriptions

There are two types of prescriptions: transition and general. The **general prescription** objective is to manage the stands to provide for structural and species diversity. However, many forest stand conditions are not ready for implementation of the general prescription. The **transition prescription** was developed because of the existing conditions of the 70-year old stands.

Both landscape areas have high density stands and simple structured 70-year old stands. Since these stands are high density, the trees that would remain after a regeneration harvest would be highly susceptible to blow down. In both landscape areas, thinning would increase wind firmness and reduce the susceptibility to extensive blow down. In Landscape Area 2, thinnings would also introduce stand heterogeneity.

The **general prescription** describes how stands would be managed to provide for structural and species diversity. Both landscape areas have an objective to develop and maintain complex stands with a mix of shade tolerant and intolerant species. In Landscape Area 1, the stands would be a two-tiered stand structure while in Landscape Area 2, the stands would be a three-tiered stand structure.

Green Tree Retention, Snags and Down Wood – A range of 6-20 trees per acre would be left in regeneration harvest. More green tree retention would be left at the lower slope positions than at the upper slope positions since that could be a resulting pattern from a moderate fire. The reverse would happen for snags and down wood. Table S-4 shows the number of leave trees for green trees, snags, and down wood for regeneration harvest. For thinning and density management, the same would be left for snags and down wood.

Table S-4 – Leave Trees

Leave Trees per Acre	Leave Tree Needs
6- 20	Green Trees
8	Snags
300 linear ft	Down Wood

3.3 Aquatic Reserves System

The Aquatic Reserve System (see Aquatic Reserves Map) were established for the following reasons:

- move closer towards approximating a fire disturbance pattern
- meet the intent of the Aquatic Conservation Strategy Objectives (ACSO)
- ensure that aquatic habitats and processes are maintained and protected
- integrate management for aquatic features with upslope management

The Aquatic Reserve System consist of the following:

- nine small basin reserves scattered throughout the MMLA
- riparian corridors on fish-bearing streams
- stream bank buffers on nonfish-bearing streams

3.3.1 Small Basin Reserves

Nine Small Basin Reserves were established to meet the intent of the ACSO and to provide connectivity between upland and riparian areas (integrate aquatic and upslope management) and to link to other reserve areas. Small Basin Reserves also play a role in approximating a fire disturbance pattern. The small basin reserves contain aquatic habitats that are fish bearing and non-fish bearing. Small Basin Reserves are designed to maintain and provide for late-successional habitat. It should be noted that the small basin reserves do not always consist of a topographically complete basin due to land ownership patterns.

3.3.2 Fish-bearing Streams – Riparian Corridors

A one-tree-height reserve will be placed on both sides of confined fish-bearing streams. A two tree height reserve will be placed on both sides of unconfined or moderately confined fish bearing streams. Management activities would be similar to what would occur under the NFP.

3.3.3 Nonfish-bearing Streams – Streamside Buffers and Streamside Management Areas

Streamside Buffers

A 25-50 foot streamside bank buffer would be placed along nonfish-bearing streams. The purpose of the buffer is to maintain streambank stability.

Streamside Management Areas

The streamside management area (SMA) is an ½ to 1 site tree distance beyond the Streamside Buffer. This is a transition between the streams and the upland. A "Streamside Management Prescription" would be applied to the SMA. The Streamside Management Prescription purpose is to reduce temperature and microclimate effects that may be higher than on subsequent entries due to the single cohort of trees occupying much of the landscape headwaters. After more complex multi-cohort stands have been established in proximity to these channels, the streamside management prescription should end and the General Prescription would be applied.

3.4 Fuels Management Strategy

Implementation of fuels management within the MMLA, especially the use of prescribed fire, can serve as a tool to provide ecological benefits that low-severity fires likely would have provided historically in the MMLA. With the silvicultural prescriptions and timber management techniques outlined in this Landscape Design, fuels management will provide tools that can be utilized to help maintain or develop some of the above attributes.

3.5 Inclusions

These are areas that are to be managed differently than the surrounding general forest matrix (non-reserves). Management actions and landscape prescriptions for an Inclusion may be different from the general landscape prescriptions, including a no action option.

3.6 Unplanned Disturbances

The forest ecosystem is dynamic. Unplanned disturbances (wind throw, disease mortality, snow damage, insect induced mortality, animal damage mortality, catastrophic and small fires) occur naturally. Many times, small natural disturbances are biologically desirable since they increase the variability of the forest. When natural disturbances are small, the planned schedule of activities should not be altered. Large scale disturbances should be evaluated for their impact upon the management objectives of the MMLA and surrounding ownership patterns.

3.7 Restoration

Restoration could include the following projects: instream habitat improvements, riparian vegetation site restoration, road restoration, culvert replacement, and scenic improvements or mitigation.

4.0 SPATIAL AND TEMPORAL PROJECTION

A ten-decade harvest and forest composition projection was completed as a part of the analysis of the Landscape Design. This ten-decade projection is meant to be a forecasting tool, designed to develop information about the effects of applying the area control harvest rotation over the landscape, and the ages and spatial relationships, which occur as a result of applying the scheduling criteria. The purpose of this projection is to develop an understanding of the effects of the Landscape Design on the spatial distribution of forest types, which emerge from the application of this area control block patchwork. A pattern that emphasized the placement of harvest units so that they tend to avoid other harvest units selected.

Harvest scheduling on this landscape is controlled by the three identified scale levels: Landscape Area, Landscape Region and Landscape Block. Harvest scheduling was completed using the Landscape Block as the basic harvest unit for a decade.

Chart S-1 shows the changes in seral stages, over time, as this plan is implemented and compares the seral stage projection between the Landscape Design and the NFP.

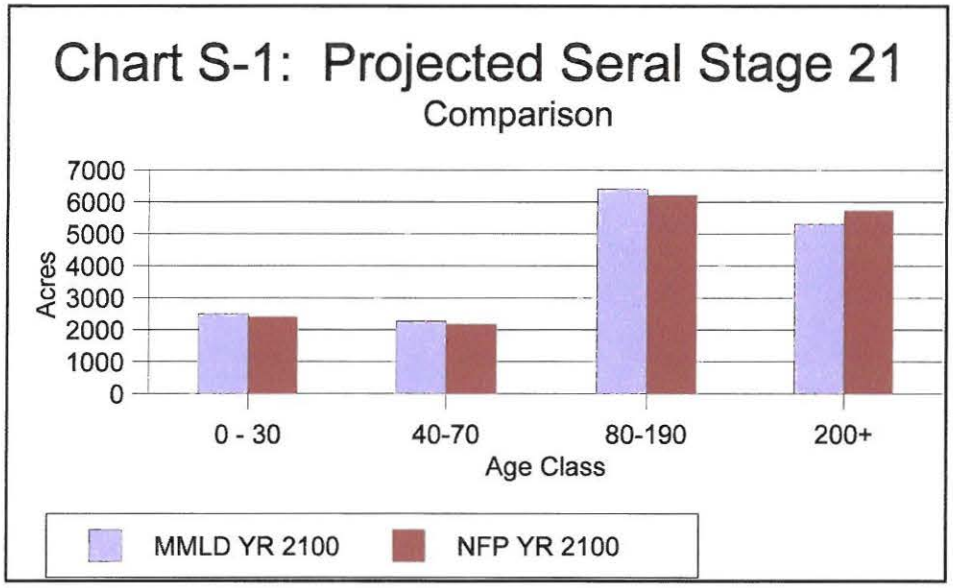


Table S-5 shows at the estimated output per decade under the Landscape Design.

Table S-5 -- Harvest Projection

Landscape Area	Rotation Year	Thinning Acres/Decade	Regeneration Acres/Decade	MBF/Decade
Landscape Area 1	100	392	340	17,430
Landscape Area 2	180	541	254	15,420
Total		933	594	32,850

5.0 Evaluation

5.1 ACS Comparison

5.1.1 ACS Objectives 1 and 2
(watershed and landscape features – diversity, complexity and connectivity)

Implementation of the MMLD would provide habitat to maintain the diversity and complexity of the aquatic system on public lands. Both the MMLD and NFP would provide similar levels of fish habitat. The MMLA maintains spatial and temporal connectivity of habitats within and between watersheds over the long term through the following landscape features:

- A well-distributed Small Basin Reserve system, linking upland and riparian systems
- Riparian Corridors on perennial fish-bearing streams
- Transition prescriptions along non-perennial streams

- The pattern and distribution of green tree retention, such that higher numbers occur on lower slope positions
- Management for higher levels of down logs and snags (eventual down logs) more closely resembling natural conditions.

For fishbearing streams, the amount of large wood entering the streams from within a site potential tree width from streams would be similar to the NFP. For non-fishbearing streams, trees entering the streams will be larger under the MMLD in the long term.

5.1.2 ACS Objectives 3, 4 and 5 (physical integrity, water quality, and sedimentation)

a) Nonfish-bearing Streams

Physical Integrity

The streambank buffer and the addition of wood into streams would maintain or enhance the physical integrity of the streams.

Sedimentation

Little addition of sediment to the stream channels from sources adjacent to the channel would occur because of the following elements of the MMLD:

- 25 - 50 feet streambank buffers
- green tree retention levels
- transition prescriptions

In the long-term, sedimentation levels from public lands within landscape areas may actually be less than compared to the NFP. The local intensity of regeneration harvest disturbance would be greater than the NFP; however, the disturbance is minimized by 1) 25-50 foot buffer 2)10-20 trees per acres and 3) longer rate of rotation (100 and 180 year rate of regeneration). Also, moderate retention levels upslope provide slope stability and minimize mass wasting within harvest units. Both plans include provisions to avoid management activities on highly unstable slopes. Mass wasting/slope failures would not be any more likely under the Landscape Design, and may actually be less because of the increase in green tree retention, cwd, and snags.

Water Quality

For nonfish-bearing streams, water quality would be maintained with the implementation of the Landscape Design. Stream temperatures and turbidity levels may increase locally in the short-term on nonfish-bearing with implementation of the Landscape Design, but would be well within the range of natural variability and would meet the State Water Quality criteria. It is expected that these potential impacts would be within the normal natural fluctuations and not be detectable at the sub-watershed level.

b)Fish Bearing Streams

Physical, Sedimentation, and Water Quality

Fish bearing streams, on public lands, would be surrounded by either a one or a two tree site potential tree-height buffer width on each side of the channel. Streams with the 2 site potential tree-height buffer width will be identical to the NFP. It is expected that the one tree buffer will function similar to the NFP for

maintaining physical integrity, sedimentation and water quality because 1 site potential tree-height buffer width is more than adequate for maintaining these resources.

5.1.3 **ACS Objective 6** (Peak Flows)

Peak flows could potentially increase in small channels for short periods (e.g. 10-20 years) while stands are hydrologically immature. Increases would probably be less than those resulting from natural variation in flow patterns resulting from climate and fire episodes. Also, any peak flow effects would be attenuated downstream and would not be distinguishable at the sub-watershed or 5th field watershed.

The level of harvest activity on public lands would involve only limited acreage in a sub-watershed at any one time, and would not be sufficient by itself to induce measurable changes in streams where fish are located.

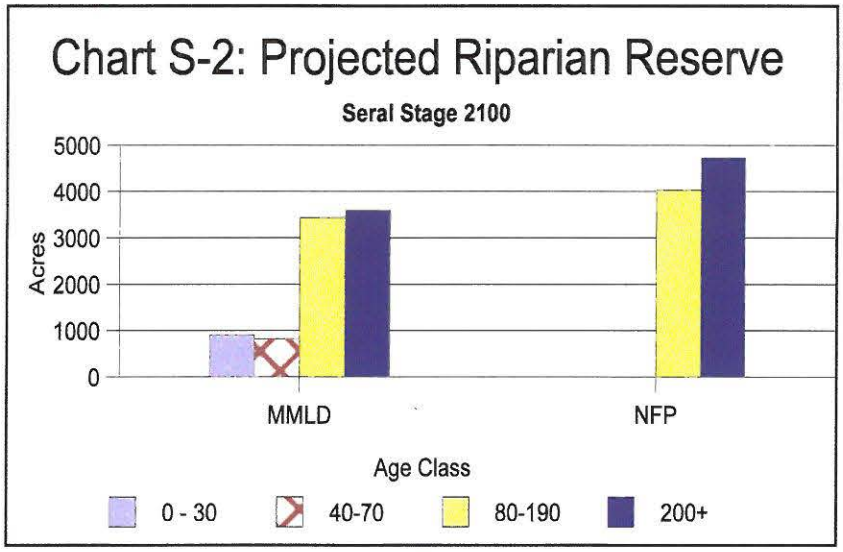
Implementation of the NFP or the MMLD would have similar impacts on stream flows, with both meeting the requirements of the ACS objective.

5.1.4 **ACS Objective 7** (floodplain, meadows and wetlands)

Local changes in the hydrology of floodplains and wetlands could occur through implementation of the MMLD through timber harvest. Water yield increases following timber harvests are possible relative to unharvested forested conditions. Precipitation interception and evapotranspiration would be reduced in the short term and water yields could increase (Refer to ACSO #6). However, these changes are expected to vary across the landscape, with the magnitude of changes remaining within the range of historical variation, and be of similar or lower magnitude than that which could be expected under the NFP.

5.1.5 **ACS Objective 8** (species compositions and structural diversity of plant communities in riparian areas)

Stand-initiation timber harvests (100 &180 years) in the Landscape Design are designed to approximate the frequency, severity, and spatial pattern of historical fires restoring the historical distribution of habitats. Fine and coarse grained biotic and abiotic components that provide the vegetation composition and structure necessary for a naturally functioning forest and riverine system will be maintained. This combination of disturbance followed by longer periods of no regeneration harvest will provide for an array of habitats at different seral stages over time (Chart S-2), on a scale that more closely approximates historical habitats within the MMLA.



Additional provisions of the Landscape Design ensure adequate riparian functions. Small Basin Reserves, Riparian Corridors on fish-bearing streams, and green tree retention near nonfish-bearing streams provide for riparian functions and maintain species composition and structural diversity of the plant community in the riparian areas. In the long-term, where timber harvest occurs plant species composition will change and structural diversity will increase. The placement of wood in streams would maintain or restore the distribution of coarse woody debris.

5.1.6 ACS Objective 9 (riparian dependent species)

The MMLD maintains habitat to support populations of native plant, invertebrate, and vertebrate riparian-dependent species on public lands. Riparian Corridors on fish-bearing streams and small-basin reserves (which include biologically sensitive or unique habitat, special interest areas, and spotted owl nesting areas) are distributed across the landscape, providing refugia for these plants and animals.

Impacts to habitat from implementation of the MMLD, are not expected to exceed estimated impacts from historically-occurring disturbance events such as wild fires.

The Plan is intended to approximate vegetation patterns left across the landscape under what is thought to be the historical fire regime for the area. Small Basin Reserves are expected to function to protect the existence of these species and serve as source areas for recolonization of riparian habitats that have recovered from past project impacts. For those species identified as Localized and Rare under the Riparian Reserve Evaluation Techniques and Synthesis (1997), the MMLD will provide equal or better habitat conditions for these species of concern.

The MMLD will accelerate the complexity of riparian habitats that currently may not function as refugia through silvicultural practices and the addition of large coarse woody debris (snags and down logs). Other than the reserved headwater streams, there may be some reduction in riparian

vegetative communities that would not provide for a full complement of habitat components until the woody vegetation regrows. Aquatic and terrestrial habitats in non-fishbearing riparian zones would be reduced in amount and quality in the short-term due to harvest activities although a 25-50 foot stream bank buffer would be provided. These effects will be greater in intensity (due to narrower riparian buffers) yet less in frequency (due to longer rotations) as compared to the forest plan but are expected to be mostly local and short-term with recovery in 10-30 years.

5.2 Threatened and Endangered Species

5.2.1 Northern Spotted Owl *(Strix occidentalis caurina)*

Overall, implementation of the MMLD will provide benefits to spotted owls similar to natural conditions and greatly exceeding those expected under the NFP. The MMLD would provide greater benefits to spotted owls as compared to the NFP due to the following:

- Harvest prescription designs for higher levels of green tree retention, down logs and snags, increased conifer species diversity, and muti-tiered 3 and 2 cohort stands.
- Longer rate of regeneration harvest.
- Larger harvest patch size leading to less fragmentation.
- Improved spatial orientation, functionality, and availability of suitable and dispersal habitats.
- Augmentation of Unmapped-LSR cores with Small Basin Reserves.
- Maintenance of high levels of suitable habitat through time.

5.2.2 Bald Eagles

Benefits from implementation of the MMLA will be similar to natural conditions and exceed those expected under the NFP.

Implementation of the MMLD will adequately maintain and enhance perching, foraging, midwinter roost and nesting habitats within the MMLA through :

- Implementation of the McKenzie Resource Area Bald Eagle Habitat Management Plan (MBEHMP) and compliance with the Endangered Species Act, including restrictions on habitat removal, noise disturbance, and application of seasonal restrictions if necessary.
- Management of other withdrawn areas, especially The McKenzie Wild & Scenic River Corridor and Aquatic Reserves.
- No net increase in roads in the Bear Creek and Marten Creek Key Watersheds.
- Maintenance of the currently low amount of human disturbance and naturally limiting access in the area.
- Harvest prescription designs for greater green tree retention, higher levels of down logs and snags, increased conifer species diversity, and muti-tiered 2-3 cohort stands as compared to the NFP.
- Relatively long rate of regeneration harvest of 100 and 180 years.

5.2.3 Bull Trout and Spring Chinook

The MMLD is consistent with the ACS. Implementing the MMLD would not prevent the attainment of the ACS objectives. MMLD would provide 1-2 site potential height buffer widths on fish-bearing streams. MMLD would provide wood for streams, stream bank protection, and aquatic

reserves. It will provide for longer rotation, more down wood, snags, and green tree retention than the NFP. The MMLD will maintain or enhance habitat on public lands. The MMLD would meet State Water Quality standards. A habitat management plan is the process of being prepared.

5.3 ACEC

The relevant values are

- Management of the south bank of the McKenzie River scenic values;
- Large Blocks of Low Elevation Land;
- Management of BLM Special Status fish resources; and
- Management of large blocks of low elevation lands for wildlife resources.

These relevant values will be maintained or enhanced, and should receive benefits equal to or greater than would be expected under the NFP or ACEC designation. The temporal and spatial harvest arrangement combined with longer rotation periods for regeneration harvests is expected to sustain wildlife and habitat elements identified in the original ACEC nomination. Specific components or features of the MMLD that contribute to maintaining or enhancing the relevant values are as follow:

Management of the south bank of the McKenzie River scenic values

- timber harvest guidelines would mitigate or improve visual contrast; and
- protect the McKenzie River and Highway 126 viewsheds from undesireable visual contrast.

Large Blocks of Low Elevation Land

- Maintain and develop complex stands.
- 63% of the land base is in reserves, not part of the harvest base; harvesting may occur for the benefit of the reserves.
- Connectivity to Mt. Hagen LSR would be maintained.

Management of BLM Special Status Fish Resources

- Riparian Corridors on fish-bearing streams;
- streambank buffers on non fish-bearing streams and transition prescriptions; and
- MMLD meets the ACS objectives.

Management of large blocks of low elevation lands for wildlife resources

- Small Basin Reserves;
- leaving 8 snags per acre, and 300 linear feet of down logs;
- less fragmentation; and
- Riparian Corridors on fishbearing streams
- longer rate of regeneration harvest (100 and 180 yrs in MMLD vs. 80 in the NFP)

MIDDLE MCKENZIE
LANDSCAPE DESIGN

1.0 INTRODUCTION

The Middle McKenzie Landscape Design (MMLD) is an approach to meeting the objectives of the Northwest Forest Plan (NFP). Some components of the historical fire disturbance regime were used to develop the landscape design. This section will provide background information, goals and objectives, AMA concepts, relationships to NFP, AMA Guide, NEPA and brief discussion of the process. In Chapter 5 of this document, an analysis was completed comparing MMLD to the landscape under a Matrix scenario. Matrix was selected as a point of comparison.

1.1 Background

The Middle McKenzie Landscape Area (MMLA) is within the Central Cascades Adaptive Management Area (CCAMA) land allocation (see General View map). This allocation encourages development and evaluation of new approaches to integrating ecological and social objectives. Specific objectives for the CCAMA listed in the Record of Decision for the Northwest Forest Plan include: "intensive research on ecosystem and landscape processes and its application to forest management in experiments and demonstrations at the stand and watershed level; approaches for integrating forest and stream management objectives and on implications of natural disturbance regimes" (ROD p. D-12).

The MMLD was developed to meet AMA objectives and to develop a strategy for managing the landscape. Fire history information was used as the basis for this strategy in an attempt to manage the landscape within the range of natural variability. Our assumption is that if we apply management within this range, we are more apt to be managing for the "appropriate" mix of structure, function and composition of this watershed. Both approaches will play an important part of the adaptive management process. Natural variability is a starting point. In some cases, it may **not be socially or politically** acceptable to apply the fire history concept in its entirety. For example, large stand replacement fires will not be used in this design.

The Blue River Project and the MMLD are testing the hypothesis that it is feasible to use historical fire regimes as a general template for future vegetation management.

1.2 Project Goals and Objectives

1.2.1 Goal

Design an alternative approach to achieving the basic objectives underlying the Northwest Forest Plan. Incorporate some components of historical disturbance regimes through forest management practices on BLM lands.

1.2.2. Objectives

a. Utilize some components of fire history information collected from the MMLA by Pete Weisberg to assist in crafting a Landscape Design (Weisberg, 1997)

b. Integrate components of the Blue River Landscape Plan to provide consistency across Middle McKenzie and Blue River landscapes.

c. Contribute substantially to the achievement of SEIS/ROD objectives, including provision of well-distributed late-successional habitat outside of reserves; retention of key structural elements of late-successional forests on lands subject to regeneration harvest; restoration and protection of riparian zones; and provision of a stable timber supply (Eugene ROD and RMP, June 1995, p32).

d. Sustain and restore native habitats, species, ecological processes, and water quality.

e. Retain the existing character of the landscapes in the McKenzie River Special Recreation Management Area and maintain and enhance the McKenzie River Outstanding Remarkable Values in compliance with the Wild and Scenic River Act.

f. Maintain or enhance the primary values of the Proposed Area of Critical Environmental Concern (ACEC).

1.3 AMA Concepts

The central concept of this project is that approximating key aspects of historical fire regimes through forest management practices are thought to sustain native habitats and species, maintain ecological processes within historical ranges, and provide a sustained flow of timber. A premise of this approach is that native species are adapted to the range of habitat patterns resulting from historical disturbance events over the last 500 years, and the probability of species survival is reduced if their environment lies outside the range of historical conditions for a prolonged period of time (Blue River Plan, 1997). Similarly, ecological processes, such as those involved in nutrient and hydrologic cycles, have functioned historically within a range of conditions established by disturbance and successional patterns. Operating outside the range of past conditions may affect these processes in unforeseeable and perhaps undesirable ways. While this concept is largely untested, various projects are exploring this approach in a variety of settings across North America (Blue River Plan, 1997).

General fire regimes have been identified and mapped for the Middle McKenzie landscape. In the MMLD, timber harvest has been set to approximate key parameters of historical fire regimes (e.g., disturbance frequency, intensity, and spatial pattern) to the degree feasible while still meeting the underlying objectives of the Northwest Forest Plan. These management regime interpretations of past fire regimes reflect mean conditions and do not incorporate the extremes of past fire behavior. For example, very large and intense fires were a part of the historical fire regime, but are not incorporated into future management regimes.

Two important qualifications to this approach should be understood. First, in many cases existing conditions are far different from historical conditions (e.g., the presence of roads, and

clear cuts). Existing conditions require modification to historical disturbance regime-based approaches in order to meet the objectives of the Northwest Forest Plan. Second, timber harvest is different from the historical occurrence of fire in ways that can not be replicated in a timber harvest regime (e.g., much lower levels of residual dead wood). Large-scale habitat modifications resulting from past management actions in combination with societal expectations (e.g., that native species be maintained, timber produced, and fire suppressed) limit the degree to which historical patterns can be applied in future management regimes.

Testing these concepts requires ongoing monitoring, evaluation, and adjustment programs. A preliminary Inventory, Monitoring and Research Guide is being prepared for this document. Periodic interdisciplinary assessment of monitoring results and evaluation of the need to modify the landscape management strategy would occur.

1.4 Relationship to NFP, AMA Guide, NEPA and Watershed Analyses

This document describes the landscape management strategy intended to guide management activities within the MMLA. It is an implementation and monitoring guide meant to provide consistency and focus to activities in the MMLA that are directed to achieving Central Cascades Adaptive Management Area objectives. The MMLD is based upon concepts developed at the landscape scale. It provides context and guidance to projects so that the underlying concepts are implemented over time.

This document is consistent with the Northwest Forest Plan (USDI and USDA 1994). The MMLA and surrounding lands were allocated as part of the Central Cascades Adaptive Management Area in the Northwest Forest Plan. This document is also consistent with the Central Cascades Adaptive Management Area Strategic Guide. The guide was developed to provide focus and coherence to Adaptive Management Area activities, and to meet Northwest Forest Plan requirements. The Adaptive Management Area Guide identifies themes for Adaptive Management Area activities, and suggests potential projects for implementing those themes. The MMLD is identified in the Guide.

This document does not make formal decisions resulting in activities affecting the environment. Decisions that commit resources to management actions will be made at the project-scale. Prior to commencement of any activity potentially affecting the environment, a formal NEPA document will be prepared. The development of site-specific projects and associated environmental analysis will incorporate relevant material from this document. In particular, cumulative effects analyses for project assessments will incorporate information from this document.

1.5 Analytical Process

The MMLD was developed in four distinct phases. In practice, however, there was a great deal of overlap among phases and multiple iterations of some work.

- **First Phase** – Information from the watershed analyses and fire history study was reviewed. A general description of landscape and its resources, land use designation,

landscape structure, and disturbance patterns is provided.

- **Second Phase** – A landscape management design was developed based on the range of "natural" variability of forest conditions as interpreted from fire history information. The watershed was stratified into various landscape units and silvicultural prescriptions. An alternative approach to Riparian Reserves was developed.

- **Third Phase** – Spatially and temporally-explicit portrayals of potential future landscape conditions were developed based upon the management strategies developed in the second phase. The resulting maps of future landscape structure provide a specific and direct link to project-scale planning for timber sales, silvicultural activities, and restoration projects.

- **Fourth Phase** – This landscape management approach was evaluated, in part by comparison to the standard, unmodified Northwest Forest Plan direction as applied to Matrix lands. Key objectives, such as the Aquatic Conservation Strategy Objectives, Special Status Species, landscape structure, and timber harvest volume were evaluated through a combination of quantitative and qualitative methods. The portion of the landscape that is part of the Potential ACEC was examined to evaluate as to how well the Landscape Design would meet the concerns of the ACEC.

2.0 BASIC INFORMATION – PHASE 1

This landscape area contains a tier-1 key watershed, the Low Elevation Headwaters of the McKenzie River Potential ACEC, unmapped LSRs and Bald Eagle Habitat Areas (see Land Use Designation Map). This chapter gives a description of the landscape in terms of the underlying land use designations, landscape structure, and disturbance patterns.

2.1 General Description

2.1.1 Setting

The Middle McKenzie landscape lies within the McKenzie River subbasin (approximately 873,000 acres), a major tributary to the Willamette river in western Oregon. The water of the McKenzie River provides recreational, scenic, and economic values, and is a source of drinking water for over 200,000 people. An estimated 16,650 acres of the landscape administered by the McKenzie Resource Area Eugene BLM District. The Vida/McKenzie and the Bear/Marten watershed analyses covered the land within the MMLA.

The landscape area lies within the western slopes of the Cascade foothills. Precipitation varies from 50 to 80 inches annually, with temperatures slightly below freezing in the winter to 90 to 100 degrees in the summer. The terrain ranges from rolling hills to steep dissected mountains. Elevations range from 617 to 4,830 feet. The stream gradients in this landscape range from 2 to 22 percent. There are a mixture of confined, unconfined, and moderately confined streams.

Two threatened and endangered wildlife species inhabit this landscape: northern spotted owl, and bald eagles. Two threatened and endangered fish species use this landscape area, spring chinook salmon, and bull trout. An estimated 156 miles of fish-bearing streams exists within the MMLA. Of that 156 miles of fish-bearing streams, an estimated 32 miles are on BLM administered lands. The River has four dams on it. The three dams above the landscape area are barriers to fish. Leaburg dam, below the MMLA, is passable.

2.1.2. Tier 1 Key Watershed

Bear Creek and Marten Creek are designated as a Tier-1 Key Watershed under the Northwest Forest Plan. Bear Creek and Marten Creek were designated Key Watershed because of the generally high water quality, potential use by Federally-listed spring chinook and bull trout, populations of native cutthroat and rainbow trout, and a diverse amphibian community. The Bear Creek and Marten Creek Key Watershed is 14,377 acres and BLM manages 8,282 acres (58%), with a small part of the Bear Creek watershed is managed by the U.S. Forest Service. Several private residences are located at the mouth of both Bear and Marten Creek; otherwise lands are managed by BLM or private industrial forest companies.

Bear Creek originates from the ridge separating it from Gate Creek to the north and west, and Mt. Jimbo to the east and south, flowing generally westward to enter the McKenzie River from the north. The creek is divided into two reaches by a waterfall approximately one mile

above its mouth. Steelhead and native rainbow trout migrate into Bear Creek up to the falls. Only cutthroat trout and sculpin are found above the falls, their range extending in the main steam and tributaries where suitable habitat is found. Only limited entry has been made into the watershed. Riparian vegetation is in good condition in most of the watershed. Water quality is good although past erosional events and limited structure in the stream limit the development of spawning and rearing habitat.

Marten Creek arises on the slopes of Mt. Pernot, on the ridge between Marten and Fall Creeks, flowing generally northward to empty into the McKenzie from the south. Gale Creek, a major tributary, enters Marten Creek from the south and west a short distance above the mouth of Marten Creek. Spawning by the Federally-listed spring chinook, steelhead, native rainbow trout, and native cutthroat trout has been documented. While the Federally-listed bull trout has not been documented in Marten Creek, habitat was considered suitable for rearing, and they have been found nearby in the McKenzie River. Chinook and bull trout, if present, are restricted to the lower mile to a mile and half, but steelhead have been documented spawning over three miles upstream. Cutthroat trout are found throughout the watershed. Steelhead, rainbow, and cutthroat trout use Gale Creek.

Marten Creek water quality is generally good but has declined in the past 15 years as a result of increased sediment production from upstream. Timber management activities and road building have modified the hydrologic and sediment regimes. Riparian vegetation is variable, with reaches bordered by older growth and other reaches having only young alder. The stream channel shows deterioration from flooding and there is an absence of large structural materials resulting in the loss of spawning habitat and larger, deeper pools. A number of landslides and channel failures have delivered sediment and debris to the stream channels. Some of the material has flushed out of the stream, but other debris remained and formed a series of debris jams in both Marten and Gale Creeks that store sediment and debris and create barriers to upstream movements of fish. Some of the smaller tributaries retain very good habitat, while the main Marten and Gale Creeks would benefit from restoration efforts.

2.1.3. Low Elevation Headwaters of the McKenzie River Potential ACEC (Area of Critical Environmental Concern)

To qualify for ACEC status under BLM Manual 1613 (1988), an area must first be nominated as a Proposed ACEC, pass a screening evaluation that identifies the area as a Potential ACEC, and then must be designated as an ACEC within a planning environment (resource management planning or amendment process). To be designated as an ACEC, an area must also require special management prescriptions to protect the significant values that would not be prescribed in the absence of an ACEC designation. The Low Elevation Headwaters of the McKenzie River was nominated for ACEC status in February 1993. In May of 1994, the area was evaluated under the BLM ACEC Screening Criteria (BLM Policy 1613, 1988) and qualified as a Potential ACEC by containing Relevant and Important values specific to the area. The Low Elevation Headwaters of the McKenzie River Potential ACEC is currently being managed for the Relevant and Important values that were identified in the 1994 screening process as per Eugene District RMP (1995) and BLM Manual 1613 (1988). The Relevant and Important values for which the area was nominated have been considered

in the development of the Middle McKenzie Landscape Design.

The Low Elevation Headwaters of the McKenzie River Potential ACEC is a large block of minimally disturbed even-aged mature forest with scattered remnants of older forest. As shown in Table 2-1, 10 percent of the area has been harvested in the last 20 years and an estimated 68 percent of the area is 80 years old or older.

Table 2-1 ACEC Age Distribution

Age	Acres	Percentage
0-10	286	4
10-19	485	6
20-39	0	0
40-79	1605	21
80-199	5246	68
200+	0	0
nonforest	52	1
Total	7674	100

The area supports habitat important for maintaining endangered, threatened, and sensitive fish and wildlife species. The area also includes the intact low elevation Bear and Marten Key Watersheds, representing excellent conditions for water quality and other riparian values. The Potential ACEC is 7,674 acres, with 6,430 acres within the Key Watersheds. The original ACEC nomination did not recommend a "forest preserve where commercial forestry operations were to be precluded or even a long-term deferral", but rather the nomination focused on a "desire to secure the special management attention needed to adequately protect (and enhance where possible) all of the relevant and important natural values associated with these areas during all future management for commercial forest products".

The key Relevant and Important Criteria meeting the ACEC Screening Criteria for the nominated area are outlined in Chapter 5.0 Phase 4 - Evaluation and consist of the following 4 key criteria:

1. Management of the south bank of the McKenzie River scenic values
2. Management of BLM Special Status fish resources
3. Management of BLM Special Status wildlife resources
4. Management of Large Blocks of low elevation lands for wildlife

The following table outlines species that will be considered under the Landscape Design

Table 2-2 – Fish and Wildlife Species Considered in the Original Nomination for the Low Elevation Headwaters of the McKenzie River ACEC		
Special Status Species Fish and Wildlife Species Considered in the ACEC Proposal	**Status (FY1993)**	**Current Status (FY2000)**
FISH		
Bull Trout	Federal Candidate	Federal Threatened
Cutthroat Trout	ODFW Monitoring List	ODFW Monitoring List
Summer Steelhead	None	None
Chinook Salmon	Federal Candidate	Federal Threatened
WILDLIFE Known to Occur in Proposed ACEC		
Northern Spotted Owl	Federal Threatened	Federal Threatened
Mountain Quail	Federal Candidate	BLM Bureau Tracking
Northern Red-Legged Frog	BLM Bureau Assessment	BLM Bureau Tracking
Cascade Torrent Salamander	State Vulnerable	BLM Bureau Tracking
Northern Saw-Whet Owl	BLM Bureau Assessment	None
Northern Pygmy Owl	BLM Bureau Tracking	BLM Bureau Sensitive
Harlequin Duck	Federal Candidate	BLM Bureau Assessment (under review for Bureau Sensitive)
White-footed Vole	Federal Candidate	BLM Bureau Tracking
Tailed Frogs	BLM Bureau Assessment	BLM Bureau Tracking
WILDLIFE Suspected or Possibly Occurring in Proposed ACEC		
Pacific Fisher	Federal Candidate	BLM Bureau Sensitive
Pine Marten	Bureau Assessment	BLM Bureau Tracking
Oregon Slender Salamander	Bureau Sensitive	BLM Bureau Tracking

2.1.4 Federally Threatened and Endangered Species

Northern Spotted Owl – There are 8 known spotted owl sites on BLM managed lands within the AMA. At least 4 additional sites exist on private or USFS lands within one mile of BLM lands. A total of 517 acres has been allocated for these unmapped LSRs.

Bald Eagles – No known northern bald eagle midwinter roost or nest locations currently exist on BLM lands within the MMLA. There are roughly 1667 acres of BLM lands in the MMLA designated as Bald Eagle Habitat Areas (BEHAs). These lands will be managed for the maintenance of nesting and roosting habitat. All actions within these lands will be to enhance or maintain the structural characteristics necessary for bald eagle nesting and roosting.

Spring Chinook Salmon – Chinook salmon are more likely to be found in larger streams and rivers 4th order or larger, with low gradients (<3%) and drainage areas >1900 acres (Armantrout 1995). Salmon streams in this watershed are the McKenzie River, Deer Creek, and Marten Creek. The preferred temperature for fry and juveniles ranges from 54 to 57°F. Spring chinook adults enter the McKenzie River between May and August. They hold in deep pools during the summer and spawn in the September/October when the first rains come and water temperatures drop. The young spend only a short time in the area before gradually migrating to sea.

Bull Trout – McKenzie River bull trout (formerly called Dolly Varden) are the only remaining bull trout population west of the Cascades, and are found in the McKenzie River from Leaburg Dam to Tamolitch Falls. They are the top predator in the river system and feed primarily on chinook salmon juveniles. A critical limiting factor for bull trout is suitable spawning habitat. They spawn in the fall and the eggs/fry require very cold (<43°F) water. All known spawning habitat is currently in the upper McKenzie and the south fork McKenzie which is outside of the MMLA. They use the McKenzie and probably larger tributaries such as Marten and Deer Creeks for migration and feeding.

2.2. Landscape Forest Structure and Condition

2.2.1 Introduction

The MMLA is predominately mature forest. The current forest was established as a result of at least three fire disturbance episodes. Most stands generally range in age from 70 to approximately 120 years in age. Many of these stands are of high density with basal areas greater than 200 sq.ft./ac. and relative densities (RD) above a RD of 40. As a result, they are composed generally of a single or closely spaced cohorts of Douglas-fir with little development of understory vegetation or shade tolerant species. Some stands are now beginning to develop small size shade tolerant trees as an understory but, with some exceptions, this process is in its early stages.

In the western edge of this analysis area, stands with lower densities occur, and these stands

have more developed understory vegetation and a greater diversity of tree sizes and species. Here, understory vegetation is typically vine maple. Evidence of fire history is also contained throughout in a wide ranging seed bank of *Ceanothus velutinus* in the soils of this area, which appears whenever disturbance such as burning during slash disposal associated with harvest or road construction occurs.

Although most of the landscape is covered by a mature, nearly single cohort forest of almost exclusively Douglas-fir, forest types other than that indicated above also occur. Plantations of young Douglas-fir are located within the analysis area, resulting from prior clear cut harvest. These stands range from precommercial thinning age to recent clear cuts of approximately 2-3 years of age. Most of these stands are located in the western 1/3 of the area, where harvest has been more concentrated in the past.

A small amount of 50 year old forest exists within the area, and some of this type has been commercially thinned in the last few years. Additionally, there are two notable types of mixed age stands within the analysis area. One of these types is small fragments of old growth forest that survived the fires of approximately 120 years ago. These consist of a combination of old growth trees intermingled with trees dating from that fire event. Within the Bear Creek watershed, some mature forest contains two age classes, approximately 70 and 120 years of age. These resulted from fires at both 120 years ago and 70 years ago. These stands show a wider variety of sizes than do the single cohort stands that are typical of this area.

The current age class distribution is shown in Table 2-3. These are typically high density stands. As noted above, scattered remnants of 190+ age class lie typically in low slope or streamside positions. These may consist of single trees or small isolated strips and many have not been mapped. Old growth fragments assumed to be typical of stands within this area prior to the last round of fire disturbance exist in some of the headwalls in Bear Creek. Areas previously clear cut harvested in the last couple of decades, are scattered within the landscape planning area.

Table 2-3 – BLM Lands Age Class Distribution

Age class	Totals (acres)	Percentage
0	863	5
10 - 30	2532	15
40 - 60	1544	9
70	1772	11
80 - 120	9112	55
130 - 180	238	1
190+	428	3
nonforest	161	1

2.2.2 Disturbance Patterns

Fire history information can assist land managers in understanding why certain landscape patterns develop and how these systems function to support biotic and abiotic components. Information on fire frequency, fire severity, and the spatial distribution of disturbance processes are all important criteria necessary in characterizing fire events. Disturbance regimes, especially fire, occurring in forest ecosystems of the central Cascade Range, are primary factors influencing the following:

- Successional patterns of vegetation
- Species composition
- Patch sizes and patterns
- Structural components

Historic fire regimes were largely driven by such factors as climate, land type, and the biotic composition/condition of a given area. Several studies have been completed that characterize the fire regimes of the Oregon Cascades, including studies implemented within the CCAMA. Although other types of disturbances such as windthrow, insects, and landslides have influenced the landscape at smaller spatial scales and should not be ignored, fire disturbance has been a primary factor shaping the distribution and types of habitats found within the CCAMA.

2.2.3 Fire History of the Bear Marten Watershed

Fire history and fire regimes of the Bear-Marten Watershed, which occurs within the MMLA, were reconstructed during the summer of 1995 and 1997 by Weisberg (1997). The information analyzed from this project serves as a reference condition describing the historical fire disturbance patterns found within the Bear-Marten Watershed. Information about historic fire disturbance patterns has been used in the Middle McKenzie Landscape Design (MMLD) to define the range of natural variability expected within the MMLA.

Fire history was reconstructed from 1574 to1997 for the Bear-Marten Watershed. Although fire frequency and severity vary consistently for different topographic positions, and for the geographic areas north and south of the McKenzie River, the historic fire regime from 1574 to 1997 within the whole study area may be best described as a "variable regime; frequent, low intensity surface fires and long return interval, stand replacement fires (100-300 year intervals)" (Weisberg 1997).

2.2.3.1 Fire Frequency

According to Weisberg (1997), at coarser scales, the area north of the McKenzie River experienced a higher fire frequency than areas south of the river. At finer scales, fire severity was greater and reburns were less likely on wetter slope aspects, on steeper slopes, and at lower elevations. Environmental settings (e.g., mesic steep slopes) south of the McKenzie River may have lacked the frequent surface fire component, at least under the climatic conditions from the late 1500s through the mid-1800s. After 1850, fire frequency increased within the watershed and may be attributed to European

settlement and greater use along the river, a greater ability to detect small fires, and possibly a warmer climate. Fire data from 1574 to 1849 were used as the primary reference period in the MMLA because it tended to eliminate fires that may have been caused by European settlers in the area after 1850.

A variety of analyses were utilized to characterize fire frequency information. No one method by itself is a definitive indicator and all used together provide a better understanding of fire behavior. Weisberg (1998) suggests, however, that Mean Fire Interval (MFI) is the only measure that provides information about both long and short fire intervals and probably is the easiest to employ when trying to implement complex silvicultural prescriptions. It is not a measure to accurately describe what might have occurred at a specific site, but is better utilized to characterize fire behavior at coarse landscape levels. MFI was the primary indicator utilized to characterize rotation patterns in Landscape Areas 1 and 2 within the MMLA.

Fire history indicates that the Bear-Marten Watershed might be divided into spatially distinct fire regimes over at least two different scales with the larger scale important for fire frequency and the smaller scale important for fire severity. The larger scale delineation would involve splitting the watershed at the McKenzie River (see Landscape Units Map). The part of the watershed north of the McKenzie River (Landscape Area 1), and in particular the Bear Creek drainage, might be considered a higher frequency fire regime than the part south of the river (Landscape Area 2) (Weisberg 1997).

Weisberg (1997) did not specifically calculate fire frequency measures separately for Landscape Area 1 (north) and Landscape Area 2 (south). Sample points were limited in some areas within the watershed, especially in the northwestern portion of the watershed where older trees were not available for fire dating because of tree mortality from past stand replacement fires. During the period from 1574-1850 (276 years), fire data suggests that, on the north side of the McKenzie River 1-2 fires were identified that appeared to impact approximately 40 percent of the area and 3-5 fires occurred on approximately 60 percent of the area. These data suggest that on at least 40 percent of the area north of the river, the MFI was probably somewhere between 138-276 years. On about 60 percent of the landscape north of the river, a representative MFI might have been 55-92 years. 100-year MFI was selected to represent the mean disturbance frequency in Landscape Area 1. On the south side of the river a somewhat opposite pattern emerged with a greater proportion of the area undergoing 1-2 fires and a smaller proportion of the area experiencing 3-5 fires during the period from 1574-1850. A 180 year MFI was selected to represent the mean disturbance frequency in Landscape Area 2.

Fire history information from the Bear-Marten Watershed is only an approximate reconstruction of fire behavior due to inherent limitations of detecting all fire events that may have occurred in the area, and provides a general spatiotemporal fire history pattern for the area (Weisberg 1997) that can guide future management activities. Not only are low intensity fires difficult to detect but, at the opposite extreme, large fires of several hundred acres or more that may have occurred within the area leave little data to

reconstruct past fire events.

Conclusion – Silvicultural rotations in the MMLD should approximate fire intervals for Landscape Area 1 and Landscape Area 2. A rate rotation of 100 years in Landscape Area 1 (north) and 180 years in Landscape Area 2 (south) was selected for the MMLD and considered to be within the natural range of variability for Bear-Marten Watershed. Similar rotation ages for both the MMLA and the Blue River Landscape Design are also valuable for designing and implementing future research projects.

Fire history data were not collected for areas outside of the Bear-Marten Watershed that are still located within the AMA. Geology and topography were the primary criteria used to define Landscape Areas 1 and 2 where fire history information was lacking. It was assumed that land form features would be one important factor influencing fire behavior and would serve as an indicator in the absence of fire history data. The western edge of the north side of the McKenzie River from Finn Creek west was included in Landscape Area 2. Not only did this area resemble the topography of Landscape Area 2 better, but could also provide a better mix of checkerboard landscape patterns between Landscape Area 1 and Area 2 for future experimental design.

2.2.3.2 Fire Severity/Stand Structure

Weisberg (1997) reported that the fire regime for the Bear-Marten Watershed included both low-severity fires that killed only some of the overstory canopy and high-severity stand replacement fires. The landscape patterns that are currently present will fluctuate over time as disturbance events occur in the area. During the 1840s the area was predominantly old growth, and in 1590 it was predominately young Douglas-fir regeneration. Increases in fire frequency from 1850 to 1950 influenced stand composition and structure by reducing shade tolerant western hemlock and western red cedar and by decreasing available seed sources needed to sustain future establishment of shade-tolerant species.

Information from early Government Land Office (GLO) survey notes (1871 to1909) indicate that western hemlock was probably more common within the area than presently exists today. The high severity fires between 1850 and 1950 influenced successional processes resulting in the current vegetation patterns we see today which are dominated by homogenous mature Douglas-fir forests.

Low-severity fires within the watershed also influenced stand structure by killing the shade-tolerant trees in the understory and sub-canopy. Only half of the samples taken in the study area had evidence of old growth tree(s) due to high-severity fires of 1850 to 1950s. Most sites with old growth occur on the north-bounding ridge, west-bounding ridge, Deer Creek drainage, and the headwaters of the Marten Creek drainage. Areas with low-severity fire, such as drier aspects and higher elevations, tend to have more old growth tree(s) opposed to areas with high severity, stand replacement fire regimes where establishment and growth of coniferous species did not develop into mature or late seral conditions. Dr. Weisberg analysis states that existing fire history studies may not

accurately characterize fire severity (Weisberg 1998).

In other studies within the Central Cascades, Dr. Weisberg reported little difference in the fire severity between different Landscape Areas as it relates to post fire green tree retention and that differences in fire severity may be more apparent at finer scales such as hillslope position, suggesting a "weakly significant" effect of hillslope position where fires burned with lower severity in lower slope positions (Weisberg 1998). Additional research is needed on fire severity patterns to support prescriptions. His study also reported that on finer scales post fire green tree retention can be observed both as clumped and scattered individuals. Because fires often tend to be less severe in lower slope positions, conifers can survive fire and are often older age classes. Conifers that survive fires in any slope position tend to be older and of larger size classes and include a variety of structural components such as wolf trees, leaning trees and snags.

Conclusion – After harvest, the number of trees left for green tree retention and the species composition of the trees left should vary by slope position and aspect. More trees should be left on the lower slope position than on the upper slope areas near ridge lines. The number of trees left per acre does not differ by landscape area. Species composition and stand development will differ by landscape area.

2.2.3.3 Fire Size/Patch Dynamics

Weisberg (1997) suggests that fire episodes in the Bear Marten Watershed appeared to be much smaller in the 20th century than in previous years. This could have been due to increased fire suppression activities that prevented larger fires from occurring. The distribution and abundance of patches formed by fire events are important spatiotemporal elements influencing structure, function, and the composition of ecosystems. Specific historic information on patch sizes were not assessed in the Weisberg (1997) study and, where possible, may be a subject of future analysis.

2.2.4 Landscape Units

By designing management practices and techniques that fall within the historic range of disturbance patterns and processes known to occur within this landscape, it is hypothesized that structural features, functional processes, and species diversity occurring in the Middle McKenzie Landscape Area can be ecologically sustained by moving towards historical norms. This project utilizes average fire conditions that might have occurred in the area over a period of several hundred years. Forest management, such as timber harvest, differs from fire disturbance events in many important ways. This Plan seeks to utilize some components of fire history and behavior in the area and does not intend to "mimic" fire. The Blue River Landscape Project (1998) lists several important differences including the following:

- **Variability** – historical fire frequency, severity, size, and spatial pattern were all more spatially and temporally variable than the landscape management strategy.

- **Intense Fire** – the effects of an intense fire are different than the effects of timber harvest

followed by prescribed burning such as in litter consumption and nutrient cycling.

- **Harvest logistics** – the use of timber harvest machinery and roads impose limitations on the resulting opening size, configuration, and remaining forest structure.

- **Dead trees** – only a small percentage of dead trees (snags or down logs) remain on the site in comparison to a similar severity fire.

- **Frequency of low-severity-fires** – low severity fires will be significantly less frequent in this landscape management strategy than historically probably occurred in this area.

- **Large patches** – the very large patches (thousands of acres) that sometime occurred historically will not be reproduced in this landscape management strategy

The MMLD divides the MMLA into various landscape units that are intended to approximate historic fire disturbance patterns at various scales. These units are critical to scheduling of harvest and other project activities within the MMLA and they include (See Landscape Units Map):

- **Landscape Areas** – Landscape Areas are the largest ecological unit identified in the MMLD and correspond to the mean fire return interval (MFI) for the MMLA. Two distinctly different Landscape Areas have been identified in the MMLA with most of the north side of the AMA having a greater frequency of fire than the south.

- **Landscape Regions** – Landscape regions are intended to correspond in size with the outer perimeters of past wildfires. Data suggests that fires for the central Oregon Cascades vary considerably in size. Fire patches mapped in the 1930s ranged from 121 to 8,985 acres with a mean of about 840 acres. Studies suggest that large fire episodes also occurred in the area – up to 25,000 acres. Determining Landscape Regions for the MMLA is complicated by BLM checkerboard ownership. Landscape regions are based in part or in whole on six field watersheds and are thought to fall within historic size ranges for fire events.

- **Landscape Blocks** – Landscape blocks have been delineated for planning purposes associated with stand modeling and harvest scheduling. The primary goal in delineating landscape blocks was to emulate the size and distribution of disturbance patches that might be found within the MMLA at any time due to historic fire events. Data regarding the range and size of these events, however, is not readily available. While some patches were easily identified as resulting from post 1850 fire events, fires occurring prior to European settlement were not. Additional data on mean size and distribution as they relate to Landscape Areas 1 and 2 are needed to better characterize past disturbance events. In the absence of this information, other criteria were used to help identify landscape block boundaries that would help maintain the operational feasibility and ecological integrity of this area.

  The following eight criteria are not intended to be the only method of delineating

treatment areas. As Interdisciplinary Teams develop more specific adaptive management goals and site management prescriptions, or when fire history data on the size and distribution of past fire mortality patches becomes available, the criteria for delineating landscape blocks may change. Site specific analysis may also lead to minor adjustments in landscape block boundaries since block boundaries were done from aerial photos and topographic maps rather than actual on-site analysis. The following criteria were used to delineate Landscape Blocks:

(1) Existing patches of similar structural stage were maintained wherever possible.

Rationale – Large patches with interior mature forest habitat are most critical to retain. Interior, older forest habitat is the most difficult forest habitat to establish and maintain. Many of these patches are results of past post European settlement fire events.

(2) Ridges and streams were used for boundaries whenever feasible.

Rationale – Ridges and streams are easily identifiable natural features. Smaller scale natural processes and disturbances are typically confined by ridges and streams.

(3) Block boundaries were designed from stream to stream, rather than ridge to ridge, when feasible.

Rationale – Past cable harvest settings normally spanned from one ridge line to the next adjacent ridge line. Streams were impacted by removing vegetation on each side of the stream. By limiting land management treatments to only one side of a stream, the associated impacts are significantly reduced.

(4) Roads were used as boundaries in situations where ridge and stream boundaries are not feasible.

Rationale – Roads are easily identifiable artificial structures that normally follow topographic features. Depending upon the road location, width, and standard of construction, it may influence habitat conditions due to the edge effect.

(5) Blocks were delineated to include similar land forms and drainage patterns, when feasible.

Rationale – Land forms have a direct influence on disturbance processes and environmental conditions.

(6) Smaller block sizes were designated adjacent to the USFS, LSR, and private lands.

Rationale – Smaller blocks adjacent to the LSR will promote less disturbance along the MMLA and LSR interface from BLM management activities. Smaller block sizes on BLM lands adjacent to private lands will help to mitigate for areas of much larger

disturbance patterns, especially while blocks on BLM lands transition into 100 and 180-year rotation lengths.

(7) Smaller blocks were designated in the most visually sensitive areas.

Rationale – Areas that have high visual resource attributes are managed to provide the least amount of impacts to the scenic quality of the landscape. Creating smaller treatment areas in areas of high scenic quality may blend better into the surrounding landscape.

See Appendix A for a summary of landscape blocks and region acres.

3.0 LANDSCAPE MANAGEMENT STRATEGY – PHASE 2

3.1 Introduction/Summary

This chapter is the landscape design and discusses alternative ways to meet the NFP intent for ACS Objectives, green tree retention, down wood, and snag requirements. It describes the type of restoration work that might occur. The table below shows the four categories that BLM land was assigned. Non-reserve lands are where the transition and general timber harvest prescriptions apply. For the Reserves category, timber harvest may occur but would be for an objective related to the type of Reserves. The rest of this section gives a brief discussion of each component of the landscape design.

Table 3-1 – Acres by Categories

Categories	Acres	Percent
Non-Reserves	8195	49%
Reserves		
Riparian Reserve Corridors	4016	24%
Small Basin Reserves	2581	16%
Other Reserves	1858	11%

3.1.1 Landscape Areas Silvicultural Prescriptions

Based on the fire history information, the MMLA was divided into two landscape areas and each landscape area was assigned a rotation age and prescriptions. Landscape Area 1 is 6,459 acres with a 100-year rate of regeneration. Landscape Area 2 is 10,191 acres with a 180-year rate of regeneration. There are two types of prescriptions – **Transition** and **General**.

Table 3-2 – Current Acres by Age Class

Age class	Landscape Area 1	Landscape Area 2
0	346	517
10 - 39	974	1558
40 - 79	2233	1083
80 - 109	805	1451
110 - 180	2049	5044
190+	34	394
nonforest	18	141
Total	6459	10,191

The **Transition Prescription** was developed because of the existing conditions of the mature stands. Both landscape areas have high density stands and simple structured 70 and 110 year old stands. Since these stands are high density, the trees that would remain after a regeneration harvest could be highly susceptible to blowdown. In both landscape areas, thinning would increase wind firmness and reduce the susceptibility to extensive blowdown. Thinnings would also increase stand heterogeneity.

The **General Prescription** describes how stands would be managed to provide for structural and species diversity. Both landscape areas have an objective to develop and maintain complex stands with a mix of shade tolerant and intolerant species. In Landscape Area 1, the stands would be generally two-tiered and in Landscape Area 2, the stands would be generally three-tiered.

3.1.2 Green Tree Retention, Snags and Down Wood

More green trees will be left at the lower slope position than at the upper slope positions since that could be the resulting pattern from a moderate fire. The reverse would generally happen for snags and down wood. The table below shows the number of leave trees based on need.

Table 3-3 – Leave Trees

Leave Trees per Acre	Leave Tree Needs
6- 20	Green Trees
8	Snags
300 linear ft	Down Wood

3.1.3 Aquatic Reserves System

The Aquatic Reserves consist of riparian corridors on fish-bearing streams, streambank buffers on non-fish-bearing streams, Transition Prescriptions and nine Small Basin Reserves scattered throughout the MMLA.

Riparian Corridors – A one-tree height reserve will be placed on both sides of confined fish-bearing streams. A two-tree height reserve will be placed on both sides of unconfined or moderately confined fish-bearing streams.

Streambank Buffers – In general, streambank buffers on non-fish bearing streams are a 25-50 foot no harvest buffer. The combination of relatively low cutting rates, longer rotations, and higher green tree retention levels should provide sufficient large wood input, old forest habitat, and streambank stability on non-fish-bearing streams.

Small Basin Reserves – The purpose of the Small Basin Reserves is to promote contiguous habitats, meet the ACS objectives, and link with inclusions (other reserves). The Small Basin Reserves contain aquatic habitats that are fish-bearing and non-fish-bearing. As a result of

land ownership patterns, it should be noted that the Small Basin Reserves do not always consist of topographically complete basins.

3.1.4 Fuels Management Strategy

Implementation of fuels management within the MMLA, especially the use of prescribed fire, can serve as a tool to provide ecological benefits that low-severity fires likely would have provided in the MMLA. This, in conjunction with silvicultural prescriptions and timber management techniques outlined in this Landscape Design, will provide tools that can be utilized to help maintain or develop some of the above attributes.

3.1.5 Inclusions

Inclusions are areas that are to be managed differently than the surrounding general forest matrix (non-reserves). Management actions and landscape prescriptions for an inclusion area may be different from the general landscape prescriptions, including a no action option.

3.1.6 Response to Unplanned Disturbances

The forest ecosystem is dynamic. Unplanned disturbances (wind throw, disease mortality, snow damage, insect induced mortality, animal damage mortality, catastrophic and small fires) occur naturally. Many times, small natural disturbances are biologically desirable since they increase stand heterogeneity. When natural disturbances are small, the planned schedule of activities should not be altered. Large scale disturbances should be evaluated in conjunction with the management objectives of the MMLA.

3.1.7 Watershed Restoration

Restoration opportunities are similar to what would occur under the NFP and could include the following projects: instream habitat improvements, riparian vegetation site restoration, road restoration, culvert replacement, scenic improvements or mitigation.

3.2 Landscape Areas Sivilcultural Prescriptions

3.2.1 Transition Prescription for Landscape Areas 1 and 2

Objectives

- Develop wind firmness in stands below and above rotation age in both landscape areas
- In Landscape Area 1, thin 70-80 year stands while stands are still at an age to respond to thinning and before they become more susceptible to post thinning damage
- Begin silvicultural development of existing simple stands including those of the 120 year age class group toward the final complex stand type
- All stands will be within the General Prescription within 100 years in LA 1 and 180 years in LA 2
- Reduce visual impacts of past harvest boundaries

Introduction/Need

It is assumed that immediate regeneration or final harvest of high density stands could result in undesirable effects. Based on monitoring of current harvests within this landscape area, using a standard regeneration harvest under the NFP may result in significant loss of the standing green trees due to blowdown. This loss is assumed possible even in the event that special techniques are utilized, such as clustering retention trees, feathering, and avoidance of sharp density changes in canopy, and placement of retention trees in locations believed to be protected from expected wind events. The presence of blowdown along the edges of past harvest provides evidence that some different prescription may be needed.

A late thinning as a preliminary treatment to regeneration harvest may be desirable to implement on some of the landscape, while trying more traditional blowdown reduction methods elsewhere. This technique could be used to develop wind firmness in stands both below and above rotation age. While not proven effective for growth enhancement or structure development, a late thinning to encourage the development of wind firmness ahead of regeneration harvest, followed by the above techniques, would likely prove effective in retaining more of the legacy trees left at time of final harvest. These harvests would be linked, with thinning occurring approximately one decade ahead of final regeneration harvest. Areas of lower density and lower height/diameter ratios could be final harvested without a preliminary treatment.

Several past harvest edges in both landscape areas diminish the overall scenic quality. There are abrupt and highly visible edges at the interfaces of past clear cuts and fully stocked or overstocked stands. Thinnings could be used to substantially reduce crown closure in such locations, would reduce these visual contrasts, and provide a much more natural appearing forest when viewed from the McKenzie River and Highway 126.

Landscape Area 1 contains an extensive area of high density, approximately 70 year old stands, which will respond favorably to a more conventional thinning of even density without subsequent extensive blowdown. These stands are nearly at an age and density at which they will soon begin to lose resiliency and, if they are not thinned within a decade or so, risk of post thinning stand damage will increase.

Landscape Area 2 is significantly below the rotation age that would result from applying the return interval. Therefore, harvest will occur in some stands below the rotation age for Landscape Area 2. As noted above, late thinnings and subsequent regeneration harvest of sub-rotation stands could be used to transition the landscape area toward the rotation age. Coincidentally, the two major age classes nearly match the proposed ages of the second and third commercial entry. Therefore, these stands could be placed into the general silvicultural prescription at age appropriate positions. However, due to past histories of high densities, these stands will not have the structural elements that will emerge as stands are managed in accordance with the General Prescription. They would continue to retain a somewhat simpler structure until they are final harvested.

Table 3-4 shows the anticipated treatments and timing necessary to bring the existing stands into the General Prescription at the point where the General Prescription can be used for further stand development.

Table 3-4 – LA 1 and LA 2 - Transition Prescription

Current Stand Type	First Treatment Action	Second Treatment Action	Point of Entry into General Prescription
Recent regeneration harvest areas	Interplant shade tolerants into stand as needed	Move to General Prescription	PCT
Precommercial thinning stands from old clear cuts	Conventional PCT to reduce density, emphasize desired species mix, may be variable density	Uneven commercial thinning to emphasize stand heterogeneity and release understory tolerant species	At time of first commercial thinning, approximately 40 years of age
60-80 years old, stand differentiation not present	Conventional commercial thinning, reduce density to improve wind firmness, mark at an even or near even density (spacing)	2nd thinning to release future retention trees and build understory; develop heterogeneity	**Landscape Area 1**, at time of regeneration harvest as landscape and block design permits. **Landscape Area 2**, at time of 3rd thinning as landscape and block design permits
60-80 years old, stand differentiation present	Uneven density (spacing) thinning to release, develop wind firmness and maintain crown on future retention trees	**Landscape Area 1,** final harvest as landscape and block design permit. **Landscape Area 2**, move to normal prescription	**Landscape Area 1**, at time of final harvest. **Landscape Area 2**, at time of third thinning
90-120 years old, stand differentiation not present	Even density (spacing) type intermediate density management harvest to increase windfirmness and maintain crown	Uneven density (spacing) management harvest to build understory component and develop proper mix of retention trees on Landscape Area 2 only	At time of final harvest as landscape and block design permit
90-120 years old, stand differentiation present	Uneven density (spacing) intermediate harvest to target retention trees for release, or immediate regeneration harvest	Final harvest as landscape and block design permits	At time of final harvest

Narrative/Rationale

Thinnings can be used on the existing stands over and below rotation age. Lower density stands or selected areas could proceed directly to regeneration harvest with spatial arrangements designed to reduce losses to the retention trees. However, a thinning could be used in those stands where regeneration harvest is not immediately contemplated. These stands would be slower to respond, due to their longer history of high density and increased

overall height. Thinning would begin to introduce some stand diversity for those areas not targeted for immediate final harvest, while preventing fragmentation and sharp age class variation. Once these stands over rotation age are treated and wind firmness established, they can be regeneration harvested as landscape and block objectives permit.

Some of the 70-year old stands, particularly in **Landscape Area 1**, exhibit moderate levels of stand differentiation in height and diameter of trees. These stands can be moved more quickly to the General Prescription, and the treatment should utilize and develop localized variability in density.

In **Landscape Area 2**, the existing population of 70-year old stands are near or at approximately the age where the second thinning on this landscape is contemplated. While they have different structures than stands that would have gone through active management throughout their rotation, some benefit will occur provided that the stands are not so dense that they will not respond. These stands are at an age where, if treatment is not started soon, risk of stand damage after harvest will begin to rise.

Landscape Area 2 has an extensive area of high density stands of approximately 100-120 years of age. These stands could be treated to develop wind firmness. Thinnings of this type of stand, if utilized, should maintain evenness of crown density and avoid sharp changes in canopy density to minimize turbulence and variations in wind penetration into the canopy layer. Once wind firmness is developed, stand heterogeneity can be introduced with an even later thinning, or they could move to a final harvest. The purpose of these two thinnings is to first develop wind firmness and variability at a later date. In addition, since the entire watershed is below the identified rotation age, this harvest system will allow stands to approach rotation age as landscape and block objectives permit while still permitting some harvest level within the landscape area.

3.2.2 General Prescription

3.2.2.1 Introduction

This prescription has an assumed starting position of either a young pre-commercial thinning (10-15 yrs old) stand, or a recent regeneration harvest with green tree retention (GTR) that represents the best available species mix. For areas with existing high density or older stands typical of the landscape area, see **Transition Prescription** for treatments necessary to bring the stand into a position suitable for initial regeneration harvest or other elements of this prescription.

3.2.2.2 Landscape Area 1

Objectives

- Simulate a disturbance return interval typical of a more frequent fire return interval of approximately 100 years

- Develop and maintain complex two-tier stands with a mix of shade intolerant and shade tolerant species with shade tolerant species more concentrated in lower slope positions; See Appendix C for figures projecting future stand characteristics illustrating this objective

- Develop small scale spatial heterogeneity by use of gaps and clumps at all slope positions

- Alter the placement, timing, and number of snags and CWD levels to more closely simulate natural disturbance levels

Introduction – In 100 years, it is possible to produce large overstory trees with large limbs and live crowns that occupy a high percentage of tree height and an additional mix of shade tolerant trees in both overstory and understory positions creating two canopy layers. However, 100 years is not enough time to develop additional spatial variability by introducing gaps and allowing those gaps to grow to substantial size. Producing stands with more than two canopy levels will be limited to Landscape Area 2.

Therefore, a divergence in treatment between the two landscape areas begins at the first commercial thinning in which less emphasis will be on creating stand heterogeneity and more on maintenance of the overstory trees and of the shade tolerant trees within the stand than Landscape Area 2.

At the block level, more emphasis will be placed on development of shade intolerant stands on the ridgetops and higher slope positions. Shade tolerant trees, while still a component of the stands, will be more sharply attenuated within the upper slope positions than on Landscape Area 2. Overall, the level of shade tolerant trees will be lower in Landscape Area 1 due to the shorter rotation age of 100 years. This will shift the entire area towards a high percentage of Douglas-fir. Landscape Area 2 will contain a higher overall percentage of species such as western hemlock and western red cedar.

Table 3-5 – Landscape Area 1 General Silvicultural Prescription Summary Table

Prescription Elements	Landscape Area 1	Slope Position (Upper, Mid, Lower)
Rotation Age (years) / % regeneration harvested annually	100 year rotation 1.0% harvest/year	all
Landscape Block Sizes (% of area)	25%< 100ac 38% 100-200 ac 37%>200 ac	all

Table 3-5 – Landscape Area 1 General Silvicultural Prescription Summary Table		
Prescription Elements	**Landscape Area 1**	**Slope Position (Upper, Mid, Lower)**
Retention Level (% existing overstory crown closure)	30-50 % – (mainly located in sensitive areas, i.e. riparian, steep slopes)	upper: 10 – 30% mid & low: 40 – 50% *retention minimum ≥ 6 trees trees/acre , plus additional trees for cwd and snags to be treated during stand establishment
Retention Mixture, GTR (concept; species dependent upon aspect, slope position, and microsite)	Select a range of mature tree species that promote a range of biodiversity; include large, decadent, windfirm trees	When available; shade intolerant shade tolerant upper – 80% ----------20% mid & low – 60 % ----40%
Reforestation Density (trees per acre)	Reforestation will combine planting and GTR seed source	Planting: upper - 300 TPA mid & low - 300 TPA
Reforestation Mixture (species dependent upon plant series/association)	Varies with slope position	Species will include; Douglas fir, western hemlock, western red cedar. Species will be placed according to slope, aspect, elevation, and micro-site. Select species using local stand exam data
First Thinning. pre-commercial at 10-15 yrs. (trees left per acre)	Approx. 300 TPA (pct) stand establishment *plan for GTR seeding	upper – 300 TPA; limit Douglas fir to 250 TPA mid & low – 300 TPA *adjust species composition adjust CWD and snag level by treatment of GTR (originally dedicated for cwd at regen)
Second thinning, commercial thin at year 40-50	Upper & mid slope - develop stands w/ commercial trees per acre lower slope - develop stands for large individual trees and understory growth	upper and mid - 100 to 110 leave trees lower - 60 to 80 leave trees plus additional trees for cwd and snags *adjust species composition, release shade tolerant species
Third thinning, commercial thin at year 60-70	Approx. 50-60 TPA develop individual tree strength, characteristics, gap openings	all slope positions; 50-60 leave trees in the overstory at year 70 (commercial thinning). plus additional trees for cwd and snags *adjust species composition by either commercial or non-commercial entry
Final harvest @ 100 yrs	6-20 long-term retention trees,(GTR) These trees are necessary to promote historical conditions of fire frequency and severity. The units will not have less than 6 GTR's/acre plus additional trees for cwd and snags	Retention levels -- upper and mid; added buffers to sensitive areas, riparian areas, create clumps and multiple canopies. lower - placed near riparian buffers and sheltered areas to ensure long-term sources of large dominant trees of multiple species.

Narrative

a. **Reforestation mixture** shall be placed according to aspect and slope position. Placement of shade tolerant species shall be higher in lower slope positions. In addition, shade tolerant species shall be placed in higher percentages on cooler aspects, and the combination of slope and aspect will combine to increase the percentage of shade tolerant species higher upslope on cooler (North and East facing) aspects. The purpose of this guideline is to emulate the tendency for fire disturbance to be cooler at lower slope position and, to some extent, on cooler and wetter aspects. In **Landscape Area 1**, use of shade tolerant trees will rapidly drop off at higher slope positions. Due to shorter rotations in this landscape area, full development of the shade tolerant trees will be more limited, and their use will be somewhat confined to either a similar age and crown class as the Douglas-fir, or as a second tier of shade tolerant trees.

b. **First pre-commercial thinning** will provide an opportunity to adjust stocking levels to maintain full live crowns, and to adjust for unpredictable levels of natural reproduction from the GTR mix. At this time, stocking species will be adjusted to return any stocking species percentage levels to that similar to the guideline above relative to slope position and aspect. Gaps of various sizes may be created at this time to introduce stand spacing and stocking level heterogeneity into the stand to advance stand differentiation and to develop areas with highly dominant trees around these gap areas. Coupled with this action may be the introduction of tolerant species' seedlings into areas that are deficient in tolerant species, and to begin development of "second tier" trees. In addition, some GTR may be treated at this time to develop snags and CWD, and to reduce overstory shade to levels permitting faster growth for the understory stand.

c. **First commercial thinning** will be designed to maintain full live crowns on stand trees and to prevent self-thinning or excessive loss of lower crown. This thinning will retain the largest trees in the stand, and will be somewhat uneven in spacing. In addition, it will retain shade tolerant species relative to slope position and aspect and will provide release of some shade tolerant trees. Coupled with this activity will be an additional opportunity to convert some of the GTR trees and some stand trees to snags and CWD if levels are deficient in these two elements. This thinning will be at a wider spacing in lower slope positions to encourage growth of tolerant trees in the understory, while maintaining a mostly Douglas-fir stand in higher positions.

d. **Second commercial thinning** will be designed to continue maintenance of two key elements. First, those trees destined for future retention will be maintained at density levels that permit continued rapid individual tree growth. Second, shade tolerant trees, which will be below the main crown canopy, will be released by removal of both some overstory and adjacent shade tolerant trees. This will be an additional opportunity to readjust the species levels to those related to slope position and aspect in the event that gaps created in previous thinnings have levels of advanced shade tolerant trees that are not at desired stocking levels or species percentages. Some

gaps may be considered for non-commercial treatments if they have trees below commercial size.

e. **Final harvest** will leave a mix of GTR trees that will emphasize a mix of shade tolerant and shade intolerant at lower slope positions and cooler aspects, and that will emphasize trees such as Douglas-fir and other shade intolerant (if present) trees on higher slope positions. However this emphasis is not to exclude tolerants from higher slope positions. These could be maintained in clumps or other favorable aspects. Contrasted with Landscape Area 2, this landscape area will exhibit a sharper drop-off in shade tolerant trees with increasing slope position.

f. **Within this Landscape Area**, spatial heterogeneity should be expressed in the placement of patches of denser GTR in upper slope positions and in gaps located particularly in lower slope positions. For this Landscape Area, the number of patches/gaps will be less, and their deviation from the normal levels less pronounced than in Landscape Area 2

3.2.2.3 Landscape Area 2

Objectives

- Simulate a disturbance return interval typical of a more frequent fire return interval of approximately 180 years.
- Develop and maintain complex three-tier stands with a mix of shade intolerant and shade tolerant species, with shade tolerant species more concentrated in lower slope positions and at generally higher overall levels in the area than Landscape Area 1. In this area tolerant species will occur at higher slope positions than Landscape Area 1. See Appendix C for figures projecting future stand characteristics illustrating this objective.
- Develop small scale spatial heterogeneity by use of gaps and clumps at all slope positions.
- Alter the placement, timing, and number of snags and CWD levels to more closely simulate natural disturbance levels.
- Maintain shade intolerant species levels by use of gaps and small patch removal. This Landscape Area will have a higher level of gaps than Landscape Area No. 1.

Introduction

It is assumed that a 180-year rotation is sufficient time to create stands that simulate late-successional forest in a number of key elements. This amount of time is sufficient to produce large overstory trees with large limbs and live crowns that occupy a high percentage of tree height, an additional mix of shade tolerant trees in both overstory and understory positions creating multiple canopy layers, multiple cohorts, gaps and stand heterogeneity, and a

sufficient supply of snags and CWD in various decay classes.

Table 3-6 -- Landscape Area 2 General Prescription Summary Table		
Prescription Elements	**Landscape Area 2**	**Slope Position (Upper, Mid, Lower)**
Rotation Age (years)/% regeneration harvested annually	180 year rotation 0.56% harvest/year	all
Landscape Block Sizes (% of area)	40% < 100 ac 36% 100-200 24% > 200 ac	all
Retention Level (% existing overstory crown closure)	40– 50 % - (mainly located in sensitive areas, i.e. riparian, steep slopes)	upper: 10–30% mid & low: 40–50% *retention minimum ≥ 6 trees/acre plus additional trees for cwd and snags
Retention Mixture, GTR (concept; species dependent upon aspect, slope position, and microsite)	Select a range of mature tree species that promote a range of biodiversity; include large, decadent, windfirm trees	When available; shade intolerant shade tolerant upper – 70% ---------30% mid & low – 50 % ----50%
Reforestation Density (trees per acre)	Reforestation will combine planting and GTR seed source	Planting: upper - 300 TPA; Douglas fir to 250 TPA Mid & low - 300 TPA
Reforestation Mixture (species dependent upon plant series/association)	Percentage of species related to slope position	Species will include; Douglas fir, western hemlock, western red cedar, grand fir. Species will be placed according to slope, aspect, elevation, and micro-site.
First Thinning, pre-commercial at 10-15 yrs. (trees left per acre)	Approx. 300 TPA (pct) stand establishment *plan for GTR seeding	Upper – 300 TPA; Mid & low – 300 TPA plus additional trees for cwd and snags *adjust species composition
Second thinning, commercial thin at year 40–50	Upper & mid slope - develop stands w/ commercial trees per acre lower slope - develop stands for large individual trees	Upper & mid – 100 to 110 leave trees lower – 60 to 80 leave trees plus additional trees for cwd and snags *Adjust species composition, release shade tolerant species in lower slope position, limit Douglas fir to 60 TPA
Third thinning, commercial thin at year 60–70	Approx. 50–60 TPA develop individual tree strength, characteristics, gap openings	All slope positions; 50–60 leave trees at year 70 (commercial thinning) plus additional trees for cwd and snags

Table 3-6 -- Landscape Area 2 General Prescription Summary Table		
Prescription Elements	**Landscape Area 2**	**Slope Position (Upper, Mid, Lower)**
Fourth thinning commercial thin at year 90–100	40–50 TPA	All slope positions, 40– 50 large overstory leave trees at year 100 (commercial thinning); plus additional trees for cwd and snags Develop individual tree strength and characteristics, gap openings. Thin understory to lower intra cohort competition and reduce overall density
Final harvest @ 180 yrs	6–20 long-term retention TPA GTR plus additional trees for cwd and snags These trees are necessary to promote historical conditions of fire frequency and severity. The units will not have less than 6 GTR/acre.	Retention levels – upper & mid – added buffers to sensitive areas and riparian areas, create clumps and multiple canopies. lower – placed near riparian buffers and sheltered areas to ensure long-term sources of large dominant trees of multiple species.

Narrative

a. **Reforestation mixture** shall be placed according to aspect and slope position. Placement of shade tolerant species shall be higher in lower slope positions than LA 1. In addition, shade tolerant species shall be placed in higher percentages on cooler aspects, and the combination of slope and aspect will combine to increase the percentage of shade tolerant species higher upslope on cooler (north and east facing) aspects. The purpose of this guideline is to reproduce the tendency for fire disturbance to be cooler at lower slope position and, to some extent, on cooler and wetter aspects.

b. **First pre-commercial thinning** will provide an opportunity to adjust stocking levels to maintain full live crowns on reproduction, and to adjust for unpredictable levels of natural reproduction from the GTR mix. At this time, stocking species will be adjusted to return any stocking species percentage levels to that similar to the guideline above relative to slope position and aspect. Gaps of various sizes may be created at this time to introduce stand spacing and stocking level heterogeneity into the stand to advance stand differentiation and develop areas with highly dominant trees around these gap areas. Coupled with this action may be the introduction of tolerant species seedlings into areas which are deficient in tolerant species, and to begin development of "second tier" trees. In addition, some GTR may be treated at this time to develop snags and CWD, and to reduce overstory shade to levels permitting faster growth for the understory stand.

c. **First commercial thinning** will be designed to maintain full live crowns on stand trees and to prevent self-thinning or excessive loss of lower crown. Development of Late-Successional structure, particularly large limbs, requires maintenance of some trees at nearly open grown conditions. This thinning will retain the largest trees in the stand, and will be non-uniform in spacing. In addition, it will retain shade tolerant species at levels and will provide release of some shade tolerant trees. Coupled with this activity will be an additional opportunity to convert some of the GTR trees and some stand trees to snags and CWD if levels are deficient in these two elements.

d. **Second commercial thinning** will be designed to continue maintenance of two key elements. First, those trees destined for future retention will be maintained at density levels that permit continued rapid individual tree growth. Second, shade tolerant trees, which will be below the main crown canopy, will be released by removal of both some overstory and adjacent shade tolerant trees. This will be an additional opportunity to readjust the species levels to those related to slope position and aspect in the event that gaps created in previous thinnings have levels of advanced shade tolerant trees that are not at desired stocking levels or species percentages. Some gaps may have to be treated with non-commercial treatments if there are trees below commercial size.

e. **Third commercial thinning** at age 100 will maintain large dominant trees, maintain

shade tolerant trees in both the overstory and understory, and will create gaps that will serve to begin development of an additional canopy layer in those gaps. This thinning will be quite uneven, and will result in opportunities to adjust species mix within the stand to return the stand to desired species mix. If desired, gaps may be made large enough to provide areas where shade intolerant trees may seed in and develop small areas or pockets of a second age cohort of Douglas-fir. If this occurs, a later non-commercial entry may be needed to adjust stocking levels within those larger gaps.

f. **Final harvest** at age 180 will provide for initiation of another rotation. At this time GTR should be provided to accomplish the following objectives:

- any landscape objectives such as wildlife corridors.
- protection of sensitive or unusual areas or features, etc.

In addition, GTR will be adjusted for slope positions. Higher levels of both tree density and higher levels of shade tolerant trees will occur at lower slope positions. However, intermittent areas of lower density GTR should be provided at lower slope positions to provide for areas where natural fine-scale disturbance events may have occurred. This will provide areas where a continued presence of shade intolerant trees such as Douglas-fir will be maintained in lower slope and riparian areas.

g. **Within this Landscape Area**, spatial heterogeneity should be expressed in the placement of patches of denser GTR in upper slope positions and in gaps located particularly in lower slope positions. For this Landscape Area, the number of patches/gaps will be higher, and their deviation from the normal levels more pronounced than in LA 1.

3.3 Green Tree Retention

3.3.1 Objectives

- To emulate, where possible, natural disturbance patterns at the landscape area scale while creating variable patterns across landscape blocks.
- To provide habitat for terrestrial and aquatic plant and animal species.
- To protect and manage for biologically, physically and/or visually sensitive areas.
- To integrate riparian and upslope management concerns.

3.3.2 GTR Management Guidelines

Green tree retention (GTR) refers to retaining live conifer trees. Green trees in regeneration harvest units will be placed in accordance with the silvicultural prescriptions indicated above. Sizes will range across the diameters found within the stand, and will be generally representative of the diameters within the stand. However, some bias towards larger diameters to improve the height/diameter ratios of GTR to increase wind firmness

may occur. Smaller trees will be left only where they have a likely possibility of surviving harvest treatments. These trees may be clumped or scattered in order to provide appropriate conditions for growth of the new stand, as shown in the silvicultural prescriptions. Higher slope positions would average approximately 6 TPA and lower slope positions would average up to 20 TPA, with a density gradient established between. Slope position should be determined on the block or overall stream to ridgetop position. Any single harvest unit may or may not span the entire range of GTR density depending upon the specific harvest design and placement of the unit within the block.

3.3.3 Rationale

Overstory composition and shade tolerant species at the landscape block scale – Historically, the amounts and distribution of shade tolerant species within a stand were influenced by site moisture, hill slope aspect, and hill slope topographic position. North facing slopes, more mesic conditions, and lower hill slope position probably resulted in greater relative dominance of shade tolerant species and individuals within a stand. To emulate these natural processes within a landscape block, more shade tolerant species (e.g., western red cedar, western hemlock) will be retained or planted near riparian zones or other more mesic conditions and on north facing slopes. Retention and planting levels for shade tolerant species should be examined for all stand entries. Although planting of shade-tolerants may occur after any entry, emphasis will be placed on planting after precommercial thinning and the first commercial thinning entries.

Qualitative Considerations and Spatial Criteria of Retained Green Trees – Retention trees should be both clumped and scattered individuals. Clumps could range in size up to five acres. Larger blocks should have more or larger clumps. Scattered individual trees can range from 40 to 70 percent of the total retention trees. Scattered or clumped retention trees should be spatially arranged or retained to:

- Create a variable pattern within a landscape block.
- Leave a variety of size classes while meeting objectives for target levels and species retention mixture.
- Leave some of the largest, oldest live trees, decadent trees, wolf trees, and hard snags, if available, while also retaining appropriate levels of shade tolerant species.
- Leave higher levels of retention near streams and lower slope positions, and lower levels on upper slope areas.
- Use GTR to minimize edge contrast in visually sensitive areas.
- Use GTR to "feather" harvest unit boundaries to mitigate for windfall, abrupt microclimate gradients, and other edge effects, including providing shade and sediment control along non-fishbearing streams.
- Leave individual or smaller clumps of hardwood trees where operationally feasible. Interdisciplinary teams will evaluate large clumps and apply site specific management where appropriate, which would be similar to NFP.
- Retention trees could be placed around Inclusions to provide larger areas of refugia or additional protection. Retention trees could also be retained to protect or

enhance resource habitat features such as snags or down wood, bat roost sites etc.

3.4 Snags and Down Logs

3.4.1 Objectives and Rationale

Coarse woody debris is discussed in detail in Appendix F: Coarse Woody Debris (Snags, Down Logs, and Large Woody Debris in Streams) and includes discussion on the data analyses and rationale used to develop CWD management levels, and details and implementation specifications for attaining the prescribed levels.

The main objective is to provide a quantity of large sound snags and down logs, throughout the life of the stand that more closely approximate levels expected to occur in natural stands of the western hemlock plant series on the west slope of the Cascade Range in Lane County. Managed levels will focus on maintaining specified amounts and types of snags and down logs throughout the life of the stand because they are the minimum quality required by most snag dependent species. To manage for quality and quantity of snags and down logs more closely resembling that typical in natural stands, it will be necessary to periodically maintain and create dead wood throughout the development of forest stands managed for wood products.

3.4.2 Snag Management Guidelines

Snag creation and retention will be managed at each regeneration or commercial thinning entry occurring roughly between ages 30-100 years in Landscape Area 1 and 30-180 years in Landscape Area 2. Management guidelines were developed for three potential treatment types: regeneration harvest, pre-commercial, and commercial thinnings (see Table 3-7). Snags are described as follows:

- "sound" are in the early stages of decay in decay class 1-3 and
- "decayed" are in later stages of decay in decay class 4-5 as described by Cline, 1980.

The number of prescribed large sound snags was generated from data gathered in natural stands within and similar to those in the planning area. Snag levels are prescribed for the age classes where harvest treatments are expected to occur. Details on attaining the snag requirements are described following the same table in Appendix F. Snags will be retained/created at all harvest entries and will attempt to emulate natural distribution, especially at regeneration harvest, by creating higher amounts upslope where GTR is lowest and natural mortality highest.

Table 3-7 (= Table F-4 in Appendix F)
Snag Requirements and Specifications by Treatment Type and Age Class

Harvest Treatment	Snag Requirements	Snag Creation/Retention Specifications	Retention and Creation Methods For Harvest Areas (See creation methods in Appendix F)
Regeneration (any age)	≥ 8 /acre	All ≥ 50 ft tall All ≥ 16"dbh 50 % ≥ 20" dbh 50 % ≤ Decay class 1-2	Retain all existing decayed and sound snags to the extent possible. Create snags if retention levels are below Snag Requirement levels. *If stand must stabilize after regen, create at least half of the snags at regen and remaining snags within 10 - 15 yrs..*
Precommercial Thinning - A (15 - 35 yrs) ***For stands with previous harvest implemented PRIOR TO MMLD***	Depends on availability and needs.	None	Retain all existing decayed and sound snags. Create snags from existing overstory/leave trees if possible, based on availability.
Precommercial Thinning - A (15 - 35 yrs) ***For stands with previous harvest implemented UNDER MMLD***	≥ 8/acre	None (unless creation treatments not yet completed from regen)	Retain all existing decayed and sound snags. Any remaining green trees dedicated for snag creation at time of regeneration harvest not yet treated should be treated before or during this entry.
Commercial Thinnings (30 - 80 years in LA 1 30 -110 years in LA 2)	≥ 8/acre	Stands < 80 yrs: All ≥50 ft tall All ≥ 16 " dbh 50% ≥ 18-20 " dbh (if available) 50 % ≤ Decay class 1-2 Stands ≥ 80 yrs: ≥ 70 ft. tall All ≥ 16"dbh 50 % ≥ 20" dbh 50 % ≤ Decay class 1-2	Retain all existing decayed and sound snags to the extent possible. Create snags if retention levels are below Snag Requirement levels. If the stand does not contain enough live trees of the appropriate diameters, create "living snags".

3.4.3 Down Log Management Guidelines

Down log creation and retention will be managed at each regeneration or commercial thinning harvest entry occurring roughly between ages 30–100 years in Landscape Area 1 and 30–180 years in Landscape Area 2. Management guidelines are specified for three potential treatment types: regeneration harvest, pre-commercial, and commercial thinnings (Table 3-8). Logs are described as:

- "sound" - in early stage of decay in decay class 1-3 and
- "decayed" - in later stages of decay in decay class 4-5, as described by Fogel (1973) and Maser et al. (1979) – see Appendix D.

Details on attaining the down wood requirements are described following the same table in Appendix F. A minimum of 240 feet will be created at time of harvest unless it is determined that the risk of blowdown in the harvest unit is high enough to anticipate excessive loss of green trees. After the stand has stabilized, additional down logs will be created (if necessary to attain 300 lf./ ac.) within 10 years. Down logs will be retained/created at all harvest entries and will attempt to emulate natural distribution, especially at regeneration harvests, by creating higher amounts upslope where GTR is lowest and natural mortality highest.

Table 3 - 8 (= Table F-8 in Appendix F)
Down Wood Requirements and Specifications
by Harvest Treatment for a Mixed-severity Fire Regime in the MMLD

Harvest Treatment	Down Log Requirements [1] In Linear Feet/Acre	Down Log Specifications [2]	Retention and Creation Methods Maintain all existing decayed and sound logs, ≥ 16 inch diameter, on the forest floor to the extent possible for all harvest treatments AND:
Regeneration (any age)	300 lf / ac.	All created/retained logs that contribute to achieving 300 lf / ac should be : conifer species AND ≥ 20 in. diameter at small end and ≥ 20ft. length [2] AND > 50% must be sound (decay class 1 or 2) [2]	Retain and/or create down logs to meet the required amounts by falling trees that meet the specifications. *Create a minimum of 240 lf at regen (see exceptions in 3.4.3 section)* *If stand must stabilize after regen, create remaining logs within 10-15 yrs.*
Precommercial Thinning - A (15-35 yrs) ***For stands with previous harvest implemented PRIOR to MMLD***	300 lf / ac.		Retain and/or create down logs to meet the required amounts by falling existing trees that meet the specifications, if available and/or Maintain future reserve trees for the next commercial thinning.
Precommercial Thinning - B (15-35 yrs) ***For stands with previous harvest implemented UNdER MMLD***	NONE if target amounts created during regeneration harvest		Any remaining untreated green trees, dedicated for down logs at the time of the previous regeneration harvest, should be treated during this entry.
Commercial Thinnings (35 - 80 yrs in LA 1; 35 - 110 yrs in LA 2)	300 lf / ac.		Retain and/or create down logs to meet the required amounts by falling trees that meet the specifications. Used trees with diameters ≥ 16 inch and ≤ 20 inch only when trees ≥ 20 inch diameter are not available.

[1] See Table F-9 in Appendix F fFor # logs required based on d.b.h. to meet linear feet requirements.
[2] Exceptions to this requirements are permitted when doing so would be an advantage to local wildlife, or plant/fungal species. For example, creating or maintaining smaller down logs in an area known to be used by clouded salamanders or *Allotropa virgata.*

3.5. AQUATIC RESERVES SYSTEM

3.5.1 Objectives

Aquatic Reserves (see Aquatic Reserves Map) were established to ensure that aquatic habitats and processes are maintained and protected, and that management for aquatic features is integrated with upslope management. In particular, the Aquatic Reserves are meant to ensure that the Aquatic Conservation Strategy Objectives (ACSO) and key watershed requirements in the Northwest Forest Plan will be met. Stream characteristics, geomorphic setting, and key species refugia set the context for Reserve decisions. The Aquatic Reserves System in the MMLA is composed of three parts, Small Basin Reserves, Riparian Corridors, and Streambank Buffers.

3.5.2 Small Basin Reserves

Nine Small Basin Reserves were established to meet the ACSO and to provide connectivity between upland and riparian areas and to link to other reserve areas. The Small Basin Reserves contain aquatic habitats that are fish-bearing and nonfish-bearing. This habitat delineation is important because high quality nonfish-bearing habitats tend to be critical for nonfish aquatic species that have the potential to flourish in the absence of fish predation. Small Basin Reserves are designed to maintain and provide for late-successional habitat. It is assumed that historic fires would have left large patches of undisturbed habitat like the Small Basin Reserves.

Reserves are dispersed across elevation zones in locations of high aquatic diversity. In particular, selected reserves were placed in headwater locations to benefit Cascade torrent salamander, tailed frogs, and aquatic invertebrates; in locations with high potential to contribute wood and other materials to stream through mass soil movements; and serve as refugia for aquatic and riparian plants and fungi. Where possible, reserves encompass or adjoin Late-Successional Reserves associated with northern spotted owls and areas with high concentrations of late- successional habitat. **Appendix B** further depicts the selection process for the Small Basin Reserve areas.

The nine Small Basin Reserves in the planning area are Finn - SBR 1, Indian - SBR 2, Minney - SBR 3, Bear/LSR Extension - SBR 4, Upper Bear - SBR 5, West Fork Deer - SBR 6, Upper Marten - SBR 7, Middle Marten - SBR 8, and Gale - SBR (see Small Basin Reserves Map). It should be noted that the Small Basin Reserves do not always consist of topographically complete basins because of BLM land ownership patterns.

The Small Basin Reserve group was collectively designed to meet the following objectives:

- To be distributed across drainages and elevations in areas of high aquatic habitat diversity
- To contain headwaters areas
- To maintain cool microclimates and structure for sensitive species and invertebrate populations
- To encompass and adjoin existing LSR for LSR dependent species
- To contain areas with concentrations of unstable slopesTo connect high probability landslide debris flow source areas to the aquatic habitat
- To have high potential to contribute wood and other material through mass soil movements
- To protect areas critical for fulfilling life history requirements of sensitive species
- To be located for the benefit of aquatic and terrestrial plants

3.5.3 Riparian Corridors – Fish-bearing Streams

Aquatic reserves also consist of a series of riparian corridors along all fish-bearing streams. The corridors are essentially linear and occupy the entire valley bottom and adjacent toe-slopes. These corridors connect aquatic, riparian, and upland areas throughout the planning area and link with the Small Basin Reserves.

A two-tree height reserve should be placed on both sides of unconfined fish-bearing streams. Unconfined fish-bearing streams have valley bottoms that are 12 times the average stream width or greater. A one-tree height reserve will be placed on both sides of confined fish-bearing streams. Confined fish-bearing streams have valley bottoms that are less than 12 times the average stream width or greater.

Riparian corridor should be managed equivalent to Riparian Reserves as specified in the Northwest Forest Plan. Management activities in the Riparian Corridors include the development of snags and downed logs, underplanting to improve species composition, and density management to improve stand condition and structural diversity relative to the ACSOs.

3.5.4 Streambank Buffers – Non-Fish-bearing Streams

A 25-50 foot no entry zone on either side of the channel will be left for streambank stability under both the transition and general silvicultural prescriptions. The combination of relatively low cutting rates, longer regeneration rotations, and higher green tree retention levels at the landscape level should provide sufficient large wood input, old forest habitat, and streambank stability for non-fish-bearing streams.

Non-fish-bearing perennial and intermittent streams are smaller and steeper, and are generally highly confined. Since 70 percent of stream miles are typically in the smaller headwater streams, they are important areas for determining downstream flows and sediment movements in addition to providing habitat for a variety of species. Structural materials, particularly larger wood, are important in creating a stair-step configuration within these systems. The stair-step configuration reduces erosional energy and creates small low gradient patches where surface flows more readily enter the groundwater. These flats often accumulate deposits of small particle sediments which function as habitat for invertebrates, amphibians, and other species .

3.5.5 Streamside Management Area Prescription for Nonfish-bearing Streams

A "Streamside Management Prescription" would be applied within the streamside management area that is an ½ to 1 site tree distance beyond the no entry zone. See figures 3-1 and 3-2 for a illustration of the streamside management area location. The Streamside Management Prescription purpose is to reduce temperature and microclimate effects that may be higher than on subsequent entries due to the single cohort of trees occupying much of the landscape headwaters. After more complex multi-cohort stands have been established in proximity to these channels, the streamside management prescription should end and the General Prescription would be applied.

Figure3-1 Perennial Stream

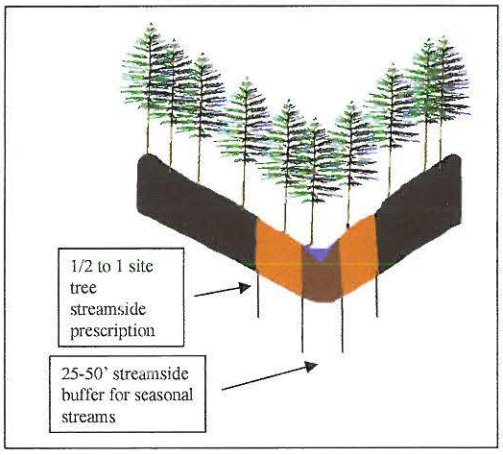
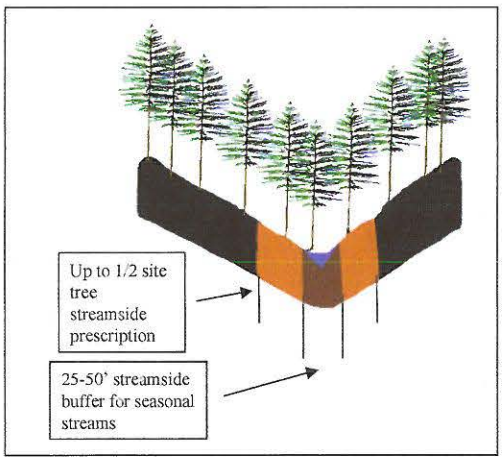


Figure 3-2 Intermittent Stream



Ta

ble 3-9 summarizes the timber harvest prescriptions and down log recommendations and/or requirements for fish-bearing, perennial non-fish-bearing, and intermittent streams. Other management activity may occur within the riparian management areas similar to that which could occur within the NFP Riparian Reserves. Some DWD or in-stream LWD are required and some are recommended. The following are items for the ID team consideration if they choose to utilize timber harvest techniques as a tool for enhancing streamside management areas:

- 8 trees per acre would be left for snags or snag creation and should be $\geq$ 16-20 inch d.b.h and 50 + feet long.
- Stand treatment for riparian zone health, stream improvement, etc. may be prescribed within the "no entry zone" on any stream type.
- For all stream treatments on all fish-bearing streams, down log amounts within Riparian Reserves and no-entry zones should be modified as new information is available. Amounts to create may depend on harvest activities adjacent to the stream or other decisions to create down wood for stream restoration projects.
- Down Log Pieces (CWD, LWD) should be conifers $\geq$ 20 " d.b.h.(at small end) and 20 feet long, with $\geq$ 50 % in decay class 1-2.
- In-stream Large Woody Debris Pieces (LWD) should be conifers $\geq$ 20 "d.b.h.(at small end) and 20 feet long, These lengths could be larger or smaller based on stream size, topography, etc. Some of the trees left for down wood should be placed into streams as LWD.

Table 3-9 – Streamside Management Prescriptions for Harvest, GTR, DWD, and LWD					
MMLA Plan Stream Type	**MMLA Streamside Mgmt Areas: Sizes & Characteristics**	**Streamside Management Area**		**Riparian Habitats: Terrestrial Down Log and In-stream Large Woody Debris Requirements (maintain/create)**	
		Transition	General	**Transition**	General
Fish-bearing streams, unconfined	2 site tree reserve	Standard NFP Actions Thin to ≥ 50 TPA or 60% CC	Standard NFP Actions Thin to ≥ 50 TPA or 60% CC	240 lf/acre *DWD recommended*	240 lf/acre *DWD recommended*
	25-50 ft no entry zone for stream bank stability (within the 2 site tree reserve) [B]	No entry width of 25-50 ft	No entry width of 25-50 ft	1 piece/66 ft *LWD into stream channel recommended*	1 piece/66 ft *LWD into stream channel recommended*
Fish-bearing streams, confined	1 site tree reserve	Standard NFP Actions Thin to ≥ 50 TPA or 60% CC	Standard NFP Actions Thin to ≥ 50 TPA or 60% CC	240 lf/acre *DWD recommended*	240 lf/acre *DWD recommended*
	25-50 ft no entry zone for stream bank stability (within 1 site tree reserve)	No entry width of 25-50 ft	No entry width of 25-50 ft	1 piece/66 ft *LWD into stream channel recommended*	1 piece/66 ft *LWD into stream channel recommended*
Non fish-bearing Perennial streams	Stream side management prescription applied: 1/2 to 1 site tree beyond the 25-50 ft. no entry zone. Determined by local conditions	Thin to 50% canopy cover (≥40 TPA) or 40 TPA	Apply Upland Thinning General Prescription	Thinnings - 300 lf/acre *DWD required*	Thinnings - 300 lf/ac *DWD required*
		no regeneration harvest 1st rotation	Apply Upland General Prescription Regeneration leave 10- 20 TPA	N/A	Regen - Leave 1 piece/66 ft *LWD into stream channel recommended*
	25-50 ft no entry zone for streambank stability	No entry width of 25-50 ft	No entry width of 25-50 ft	Some of the down log level of 300 lf/ac should be created/maintained as in stream LWD- *recommended*	Some of the down log level of 300 lf/ac should be created/maintained as in stream LWD- *recommended*
Non fish-bearing Intermittent streams	Stream side management prescription applied 1/2 site tree beyond the 25-50 ft. no entry zone.	Thin to 50% canopy cover (≥40 TPA)	Apply General Thinning Prescription	Thinnings - 300 lf/acre *DWD required*	Thinnings - 300 lf/acre *DWD required*

Table 3-9 – Streamside Management Prescriptions for Harvest, GTR, DWD, and LWD					
MMLA Plan Stream Type	**MMLA Streamside Mgmt Areas: Sizes & Characteristics**	**Streamside Management Area**		**Riparian Habitats: Terrestrial Down Log and In-stream Large Woody Debris Requirements (maintain/create)**	
		Transition	General	**Transition**	General
		Regeneration harvest to 10 - 20 TPA,	Apply General Regeneration Prescription	Regen - 300 lf / acre *DWD required*	Regen - 300 lf / acre *DWD required*
	25-50 ft no entry zone for streambank stability	No entry width of 25-50 ft	No entry width of 25-50 ft	Some of the down log level of 300 lf/ac should be created/maintained as in stream LWD - *required*	Some of the down log level of 300 lf/ac should be created/maintained as in stream LWD *required*

CWD = Snags and logs. **LWD** = Large woody debris (logs) in active stream channel.
DWD = terrestrial down woody debris (logs) **NA** = Existing stand will not be harvested.
CWD and LWD amounts within NFP Riparian Reserves widths for fish-bearing streams are recommended levels. Project ID teams should decide if these or other amounts should be applied at time of harvest or during restoration or other activities. CWD amounts within NFP Riparian Reserves widths for nonfish-bearing streams are required at time of harvest entries. Some of the DWD logs should be dedicated as in-stream LWD for these streams.

3.6 Fuels Management Strategy

The fire regime for the Bear-Marten watershed within the MMLA included both low-severity fires that killed only a small proportion of the overstory, and the high-severity stand replacement fires. The low severity fires influenced stand structure by killing shade-tolerant trees in the understory and subcanopy, and not allowing old growth western hemlock and western red cedar to develop as an important stand component except in the most mesic stands (Weisberg 1997). The Blue River Landscape Management and Monitoring Strategy points out several attributes of low-severity fires:

- Kills a small proportion of overstory trees to create snags and future down wood
- Reduces fuel loading and fuel ladders, lowering the probability of future high-severity fires
- Simulates herb and shrub growth by increased light levels and through an initial flush of nutrients released by the fire
- Provides horizontal heterogeneity to understory habitats
- Provides a mix of fine-scale habitats

The Eugene District is currently working on an Interagency Integrated Natural Fuels Management Strategy (INFMS) and potentially a Fuels Management Plan that will help outline the fuels management priorities for the Eugene District. The implementation of actions within the MMLA will be addressed in the context of District priorities. Completion of these documents is currently scheduled for 2001. Implementation of fuels management within the MMLA, especially the use of prescribed fire, can serve as a tool to provide ecological benefits that low-severity fires likely would have provided in the MMLA. This, in conjunction with silvicultural prescriptions and timber management techniques outlined in this Landscape Design, will provide tools that can be utilized to help maintain or develop some of the above attributes.

Areas within the MMLA identified for prescribed fire or fuels management strategies can be assessed on a block-by-block basis via ID team review and should focus on achieving site specific objectives such as those attributes listed above. Any fuels management strategies within reserves should seek to maintain or enhance the attributes for which these areas were reserved.

3.7 Inclusions

Inclusions are areas that are to be managed differently from the surrounding general forest matrix (non-reserves). Management actions and landscape prescriptions for an inclusion area may be different from the general landscape prescriptions, including a no action option.

Management actions within all inclusions should be designed to have neutral or beneficial effects in the long-term on the primary values for which the areas were classified. Some inclusion areas have been identified on the landscape while others will be identified or refined during project planning. ID teams should assess all known and potential inclusions affected by a project area and apply appropriate management prescriptions based on the type

of inclusion and site-specific considerations, as directed under the Eugene District RMP (1995) and Standards and Guidelines, and the Adaptive Management System (May 2000).

Inclusions are classified as one of two types: **Withdrawn** or **Not Withdrawn**, see Table 3-10 for a list of inclusion names and types.

Withdrawn Inclusions – There are approximately 9,638 acres withdrawn under this category. These areas are excluded from the commercial timber base. The ecological objectives that define the management actions and silvicultural prescriptions for these areas are not within the normal range of options available in the Transition or General Prescriptions and will be defined at the project level by ID teams.

Non-Withdrawn Inclusions – These areas are conditionally included in the commercial timber base and Probable Sale Quantity (PSQ) calculations. The management actions and silvicultural prescriptions for these areas would be defined by the ID teams and are likely to be within the range of options available in the Transition or General Prescriptions.

Table 3-10 – Summary of Inclusion Types

Inclusions may be managed through Withdrawn and/or Not Withdrawn status.
PSQ = Probable Sale Quantity

NAME	Withdrawn Inclusions (Not included in the PSQ)	Not Withdrawn Inclusions (Included in the PSQ)
Timber Production Capability Classification (TPCC) Areas	X	X
Small Basin and Riparian Reserves	X	
Recreation & Visual Resource Management	X	
Existing Recreation Sites	X	
Planned Recreation Sites		X
Planned Trails		X
McKenzie River Wild & Scenic River Corridor - all areas except Segment B.	X	
McKenzie River Wild & Scenic River Corridor-Segment B & North Fork GateCreek.		X
McKenzie River Special Mgmt Recreation Area (SRMA)	X	X
Visual Resource Management Areas	X	X
Mass Wasting Areas - High Potential	X	

Table 3-10 – Summary of Inclusion Types		
Inclusions may be managed through Withdrawn and/or Not Withdrawn status. *PSQ = Probable Sale Quantity*		
NAME	**Withdrawn Inclusions (Not included in the PSQ)**	**Not Withdrawn Inclusions (Included in the PSQ)**
Bureau Special Status Plants and Animals (Bureau Sensitive Assessment & Tracking Species)	X	X
Survey and Manage Protection Buffer Species	X	X
Survey and Manage Component 1 & 2 Species	X	X
Federally Listed/Proposed Plants (Currently none in the Planning Area)	X	X
Federally Listed/Proposed Animals	X	X
Northern Spotted Owl – unmapped LSR site cores located before 1994	X	
Northern Spotted Owl – new, moved, or alternate sites located after 1994		X
Bald Eagle Habitat Areas (BEHAs, active nests, and midwinter roosts	X	

3.8 Response to Unplanned Disturbances

The forest ecosystem is dynamic. Unplanned disturbances (wind throw, disease mortality, snow damage, insect induced mortality, animal damage mortality, catastrophic and small fires) occur naturally. Many times, small natural disturbances are biologically desirable since they increase the variability of the forest. When natural disturbances are small the planned schedule of activities should not be altered. Large scale disturbances should be evaluated for their impact upon the management objectives of the MMLA. Land management decisions made as a result of large scale disturbance should consider the associated impacts to adjacent landowners and their objectives. A reevaluation of landscape objectives and scheduled management activities may occur as a result of large scale disturbances. Although long-term landscape and watershed objectives may still be applicable, changes in short-term plans may be necessary.

If a large, severe fire produced early seral conditions over a significant portion of the planning area, an appropriate response might be to reschedule timber harvesting. Rescheduling may delay further regeneration harvest of live forest until the post-fire stands have closed their canopies. Where feasible, salvage logging of a volume of timber approximately equal to that scheduled to be removed over that time period may be appropriate to maintain projected timber flows. To offer sound wood during the salvage harvest, the rate of removal may be accelerated for a short period (2-4 years). The condition

of adjacent areas, both within and adjacent to the Adaptive Management Area, provides important context for this evaluation.

The recommended management response to disturbance would depend upon current condition and knowledge, and should include consideration of the following factors:

1. **Location of disturbance area** – If reserves were burned, the landscape blocks may need to be reconfigured to provide new reserves. In some instances, it may be desirable to redraw blocks to better align block boundaries with new, post-disturbance edges, if fire occurs in landscape areas where timber harvest is planned.

2. **Proximity of the disturbance to adjacent landowners** – If a large catastrophic disturbance within the MMLA occurred that would jeopardize the adjacent landowner's property, management activities scheduled for the block may be altered.

3. **Timing of disturbance relative to the block schedule** – If a fire occurred relatively close in time to when a block is scheduled to be harvested for timber, the block could be salvaged as a substitute for its scheduled cutting. If timber harvest is not scheduled for many decades, however, in some situations it may be appropriate to leave the block unsalvaged to provide patches of dead wood habitat and snags.

4. **Extent of disturbance** – If small areas of blow down occur, they may be considered a biological bonus adding diversity to the landscape. Large areas of blow down may trigger a reevaluation of block configuration and scheduling.

5. **Condition of surrounding watersheds** – If scattered small burned patches occur, they may serve particularly important ecological roles when they are the only patches of high snag densities in the entire watershed.

   Ecological functions of burned patches need to be considered if salvage for timber values is contemplated. Relative to natural conditions, managed landscapes are generally characterized by low levels of snags and large coarse woody debris. Managed landscapes generally lack high-density snag patches composed of trees with variable stem diameters. Leaving fire-killed patches unsalvaged and maintaining the overall block harvesting schedule may be the most appropriate response to unplanned disturbance in some cases. Unplanned disturbances may also be viewed as opportunities to refine understanding of disturbance processes and patterns, and post-disturbance recovery trajectories.

3.9 Watershed Restoration

The Watershed Analyses identified three major types of aquatic habitat restoration. The **first** would be to remove or upgrade roads and culverts to reduce the impact on hydrologic function, sediment production, and barriers to upstream fish migration. The **second** would increase the complexity of stream channels through placement of log and boulder structures. The **third** would increase the availability of large trees in riparian areas as a future source of

large woody materials in the stream channel by increasing the percentage of the riparian area that is conifer and by using silviculture practices in riparian areas to accelerate the growth of conifer trees. Because of the intermingled land ownership, restoration activities would be more effective if done cooperatively at the sub-watershed or watershed scale. Site-specific restoration plans for inchannel habitat, roads and culverts, and riparian areas within the MMLA area are currently being prepared.

4.0 SPATIAL AND TEMPORAL PROJECTION - PHASE 3

4.1 Introduction

A 10 decade harvest and forest composition projection was completed as a part of the analysis of the Landscape Design. This 10 decade projection is meant to be a forecasting tool designed to develop information about the effects of applying the area control harvest rotation over the landscape, and the ages and spatial relationships that occur as a result of applying the scheduling criteria. This projection is not meant to be a guide as to the location of harvest, nor is it the only available forecast. This projection is only probable scenario.

4.2 Projection

The purpose of this projection is to develop an understanding of the effects of the MMLD on the spatial distribution of forest types that emerge from the application of this area control block patchwork. A pattern that emphasized the placement of harvest units so that they tended to avoid other harvest units was selected. For comparison purposes, a similar analysis was completed using a harvest schedule that applies the RMP harvest system. Table 4-1 shows the changes in seral stages over time as this plan is implemented.

Table 4-1 – Seral Stage Projection

Seral Stage	Exiting Condition (2000)	Year 2100
Early (0 - 30 years)	3395	2499
Mid-seral (40-70 years)	3316	2269
Late-seral (80-190 years)	9777	6410
Old growth (200+)	0	5315

Table 4-2 shows the estimated regeneration output per decade under the Landscape Design.

Table 4-2 – Harvest Projection

Landscape Area	Rotation Year	Thinning Acres/Decade	Regeneration Acres/Decade	MBF / Decade
Landscape Area 1	100	392	340	17,430
Landscape Area 2	180	541	254	15,420
Total		933	594	32850

4.3 Timber Harvest Scheduling

4.3.1 Methodology

Scale of Analysis – Harvest scheduling on this landscape is controlled by the three identified scale levels: Landscape Area, Landscape Region, and Landscape Block. Harvest scheduling was completed using the Landscape Block as the basic harvest unit for a decade. Information is then summarized by Landscape Region and Landscape Area level to determine if any of the scheduling criteria act as limits to harvest unit selection.

Acres – The return interval was established at 100 years for Landscape Area 1 and 180 years for Landscape Area 2. This yielded an area that is regeneration harvested at approximately 340 acres/decade in Landscape Area 1 and 254 acres/decade in Landscape Area 2. This regeneration level was then applied across the MMLA for 10 decades.

Time Interval – A projection was developed to examine the spatial pattern of stand ages and types resulting from the application of the harvest schedule. This analysis was continued for 100 years in 10-year increments, and the seral stages and spatial pattern were examined at each decade step to determine if the harvest scheduling criteria continued to be met.

Analysis Steps – GIS and FOI (Forest Operation Inventory) information were compiled by block. Harvest units were selected for the purposes of this projection. Harvest unit selection was based on the criteria discussed in section IV, C 2. Volume was projected based on age class and leave tree requirements. For a more detailed discussion on the analysis steps used to develop a spatial and temporal projection, see Appendix C.

4.3.2 Criteria and Rationale for Specific Scheduling Choices

The following concepts for timber harvest scheduling should be tested and adjusted if new information indicates that the proposed concepts are invalid.

4.3.2.1 General considerations to guide scheduling choices

- Harvest scheduling must reflect the present land management constraints. Excluding areas where timber management has occurred, the present stand conditions are the result of large past fires. Land ownership patterns coupled with the requirement to comply with a variety of land use regulations dictates that future timber harvest scheduling will not result in regeneration harvest areas that cover an entire drainage or watershed, which may have occurred during past fires.

- At the watershed scale, the general approach will be to group regeneration harvests in blocks located within one or two landscape regions in a 10-year period.

- The priorities should postpone any disturbance associated with regeneration harvests in landscape regions that are contributing to the best refugia habitat for both aquatic species and for interior, late-successional species. This priority also serves to restore a desired spatial pattern of vegetation patches that are currently in the most fragmented regions. Grouping harvests within one or two landscape regions in a given time period may simulate a small scale fire event.

- Where regeneration harvest occurs, blocks selected for harvest will match the desired size of landscape blocks identified in the landscape prescriptions.

- Harvesting of the landscape blocks will be dispersed within the landscape region. In addition to simulating past small scale fires, this approach concentrates disturbance and habitat loss on relatively few spotted owl pairs at any one time. This approach also provides mid-scale refugia by not scheduling harvest in broad regions for an extended period of time. Road closure strategies in conjunction with extended post-harvest recovery periods is also enhanced by this approach.

- Within the areas of visual concern, harvest of landscape blocks will be regularly dispersed through time and space. The boundaries of harvest units may not directly correspond to landscape blocks since there may be a desire to 'feather' the edge of the regeneration harvest with the past cutting boundaries and the terrain. Where possible, the intent of this strategy is to disperse the visual effects of timber harvest or modify the visual results of past harvest. The viewsheds from the McKenzie River and Highway 126 are the most critical areas of concern.

4.3.2.2 Specific Criteria to Guide Scheduling Choices

- No more than one block adjacent to a given Late-Successional Reserve (LSR) should be regeneration harvested in a given time period (20 years). Stand maintenance treatments, precommercial thinning, and commercial thinning may be conducted adjacent to stands that have been recently regeneration harvested. Staggering block treatments on a 20-year cycle will avoid rapid changes in habitat and edge conditions in close proximity to spotted owl nest sites.

- No more than 25 percent of the area in the "high" rain-on-snow susceptibility zone should be regeneration harvested in a 10-year time period. This will avoid concentration of timber cutting in areas potentially susceptible to harvest-induced increases in peak stream flows.

- Schedule initial regeneration harvests in areas that are currently the most fragmented. Retain existing large blocks of older forest stands for the maximum potential time. This strategy facilitates obtaining the desired landscape pattern most quickly by maintaining contiguous blocks of older forest and by creating larger younger forest blocks where fragmented conditions currently exist. Reducing

harvest boundary lines in homogenous stands of older forest also reduces the visual impact associated with some regeneration harvests.

- Depending upon the block sizes, delay regeneration harvest of a landscape block that is adjacent to a block containing natural openings, covering 50 percent of the area and are each greater than 10 acres in size. Since spatial pattern objectives are designed directly into the landscape block pattern itself, cutting a large block next to a forest stand with several large existing openings would create a combined opening larger than that described in the landscape objectives. If the combined area of the adjacent blocks are less than 250 acres, it is recommended that the adjacent blocks be combined and harvested simultaneously.

- Recognize the potential impacts of harvest induced wind throw in naturally regenerated Douglas-fir stands that have not received stand density regulation and intermediate harvest. If necessary to avoid large scale (areas greater than 10 acres) or catastrophic wind throw, enlarge landscape blocks to ensure the majority of retention trees are not confined to wind throw prone areas.

5.0 EVALUATION - PHASE 4

This section provides an analysis comparing the MMLD to NFP. The analysis includes a comparison of the MMLD and NFP in providing habitat for plants and animals, contributing to meeetng the ACS Objectives and providing for Threatened and Endangered Species. An analysis was also done to discuss how the MMLD provides for the Important and Relevant factors in the Proposed ACEC. Overall plan impacts are similar to NFP. There is potential for site specific differences.

5.1 Landscape Structure

Table 5-1 compares the MMLD to the NFP at three different scales: landscape, stand, and riparian.

Table 5-1 – Spatial Temporal Comparison

LANDSCAPE PLAN	NFP
Landscape Level	
• Overall seral stage similar to NFP • Overall population statistics is dominated by the large percentage of reserves. Because of the large percentage of reserves, the effects on the landscape seral stages by harvest of individual stands will be diminished by aging of the reserves 49% in reserves (8,455 acres) 51% in non-reserved areas (8,195)	• Similar seral stage as the Landscape Design • Same as Landscape Design 63% in reserves (10,477 acres) 37% in non reserved areas (6,173)
• Harvest is scattered across the overall landscape to minimize local impacts.	• Could be either scattered or aggregated harvest
• Longer regeneration rotation rate (100, 180 years) • Larger units • Less fragmentation and edge effects • Landscape pattern consisting of larger more similar blocks, with less sharp edges between blocks.	• Shorter regeneration rotation (80 years) • Smaller units • More fragmentation and edge effects • Boundary between the Riparian Reserve and the harvested land base will be sharper with more pronounced age and density divisions
• Higher percentage of the land base harvested – 594 regeneration acres per decade and 1,033 thinning acres per decade • Less trees removed per acre	• Lower percentage of the land based harvested – 563 regeneration acres and 471 thinning acres per decade • Higher intensity (more trees removed) in the disturbance
Stand Level	
• For a specific stand, Landscape Area 1 would have 1.0 regeneration entry in a 100-year period. Landscape Area 2 would have 1.0 regeneration entry in an 180-year period	• For a specific stand, Landscape Area 1 would have 1.25 regeneration entries in a 100-year period. Landscape Area 2 would have 2.5 regeneration entries in a 180-year period.

Table 5-1 – Spatial Temporal Comparison	
LANDSCAPE PLAN	**NFP**
• A higher level of shade tolerant species • A lower percentage of Douglas-fir. (increase in the amount of hemlock, cedar)	• Mostly Douglas-fir
• Increase in stand growth and development	• High density stands will continue to have slow growth and development
• Shade tolerant species will be more integrated into the total stand and will begin to be a significant component in these stands • Complexity of harvested stands will also increase in harvest units due to: ▸ 6– 20 GTR trees for regeneration harvests ▸ 8 trees per acres of large diameter, sound snags ▸ 300 linear feet per acre of down logs, ▸ (snags and down wood will be maintained/ created at <u>each</u> harvest entry) ▸ Down logs will be created within riparian zones for nonfish-bearing streams • 2-3 cohort stands • Openings will encourage light, understory & overstory development – gaps and clumping would be used	• At least the harvest base portion will continue as more simple stands with two cohorts expected. • Single level stands in harvested areas with retention trees • Complexity is less in harvest units due to: ▸ 6-8 GTR trees for regeneration harvests, ▸ 3.4 trees per acre of large diameter, sound snags ▸ 240 linear feet per of down logs ▸ snags and down wood would be maintained/created only at regeneration harvest entry • 1-2 cohort stands • Slower overstory and understory development
Riparian Areas	
• Arrangement of Small Basin Reserves includes upslope forests resulting in blocks of higher quality plant and wildlife habitat that is more functional and available due to patch size and spatial orientation	• There are no Small Basin Reserves • Arrangement of Riparian Reserves includes only strips of terrestrial habitats providing less benefits to plants and wildlife
• Restoration opportunities same as the NFP	• Restoration opportunities same as the Landscape Design
• Levels of protection in the Landscape Design will be more graded than in the forest plan, with different sizes of streams protected in different manners, more closely resembling natural fire patterns	• Sharp edges between the harvest stands and the Riparian Reserves. Reserves are less graded with less resemblance to natural fire patterns
• 2-3 multi-level stands	• 1-2 multilevel stands
• Fish-bearing streams will continue to receive a high level of protection • Nonfish-bearing streams will receive a 25-50 foot streambank buffer and a Transition Prescription • 4,016 - Riparian Reserves acres 2,581 - Small Basin Reserve acres • Areas of high mass wasting potential will be managed the same as the NFP	• Fish-bearing streams will continue to receive a high level of protection • Nonfish-bearing and intermittent streams would receive standard Riparian Reserves of one site tree. • 8,840 Riparian Reserve acres • Areas of high mass wasting potential will be managed

5.2 Plant and Animal Habitats

5.2.1 Introduction

The components of this landscape design are: longer rate of regeneration rotation, more snags, down wood and green tree retention in harvest units, spatial location of green tree retention, inclusions, Small Basin Reserves, and Riparian Corridors that were developed to move the landscape closer to approximating fire disturbance patterns. This is accomplished by utilizing fire history information in designing landscape patterns and in developing stand structure. This section provides a discussion relevant to ASC Objective #8.

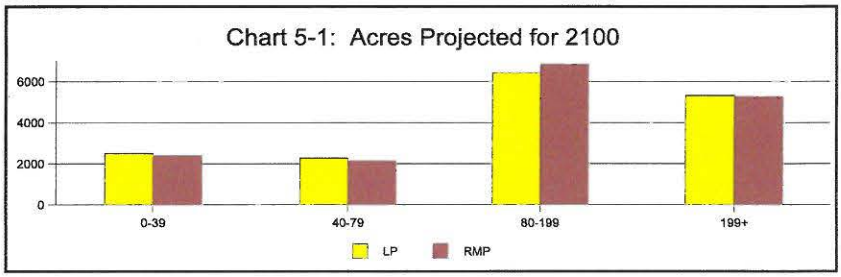
5.2.2 Seral Stage Distribution

The seral stage distribution under the NFP and the MMLD are approximately the same proportion when projected over 100 years (see Chart 5-1). Significant structural and spatial differences; however, will be expressed on the stand and landscape levels between the two plans (see Section 3.2). These differences will influence the plant community composition that develops within the planning area. The MMLA is classified within the Western Hemlock Zone Plant Series (approximately 16,304 acres) with smaller portions of the Douglas-fir Zone Plant Series on hotter, drier aspects (approximately 1,195 acres).

5.2.3 Stand Structural Characteristics

The longer time between regeneration harvests within Landscape Area 1 (100 years) and Landscape Area 2 (180 Years) will allow for the development of greater stand complexity (both horizontal and vertical) within all seral stages once the General Prescription is applied. It is expected that a forest with two major canopy levels or layers (two-tier) will develop in Landscape Area 1 and a three-tier forest (3 major canopy layers) will develop in Landscape Area 2. Resulting stands in any of the seral stages of the MMLA will likely provide greater habitat niche diversity than in the NFP.

This could potentially result in changes in the proportions of plant species found within the landscape and, in some cases, increasing plant diversity. The longer rotation rates and potential retention of older more decadent trees may provide longer time frames for species such as epiphytic lichens and bryophytes to colonize and disperse. These species are often more closely associated with structurally complex older forests, which would be found in Small Basin Reserves and fish-bearing streams under the MMLD, and would not be expected to benefit under the NFP except in riparian areas.



The silvicultural prescriptions in the MMLD are designed to increase the number of tree species that will be developing on the landscape, and increase their distribution relative to current conditions. This is expected to be realized more fully in Landscape Area 2 where a three-tier forest could develop within 180-year time frame, allowing shade tolerant species and other minor tree species to develop as part of the stand. This level of complexity would not be realized in the NFP. The MMLD prescriptions will allow the development of stands that will more closely approximate the species composition expected within the Western Hemlock Plant Series, especially in lower slope positions.

The following benefits of the MMLD contributes to both quality and quantity of habitats available to many wildlife species:

- increased stand structural diversity
- differences in canopy complexity
- multi-cohort stands
- continual availability of older and legacy trees
- reduction in edge effects due to fragmentation
- increased conifer diversity
- larger tracts of older and less disturbed stands
- overall closer resemblance to natural/historical conditions

5.2.4 Inclusions

Some of the greatest botanical diversity found within the Eugene District occurs within Special Habitat features such as rock outcrops, meadows, wetlands, and hardwood forests, etc. Retention, protection, and management of special habitat features would occur under both the NFP and the MMLD. Inclusions will be directly used to manage for spotted owls and bald eagles. Although inclusions would be managed the same under the MMLD and the NFP, many MMLD inclusions are augmented by Small Basin Reserves that will greatly increase their size and quality through time. Species requiring late seral stands or larger patches of intact, complex, higher canopy forests will receive benefits greater than provided in the NFP. See section 3.7 for additional information.

5.2.5 Green Tree Retention

Green trees left as legacy trees will contribute to stand diversity through time and function as a possible source of snags or down logs. Varying the conifer GTR leave levels by slope position is thought to more closely mimic fire disturbance patterns at the stand level. The availability of older or legacy trees under the MMLD will be greater than the NFP.

The spatial patterning of gaps and clumps applied as part of the harvest prescriptions on the block level will provide for a mix of early seral species in the gaps while potentially retaining some plant species more common to mid or late seral conditions within the clumps, depending on gap/clump sizes. This is expected to be true for either the Transition or the General Prescription under the MMLD.

The retention of hardwoods and shrubs are critical for epiphytic lichen and bryophyte species. Retention of hardwoods will benefit overall habitat diversity at the stand level while providing site specific habitat for some species (e.g., *Megomphix hemphilii* appears to benefit from the presence of bigleaf maples). Hardwood conversions would occur only after the full range of ecological benefits have been evaluated and managed similar to NFP direction. This will occur on a site by site basis under ID team evaluation.

At the stand level, live leave trees contribute to overall stand complexity and resiliency including: crown-class differentiation, decadence, canopy stratification, canopy closure, habitat niche diversification, retention and accumulation of biomass and nutrients, and future recruitment of snags and down logs. Greater stand complexity generally results in the greatest benefits to the most number of wildlife species throughout the life of the stand. Many wildlife species will use stands following a harvest much sooner when legacy trees remain. For example, live leave trees may be used as soon as immediately after harvest by bird species for staging, foraging, roosting, or nesting. Bats may use sloughing bark in sun exposed live

trees for roosting. Species such as spotted owls are known to use stands much sooner for nesting if sufficient legacy components are present.

5.2.6 CWD (Snags and Down Logs)

Greater amounts of CWD will be applied in the MMLD and are expected to result in increased benefits for those plant/fungal species that utilize the long-term moisture storage and nutrients provided by CWD. The MMLD CWD levels more closely approximate CWD levels thought to be associated with the Western Hemlock Plant Series, potentially benefitting a wide range of Survey and Manage and other plant/fungi species. It is thought that species such as the Survey and Manage species *Allotropa virgata*, many bryophytes, and many species of fungi all utilize CWD as an integral part of their life cycle.

Snags are used by wildlife for a variety of functions such as nesting, foraging, perching, staging, hibernating and roosting. Of the nearly 100 species of wildlife that use snags, over half are dependent on cavities for at least 1 of 18 life cycle behaviors, of which at least 4 relate to nesting (Thomas et al. 1979, Nietro et al. 1985 in Brown Chapter 7). Examples of species that will benefit include pileated, hairy, and downy woodpeckers (primary cavity nesters), brown creepers, red-breasted nuthatches, American martens, northern flying squirrels, several owl species (secondary cavity-nesters), and up to 15 bat species (use for nesting and roosting/hibernating).

Down logs reduce erosion, affect soil development, intercept and stabilize water in upslope habitats, are a major source of energy and nutrients, serve as a seedbed for vascular plants and surface for lichens and bryophytes, and provide habitat for a broad array of organisms – including microbes, plants, invertebrates, and vertebrates. Down logs provide habitat for insects and fungi that, in turn, provide food for many species of birds, mammals, reptiles, amphibians, and fish. Logs also provide shelter, protective cover, nesting sites, travel corridors, and thermal protection for a variety of wildlife species. For example, large hollow logs provide potential den sites for martens, bears, and other carnivores and smaller logs provide hiding cover and travel corridors for small mammals such as red-backed voles and for amphibians such as clouded salamanders.

In addition, large logs provide habitat complexity and cover within streams for many fish species. In-channel large woody debris regulate channel processes by slowing water flow, decreasing width-to-depth ratio, enabling flood plain connection/side channel development, and create habitat for fish and other aquatic dependent species.

The amount and topographic position of CWD under the MMLD will more closely mimic natural conditions. A significant benefit to wildlife and plant species will be realized by management for CWD at all stand entries, versus only at regeneration harvests under the NFP, including maintaining/creating down logs in and near nonfish-bearing streams. Stands after regeneration harvest will begin their next cycle with a greater quantity and quality of CWD than would be expected under the NFP due to longer regeneration rotation rates, increased stand diversity before harvest, and prescribed greater amounts of CWD creation/retention. Longer regeneration rates, higher levels of GTR, and management for greater conifer species diversity will contribute to greater quality and quantity of natural recruitment of wood in MMLD stands. Overall, the MMLD will result in a higher and more consistent level of CWD available throughout the life of the stand as compared to the NFP, due to managed levels and increased natural recruitment.

5.2.7 Small Basin and Riparian Reserves

5.2.7.1 Plant Species

Small Basin Reserves – Large blocks of undisturbed habitat within the Small Basin Reserves and the associated stream systems will provide high quality refugia for vascular, non-vascular, and fungal species. These areas are not part of the Transition and General Prescriptions and are expected to reach older forest conditions sooner than the surrounding landscape over time. Depending on the developmental pathways that these reserves/stands proceed along, the areas are likely to benefit a host of mid to late seral plants and fungi associated with older forest conditions such as:

- Increased levels of CWD - fungi, bryophytes, vascular plants
- Development of productive soil and duff layers – fungi, vascular plants
- Stand structural complexity such as large limbs with "perched soils" – bryophytes
- Long periods of disturbance free substrates – lichens, bryophytes, fungi
- Undisturbed riparian/aquatic habitats – bryophytes, lichens, fungi

Planned disturbances that occur in the Small Basin Reserves will focus on maintenance of, or benefit to, the primary values for which these areas were set aside. The Small Basin Reserves will provide habitats where biotic and abiotic attributes, such as microclimate features and below ground systems, will be maintained for those plant species sensitive to disturbance, including saprophytic vascular species (ex. orchids, montropes, *Allotropa virgata*), moisture loving lichens, bryophytes, and a wide array of fungi, many of which are classified as Survey and Manage species under the NFP. The reduction in planned disturbances and decreased fragmentation will also retard the spread of exotic or introduced species into these areas, which compete with native flora and reduce botanical diversity. The associated riparian system will provide uninterrupted dispersal corridors for plant species that utilize riparian or aquatic habitats for all or part of their life cycles. The NFP, while providing riparian corridors, does not provide large blocks of undisturbed habitat in Matrix lands that are beneficial to a wide array of botanical resources.

Overall, the combination of Small Basin Reserves and Riparian Reserves will provide larger tracts of older and less disturbed habitat, greater stand diversity and natural succession, connectivity corridors within the BLM lands and to the adjacent USFS LSR, both aquatic and terrestrial habitat necessary for many riparian dependent species, and refugia for both persistence and future source populations. Many of these benefits would not be provided under the NFP.

Riparian Habitat – In the Pacific Northwest, riparian zones are hotspots for lichen and bryophyte diversity (Ruchty 2000). Riparian forests host more nitrogen fixing cyanolichens (lichens with cyanobacterial photobionts) than surrounding upland forests (Nietlich 1994, Peterson 2000, Rosso 2000) and provide an important function in the generally nitrogen-limited forests of the Pacific Northwest. Some lichen species, including the ROD-listed lichens *Cetrelia cetrariodes*, *Platismatia lacunosa*, and *Ramalina thaustra*, are believed to be obligate residents of riparian zones. Riparian forests also support a large biomass of mat-forming bryophytes (Peck 1997). Such mats host invertebrates that may be important as food for birds (Petersson et al. 2000). Forage lichens found in riparian zones, including *Alectoria* and *Bryoria* spp., are used by *Glaucomys sabrinus* (flying squirrel) for nest building (Masar 1985) and by deer and elk as winter forage. As hotspots of lichen and bryophyte diversity, riparian zones may function as important dispersal centers for these groups to upland forests. Large intact riparian systems connecting upland habitats through the Small Basin Reserve complex would be provided under in the MMLD. These areas may provide better functions as compared to the NFP because of the Small Basin Reserve complex.

Under the MMLD, the Small Basin Reserve riparian system will provide excellent refugia for lichen and bryophyte species and will serve to meet those ecosystems functions identified above. Some habitat for lichen species and bryophyte species will be provided for through:

- Riparian stream reserves on perennial fish-bearing streams
- Transition prescriptions on non-fish-bearing streams
- 25–50 foot streambank buffers on perennial non-fish-bearing and intermittent streams

For vascular and non-vascular plant species found to be Localized and Rare or Exclusive and Restricted under the riparian module, it is expected that site-specific surveys would occur prior to any ground-disturbing activities and, if found, would be appropriately mitigated for, including those species found along intermittent streams. Less sensitive bryophytes, lichens, and fungi identified as Survey and Manage species would be subject to the provisions of policy paper titled "*the Standards and Guidelines and Adaptive Management Area System*" (May 2000).

Lichen, bryophyte, and fungal species will benefit from the following MMLD elements:

- silvicultural techniques implemented to promote tree species diversity and structurally more complex riparian forests
- retention of hardwoods
- retention and development of snags and CWD;
- retention of old "wolf trees, etc., within Riparian Reserves
- 25–50 foot streambank buffers and Transition Prescriptions

Because silvicultural prescriptions are designed to restore some attributes of historic forest conditions, it is expected that at the landscape and the stand level the MMLD should provide adequate habitat conditions for these species. Greater stand level complexity, longer 100 and 180 year regeneration harvest return rates, unfragmented Small Basin Reserves (functioning to connect riparian and uplands), and mitigating measures for the rarest of these species should provide equivalent, if not improved, management strategies for these species as compared to the NFP.

5.2.7.2 Wildlife Species

Small Basin Reserves – Wildlife species will receive significant benefits from these reserves that would not be provided under the NFP. Bird and mammal species utilizing larger tracts of mature-late seral habitats will receive greater benefit under the MMLD. Examples include woodpeckers, songbirds, owl species, large mammals such as fisher and marten, and small mammals such as red-tree voles. These reserves will provide extensive benefits to species of invertebrates and amphibians, especially those using both aquatic and terrestrial habitats such as red-legged frogs and tailed frogs or species with limited dispersal capabilities into adjacent drainages such as cascade torrent salamanders.

Overview of Terrestrial and Riparian Habitats of Riparian Dependent Species – Aquatic invertebrates, amphibians, and one reptile species are the animals most dependent on, and expected to benefit from, riparian habitat and management within riparian zones. Many of these species use several types of riparian and/or terrestrial habitats throughout their life cycle. Up to 18 Bureau Special Status invertebrate species that benefit from aquatic habitats are known or suspected to occur in the planning area. Very little is known about these species' habitat requirements or occurrence in the planning area. Implementation of this MMLD Design, in the long-term, is expected to provide benefits to aquatic invertebrates similar to the NFP and natural conditions. General invertebrate habitat information is discussed in Appendix D. Western pond turtles are the only riparian dependent reptile potentially occurring in the MMLA and are entirely dependent on water for all of their life cycle except egg laying. While every species of amphibian in the watershed can be found within riparian areas during some part of their life cycle, nine species are dependent on streams and riparian habitats. The five key species are described in Appendix D: Table CC and in ACS Objective 9.

Terrestrial Habitats of Riparian Dependent Species – Many riparian dependent species also require terrestrial habitats for some part of their life cycles. For example, red-legged frogs breed in aquatic habitats yet require moist terrestrial habitats for access to breeding sites, foraging and dispersal, including travel over ridge tops.

Small Basin Reserves (particularly #s 6-10) and several other withdrawn areas are currently suitable habitat for many of the riparian dependent species in the area and were designated, in part, to provide current and future habitats through time, including connectivity to the adjacent USFS Mt. Hagen LSR. These reserves and other withdrawn areas combined with longer regeneration harvest rotations, green tree retention, additional managed levels of coarse woody debris and increased vegetative diversity in non-withdrawn areas will result in more functional terrestrial habitats of greater quality, size, and spatial orientation on the landscape than those expected under the NFP and similar to natural conditions.

Riparian Habitats of Riparian Dependent Species – At the landscape scale, the long-term benefits to aquatic invertebrate and amphibian individuals and their riparian and terrestrial habitats as a result of implementing the MMLD are expected to be similar to natural conditions and greater than the NFP. While localized short-term benefits may occasionally be less in some nonfish-bearing streams, long- term benefits are expected to equal or exceed those provided under the NFP.

Aquatic Reserves and other withdrawn areas (8,455 acres) alone are expected to provide habitat for persistence, breeding, dispersal, and future source populations for many aquatic invertebrates and amphibians. Small Basin Reserves # 6-10, in particular, are currently suitable habitat for many of the aquatic invertebrate and amphibian species in the planning area. These reserves were designated, in part, to provide current and future aquatic habitats, connectivity to other riparian withdrawn areas, and aquatic dispersal corridors. Much of this assumption is based on local knowledge of species use and habitat conditions. Habitats similar in size and quality to those in the Small Basin Reserves alone probably would not be provided by the NFP (short or long-term).

5.3 Aquatic Conservation Strategy (ACS) Objectives

5.3.1 Introduction

There were **three key elements** considered in the development of the analysis for the ACS Objectives. One element was **private lands**. How do we account for private lands in our analysis? The second element was **Riparian Reserves**. The Riparian Reserves are different between the two plans. How will the analysis compare how the Riparian Reserves contribute to meeting the ACS objectives in a way that is meaningful? The third element was **species analysis**. Which species need to be discussed when adjusting the riparian reserve widths? This section details how the three key elements were addressed in the ACS Objectives analysis.

For each ACS Objective in the document, there is a table that describes the desired landscape features particular to each ACS Objective. The table also includes the MMLD elements or RMP Best Management Practices (BMPs) that will contribute to obtaining the desired landscape features.

Private Lands – The ACS objectives analysis is based on activities on lands managed by the Bureau of Land Management in the MMLA. The majority of the lands in the MMLA are privately owned and managed by industrial forest companies under Oregon Department of Forestry regulations. *The BLM assumes a short rotation on private industrial forest lands.* Impacts from private land activities were considered and assumed to be the same under both plans. Therefore, impacts from private land activity were not analyzed in this document.

Riparian Reserve Comparison – For the purposes of this analysis, the riparian areas were defined as the interim NFP widths, which are two site potential tree widths adjacent to fish-bearing streams and one site potential tree width adjacent to non-fish-bearing streams. When discussing seral stage distribution, this analysis will examine the difference in riparian seral stage between the two plans using the interim NFP Riparian Reserve width as the area for comparison.

Species Analysis – The effects of implementing the MMLD on plant, fungal, and wildlife species that are expected to benefit from Riparian Reserves in the NFP were analyzed using the *Riparian Reserve Evaluation Techniques and Synthesis Document; Supplement to Section II of Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis (version 2.2, 1997).* This is also referred to as the "Riparian Reserve Module". Only species known or suspected to occur in the planning area were examined.

A wildlife and plant species list was generated based on the Riparian Reserve Module and NFP Survey and Manage or Protection Buffer status. Local species of concern, species in the original ACEC nomination, BLM Special Status species, and federally listed or proposed threatened and endangered species were also considered when compiling the wildlife species list. The Oregon Natural Heritage Program and the Local District non-vascular and vascular sensitive species of concern list were also used to compile the plant list. Fungi were not analyzed due to insufficient information available for many of these species. Future analyses should consider fungi species as more information is generated.

Plant and animal species identified in the Riparian Reserve Module were reviewed during this species analysis. Since 1997, new information has been generated on the distribution and abundance for several of these species. The data suggest that some of the species classified as Survey and Manage Species under the

NFP, which were considered Localized and Rare, no longer belong in this category (see appendix D for discussion). In addition, some species were added to the MMLD riparian analyses, that were not considered in the1997 Localized and Rare species analyses, because of current information indicating presumed rarity. It is expected that over time this list would be dynamic and updated as new information becomes available.

Table 5-2 shows species that were identified through Riparian Reserve Module analysis results as most benefitting from, and dependent on, riparian habitats (see shaded blocks in Table D-2 in Appendix D). These species are discussed **in detail under ACS Objective # 9** and were analyzed to compare how ACS Objectives would be met in the MMLD vs. the NFP and natural conditions.

Table 5-2 – Riparian Dependent Species Analyzed for ACSO Compliance

Species Type	Species List
Amphibians	tailed frog
	red-legged frog
	cascade frog
	cascade torrent (=Olympic) salamander
	Dunn's salamander
	western pond turtle
Birds	harlequin duck
Mammals	white-footed vole
Lichens	*Hypotrachyna riparia*
	Bryoria pikei
	Cetrelia cetrarioides
	Dermatocarpon luridum
	Hydrothyria venosa
	Leptogium rivale
	Leptogium cyanescens
	Leptogium saturninum
	Pannaria rubiginosa
	Usnea longissima
Liverworts	*Sphaerocarpos hians*
Bryophytes	*Crumia latifolia*
	Plagiochila satoi
	Plathypnidium riparioides
	Racomitrium aquaticum

Species Type	Species List
	Scouleria marginata
	Tritomaria exsectiformis
Vascular Plants	*Mimulus cardinalis*
	Epipactus gigantea

Note: See Appendix D-Riparian Reserve Module Analyses for a complete list of riparian dependent and associated wildlife and plant species. Section 3.4: Aquatic Reserves, also provides additional discussion on some wildlife species and habitats associated with Aquatic Reserves under the MMLD.

5.3.2 Objective #1

Maintain and restore the distribution, diversity, and complexity of watershed and landscape-scale features to ensure protection of the aquatic systems to which species, populations and communities are uniquely adapted.

Desired Landscape Features	MMLD Elements or RMP - BMPs
• Landscape structure (vegetation composition, structural stage, and spatial pattern) approximating historical/natural landscape and watershed patterns.	• Minimize sharp edges across forest classes (overstory retention levels and the spatial pattern of retention trees within a harvested block). (MMLD Element)
• Historical/natural disturbance regimes and natural processes.	• Restore vegetation as a source of woody material. (MMLD Element) • Maintain natural delivery processes for wood and sediment, and natural hydrologic cycles. (MMLD Element)
• Transportation system that minimally impacts hydrologic and sediment regime.	• Recondition or decommission roads that are presently affecting soil mass movements and peak flows. (RMP-BMP)
• Stream network free of culvert barriers to upstream and downstream fish migration.	• Remove culvert barriers to migration of aquatic species. (RMP-BMP)

5.3.2.1 Conclusion and Comparison to NFP

Implementation of the MMLD would provide habitat to maintain the diversity and complexity of the aquatic system on public lands. Both the MMLD and NFP would provide similar levels of fish habitat. With the fire history as the basis for the MMLD, the MMLD should be equal to, and possibly an improvement on, the NFP in terms of restoring diversity and distribution of complex landscape processes. The basis of fire history should result in a disturbance regime that is closer to pre-settlement conditions to which the local populations and communities are uniquely adapted.

5.3.2.2 Discussion

Aquatic Refugia – The establishment of Small Basin Reserves in the MMLA

distributed throughout the watershed (approximately 16% of the watershed area on BLM lands) maintains a distribution of Late-Successional Reserves that can serve as refugia for many late-successional dependent species (see Small Basin Reserves Map). The NFP does not provide blocks of aquatic refugia. These areas are also intended to protect unstable soils, provide large wood input to upper watersheds, and provide refuge for aquatic amphibian and invertebrate species of concern as well as riparian travel corridors for many wildlife species, including connectivity to the adjacent Forest Service Hagen LSR.

Populations of aquatic amphibians, such as tailed frogs, cascade torrent salamanders, Pacific giant salamanders, and some aquatic invertebrates are currently provided sustainable refugia in Marten, Rough, and Bear creeks, particularly due to the current water quality and mostly contiguous forested landscape that also provides opportunities for aquatic and terrestrial movement to adjacent habitats. The contiguous Forest Service Mt. Hagen LSR is also currently providing habitat for these species and is expected to provide sources of new individuals into some of the MMLA populations. Designation of Small Basin Reserves in this Landscape Design are expected to contribute to refugia habitat and source populations for aquatic dependent amphibians, particularly in Bear, Marten, and Gale creeks as well as terrestrial connectivity to the FS LSR.

The high-quality stream sections in the MMLA are not large enough to function as aquatic refugia for fish. The capability of the streams to provide an adequate population of fish for recolonizing adjacent disturbed habitat is limited by the size of the habitat. The habitat limitation is due primarily to the size of the streams and not the presence of severely degraded habitat. The McKenzie River provides connectivity to refuge habitat outside the MMLA, which may provide colonizers if disturbance occurs in the MMLA or while disturbed areas elsewhere are recovering. Natural barriers restrict upstream movements in Bear, Indian, and Toms creeks, reducing the potential for recolonization of these areas from elsewhere in the McKenzie basin in the event the populations in these creeks were lost. Bear and Toms creeks contain populations of trout above these natural barriers that may be genetically distinct. The barriers separate the trout populations from upstream migration of trout or salmon, helping to maintain these genetically distinct populations. For other non-fish aquatic species, the Small Basin Reserves would provide refugia from which downstream areas may be recolonized following disturbance events.

Riparian Stand Structure – Flexibility is built into the Landscape Design so that site-specific implementation can provide additional riparian and upslope protection to prevent mass movements or unacceptable increases in stream temperature based on local conditions. Openings would occur to provide light for understory development and maintenance of hardwood species. The resulting vegetation composition and structure would approximate historical stands and disturbance regimes to which aquatic species have adapted.

In MMLD, fish-bearing streams would have reserves, akin to Riparian Reserves under the NFP. The Riparian Corridors are expected to provide connectivity between the

stream channels and Small Basin Reserves. The Riparian Corridors would also provide additional protection for instream and near stream components and processes. In a landscape setting, the Riparian Corridor approximates the moist valley bottom areas that are generally not as susceptible to high fire severity.

Riparian stand composition and structure is an important component in restoring riparian and aquatic functions across the landscape. The MMLD and NFP would result in different riparian composition and structure for nonfish-bearing streams. Aquatic and riparian-dependent species are believed to have evolved under the influence of riparian stands composed of a diversity of seral stages. Riparian stand composition is expected to more closely resemble historical riparian composition and structure if managed by the MMLD than by the NFP. The combination of NFP Riparian Reserve management and fire suppression may move stands exclusively toward late-seral conditions within the next 100 years under the Northwest Forest Plan. This would reduce the seral stage and species diversity in the riparian areas.

Non-fish-bearing streams would not have a designated reserve outside of the streambank area. These areas would have a 25–50 foot streambank buffer and a Transition Prescription for non-fish-bearing streams. The riparian habitat areas would be expected to be in a range of age classes over time. Only intermittent streams would move immediately toward this condition. Perennial non-fish-bearing streams would not have a regeneration harvest applied until such time as a more complex stand canopy developed near these perennial non-fish-bearing streams. Riparian and adjacent areas, under the MMLD, would be managed to move toward historical conditions and may more closely approximate historic stand composition and structure on federal lands.

Stream Temperatures – Although guidelines in the Landscape Design call for no removal of bank trees or trees directly contributing to streambank stability (25–50 feet), stream canopy openings, if of sufficient size, may contribute to slight local temporary increases in stream temperature. Such increases are usually of short duration and within the natural stream temperature fluctuations. State water quality criteria for temperature, based upon the needs of cold water fish, would be met.

Large Wood – For fish-bearing streams, the amount of large wood entering the streams from within a site potential tree width from streams would be similar to the NFP. In harvest areas near non-fish-bearing streams there would be a reduction in the number of trees. This may lead to a reduction in large wood that would enter the streams naturally; therefore, trees would be placed in streams that will result in large wood in streams similar to NFP or greater. In the long-term, trees entering the streams will be larger under the MMLD for non-fish-bearing streams. For non-fish-bearing streams, terrestrial down logs will be maintained/created as part of the typical prescription in all harvest entries at a rate of 300 linear feet/acre with a portion of this dedicated as in-stream LWD.

The addition of large wood into streams in the planning area will restore in-stream complexity, and restore an important channel component that existed in streams historically. Aquatic dependent wildlife species, particularly invertebrates and amphibians, rely on small pool and depositional area habitat in headwater streams that is

usually created by large wood. Restored channels will act as refuge for native aquatic species as adjacent streams recover from disturbance. In-stream restoration efforts will focus on habitat recovery while maintaining or enhancing high-quality habitat (refugia) within the planning area. By identifying refugia and integrating in-stream restoration and vegetation management, recovery of Middle McKenzie aquatic habitat is expected.

5.3.3 Objective #2

Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.

Desired Landscape Features	MMLD Elements or RMP – BMPs
• Unobstructed subsurface water flows	• Correction of culvert barriers to movements of aquatic species.(RMP-BMP)
• Maintain natural wood and sediment delivery and movement processes	• Use 100 and 180 year timber harvest rotations, moderate levels of overstory retention, and distribute retention trees near streams to maintain riparian and landscape connectivity.(MMLD Element) • Provide a system of Small Basin Reserves (MMLD Element)
• Continuity of habitat features both within the stream network and between aquatic and terrestrial ecosystems	• Use 100 and 180 year timber harvest rotations, moderate levels of overstory retention, and distribute retention trees near streams to maintain riparian and landscape connectivity.(MMLD Element) • Use small protected areas and Stream bank buffers to connect high-probability landslide and debris-flow source areas to fish-bearing channels.(MMLD Element)
• Connected system of aquatic refugia	• Provide a system of Small Basin Reserves.(MMLD Element)
•Streams that can access their flood plains during flood events	• Restore channel structure and stream bed development to facilitate lateral connectivity into the flood plain.(RMP-BMP)
• Water quality needed to maintain aquatic community and not limit species movements	• Implement the following MMLD elements: ‣ stream bank buffers ‣ stream side prescriptions ‣ Riparian Corridors
• A system free of human barriers to movements	• Correction of culvert barriers to movements of aquatic species. (RMP-BMP)

5.3.3.1 Conclusion and Comparison to Northwest Forest Plan (NFP)

The MMLA maintains spatial and temporal connectivity of habitats within and between watersheds over the long-term through the following landscape features:

- A well-distributed Small Basin Reserve system, linking upland and riparian systems

- Riparian Corridors on perennial fish-bearing streams
- Transition Prescriptions along nonfish-bearing streams
- The pattern and distribution of green tree retention, so that higher numbers occur on lower slope positions
- Management for higher levels of down logs and snags (eventual down logs) more closely resembling natural conditions. This will occur upslope and within and near non-fish-bearing and intermittent streams at all harvest entries.

These connections provide chemically and physically unobstructed routes to areas critical to fulfilling life history requirement of aquatic and riparian-dependent species. By approximating historical fire vegetative patterns, future landscape patterns should provide for improved connectivity across the landscape.

For fish-bearing streams, the amount of large wood entering the streams from within a site potential tree width from streams would be similar to the NFP. For non-fish-bearing streams, trees entering the streams will be larger under the MMLD in the long-term.

5.3.3.2 Discussion

Small Basin Reserves – One criteria for establishing Small Basin Reserves was to include currently known and suspected habitats and populations of species dependent on headwater streams. Considerations included both aquatic and terrestrial habitat life history needs. Small Basin Reserves protect areas that appear to be critical for fulfilling the life history requirements of some aquatic and riparian dependent species, particularly amphibians and aquatic invertebrates. These reserve blocks are well distributed across the landscape and particularly situated in headwater areas identified as a priority for current and future habitat.

Although the total acres in reserves may be less, the quality of these habitats would exceed those provided under the NFP. Benefits include increased quality of refugia and source population habitats with greater availability of terrestrial habitats necessary for the life history of many of these species. Intact terrestrial habitats in upslope environments in Small Basin Reserves (especially #s 4 - 8) would provide critical routine travel and connectivity between drainages for species such as red-legged frogs, tailed frogs, Dunn's salamander, and mollusks, plus undisturbed breeding habitats for harlequin ducks.

Under the MMLD, Small Basin Reserves combined with other reserves, longer regeneration rotations, and coarse woody debris management are expected to be a net benefit for most riparian dependent non-fish wildlife species as compared to the NFP.

At the landscape scale, Small Basin Reserves will greatly increase the quality and functionality of the aquatic and terrestrial habitats within them for aquatic species when compared to the NFP. They will provide intact riparian and upslope terrestrial habitats that connect over ridgetops, providing travel, dispersal, and refugia habitats that would not be provided under the NFP.

Fish-bearing and Nonfish-bearing Streams – Reserves established along fish-bearing streams protect the stream form and function. Riparian Corridors are designed to provide

shade, maintain cool, moist microclimate conditions, provide a source of nutrients, and provide a near-stream source of potential large wood for recruitment. These reserves also provide connectivity to areas critical to fulfilling aquatic and riparian-dependent species life history requirements. Guidelines in the MMLD call for a streambank stability buffer and a Transition Prescription on non-fish-bearing streams. By restoring and maintaining the integrity of channel features, the design provides for maintaining the connectivity between the headwaters and fish-bearing reaches of the streams, and between the individual tributaries and main stem of the McKenzie River and its larger tributaries.

Headwater Streams – Headwater streams would have less overstory retention than the fish-bearing streams and the overall habitat quality of in/near-stream segment for invertebrates and amphibians would be reduced in the short-term as a result of harvest activities until they recover from disturbance in 5-20 years. The local intensity of regeneration harvest disturbance would be greater than the NFP; however, the disturbance is minimized by 1) 25-50 foot buffer 2)10-20 trees per acres and 3)100 and 180 year rate of regeneration. Retention of non-tree vegetation and up to 20 trees per acre, depending on slope position in the riparian area, should be sufficient to maintain water quality and habitat for aquatic species using the headwater areas in the long-term. Project planning teams are directed to provide additional protection measures on all streams that are within or adjacent to areas of high mass wasting potential.

Upslope Areas – Almost 71 percent of the landscape is projected to be in forests greater than 80 years of age in 2100, and the majority of younger forests would have one or more older overstory cohorts, which would vary by slope position. The upslope forest would connect to the riparian area through the appropriate streamside management prescription to help maintain water quality (see section 3.4). Maintaining a larger percentage of the forest in ages greater than 80 years helps to maintain the hydrologic and sediment delivery processes.

Under the NFP, 72percent of landscape is projected to be in forest greater than 80 years of age in 2100 and the majority of the younger forest would have less tree species diversity, structural diversity, cwd, and snags than under the MMLD.

5.3.4 Objective #3

Maintain and restore the physical integrity of the aquatic system, including shorelines, banks, and bottom configurations.

Desired Landscape Features	MMLD Elements or RMP - BMPs
• Streambanks and channel substrates exhibiting historical/natural dynamics.	• Do not remove bank trees, or trees contributing directly to streambank stability which is estimated to be a 25 - 50 feet buffer during commercial harvest. (MMLD Elements) • Active restoration and maintenance of stream channels currently lacking large wood or other channel structural elements sufficient to stabilize the stream channel and create a more diverse system. (RMP - BMP)

• Inputs of wood and bedload materials that closely approximate historical/natural rates of input, and contain similar types, quantities, and sizes of materials as historically input.	• Maintain conifers along fish-bearing streams as a source or large wood.(MMLD Elements) • Place Small Basin Reserves in critical source areas for large wood and inorganic materials (MMLD Elements) • Encourage growth of streamside conifers for future input of large wood to streams.(MMLD Elements) • Avoid timber harvest and road construction in areas with potential high slope instability.(RMP - BMP) • Active restoration and maintenance of stream channels currently lacking large wood or other channel structural elements sufficient to stabilize the stream channel and create a more diverse system.(RMP - BMP) • Add large wood and boulders to streams to increase channel stability and retention of organic and inorganic materials.(RMP - BMP)
• Unobstructed stream crossings (primarily roads) that allow materials normal movement down the stream network.	• Replace culverts or decommission roads where culverts are barriers to fish. (RMP -BMP)

5.3.4.1 Conclusion and Comparison to NFP

Aquatic system physical integrity on public lands would be maintained or restored with implementation of the Landscape Design. Streambanks will be maintained through the use of streambank buffers and Riparian Corridors. For fish-bearing streams, the amount of large wood entering the streams from within a site potential tree width from streams would be similar to the NFP. In harvest areas near non-fish-bearing streams, there would be a reduction in the number of trees. This may lead to a reduction in large wood that would enter the streams naturally; therefore, trees would be placed in streams that will result in large wood in streams similar to NFP or greater. In the long-term, trees entering the streams will be larger under the MMLD for non-fish-bearing streams. Over the long-term, as trees in the riparian area grow larger and more susceptible to falling into the stream, habitat diversity within riparian areas and the aquatic system would approach historical conditions.

5.3.4.2 Discussion

Table 5-3 – Three Stream Buffers

Stream Types	NFP	MMLD
Non-fish-bearing intermittent	1 site potential tree width	▸ 25 - 50 feet stream bank buffer ▸ 50 feet from stream to 1/2 site potential tree width from stream – thinning, or up to 20 trees per acre
Non-fish-bearing perennial	1 site potential tree width	▸ 25 -50 feet stream bank buffer ▸ 50 feet from stream up to 1 site potential tree width from stream; 40 trees per acre or 50% canopy cover

Fish-bearing confined	2 site potential tree width	▸ 1 site potential tree width
Fish-bearing unconfined	2 site potential tree width	▸ 2 site potential tree width

Table 5-4 – Seral Stage for All Stream Types Projected for 2100

Age Class	MMLD (%)	NFP (%)
Early (0 - 30)	10	0
Mid (40 - 70)	9	0
Late (80-190)	39	46
Old growth 200+	41	56

Note: Interim NFP Riparian Reserves width is the area used for comparison using 1 site tree buffer width of 220 feet

When compared to standard NFP/ROD buffers, the MMLD would provide Riparian Reserves that are the same in unconfined fish-bearing streams, one half width in confined fish-bearing streams, and roughly one sixth width in non-fish-bearing streams.

The amount of terrestrial riparian zone habitat in Riparian Reserves, using standard NFP/ROD buffers, along all stream types under the NFP would be about 8759 acres. When the same area is overlayed on the MMLD, 4016 acres will be in Riparian Reserve Corridors (Table 3-1) – a difference of 4743 acres. Of this 4743 acres, 2,842 acres will be managed as Small Basin Reserves (SBR) that will provide much wider riparian buffers plus contiguous upland habitats, which far exceed the quality of those provided in the NFP.

This results in roughly 1901 acres less in the MMLD that will receive riparian reserves (as Riparian Corridors or Small Basin Reserves) when compared to the NFP/ROD buffer area. Of the 1901 acres subject to harvest , roughly 57 % will be > 40 years old, and 49 % > 80 years old at any random location and point in time under the general prescription.

From the overall landscape view, in 100 years, on average, 80 % of the total MMLA riparian acres (all land allocations and stream types) would be $\geq$ 80 years old, and 90 % (1705 acres) would be $\geq$ 40 years old.

Table 5-5 – Projected Riparian Reserve Seral Stage on Fish-bearing Streams Percentage in 2100

Age Class	2000 (%)	MMLD (%)	NFP (%)
Early (0-30)	17	4	0
Mid (40-70)	13	4	0
Late (80-190)	71	38	40

Old growth 200+	0	54	60

Note: Interim NFP Riparian Reserves width is the area used for comparison; using 1 site tree buffer width of 220 feet

Fish-bearing Streams – Along fish-bearing streams, the Landscape Design would provide a high degree of protection for existing riparian areas throughout the MMLA. These larger, perennial streams were historically more likely to maintain adjacent riparian vegetation resulting from natural disturbance such as fire. In the long-term, approximately 54 percent of all riparian areas along fish-bearing streams would remain in old growth conditions (>200 years old.). An additional 38 percent would be late forest (80-200 years old), with another 4 percent in 0-39 seral stage with a retention of overstory trees. The reserve system along these streams would provide a source of large wood delivery, canopy cover, and streambank protection in both the short and long-term. In comparison, the NFP would maintain 60 percent of riparian areas along fish-bearing streams in old growth over the long-term. For fish-bearing streams, the amount of large wood entering the streams from within a site potential tree width from streams would be similar to the NFP.

Non-fish-bearing Streams – In harvest areas near non-fish-bearing streams there would be a reduction in the number of trees. This may lead to a reduction in large wood that would enter the streams naturally; therefore, trees would be placed in streams, which will result in large wood in streams similar to NFP or greater. In the long-term, trees entering the streams will be larger under the MMLD for non-fish-bearing streams. The Landscape Design would provide for greater diversity among riparian areas and the aquatic system across the landscape, similar to historic conditions. Streambank stability would be maintained by retaining overstory trees near streams (25–50 foot buffer), and in potentially unstable sideslope areas. The NFP would maintain these Riparian Reserves in old growth conditions (>200 years in age) as a source of large wood delivery to stream channels in the long-term.

Table 5-6 – Projected Riparian Riparian Seral Stage on Non-fish-bearing Streams Percentage in 2100

Seral Stage	Current Condition	MMLD (%)	NFP (%)
Early (0-30)	21	14	0
Mid (40-70)	18	13	0
Late (80-190)	61	40	50
Old growth 200+	0	33	50

Note: Interim NFP Riparian Reserve width is the area used for comparison using 1 site tree buffer width of 220 feet

5.3.5 Objective #4

Maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems. Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Desired Landscape Features	MMLD Elements or RMP - BMPs
• Maintain or restore historical/natural stream temperature, nutrient and sediment regimes, including the temporal variability of those regimes.	• Manage riparian vegetation so that the composition and structure of riparian areas are similar to historical/natural conditions. (MMLD Elements) • Schedule timber harvest to reduce the potential impacts on water quality over the long-term. (MMLD Elements) • Avoid new permanent road construction in riparian or mid-slope areas unless the potential impacts are demonstrably less than the alternatives. (RMP-BMP) • No net increase in permanent roads in the Key Watershed (Bear and Marten Creeks)(RMP-BMP) • Avoid timber harvest and road construction in areas with potential high slope instability.(RMP- BMP) • Control use of equipment and chemicals to limit the potential for introduction into the surface and ground water systems.(RMP-BMP)

5.3.5.1 Conclusion and Comparison to NFP

Water quality would be maintained with implementation of the Landscape Design. Stream temperatures and turbidity levels may increase locally in the short-term on non-fish-bearing perennials with implementation of the Landscape Design, but would be well within the range of natural variability and would meet the State water quality criteria. It is expected that these potential impacts would be within the normal natural fluctuations and not be detectable at the sub-watershed level. Under the MMLD, such short-term loading increases would be spatially and temporally isolated and offset by longer regeneration rates, 25-50 feet stream bank buffers, and Transition Prescriptions.

In the long-term, water temperature and turbidity along small, non-fish-bearing streams would remain in a natural range that maintains the integrity of the system and benefits individual species. Some streams within the MMLA may have reduced water quality as a result of recent and historic management activities on lands within the watershed. Primary changes have been increased sediment and higher water temperatures. The proposed actions, including transportation system upgrades, an active stream channel and riparian restoration program, retention of stream side vegetation, and control of chemical use under the MMLD would maintain or improve water quality in streams on public lands.

Table 5-7 – Comparision of Riparian Management Practices under the MMLD and the NFP	
Fish-bearing Streams	Temperature • equivalent to NFP Turbidity • equivalent to NFP Comments: Under both plans, fish-bearing streams would be buffered by at least 1 site potential tree.
Non-fish-bearing Streams	Temperature • possibility of some localized, short-term impact that would not occur under NFP but would be within the state Water Quality criteria Turbidity • possibility of some localized, short-term impact that would not occur under NFP

Fish-bearing Streams – Confined and unconfined fish-bearing streams will be buffered by one and two site trees, respectively. Solar exposure and water temperatures should remain unaffected due to Riparian Reserve widths. Water temperature and turbidity will be maintained to State standards necessary for designated uses including cold water fish species. Sediment inputs are expected to be similar to the NFP and natural amounts and less than historical fires in an episodic context.

The reserves are expected to maintain the quality of fish-bearing stream aquatic and terrestrial riparian zone habitats for these species with little short or long-term effects from harvest or other management activities. The short and long-term benefits to aquatic habitats, individuals, and associated upslope terrestrial habitats are expected to be greater when compared to the NFP or natural conditions (mostly due to the addition of Small Basin Reserves under the MMLD).

Non-fish-bearing perennial and intermittent streams, seeps and springs – Seeps and springs will be managed as Special Habitats (Inclusions) as directed in the NFP.

Non-fish-bearing perennial and intermittent streams will receive Riparian Reserve widths less than the NFP. Harvest activities may result in short-term increases in water temperature and turbidity. Solar exposure increases would be localized and short-term, with shade recovery expected within 5-20 years. The local intensity of regeneration

harvest disturbance would be greater than the NFP; however, the disturbance is minimized by 1) 25-50 foot buffer 2)10-20 trees per acres and 3)100 and 180 year rate of regeneration. Under both the MMLD and the NFP, State water quality criteria would be met and there would be no net increase in roads in the Key Watershed. Small Basin Reserves and other reserves (8455 acres), which are expected to provide refugia, source populations, and dispersal opportunities for many aquatic invertebrates and amphibians, would provide areas where water quality would generally not be effected by management activities. Overall, it is expected that the NFP and the MMLD would be equivalent with respect the ACSO#4.

5.3.5.2 Discussion

The two water quality issues that are of most concern are water temperature and turbidity. Solar exposure can influence stream temperatures, periphyton production, and invertebrate prey biomass. The amount of fine sediment in stream beds influences the size and amount of interstitial space available to amphibian and invertebrate populations in a stream. Each of these variables, in different combinations and degrees, can have different impacts (positive or negative) on each of the stream-breeding amphibians, invertebrates, or the other wildlife preying on these organisms. In-stream and nearby down woody debris, vegetation composition, and the type of stream substrate are contributing factors affecting the influence of the variables mentioned above.

The Middle McKenzie watershed aquatic-dependent community is adapted to cold, clear water. Implementation of the Landscape Design should maintain and possibly contribute toward long-term reduction of temperature and turbidity levels along all fish-bearing streams on public lands (also see discussion for Objective #5 referring to sediment).

Stream Temperature

Fish-bearing streams – No measurable stream warming is expected along fish-bearing streams as a result of proposed actions. Overall stream temperatures are expected to meet the State water temperature criteria developed for cold water fish species. Benefits to these streams are expected to be similar to the NFP and natural conditions.

Non-fish-bearing streams – Along non-fish-bearing streams, some timber harvests could create openings that could slightly elevate short-term stream temperatures. The non-fish-bearing streams would have stream bank buffers, and Transition Prescriptions beyond the 25-50 feet. The combination of GTR, geologic shade and, in many places, stream orientation should reduce any short-term effects in non-fish-bearing streams. Regeneration harvest rates are low and rotation ages are long (100 and 180 years), so very little of the planning area would be in an open or young condition at any one time. The development of multi-cohort stands would result in a high degree of shade maintenance under thinning prescriptions. Thermal effects would be small and of short duration because of rapid vegetation regrowth and overstory canopy closure. The changes would be localized in small headwater tributaries and would generally not have a measurable effect on waters of fish-bearing streams.

Intermittent Streams – Increased stream temperature in intermittent (non-fish-bearing) streams is generally not a direct concern for fish because the streams are often dry in late summer when water temperature increases would have the greatest impact. Short-term, localized, cumulative warming is possible immediately downstream; however, it is not expected to be detectable at a sub-basin level. In smaller (1st - 3rd order), non-fish-bearing streams, seeps and springs, water flow, stream temperature, and nearby ambient humidity are key, often limiting, concerns for some aquatic invertebrates and amphibians (e.g., cascade torrent salamanders). These habitats may depend on continuous or intermittent surface and/or subsurface flows during warmer or drier times of the year. Some species may survive the drier and warmer times of the year by using subsurface habitats or cool and moist terrestrial areas adjacent to streams. Even species normally not obligated to these conditions may utilize these habitats to avoid predation from fish or other amphibian species downstream or when other preferred habitats are unavailable. Slight, temporary stream temperature increases can have a positive influence on some species (e.g., some aquatic invertebrates, larval tailed frogs, and forage invertebrates for harlequin ducks).

Intermittent flows (at any time of year) may still provide isolated areas of pooled water, where stream temperatures may increase at a faster rate than under the NFP during the late summer that could affect some aquatic species. Some species of concern (Table C3 in the ROD, USDA FS and USDI BLM, 1994) such as algae some aquatic invertebrates, larval tailed frogs, and forage invertebrates for harlequin ducks can benefit from smaller, local, temporary open forest conditions created by this management approach. Any detrimental effects that do occur would likely be local, infrequent, and short-lived. Plants that require higher inputs of solar radiation would also benefit.

Stream temperatures are not expected to reach short-term levels that would limit aquatic organisms as a result of the proposed actions. Longer regeneration rotations of 180 years would provide long time periods of dense canopy cover. Approximately 73 percent of non-fish-bearing stream riparian areas would be >80 years old, with 14 percent of 0-39 year old stands maintaining some canopy retention level. Prescribed retention levels for both landscape areas are thought to be within historical ranges. In many cases, retention levels may be higher than what may have existed following a natural fire. Stream temperatures associated with the various retention levels are likely to remain within the range of historical variability. All streams will receive at least some canopy retention. Even without full canopy retention, deciduous cover usually shades small streams within 20 years. The Landscape Design also prescribes relatively long timber regeneration harvest rotations (100 and 180 years). In this scenario, only a small percentage of the stream network would be effected at any time. It is unlikely that implementation of the Landscape Design would increase average stream temperatures beyond those expected under natural conditions.

Currently, the only stream in the planning area that is listed on the DEQ 303(d) list is the McKenzie River, which is listed for temperature. However, the DEQ 303(d) listing matrix (ODEQ, 1998) indicates that water releases from Blue River and Cougar Reservoirs are contributors towards the listing. Coldwater aquatic species in the McKenzie prefer temperatures of 64° or less although they may tolerate higher temperatures for short

periods of time. Most streams have temperature regimes that are within this tolerant range of native species, with the exception of bull trout. Bull trout require temperatures of 42° or less for up to six month while eggs are in gravels. This requirement for low temperatures currently limits potential use of streams for spawning although foraging fish, which are more tolerant of temperatures up to 64°, may use the McKenzie River and tributaries in the MMLA. The actions proposed under both the NFP and MMLD would maintain current temperature regimes on public lands for both the short and long-term, meeting the ACS objective for maintenance. Improvements in temperature would depend on over-all management of aquatic systems in all ownerships in the McKenzie Sub-basin.

Turbidity – Most of the streams in the MMLA have had episodic sediment delivery resulting from the February 1996 floods. As a result of the recent episodes, sediment levels continue to be elevated until natural fluvial processes transport sediment out of the system. The flooding may have reduced some structural features that moderate movements of material. As a result of the recent disturbances, many of the channels are in an early stage of recovery. The proposed MMLD would contribute to the general recovery on public lands as would the NFP.

Fish-bearing Streams – On fish-bearing streams Riparian Corridors would extend at least one site potential tree height resulting in no direct input of sediment from harvest activities. Appropriate mitigation and Best Management Practices (BMP) would be applied with respect to transportation systems. Overall, turbidity is expected to be similar to the NFP and natural conditions.

Non-fish-bearing – Local turbidity levels along the smaller, non-fish-bearing streams may increase as compared to the NFP in the short-term as a result of partial harvest within riparian areas (outside of the 25-50 foot streambank buffer). It is expected that State turbidity criteria would not be exceeded. Turbidity would be less than levels resulting from historical fires in an episodic context. Guidelines for green tree retention placement are intended to prevent streambank and upslope slides. Short-term sediment inputs may limit or prevent use of these streams, especially for breeding, by some aquatic invertebrates or amphibians until conditions recover in (5-20 years). Turbidity levels are not expected to exceed those necessary to support healthy riparian and aquatic ecosystems over the long-term.

Summary for all stream types – Implementation of the MMLD would contribute to the maintenance of current water quality in streams. Fluctuations in temperature and sediment, in both fish-bearing and non-fish-bearing streams would remain within natural fluctuation levels. Since the streams are mostly in a recovery phase, the general trend of both temperature and sediment input levels as a result of management of public lands would be downward. It is expected that decreased regeneration harvest rotations, green tree retention, additional managed levels of coarse woody debris, and increased vegetative diversity would result in sediment inputs similar to those expected under the NFP and natural conditions; and will not be limited to the long-term health of aquatic dependent organisms.

5.3.6 Objective #5

Maintain and restore the sediment regime under which aquatic ecosystems evolved. Elements of the sediment regime include the timing, volume, rate, and character of sediment input, storage, and transport.

Desired Landscape Features	MMLD Elements or RMP - BMPs
• Maintain or restore the historical/natural sediment regime, including the temporal variability of that regime.	• Delay timber harvest in areas where roads with a high potential to deliver sediment to streams can be decommissioned, or schedule harvest in areas needing reconditioning to fund repairs. (MMLD Elements) • Maintain and restore stream channels to retain materials for maintenance and renewal of channel and riparian habitat. (MMLD Elements) • Do not remove bank trees, or trees contributing directly to streambank stability. (MMLD Elements) • Place Small Basin Reserves in critical source areas for large wood. (MMLD Elements) • Concentrate retention trees and Small Basin Reserves in areas of potential slope instability. (MMLD Elements) • Avoid new, permanent road construction in riparian or mid-slope areas. (RMP – BMP) • No net increase in roads in Key watershed (Bear and Marten Creeks) (RMP – BMP) • Avoid timber harvest and road construction in areas with potential high slope instability. (RMP – BMP) • Use timber harvest systems least likely to generate sediment and are still economically viable. (RMP – BMP) • Decommission or rehabilitate roads in areas where timber harvests will be delayed. (RMP – BMP)

5.3.6.1 Conclusion and Comparison to NFP

Natural slope failures will remain the primary contributor of geologic materials and large woody debris into stream systems. Sediment transport in the form of sheet erosion will continue to be rare. Dry ravel will be minimized by maintaining existing litter cover and large woody debris, and through continued litter input from the remaining canopy. The rate of stream channel migration, bank erosion, and the transport of geologic materials within the drainage network will not likely be altered via implementation of the Landscape Design.

In the Key Watersheds, the permanent road mileage on public lands will remain the same or decrease. Additional roads may be built in other parts of the MMLA, but these would mostly be local spur roads since the main haul road network is in place. Rehabilitation or decommissioning of roads would decrease the potential for both road-related sediment delivery and landslides.

Fish-bearing streams on public lands would be surrounded by either a one or a two tree height buffer on each side of the channel. Streams with the two tree height buffer will be

identical to the NFP. It is expected that the one tree buffer will function similar to the NFP as it relates to water quality issues. Very little addition of sediment to the stream channels from sources adjacent to the channels is expected because of the following MMLD elements (see the turbidity discussion in ACSO #4):

- Green tree retention levels,
- 25-50 foot streambank buffers
- Transition Prescriptions, adjacent to non-fish-bearing streams

In the long-term, sedimentation levels from public lands within landscape areas may actually be less than compared to the NFP. The local intensity of regeneration harvest disturbance would be greater than the NFP; however, the disturbance is minimized by 1) 25-50 foot buffer 2)10-20 trees per acres and 3)100 and 180 year rate of regeneration. Also, moderate retention levels upslope provide slope stability and minimize mass wasting within harvest units. Table 5-8 shows the distribution of acres within the watershed by stand type for the Landscape Design as compared to the NFP. Both plans include provisions to avoid management activities on highly unstable slopes. Mass wasting/slope failures would not be any more likely under the Landscape Design, and may actually be less because of the increase in green tree retention, cwd, and snags.

Table 5-8 Projected Age Class Distribution For 2001

Age Class	MMLD	NFP
0 - 30	2499	2394
40-70	2269	2173
80-190	6410	6200
200+	5311	5722

5.3.6.2 Discussion

Age Class Distribution – Table 5-8 shows the distribution of acres within the watershed by stand type for the Landscape Design as compared to the NFP. From regeneration harvest under the MMLD, the stands that emerge will have more stand structure and more species diversity than the NFP. While this planning area is generally prone to mass wasting events, at the project level actions will be taken to mitigate any potential unstable areas. ID Team review of management proposals would remove high risk areas from harvest and modify or eliminate other management proposals that are not appropriate for the site.

Slope and Channel Failures – Streams in the MMLA have shown increased sediment delivery and channel changes in recent years. In particular, Gate Creek and Indian Creek had substantial debris torrents and landslides during a February 1996 storm event. All

streams, with the exception of Bear Creek, have had increased sediment delivery and a history of landslides and channel failures during the previous two decades. Some sediment delivery continues to occur from previously disturbed areas.

The frequency and magnitude of slope and channel failures predicted to occur on public lands with implementation of the Landscape Design, while likely higher than in unharvested forests, should be similar to what would be expected under the NFP. Roads are the greatest contributors to the increases in failures. However, slope failures not associated with roads will probably have a frequency and magnitude expected following a stand-replacement fire. The disturbance regimes proposed on public lands in MMLA, through timber harvest, will leave more live trees than a stand replacement fire. The greater densities of trees and the strategic locations of those trees (e.g., left on potentially unstable slopes and near stream channels) provides effective slope stability by maintaining a higher density of live roots and higher evapotranspiration demands.

Landscape Structure – The Landscape Design establishes disturbance regimes that would approximate a landscape pattern/structure created historically through infrequent high and moderate severity fires that occurred during the last 200 years. By approximating the fire disturbance patterns within which the present forest community developed, the temporal and spatial distribution of impacts by timber harvest (erosion and slope failure) will more closely match the frequency and amplitude of the natural system than did past timber harvest strategies. Leave tree retention along riparian areas under both the NFP and the MMLD would maintain bank stability and provide for future additions of large wood for the retention of gravel and cobble substrate within stream channels.

5.3.7 Objective #6

Maintain and restore in-stream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and retain patterns of sediment, nutrient, and wood routing. The timing, magnitude, duration, and spatial distribution of peak, high, and low flows must be protected.

Desired Landscape Features	MMLD Elements or RMP - BMPs
• Landscape structure (vegetation composition, structural stage, and spatial pattern) approximating historical/natural landscape and watershed patterns.	• Match timber harvest regimes to historic/natural fire regimes (rotation age, overstory retention level, spatial pattern of retention trees within a harvested block, block size, spatial pattern of blocks). (MMLD Elements)

• Historic/natural disturbance regimes.	• Avoid large open-canopied areas within the transient snow zone; avoid having more than 25% of a subwatershed in a hydrologically immature condition within the transient snow zone. (MMLD Elements) • Maintain a forest age distribution pattern that moderates impacts on stream peak flows. (MMLD Elements)
• Stream channel structure to maintain channel conditions and moderate impacts of flow variation.	• Restore and maintain stream channel structure and integrity. (RMP – BMP)
• Transportation system that minimally impacts the hydrologic regime.	• Avoid new, permanent road construction in riparian or mid-slope areas. (RMP – BMP) • Recondition or decommission roads where existing road drainage appears to be altering the timing or intensity of peak flows. (RMP – BMP)

5.3.7.1 Conclusion and Comparison to NFP

Peak flows could potentially increase in small channels for short periods (e.g., 10-20 years) while stands are hydrologically immature. Increases would probably be less than those resulting from natural variation in flow patterns resulting from climate and fire. Also, any peak flow effects would be attenuated downstream and would not be distinguishable at the sub-watershed or 5th field watershed.

The level of harvest activity on public lands would involve only limited acreage in a sub-watershed at any one time, and would not be sufficient by itself to induce measurable changes in streams where fish are located. Implementation of the NFP or the MMLD would have similar impacts on stream flows, with both meeting the requirements of the ACS objective.

5.3.7.2 Discussion

Water yield increases following timber harvests are possible relative to unharvested forested conditions due to reduced interception of precipitation and reduced rates of evapotranspiration. However, these changes are expected to be relatively short-term (less than 20 years) and generally do not exceed 10 percent. On a localized basis, there may be small increases in low flows due to less evapotranspiration. However, these effects would be localized and not detectable on a 5th field watershed or sub-watershed scale.

The majority of landscape blocks do not have any areas in the transient snow zone. Of those blocks that contain transient snow zone areas, the amount varies from 1 to100 percent. No more than 25 percent of the transient zone in any sub-watershed may be in a hydrologically immature condition at any given time. This should reduce concentrating timber harvest on public lands in areas that are potentially susceptible to harvest induced increases in peak stream flows.

Increases in flow may be beneficial to some aquatic species if the increases occur in summer low flow periods. Retention of interstitial and subsurface habitats may be a limiting factor for some species. The magnitude of these changes will remain within the range of historical variation, and be of a lower magnitude than that which could be expected under the NFP. As the trees increase in size (30-60 years), they increase the use of water and reduce flows below pre-harvest levels. Changes, as with post-harvest increases, would be small, notable mainly in headwater areas, and within normal fluctuations.

Upslope retention levels would provide tree canopies to intercept some snow, but harvest blocks would still create openings for snow accumulation on the ground. Changes in peak flow may be detectible in smaller headwater channels, but would lessen downstream. The small increases in peak flows expected from implementation of the MMLD would be less than flows that likely resulted historically from large-scale fires. With 71 percent of the area projected to be composed of stands >80 years in age in year 2100, and younger stands retaining a level of the overstory canopy, the probability of snow accumulation on the ground is equal to the NFP. The NFP would provide very little canopy to reduce snow accumulation on the ground except in riparian areas. In the long-term, peak flows within both landscape areas would be within the historical range of variability, retaining patterns of sediment, nutrient, and wood routing on both a channel and watershed scale. Increases in peak flows of perennial streams are not expected in the planning area under either the NFP or the MMLD.

5.3.8 Objective #7

Maintain and restore the timing, variability, and duration of floodplain innundation and water table elevation in meadows and wetlands.

Desired Landscape Features	MMLD Elements or RMP - BMPs
• Landscape structure (riparian vegetation composition, structural stage, and spatial pattern) approximating historic/natural landscape and watershed patterns.	• Approximate timber harvest regimes to historical/natural fire regimes (rotation age, overstory retention level, spatial pattern of retention trees within a harvested block, block size, spatial pattern of blocks). (MMLD Elements)
• Stream channel with natural structure, channel elevations, and lateral connectivity.	• Restore and maintain channel structure, maintain elevation and lateral connectivity. (RMP – BMPs)
• Historic/natural disturbance regimes.	• Maintain and restore stream access to flood plains during floods. (RMP – BMPs)
• Transportation system that minimally impacts the hydrologic regime.	• Correct road drainage problems affecting meadows, wetlands, and riparian areas (RMP – BMPs) • Recondition or decommission roads where existing road drainage appears to be altering the timing of peak flows. (RMP – BMPs) • Avoid new, permanent road construction in riparian or mid-slope areas. (RMP – BMPs)

• Drainage into and out of meadows and wetlands that is not altered by human activities.	• Correct road drainage problems affecting meadows, wetlands, and riparian areas. (RMP – BMPs)

5.3.8.1 Conclusion and Comparison to NFP

Local changes in the hydrology of flood plains and wetlands could occur through implementation of the MMLD through timber harvest. Water yield increases following timber harvests are possible relative to unharvested forested conditions. Precipitation interception and evapotranspiration would be reduced in the short-term and water yields could increase (Refer to ACSO #6). However, these changes are expected to vary across the landscape, with the magnitude of changes remaining within the range of historic variation, and be of similar or lower magnitude than that which could be expected under the NFP.

5.3.8.2 Discussion

Due to geology, valley floors are narrow with limited flood plain development. Wet meadows are very limited in development. The wetlands or meadows that are present are mostly associated with older slumps or riparian areas and more recently, roads. The wetlands are generally small in size. Flood plain connectivity is dependent on maintenance of stream channel elevations so that water is able to move out of the active channel at higher flows. Secondary channel incision, a result of channel scouring and loss of channel structure, contribute mostly to the disconnection of streams and flood plain. Groundwater storage, movement, and equilibriums are maintained by preserving stream channel and subsurface connectivity.

Implementation of the Landscape Design – The proportion of the watershed in a relatively open canopy condition (shrub-sapling seral stage) can be used as a general index of potential changes in watershed hydrology. Early seral stages have lower transpirational capacity and reduced interception of precipitation. Approximately 7.8 percent of the planning area will be in a shrub-sapling stage (less than 20 years old) under the Landscape Design, while approximately 7.6 percent of the planning area will be in the same age class under the NFP.

The spatial and temporal distribution of management activities could also affect the potential for changes in watershed hydrology and wetland and flood plain inundation. Clustering of timber harvests in space and/or time can result in a higher magnitude change as compared to dispersed harvests. The greater variation in hydrology in the MMLD is assumed to more closely resemble historic variations and restores wetland and flood plain hydrology.

Under both plans, total road miles would be similar to or less than current mileage. Rehabilitating or decommissioning roads and the removal or replacement of inadequate culverts, would reduce impacts from roads on both stream channels flow and connectivity. Roads may intercept water, altering the run-off pattern and modifying groundwater

movements; road rehabilitation and restoration would reduce these impacts.

Connectivity of the stream channel to riparian areas depends on the ability of surface flows to move out of the stream channel at higher flows. Maintenance and restoration of stream channels to provide structure to intercept wood and sediments, preventing secondary channel incision, and maintaining channel elevations would facilitate maintenance of out of channel flows during flood events. This would also help maintain groundwater levels since secondary incisions also reduce valley floor groundwater storage capacity.

Wetlands – Wetland habitats (Inclusions) will be directly protected through designation as reserves or site-specific placement of retention trees within harvested blocks. Although the hydrology immediately below a harvested sub-basin or block may change, the magnitude of these changes will remain within the range of historical variation, and similar to NFP. Where wetlands occur in Small Basin Reserves, the MMLD would be better for wetlands than the NFP. Transportation management planning would be similar under both plans for wetlands management.

Flood plain – Flood plain inundation occurs during the winter and spring runoff period and during flood-producing rainfall events. Water yield increases are possible on lower order channels (Refer to ACSO #6) following timber harvests relative to unharvested forested conditions due to reduced interception of precipitation and reduced rates of evapotranspiration. Although the hydrology immediately below a harvested sub-basin or block may undergo short-term change, the magnitude of these changes is expected to remain within the range of historical variation and be of a lower magnitude than that which could be expected with the NFP due to level of GTR in the MMLD.

5.3.9 Objective #8

Maintain and restore the species composition and structural diversity of plant communities in riparian areas and wetlands. Provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration. Supply amounts and distribution of coarse woody debris sufficient to sustain physical complexity and stability.

Desired Landscape Features	MMLD Elements or RMP - BMPs
• Composition, structural stage, and spatial pattern of riparian vegetation that approaches historic/natural vegetation patterns.	• Approximate timber harvest regimes to historic/natural fire regimes (rotation age, overstory retention level, spatial pattern of retention trees within a harvested block, block size, spatial pattern of blocks). (MMLD Elements) • Place "no scheduled harvest areas" in places where fire rarely occurred (e.g., along sheltered stream reaches). (MMLD Elements) • Utilize riparian silviculture to encourage streambank stability and growth of young stands. (MMLD Elements) • Provide for species composition that meets needs of terrestrial species, and provides a source of large wood and nutrients for the stream system. (MMLD Elements)
• Riparian area to upslope environment gradients that approach historical/natural patterns.	• Provide transition zones between riparian areas and upslope areas with intermediate levels of overstory retention. (MMLD Elements) • Design corridors, connectivity routes, and block size to meet needs of a range of species. (MMLD Elements) • Provide a system of Small Basin Reserves. (MMLD elements)

5.3.9.1 Conclusion and Comparison to NFP

Stand-initiation timber harvests (100 to 180 years) in the Landscape Design approximate the frequency, severity, and spatial pattern of historic fires restoring the historic distribution of habitats. Fine- and coarse-grained biotic and abiotic components that provide the vegetation composition and structure necessary for a naturally functioning forest and riverine system will be maintained. This combination of disturbance followed by longer periods of no regeneration harvest will provide for an array of habitats at different seral stages over time (Table 5-8), on a scale that more closely approximates historic habitats throughout the western Cascade Range.

The additional provisions of the Landscape Design ensure adequate riparian functions:

- Small Basin Reserves,
- Riparian Corridors on fish-bearing streams,
- Transition Prescriptions on non-fish-bearing streams
- Stream bank buffers on non-fish-bearing streams

These provisions provide riparian functions and maintain species composition and structural diversity of plant community in the riparian areas. In the long-term, where timber harvest occurs plant species composition will change and structural diversity will increase. The placement of wood in streams would maintain or restore the distribution of coarse woody debris.

5.3.9.2 Discussion

Riparian Vegetation – The long-term goals of the MMLD Aquatic Reserves system are to provide a diversity of seral stages and stand structures that will support native species and ecological functions. The Aquatic Reserves system was designed to maintain and restore habitat to support populations of native plant and riparian-dependent species. Long stand rotations of 100 to 180 years will provide habitat with old growth attributes and species diversity.

Streamside retention of overstory trees and the Transitions Prescription will provide habitat and connectivity for fungi, vascular, and nonvascular plant species with limited dispersal capabilities. In addition, various Small Basin Reserves dispersed across elevation zones will provide refugia for aquatic and terrestrial plant species. These reserves are located at specific headwaters, important stream junctions, and adjacent to specific Late-Successional Reserves. The Landscape Design will create a forest pattern similar to historical conditions with which species have persisted. The Aquatic Reserves system will integrate with upslope stands by retaining overstory trees in the upslope stands.

Conservation of riparian-dependent plant species will be provided by Riparian Corridors on all fish-bearing streams. The Landscape Design Riparian Corridors are one tree-height in constrained channels and two tree-height adjacent to unconstrained stream segments.

Streamside green-tree retention levels will provide habitat and stand structure for epiphytic bryophytes and lichens as well as terrestrial plant and fungi species that occur in riparian areas. Remnant trees will moderate habitat climatic factors. Riparian areas with a mixture of hardwood and conifer species usually have the greatest diversity of species and habitats. The young upslope stands adjacent to perennial non-fish-bearing stream channels will have retention levels of 40 trees per acre (Transition Prescription) from the original stand. Older remnant trees are often biologically rich and provide habitat for a diversity of species. Many of these species are able to recolonize into younger stands as habitat conditions improve. Retention levels of 10 - 20 trees per acre adjacent to intermittent channels with streamside bank trees will moderate environmental conditions directly contributing to the habitats and microclimates within the riparian zone.

Under the NFP, the riparian areas would be allowed to move exclusively to late-seral stage. The MMLD would harvest in some non-fish-bearing riparian areas creating a younger age class, thus providing an increase seral stage diversity over the NFP. Where timber harvesting occurs in what is now known as Riparian Reserves, the stand that is reestablished would have more structural diversity and species diversity than what is currently there.

The Small Basin Reserves and Inclusions provide areas of refugia. The Small Basin Reserves and Inclusions would represent areas under a fire regime that would not be touched by fire or have a low intensity burn. The MMLD would provide large areas of refugia not provided for in the NFP. The MMLD would provide greater species diversity, structural diversity, and refugia than the NFP.

Large Wood – For fish-bearing streams, the amount of large wood entering the streams would be similar to the NFP within a site potential tree width from the stream. In nonfish-bearing streams, where some timber harvesting occurs, there may be a reduction in number of trees naturally entering the streams and an increase in trees growth is expected. Through management actions wood will be placed in the streams where deficient. LWD in streams would be similar to the NFP. In the long-term, trees entering the stream would be larger sooner than under the NFP.

See Section 3.5 Aquatic Reserves System for a discussion relevant to ASC Objective #8.

5.3.10 Objective #9

Maintain and restore habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species.

Desired Landscape Features	MMLD Elements or RMP – BMPs
• Composition, structural stage, and spatial pattern of riparian vegetation that matches historic/natural vegetation patterns.	• Approximate timber harvest regimes to historic/natural fire regimes (rotation age, overstory retention level, spatial pattern of retention trees within a harvested block, block size, spatial pattern of blocks). (MMLD Elements) • Place "no scheduled harvest areas" in places where fire rarely occurred (e.g., along sheltered stream reaches). (MMLD Elements) • Provide a variety of different habitats and habitat elements, such as down wood. (MMLD Elements)
• Riparian area to upslope environment gradients that approximate historic/natural patterns.	• Place "no scheduled harvest areas" in places where fire rarely occurred (e.g., along sheltered stream reaches). (MMLD Elements) • Provide transition zones between riparian and upslope areas with intermediate levels of overstory retention. (MMLD Elements)

5.3.10.1 Conclusion and Comparison to NFP

The MMLD maintains habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species on public lands. Riparian Corridors on fish-bearing streams and Small Basin Reserves (including biologically sensitive or unique habitat, inclusions, and spotted owl nesting areas) are distributed across the landscape, providing refugia for these plants and animals. Impacts to habitat from implementation of the MMLD, are not expected to exceed estimated impacts from historically-occurring disturbance events such as wildfire. The MMLD is intended to approximate the pattern of vegetation left across a landscape under what is estimated to be the historical fire regime for the area. Small Basin Reserves are expected to provide for persistence for these species and serve as source areas for recolonization of adjacent

riparian habitats in the future. For those species identified as Localized and Rare under the Riparian Reserve Evaluation Techniques and Synthesis (1997), the MMLD will provide equal or better habitat conditions compared to the NFP.

The MMLD will accelerate the recovery of riparian areas, which currently may not function as refugia, through silvicultural practices and the addition of large coarse woody debris (snags and down logs). Other than the reserved headwater streams, there may be some reduction in riparian vegetative communities that would not provide for a full complement of habitat components until the woody vegetation regrows. Aquatic and terrestrial habitats in non-fish-bearing riparian zones would be reduced in amount and quality in the short-term due to harvest activities. These effects will be greater in intensity (due to narrower riparian buffers) than the NFP; however, the disturbance is minimized by 1) 25-50 foot buffer 2)10-20 trees per acres and 3)100 and 180 year rates of regeneration. The impacts are expected to be mostly local and short-term with recovery in 10-30 years.

5.3.10.2 Discussion

Species of Concern – As a result of the Riparian Module Analyses, species that are expected to be most affected by Riparian Reserve management are discussed in detail below. These plant and wildlife species are included in Table D-1 and D-2 of Appendix D – Riparian Reserve Analyses and were generated from the shaded blocks in Table D-3.

Federal threatened or endangered species are discussed in section 5.4. Survey and Manage species are discussed in section 5.5. Additional information on aquatic animal species known or suspected to occur within the Small Basin Reserves can be found in Appendix D – Small Basin Reserve Descriptions and Selection Information.

1. **Vascular and Non-vascular Plants** – Limited inventories have been implemented within the AMA for vascular and non-vascular plant species. No known sites of the following species have been documented. Botanical surveys are done prior to ground disturbing activities and, if any of the species identified below were located, mitigation would be applied to protect and manage for the target species.

   Lichens

   Hypotrachyna riparia – This species was newly described by McCune (1998) from two sites in the Cascade foothills of Oregon. It may be an obligate riparian associate and is probably quite rare. So little is known about the distribution and ecological needs of this possibly endemic species that any new sites should be preserved. This newly described species has not yet been ranked by the Oregon Natural Heritage Program due to the newness of the taxa and overall paucity of knowledge on the species. It will likely be added to the Oregon Natural Heritage Program list in 2001 (J. Christy, personal communication, B. McCune, personal communication).

   Conclusion – Under the Northwest Forest Plan, buffers along streams would protect the habitat of this species, though the buffer widths may be inadequate to

preserve conditions necessary for the species long-term survival and viability. By preserving some larger, continuous tracts of land surrounding riparian zones in the Small Basin Reserves, the Middle McKenzie Landscape Design may help ensure that desirable conditions are maintained.

Bryoria pikei – This lichen is found along the west coast of North America, from the Queen Charlotte Islands to Oregon, and is very rare in the west Cascades. This species is usually found in humid forests close to the coast or a lake up to 1250 m elevation. It is taxonomically problematic, since it may be a rare chemotype of *Bryoria capillaris*. This species is not ranked by the Oregon Natural Heritage Program and has no status as a Survey and Manage species.

Conclusion – Under the Northwest Forest Plan, buffers placed along streams might protect important habitat for this species, though the buffer width may be inadequate to preserve conditions necessary for the species' long-term survival and viability. By preserving some larger, continuous tracts of land surrounding riparian zones in the Small Basin Reserves, the Middle McKenzie Landscape Design may help maintain desirable conditions.

Cetrelia cetrarioides – This lichen is sporadically found throughout its range, and is classified as a Survey and Manage Category C lichen. It grows almost exclusively on *Alnus rubra* in riparian forests, but rarely may be found growing on the bark of other hardwoods or conifers or on mossy rock. Management actions that preserve hardwoods in riparian zones, especially old *Alnus rubra*, will benefit this species. Under the Northwest Forest Plan, buffers placed along streams might protect important habitat for this species, though the buffer width may be inadequate to preserve conditions necessary for the species' long-term survival and viability. Silvicultural treatments aimed at encouraging conifer dominance in riparian zones (including the removal of *Alnus rubra* from riparian stands) are detrimental to this species.

Conclusion – Hardwood conversion, occurring under both plans, would not be implemented if this species were located during site-specific surveys. By preserving some larger, continuous tracts of land surrounding riparian zones in the Small Basin Reserves, particularly hardwood-dominated areas, the Middle McKenzie Landscape Design will help maintain conditions that are desirable for this species.

Dermatocarpon luridum – This semi-aquatic lichen is a riparian obligate and is listed as a Survey and Manage Category B species. It grows on streamside or lakeside rocks where frequently wetted. As a semi-aquatic species, poor water quality, including heavy siltation, and flooding that exceeds historical levels, are probably detrimental to this species.

Conclusion – The Middle McKenzie Landscape Design seeks to approximate historical hydrological regimes and, though peak flows could potentially increase in small channels for short periods (e.g., 10-20 years), under this plan increases

would probably be less than those resulting from natural variation in flow patterns.

Hydrothyria venosa – This aquatic lichen species is a riparian obligate. It grows submerged on rocks in mountain streams or springs without marked seasonal fluctuations. As an aquatic species, poor water quality including heavy siltation, and flooding that exceeds historical levels, are probably detrimental to this species.

Conclusion – The Middle McKenzie Landscape Design seeks to approximate historical hydrological regimes and, though peak flows could potentially increase in small channels for short periods (e.g., 10-20 years), under this plan increases would probably be less than those resulting from natural variation in flow patterns.

Leptogium rivale – This aquatic lichen species is a riparian obligate and is listed as a Survey and Manage Category B species. It grows submerged on rocks in smaller, mid-elevation (1250-3200 ft) clear mountain streams. In Oregon, it occurs most often along shady streams running through old growth conifer forests. As an aquatic species, poor water quality, including heavy siltation, and flooding that exceeds historical levels, are probably detrimental to this species.

Conclusion – The Middle McKenzie Landscape Design seeks to approximate historic hydrological regimes and, though peak flows could potentially increase in small channels for short periods (e.g., 10-20 years), under this plan increases would probably be less than those resulting from natural variation in flow patterns.

Leptogium cyanescens – This small, foliose lichen species is found most often on the bark of deciduous trees, but may also be found on conifer bark, decaying logs, or rocks in low elevation, sheltered forests, often on flood plains or near sloughs, lake shores, and in other wet forest sites. This species is a Survey and Manage Category A species.

Conclusion – Under the Northwest Forest Plan, buffers placed along streams might protect important habitat for this species, though the buffer width may be inadequate to preserve conditions necessary for the species' long-term survival and viability. By preserving some larger, continuous tracts of land surrounding riparian zones in the Small Basin Reserves, the Middle McKenzie Landscape Design may help maintain desirable conditions.

Leptogium saturninum – This small, foliose lichen species is found most often on the bark of deciduous trees and shrubs, and occasionally on rock or moss over rock, in moist riparian forests at low elevations (usually between 7,000 to 12,000 ft.). Under the Northwest Forest Plan, buffers placed along streams might protect important habitat for this species, though the buffer width may be inadequate to preserve conditions necessary for the species' long-term survival and viability. Silvicultural treatments aimed at encouraging conifer dominance in riparian zones (including the removal of hardwood trees and shrubs from riparian stands) are probably detrimental to this species.

Conclusion – Hardwood conversion, occurring under both plans, would not be implemented if this species were located during site-specific surveys. By preserving some larger, continuous tracts of land surrounding riparian zones in the Small Basin Reserves, particularly hardwood-dominated areas, the Middle McKenzie Landscape Design will help maintain conditions that are desirable for this species.

Pannaria rubiginosa – This species in ranked as apparently secure globally, but with cause for long-term concern (G4), and is considered to be critically imperiled in Oregon (S1). It is a ranked as a list 3 species (more information is needed before status can be determined, but may be threatened or endangered) by the Oregon Natural Heritage Program, and is a Survey and Manage Category E species. In the west Cascades, it is widespread but scattered and rare. This species grows on the bark and wood of conifers and hardwoods in a wide variety of moist lowland habitats. In Oregon, it is found in greatest abundance in coastal shrub thickets on wet deflation plains.

Conclusion – Under the Northwest Forest Plan, buffers placed along streams might protect important habitat for this species, though the buffer width may be inadequate to preserve conditions necessary for the species' long-term survival and viability. By preserving some larger, continuous tracts of land surrounding riparian zones in the Small Basin Reserves, the Middle McKenzie Landscape Design may help maintain desirable conditions.

Usnea longissima – This lichen is widespread and not uncommon in the Pacific Northwest, though it is threatened or extirpated throughout most of its world range. The extremely patchy distribution of this species on the landscape suggests dispersal limitations that will impede its ability to recover from habitat disturbances. In addition, this species is a common target of the wild-craft and moss harvest trade in the Pacific Northwest. It often grows epiphytic in riparian zones, though it may also be found on other parts of the landscape, particularly ridge tops (D. Keon, personal communication). This species is a Survey and Manage Category F species.

Conclusion – Under the Northwest Forest Plan, buffers placed along streams might protect important habitat for this species. By preserving some larger, continuous tracts of land surrounding riparian zones in the Small Basin Reserves, the Middle McKenzie Landscape Design may help maintain current populations of this species over time, allowing for dispersal of this species to other suitable sites.

Liverworts

Sphaerocarpos hians – The distribution of this species is sparse in the Pacific Northwest, with only three sites region-wide (Christy and Wagner 1996). This species grows on the mud where water levels are low along streams or rivers. Since its habitat is ephemeral and restricted and its distribution seems limited, this species may be especially sensitive to habitat modification. It is likely that this species is dependant

upon long-term ecological stability. In the MMLA, it may be found along the McKenzie River or tributaries west of Leaburg (John Christy, personal communication). This species is considered to be critically imperiled throughout its range (G1 rank), critically imperiled in Oregon (S1), and critically imperiled because of extreme rarity or because it is especially vulnerable to extinction or extirpation (ONHP list 1).

Conclusion – Under the Northwest Forest Plan, buffers placed along streams would protect the streambank habitat of this species, though the buffer width may be inadequate to preserve conditions necessary for the species' long-term survival and viability. By preserving some larger, continuous tracts of land surrounding riparian zones in the Small Basin Reserves, the Middle McKenzie Landscape Design may help maintain desirable conditions.

Bryophytes

Crumia latifolia – This moss species is globally rare, uncommon or threatened (G3), and considered critically imperiled within the State of Oregon (S1), and is listed as threatened with extirpation, or presumed extirpated from the State of Oregon (List 2) by the Oregon Natural Heritage Program, but has no status under the Northwest Forest Plan. It forms dense cushions or sods on wet rocks and cliff faces, usually on calcareous substrates. Though rare, it may be locally abundant. Calcareous rocks are rare in this area, and activities (such as quarrying) that threaten remaining habitat are detrimental to this species. It is unlikely that this species would be found in riparian areas within the AMA, but its extreme rarity suggests the need to protect all existing populations and its habitat specificity makes it a straightforward species to survey.

Conclusion – Under the Northwest Forest Plan, buffers placed along streams might protect important habitat for this species, though the buffer width may be inadequate to preserve conditions necessary for the species' long-term survival and viability. By preserving some larger, continuous tracts of land surrounding riparian zones in the Small Basin Reserves, the Middle McKenzie Landscape Design may help maintain desirable conditions. Under both plans Special Habitat features would be protected.

Plagiochila satoi – This leafy liverwort is found in low elevation riparian forests, on cliffs, rock, and bark. It is taxonomically problematic, a fact which has further obscured the ability to gather and compile information on the species.

Conclusion – Under the Northwest Forest Plan, buffers placed along streams might protect important habitat for this species, though the buffer width may be inadequate to preserve conditions necessary for the species' long-term survival and viability. By preserving some larger, continuous tracts of land surrounding riparian zones in the Small Basin Reserves, the Middle McKenzie Landscape Design may help maintain desirable conditions. Under both plans Special Habitat features would be protected.

Platyhypnidium riparioides – This aquatic moss grows attached to stones in or at the edge of streams. It is considered secure, globally, but with cause for long-term concern (G4), and is listed as critically imperiled within the State of Oregon (S1). It is listed by the Oregon Natural Heritage Program as a list 3 species (more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout its range), but has no Survey and Manage Category rank under the Northwest Forest Plan.

Conclusion – The Middle McKenzie Landscape Design seeks to approximate historical hydrological regimes and, though peak flows could potentially increase in small channels for short periods (e.g., 10-20 years) under this plan, increases would probably be less than those resulting from natural variation in flow patterns.

Racomitrium aquaticum – This moss is found growing on wet rocks along streams, above approximately 660 m elevation. It is a Survey and Manage Category B species.

Conclusion – The Middle McKenzie Landscape Design seeks to approximate historical hydrological regimes and, though peak flows could potentially increase in small channels for short periods (e.g., 10-20 years), under this plan, increases would probably be less than those resulting from natural variation in flow patterns.

Scouleria marginata – This moss species is found on rocks in the spray zone of streams and waterfalls where the water is clean and cold, from lowlands to ~ 700 m. It is considered globally secure, but with cause for long-term concern (G4), and critically imperiled in the State of Oregon (S1). It is listed by the Oregon Natural Heritage Program as a list 3 species (more information is needed before status can be determined, but may be threatened or endangered in Oregon or throughout its range). It is also a Survey and Manage Category 4 species.

Conclusion – The Middle McKenzie Landscape Design seeks to approximate historical hydrological regimes and, though peak flows could potentially increase in small channels for short periods (e.g., 10-20 years) under this plan, increases would probably be less than those resulting from natural variation in flow patterns.

Tritomaria exsectiformis – This leafy liverwort grows on peaty or humic soil, or rotting wood, usually on shady, moist creek banks. Oregon sites where it has been found are in mixed coniferous forests from 3,200 to 5,100 feet in elevation. This species is probably closely associated with permanent, cold-water streams. It is likely that suitable sites for colonization by this species are less abundant at the present time than in the past. For this reason, existing populations are refugia that should be carefully protected. This species is globally widespread and secure (G5), but imperiled within the State of Oregon (S2). It is listed by the Oregon Natural Heritage Program as threatened with extirpation or presumed to be extirpated from the State of Oregon, and is a Survey and Manage Category B species.

Conclusion – Under the Northwest Forest Plan, buffers placed along streams

might protect important habitat for this species, though the buffer width may be inadequate to preserve conditions necessary for the species' long-term survival and viability. By preserving some larger, continuous tracts of land surrounding riparian zones in the Small Basin Reserves, the Middle McKenzie Landscape Design may help maintain desirable conditions.

Vascular Plants – All but two of the vascular plants assessed under the Riparian Module were considered to be riverine riparian associates (see Appendix D - Table D-3). All other riparian vascular plant species were associated primarily with Special Habitat features such as seeps, swamps, and rock outcrops, etc., which will be protected and managed under both plans. No alterations in riparian buffers for those habitats are expected and, if species identified in Appendix D - Table D-3 were found, they would be protected and managed.

Mimulus cardinalis – This species is much more abundant south of the Eugene District and reaches the northern most extension of the species range in the Eugene District. The species has no BLM status (Lane County Sensitive), and mitigation/protection is discretionary. The District tracts occurrences of this species because they represent the northern most populations and because sites are located infrequently. The species is found in perennial streams and is usually found in areas with reduced canopy cover.

Conclusion – It is expected that this species would benefit under both Plans. Direct impacts to plants would not be expected in either plan because of the 25-50 foot streambank buffers, Transition Prescriptions, or other Riparian Reserves.

Epipactus gigantea – Although this species is wide ranging, it occurs very infrequently in the Eugene District. It was placed on the Eugene District Review because of the potential for this orchid to be found in areas where fish projects might occur. The species has no BLM status and mitigation/protection is discretionary. The species is found in perennial streams and is usually found in areas with reduced canopy cover.

Conclusion – It is expected that this species would benefit under both plans. Direct impacts to plants would not be expected in either plan because of the 25-50 foot streambank buffers, Transition Prescriptions, or other Riparian Reserves.

2. Animals (excluding fish)

Cascade Frog – No known locations of cascade frogs exist within or near the planning area. It is unlikely locations will be discovered in the future due to lack of suitable aquatic habitats (bogs, ponds, marshes with some sun) at higher elevations (generally above 2,800 feet). This species is more typical of higher elevations east of the area. If the species is detected in the future, management strategies would be developed.

Tailed Frog – Tailed frogs could potentially be found in streams of all sizes in the

area, but are most common in smaller (1st-3rd order) streams. Habitat preferences include clean, cold, high gradient rocky streams below 6,500 feet. The species has a high degree of sensitivity to short or long-term temperature and sediment increases in streams. Individuals may concentrate in lower order streams to avoid predation from fish and Pacific giant salamanders.

Tadpoles grow for up to 4 years before transforming to the juvenile stage. Tadpoles and younger juveniles are limited to stream environments. Eggs and hatchling tadpoles require clean, cold, high gradient streams usually larger than or 2nd order with some algal growth. Transformed juveniles and adults may use all stream sizes, including 1st and 2nd order. Adults (and older juveniles) regularly use terrestrial environments, with forage, dispersal, and travel often occurring over forested land away from riparian areas, including travel over ridge tops.

In confined and unconfined fish-bearing streams, stream temperatures and sediment may increase slightly as a result of harvest activities. Effects will be short-term and localized and are not expected to impact local populations in the long- term.

In non-fish-bearing and intermittent streams, removal of some riparian vegetation might reduce the densities of juveniles and adults until canopy shade reestablishes in 5- 20 years. Tadpoles might benefit from a *slight* increase in sun and algal production as long as sediment input is not excessive. Cold water temperatures without chronic or excessive sediment inputs and contiguous moist, forested terrestrial habitat in and away from riparian zones is expected to be maintained by the MMLD.

Conclusion – Although the short-term intensity of effects to individuals and their non-fish-bearing and intermittent habitats will be greater, their frequency would be less due to longer regeneration rates when compared to the NFP. Additional benefits from harvest transition zones between riparian areas and upslope areas, increased amounts of coarse woody debris retention and creation (in riparian and upslope environments), increased riparian vegetative species diversity, some shade retention, stream restoration activities, no net increase in roads, and maintaining State water quality standards will reduce the differences in short-term effects as compared to the NFP.

Small Basin Reserves and other reserves (8,455 acres) are expected to provide persistence refugia ,source populations, and dispersal opportunities. Small Basin Reserves # 6-10 are currently suitable habitat for the species in the planning area and were designated, in part, to provide current and future habitats, connectivity to other reserves, and dispersal corridors. The highest known concentrations of tailed frogs on the Eugene District are located within Small Basin Reserves # 5-9.

Overall, the long-term benefits to the species as a result of implementing the MMLD are expected to be similar to the NFP and comparable to natural conditions with the additional benefits of larger, mostly undisturbed, refugia and source population areas in the Small Basin Reserves. Habitats similar in size and quality to those provided in the Small Basin Reserves probably would not be provided by the NFP (short and long-

term).

Cascade Torrent Salamander (= Cascade Olympic Salamander) – The torrent salamander inhabits primarily perennial and intermittent streams and headwaters, seeps, springs, and splash zones with cold, clear, well-oxygenated water below 4,000 feet. Aquatic habitat requirements are similar to but more limiting than those for tailed frogs. The species is particularly sensitive to fluctuations in water temperature and turbidity. Adult and larval individuals inhabit well-shaded streams with moss-capped rock rubble and water trickling between the rocks (Applegarth, 1994 from Anderson 1968). They are thought to be limited to streams with water temperatures less than 13° degrees C (55 deg. F), (Applegarth, 1994). Dispersal and travel are strictly aquatic, without the use of nearby terrestrial habitat. Dispersal capabilities from one low order stream to another are low, being limited by an avoidance of land, open water, and large streams. Rates of recolonization of disturbed habitats is presumed to be slow. Most of the known individuals in the MMLA (Marten and Bear Creeks) are within Small Basin Reserves # 6-8.

Under implementation of the MMLD, breeding habitats in non-fish-bearing streams, downslope from regenertion harvest activities, would receive temporary sediment inputs or water temperature increases that might affect individuals until conditions recover.

> **Conclusion** – Effects to this species and their habitats would be similar to those described under the tailed frogs; *non-fish-bearing and intermittent streams* and conclusion paragraphs. SBRs 6 - 8 will continue to provide refugia and future source populations. Overall benefits to the species, as result of implementation of the MMLD are expected to be similar when compared to the NFP and natural conditions.

Dunn's Salamander – Dunn's salamanders can be found in permanently wet/moist terrestrial conditions near *all streams and in upslope terrestrial environments*. More individuals are generally found near streams, but this might be an artifact of survey efforts or available habitats in some managed forests. These salamanders can be found in young to late-seral stands where suitable moisture and cover is available. Cover and nesting habitats include down logs, talus, and rock crevices. Little is known about specific nesting requirements. Effects to habitat would likely be short-term and localized. The species seems to have enough capability to persist, disperse, and recolonize, that local effects to individuals would be similar or less than expected under the NFP and similar to natural conditions.

> **Conclusion** – The species' apparent mobility and use of terrestrial habitats, lack of dependency on streams, combined with increased amounts of coarse woody debris creation and retention in riparian and upslope environments, general availability of closed canopy forested habitats through time, and Small Basin Reserves, suggest that benefits to the species as a result of implementation of the MMLD are expected to be equal or greater than the NFP and similar to natural conditions.

Red-legged Frog – For breeding, red-legged frogs require quiet, slow moving water that receives some sun. Most breeding habitats in the MMLA are expected to be below 2000 feet elevation in small ponds, flood plains of the McKenzie River or slow moving portions of low gradient streams. Breeding habitats are usually partially or fully shaded (but not receiving full sun) within or adjacent to forested conditions and are usually the limiting factor for this species. Beaver dams can provide valuable habitat in areas where breeding locations are scarce. Adults can be found near breeding sites at any time of year and also require moist terrestrial habitats for dispersal, foraging and travel, especially between breeding sites. Conditions must remain moist since they are not resistant to dehydration. This species is vulnerable to predation from exotic fish and bullfrogs.

Pond breeding habitats (natural and constructed) greater than 1.0 acre will be managed as " special habitats" consistent with direction in the NFP. Smaller ponds would receive similar protections when identified as known or potential breeding sites by the project IDTeams. Overall, pond habitats would be maintained through planned management.

Many of the *stream breeding habitats* on BLM land are expected to be in lower slope *fish-bearing streams* or their flood plains receiving Riparian Reserve widths adequate to maintain the integrity of the site for breeding. Most breeding would occur in these habitats or upland ponds.

Some *non-fish-bearing or intermittent stream* habitats, to a lesser degree, may fulfill breeding requirements for the species. The adjacent terrestrial vegetation, including potential travel and dispersal routes, would be reduced due to Riparian Reserve widths in this Landscape Design, but should still function until the surrounding forest recovers. Breeding habitats in non-fish-bearing streams, downslope from harvest activities, would receive temporary sediment inputs that might affect use of these sites for breeding until conditions recover. Often, breeding habitats are located in more gentle terrains that are less affected by sediment inputs from nearby activities

Availability of terrestrial habitats should be similar to the NFP with additional benefits expected from the increased conifer species diversity and down wood levels that contribute to moist and shaded conditions on the forest floor. Small Basin Reserves are expected to provide some additional breeding habitats and dispersal opportunities beyond those probably available with management under the NFP.

> **Conclusion** – Most breeding habitats will be maintained by the MMLD. Terrestrial habitats should receive benefits equal to or greater than the NFP. Overall, implementation of this MMLD is expected to provide equal or greater benefits as compared to the NFP and similar to natural conditions.

Western Pond Turtle – In the planning area, adults live in permanent water below 2,000 feet that receives high amounts of sun, and there are emergent vegetation and logs or rocks for basking. They can be found in quiet ponds and sunny, slow moving

(lentic) portions of streams and their flood plains. Adults leave the water only to bask in the sun or to lay eggs on land. Eggs are usually laid within a quarter mile of breeding sites. Juveniles will use more quiet and vegetated portions of the adults habitats or smaller ponds, swamps etc. nearby. Impacts from forest management are limited to activities that impact water quality, introduce exotic vegetation (such as Himalayan blackberry), reduce the amount of sun or overly compact soils within a quarter mile of breeding sites. Management activities that increase the amount of sun benefit the species (for basking, warmth and egg development). No known pond turtle sites exist within the planning area; they have been detected east and west of the planning area. Most potential breeding habitat in the planning area is on non-federal lands along the flood plains of the McKenzie River. Breeding habitat on BLM land might be present in the eastern portions of the planning area with all of this habitat within the McKenzie River Scenic Corridor.

Conclusion – Overall, the planning area is not considered "optimal" habitat for the species, although it is possible they might be located in the future. Implementation of this MMLD would provide benefits to individuals and their habitat equal or greater than those in the NFP and similar to natural conditions.

Harlequin Duck – Harlequin ducks have been detected in the planning area along Marten Creek. These ducks spend much of their life cycle in the Pacific Ocean and travel inland to breed in early March. Breeding and rearing occurs along streams usually greater than 2nd or 3rd Order with rocky substrates, an abundance of riffles and rapids, and a high amount of loafing sites (above water, rocks and, occasionally, logs). Higher Order streams might have a greater likelihood of providing breeding habitat.

Overhanging vegetation that still allows open space for flying is typically reported. Water quality that supports macroinvertebrate prey items such as caddis fly larvae, especially *Dicommoecus gilvipes*, seems to be a key to breeding success. Hatchlings require slower pocket water areas for foraging. This species prefers areas that are free of human disturbance (both noise and line-of-sight activities), yet they are known to use areas with human disturbance nearby. It is assumed that *some* individuals or local populations have "evolved" with some disturbance through time and have the ability to gradually adapt this behavior. In general, newly introduced disturbance from March through July is believed to disrupt breeding. There seems to be a correlation with mature and late-successional forest stages for breeding sites, although the importance of forest seral stage is not well known.

Disturbance seems to be the most likely potential effect to breeding. If breeding locations are detected, ID Teams will develop management strategies to protect nests from disturbance.

Conclusion – Implementation of the MMLD should provide benefits equal or greater than those in the NFP. The McKenzie River Scenic Corridor, Riparian Reserves, Small Basin Reserves # 5, 6, 7 and 8 and other reserves should assist in providing breeding habitat for this species.

White-footed Vole – White-footed voles seem to have a strong association to riparian areas in all forested seral stages, with the greatest abundance in hardwood riparian stands. They have also been detected in clear cuts and meadows and other non-forested habitats and might benefit from forest openings near streams. Occasionally they are located upslope from riparian areas. Diet consist of alders, willows, and other deciduous and riparian shrubs and forbs both on the forest floor and extending into the hardwood canopy. This species is generally scarce across its suspected geographic range.

Conclusion – Management activities are expected to have little to no effect on individuals or their habitats as they are known to use a variety of habitats in all seral stages and utilize a wide array of food resources.

Implementation of the MMLD is expected to provide benefits equal or greater than natural conditions or the NFP.

5.4 Federally Threatened and Endangered Species

No Federally Threatened or Endangered plant or fungi species are known or suspected in the MMLA.

5.4.1 Northern Spotted Owl *(Strix occidentalis caurina)*

Conclusion - Overall, implementation of the MMLD will provide benefits to spotted owls similar to natural conditions and greatly exceeding those expected under the NFP.

The MMLD would provide greater benefits to spotted owls as compared to the NFP due to
- Harvest prescription designs for green tree retention, higher levels of down logs and snags, increased conifer species diversity, and multi-tiered 3-2 cohort stands.
- Longer regeneration rate
- Larger harvest patch size
- Improved spatial orientation, functionality, and availability of suitable and dispersal habitats
- Augmentation of unmapped LSR cores with Small Basin Reserves
- Maintenance of high levels of suitable habitat through time.

Table 5-9 – Spotted Owl Dispersal and Suitable Nesting Habitat Acres Current and Future Conditions under the MMLD (% = % of all BLM lands in the MMLA)

Spotted Owl Habitat Acres	2000		2050		2100	
	Acres	%	Acres	%	Acres	%
Dispersal Acres (40-79 years)	3,316	20.1	3,681	22.3	2,269	13.8

Suitable Nesting Acres (80-180+ years)	9,777	59.3	10,204	62	11,725	71.1
Totals	13093	79.4	13885	84.3	13994	84.9
Overall age classes would remain very similar under the MMLD and the NFP.						

Discussion

Surveys and Known Sites – Surveys have been conducted over much of the area since 1988. There are eight known spotted owl sites on BLM managed lands within the AMA planning area. Five of these sites have designated NFP core areas (Unmapped-LSRs) totaling 517 acres. At least four additional sites are known to exist on private or USFS lands within one mile of BLM lands.

Dispersal and Suitable Nesting Habitat (see Table 5-9) – Suitable nesting habitat is generally defined as stands ≥ 80 years old. Dispersal-only habitat is defined as stands between 40-79 years old. Over the next 100 years, the amount of suitable habitat > 80 years old would increase from 9,777 to 11,725 acres; the amount of high quality old growth habitat (≥ 180 years old) would increase from 429 to 5,315 acres; while the amount of dispersal-only habitat would decrease from 3,316 to 2,269 acres (much due to conversion to suitable nesting habitat).

The amount of suitable and dispersal habitat under the MMLD, NFP or natural conditions would fluctuate through time. Under the MMLD, the amount of these habitats will be very similar to the NFP and natural conditions. Overall, when acres in age classes alone are examined, over 80 percent of the MMLA would be in dispersal or suitable habitat condition over the next 100 years. The most significant difference under the MMLD, when compared to the NFP, will be increased functionality of suitable habitat due to increased patch size and spatial orientation; and the resulting greater availability of nesting, roosting, and forage habitat within the home ranges of known sites.

Under the NFP, much of the suitable habitat would be within Riparian Reserve allocations. Under the MMLD, suitable habitat will be situated in larger patches due to larger size harvest landscape blocks and Small Basin Reserves (SBRs). These larger patch sizes will continue to be immediately available to existing known sites. Five of the spotted owl sites are included within SBRs # 5-9. These five patches alone represent 2,883 acres of which greater than 70 percent (over 2,000 acres) are currently greater than 80 years old. The quality and amount of this habitat for nesting will only improve through time as stands age and naturally develop more late-successional characteristics. These SBRs alone will significantly increase the likelihood these sites will persist through time as compared to the NFP.

Reserved and Withdrawn Inclusion Areas – Roughly 45 percent of the MMLA will be in reserve or withdrawn status not subject to standard harvest activities due to withdrawn inclusions (i.e., Aquatic reserves, spotted owl cores, BEHAs). These acres will remain

mostly undisturbed (relative to management activities) through time under the MMLD. These stands should improve as owl habitat as they age and naturally develop more late-successional characteristics. Any treatment in these areas will be directed by ecological or restoration objectives consistent with the intended values for these areas.

Non-reserved Areas – The remaining 55 percent of the MMLA will be subject to commercial thinning and regeneration harvests. The overall quality and benefits of habitat and patch sizes in non-reserve areas will exceed those in the NFP. The following MMLD design features for all harvests will improve forested habitat quality and greatly reduce effects due to fragmentation:

- **green tree retention** – provides older green tree legacy that improves short and long-term quality of harvested patch, reduces microclimate and edge effects due to sharp contrasts between harvest patches and adjacent forests, and allows for quicker re-use as nesting, roosting, or foraging habitat after harvest.
- **2-3 cohort stands with increased conifer and hardwood species (including shade tolerant species), greater canopy diversity and overall stand complexity** – improves quality and resiliency of habitat in short and long-term, providing for quicker use of habitat after harvest and greater species diversity in vegetation and prey base.
- **management for 300 linear feet of down logs and 8 snags per acre** – provides persistence habitat for some prey items and creates or maintains future nesting habitat for owls that would be available sooner when compared to the NFP.
- **Riparian Corridors** – maintains riparian habitats to be used as nesting, roosting, and foraging habitat.
- **large landscape blocks** (patch size of harvest) – reduces isolation of forested patches resulting in less created edges and fragmentation that in turn reduce effects to microclimate, edge creep (e.g, chronic wind throw), competition between interior and edge species, and owl juvenile or nest predation by other raptors.
- **relatively long regeneration rates (100 or 180 years), that are greater than the NFP** – reduces frequency of effects due to regeneration harvests and allows more time for adjacent stands to recover.
- **no net increase in roads within Key Watersheds** – creates no additional effects associated with edges; roads densities are currently very low in the nomination area.

Critical Habitat – BLM lands in the MMLA are considered important low elevation dispersal corridors between the higher elevation LSRs in CHUs OR-16 to the northeast and OR-18 to the south. The northeast portion of the MMLA is within designated Critical Habitat Unit CHU OR-16 and is intended to function as both dispersal and nesting habitat. CHU OR-16 is roughly 100,700 acres, with 4,501 acres (4.5 %) on BLM AMA lands. SBRs will contain 1260 acres of critical habitat that is currently over 80 years old. Stands within the MMLA will remain connected with the adjacent USFS Mt. Hagen LSR in CHU OR-16.

Management of Owl Sites – Current and future spotted owl sites will be managed consistent with the NFP and the Endangered Species Act for sites in Matrix lands, including all requirements to conduct consultation on projects that might affect owls or their habitat

due to habitat modification or noise disturbance.

5.4.2 Northern Bald Eagle *(Haliaeetus leucocephalus)*

Conclusion – Benefits from implementation of the MMLA will be similar to natural conditions and exceed those expected under the NFP. Implementation of the MMLD will adequately maintain and enhance perching, foraging, midwinter roost, and nesting habitats within the MMLA through:

- Implementation of the McKenzie Resource Area Bald Eagle Habitat Management Plan (MBEHMP) and compliance with the Endangered Species Act, including restrictions on habitat removal and noise disturbance, plus application of seasonal restrictions if necessary.
- Management of other withdrawn areas, especially the McKenzie Wild & Scenic River Corridor and Aquatic Reserves.
- No net increase in roads in the Bear Creek and Marten Creek Key Watershed.
- Maintenance of the currently low amount of human disturbance and naturally limiting access in the area
- Harvest prescription designs for greater green tree retention, higher levels of down logs and snags, increased conifer species diversity, and muti-tiered 2-3 cohort stands as compared to the NFP.
- Relatively long regeneration harvest rotations of 100 and 180 years.

Discussion

Surveys and Known Sites – No known northern bald eagle midwinter roost or nest locations currently exist on BLM lands within the MMLA. There is no established survey protocol for bald eagle use. Mid-winter bald eagle counts were conducted along the McKenzie River by boat in 1995 and 1996. Continuous road point surveys along the highway adjacent to the river were conducted from 1995-2000. No eagles were detected within the MMLA. All surveys were conducted one time in January. Survey intensity, steep topography, and lack of surveyor vantage points or road access were limiting factors in determining if these surveys adequately evaluated eagle use in the action area. More intense survey efforts are necessary to determine if eagles are using the area. Surveys will be conducted for activities that might affect nesting bald eagles or their habitat. The area is probably used for perching or foraging, and there is a good chance that eagles will use the area in the future for either midwinter roosting and/or nesting.

Evaluation of Current and Future Midwinter Roost and Nesting Habitat – The McKenzie River is the only major water forage resource for eagles in the MMLA. Midwinter roost and nesting habitat in the area is minimally defined as stands greater than 80 years old within 1-1.5 miles of the McKenzie River. Nests would likely be within line-of-sight of the river. Midwinter roosts could occur anywhere in the MMLA.

The area was evaluated for potential bald eagle habitat by District biologists and Frank Isaacs and Bob Anthony of the Oregon Cooperative Wildlife Research Unit in 1987. The

BLM also coordinated with the Oregon Dept. of Forestry and the U.S. Fish & Wildlife Service. The evaluation included aerial and ground surveys and office evaluation of stand characteristics. Criteria consistent with these evaluations and *The Pacific States Bald Eagle Recovery Plan* were used to develop the MBEHMP that would continue to be implemented under the MMLD or the NFP.

Bald Eagle Habitat Areas (BEHAs)are a component of this management plan and are withdrawn inclusions to be managed for current and future habitat for eagles, including a general objective to manage for old growth characteristics. Recommended management prescriptions were developed at the BEHA block and stand unit levels to maintain or improve habitat quality or likelihood of use in each BEHA (as needed) and include :

- Tree planting to improve stand composition or provide perching and foraging locations near the McKenzie River.
- Individual tree management to accelerate the growth and accentuate the features of individual trees displaying characteristics for nesting or foraging.
- Further examination of habitat for general evaluation and monitoring and to elaborate on restoration possibilities at the stand and individual tree levels.
- Density management and understory or precommercial thinning to accelerate late-successional characteristics.
- Creation of snags and down logs of quality and quantity typical in late-successional stands.
- Closure or decommissioning and sign posting of roads to reduce human disturbance.
- See the MBEHMP for further details.

BLM lands within the MMLA are considered important for eagle recovery because they contribute the majority of the total acres and best current and potential habitats within the McKenzie River recovery sector based on current stand age and structure, proximity to the McKenzie River, amount of human disturbance, low road densities, expected use and condition of lands adjacent to BEHAs, contiguous federal ownership, and immediate availability of these habitats for use by eagles.

Table 5-10- Bald Eagle Potential Suitable Nesting Habitat Acres Current Conditions under the MMLD.

	BLM AMA Acres Within 1.5 Miles of the McKenzie River		
Age Class	Acres in BEHAs	Acres Outside of BEHAs	Total Acres
All age classes	1,644	9,715	11,359
≥ 80 yrs old	1,347	5,243	6,590

Note: 173 acres of BEHAs are situated suitable for nesting but located > 1.5 miles of the river.

Table 5-10 represents the total and ≥ 80 year age class acres both in and outside of BEHAs that are within 1.5 miles of the McKenzie River. Stands in BEHAs will be managed for eagles consistent with the MBEHMP and should continue to provide nesting habitat through time. Many of the stands within 1.5 miles of the river and outside of BEHAs are in withdrawn areas (e.g., Aquatic Reserves, spotted owl Unmapped-LSRs, McKenzie Wild and Scenic River status) that will function as eagle habitat now and in the future. Stands along the south bank of the river are relatively protected from strong southern winds that can blow down nests or nest trees.

Current and future spotted owl sites will be managed consistent with the NFP and the Endangered Species Act for sites in Matrix lands, including all requirements to conduct consultation on projects that might affect owls or their habitat due to habitat modification or noise disturbance.

5.4.3 Bull Trout and Spring Chinook

Conclusion – The MMLD is consistent with the ACS. Section 5.3 give an analysis of MMLD as it relates to the ACS objectives. Implementing the MMLD would not prevent the attainment of the ACS objectives. MMLD would provide 1-2 site potential width buffers on fish-bearing streams. MMLD would provide wood for streams, stream bank protection, and aquatic reserves. It will provide for longer rotation, more down wood, snags, and green tree retention than the NFP. The MMLD will maintain or enhance habitat on public lands. The MMLD would meet State Water Quality standards. A habitat management plan is the process of being prepared.

Bull Trout – The MMLA is within the historic range of the McKenzie River bull trout. Bull trout in the McKenzie watershed are Federally listed as a threatened species. Critical habitat extends from Hendricks Bridge upstream to the headwaters of the McKenzie and larger tributaries. Bull trout use the McKenzie River in the proposed MMLA area for foraging and as a migratory corridor. Bull trout have probably used Marten Creek for spawning and rearing, and habitat remains suitable for use for foraging and rearing.

Spring Chinook – Spring chinook are listed as Federally threatened species. The spring chinook use the McKenzie River in the MMLA area for migration, spawning, and rearing. Spawning and rearing also occur in Marten and Deer Creeks.

5.5 Survey and Manage and Protection Buffer Species

The riparian and upland survey and management requirements for species listed as Survey and Manage will be directed consistent with the NFP and current management recommendations, and the Standards and Guidelines and the Adaptive Management Area System (May 2000). See Appendix D for additional information on Survey and Manage species.

5.6 Evaluation of the Low Elevation Headwaters of the McKenzie River Proposed ACEC

Section 2.0 describes the proposal, nomination and screening process history of this proposed ACEC. Appendix E contains the original wording of the key issues plus the relevant and important values that are discussed in this section. The following species' habitats and life histories are discussed in greater detail in ACS Objective # 9: tailed frog, red-legged frog, cascade torrent salamander, harlequin duck and white footed vole. Northern Spotted Owls are discussed in Section 5.4.1 Section 5.6 provides a discussion and an evaluation on how the Proposed ACEC relevant and important factors will be addressed under the Middle McKenzie Landscape Design.

5.6.1 General Discussion

The proposed ACEC nomination includes roughly 7674 acres. Approximately 4820 acres (63%) of this area will be in Withdrawn Type Inclusions, not subject to harvest prescriptions under the MMLD, due to one or more of the following: Bald Eagle Habitat Management Areas, spotted owl Unmapped-LSR cores, Riparian Reserves, Small Basin Reserves, and other resource concern withdrawals. These areas are excluded from the harvest base and management activities for the benefit of a particular inclusion. SBRs may receive some treatment which would be directed to maintain the ecological values in the reserve. The remaining 2854 acres (37 %) of the area would be regeneration harvested at a rate of approximately 1.0 percent or 14.4 acres/year in LA 1 north of the McKenzie River and 0.56 percent or 7.8 acres/year in Landscape Area 2 south of the McKenzie River.

The original ACEC nomination did not recommend a "forest preserve where commercial forestry operations were to be precluded or even a long-term deferral," but rather the nomination focused on a "desire to secure the special management attention needed to adequately protect (and enhance where possible) all of the relevant and important natural values associated with these areas during all future management for commercial forest products." These relevant values will be maintained or enhanced and should receive benefits equal to or greater than would be expected under the NFP and similar to natural conditions. The temporal and spatial harvest arrangement combined with longer rotation periods for regeneration harvests is expected to sustain wildlife and habitat elements identified in the original ACEC nomination.

5.6.2 Factors Relevant to Maintaining Many of the Values of the Proposed ACEC

The following are factors pertinent to many of the relevance and importance criteria in the original ACEC nomination.

Small Basin Reserves (SBRs) – Table 5-11 describes the SBR that were chosen, in part, to meet the relevant and importance criteria for the ACEC nomination.

Table 5-11 – Small Basin Reserves Within the Proposed ACEC

SBR Numbers	Acres	Comments

4	39	about 20 acres in proposed ACEC
5	1,221	all acres in proposed ACEC
6	298	about 140 acres in proposed ACEC
7	690	all acres in proposed ACEC
8	444	all acres in proposed ACEC
Total	**2692**	**2,525** acres within ACEC nomination

SBRs from the above list and SBR #9 would contribute an additional 407 acres that are outside of, but contiguous with, the proposed ACEC boundaries and would augment these habitats. The patch size, orientation on the landscape, and total amounts of the SBRs alone contribute greatly to maintaining the values intended for the ACEC.

Mature and older age forests – The average amount of mature or older forest within the nomination area will remain equal to or greater than the existing conditions within the proposed ACEC. The table below shows an increase of 440 acres (5 %) over the next 100 years.

Table 5-12 Forested Habitat ≥ 80 Years Old Within the Proposed ACEC

Year	Acres	Percent ≥ 80 years old
2000	5,480	72
2100	5,920	77

Forested connectivity of mature and older stands within the nomination area and to the adjacent USFS Mt. Hagen LSR - Connectivity with the Mt. Hagen LSR will be maintained through time in SBR # 4 and 5. Longer regeneration rates, SBRs, and other reserves are expected to maintain a connectivity corridor between the USFS Hagen LSR downslope, south to the McKenzie River, and then north and upslope to SBR # 7. Withdrawn type inclusions alone would provide 3 larger areas of reserved habitat that should continue to provide some level of stable connectivity through time.

Habitat Quality – An estimated 4,820 acres (63%) of the nomination area will be in within withdrawn inclusions that will continue to age and naturally progress through seral stages and/or be silviculturally treated to enhance desired habitat features. The remaining 37 percent of the area would be disturbed by regeneration harvests at a rate of 1.0 percent or less per year on the average over the next 100 years. This habitat would provide benefits greater than those expected in the NFP , including: improved conifer species diversity-including shade tolerants, multi-tiered 2-3 cohort canopies, greater amounts of down logs and snags, and less fragmentation with greater amounts of contiguous habitat and interior forest conditions. An overall objective of the MMLD is to more closely mimic the natural disturbance processes within the nomination area while maintaining

some habitats as refugia (Aquatic Reserves).

5.6.3 Discussion on Specific Relevance and Importance Criteria

The four key values for this proposed ACEC are as follows:

- Management of the south bank of the McKenzie River scenic values
- Large Blocks of Low Elevation Land
- Management of BLM Special Status fish resources
- Management of large blocks of low elevation lands for wildlife resources

Within this section is an analysis of how the MMLD would maintain or enhance each value/resource.

5.6.3.1 Management of the south bank of the McKenzie River scenic values

Relevance – The Middle McKenzie Landscape Design offers guidelines for timber harvest activities such as creating smaller treatment areas in areas of high scenic quality and feathering the edge of the regeneration harvest. These guidelines would mitigate the visual contrasts created by harvest activities if visual resource design principles are properly applied to the timber harvest. Timber management actions would require a case by case analysis and visual contrast consideration at the early project design phase to be effective. The MMLD would maintain the south bank's scenic resources by implementing the above guidelines.

Importance – The Middle McKenzie Landscape Design would maintain those scenic qualities, which qualify the ACEC as having scenic resources of more than local significance by protecting the viewsheds of the McKenzie River and Highway 126 from new visual contrast generating management activities, that traditionally degraded the scenic quality of these viewsheds. The MMLD goes further by providing the means to mitigate the visual contrasts created by past management activities that are seen by local, regional, and national originating tourists, including commercial recreation visitors, as degrading their enjoyment of this area's scenic resources.

Conclusions - The MMLD contains guidelines that will maintain the ACEC South Bank scenic resources. The plan also provides opportunities to actually enhance the South Bank area scenic quality through timber harvest design adjustments that would diminish the visual contrasts created by past timber management activities, particularly in the upland portions of the proposed ACEC (see Criteria and Rationale for Specific Scheduling Choices).

5.6.3.2 Large Blocks of Low Elevation Land

Relevance

Riparian Community – The Middle McKenzie Landscape Design, which is based on a

historic fire regime, contains guidelines to maintain and enhance both the riparian system and general water quality. Guidelines focus on maintaining and developing complex stands in riparian areas throughout the drainage network. The riparian areas would remain contiguous and unfragmented. Management guidelines are designed to encourage the development of complex mature riparian stands. The landscape area is known for its excellent water quality and supports many designated and beneficial uses. Water quality is expected to remain at high levels under the Landscape Design (refer to ACSO 4 and 5).

Vegetation – An estimated 4,820 acres (63%) of the nomination area are currently in forested mature or older stands in SBRs and other withdrawn inclusions (i.e., spotted owl cores, BEHAs). These acres will remain mostly undisturbed (relative to management activities) through time under the MMLD and are not part of the regular harvest land base. These stands should improve as wildlife habitat as they age and acquire more old growth structural components. Management treatments in these areas will be designed to restore or improve such components and the values intended for that inclusion. Remnant and future mature/old growth stands will be maintained within Riparian Reserves. Also see Table 5-12.

The remaining 2,830 acres (37 %) of the nomination area is subject to regeneration and thinning harvests. Treatments in these areas will maintain some mature/old growth components through:

- management of 300 linear feet of down logs and 8 snags per acre
- increased conifer and hardwood diversity (including shade tolerant species).
- management for mulit-tiered 2-3 cohort stands
- regeneration rates of 100 and 180 years in LA 1 and LA 2, respectively
- green tree retention

Connectivity will be maintained in areas that are withdrawn and not in the regular harvest base. The areas that are in the harvest base will also maintain some degree of connectivity due to:

- regeneration harvests that would disturb, on average, 11.1 acres per year (1.0 % or 14.4 acres/year in LA 1 north of the McKenzie River and 0.56 % or 7.8 acres/year in LA 2 south of the McKenzie River).
- Also see discussion under 4 B – Wildlife Diversity.

The Marten Creek 6th field watershed contains roughly 2,680 acres, with over half of this area in Small Basin and Riparian Reserves. The remainder would be subject to regeneration harvest at a rate of 0.56 percent or 7.8 acres/year. At any time most of the area would be in mature or older forest stages.

Table 5-12 shows that the average amount of mature or older forest within the nomination area will remain equal to or greater than the existing conditions within the proposed ACEC.

Forested connectivity between the AMA and the higher elevation Mt. Hagen LSR will be

maintained through areas in withdrawn inclusions that are not part of the regular harvest base. Implementation of the MMLD is expected to allow the continued connectivity of biotic and abiotic resources within the nomination area and to the adjacent USFS Mt. Hagen LSR.

Conclusion – Special management under ACEC designation is not needed to maintain or protect the large block of low-elevation land. The MMLD would maintain or enhance the primary values associated with the large block of low-elevation land.

5.6.3.3 Management of BLM Special Status fish resources

Relevance

Bull Trout – The ACEC nomination is within the historic range of the McKenzie River bull trout. Bull trout in the McKenzie watershed are Federally listed as a threatened species. Critical habitat extends from Hendricks Bridge upstream to the headwaters of the McKenzie and larger tributaries. Bull trout use the McKenzie River in the proposed MMLA area for foraging and as a migratory corridor. Bull trout have probably used Marten Creek for spawning and rearing, and habitat remains suitable for use for foraging and rearing.

Cutthroat Trout – Approximately 0.6 mile above the mouth of Bear Creek is a waterfall that acts as a natural barrier to the upstream migration of fish. Sculpins and cutthroat trout are found above the falls. This isolated population of cutthroat trout may have developed unique genetic characteristics. The Oregon Department of Fish and Wildlife recognizes the Bear Creek population as a Population of Interest, and have included it on the wild fish monitoring list. Steelhead trout spawn in Marten, Bear, and Deer creeks. In addition, native rainbow trout (called redsides) and cutthroat trout migrate from the McKenzie River into all accessible tributaries of the McKenzie River in the MMLA area. The young of the redsides rear for only a short time in the tributaries, but young of the cutthroat may remain for a longer time.

Anadromous Salmonids – Spring chinook are listed as Federally threatened species. The spring chinook use the McKenzie River in the MMLA area for migration, spawning, and rearing. Spawning and rearing also occur in Marten and Deer creeks.

Table 5-13 – Sub-basins Reserve Acres in the Proposed ACEC

Subbasins	Total BLM Acres	Total Acres in Reserve	Percent in Reserve
Marten Creek	3,426	1,782	52
Bear Creek	2,413	1,466	61
Deer Creek	879	668	76

The MMLD provides for fish-bearing streams to have 1-2 site potential tree width reserve

on them. Non-fish-bearing streams will have 25-50 foot stream bank buffer on them.

Importance

The McKenzie River and tributaries in the MMLA plan area provide habitat for two Federally-listed species and one genetically isolated population of a third species. The area is included as Critical Habitat for the two Federally-listed species. In addition, the McKenzie River provides habitat for other resident and anadromous salmonid species. The MMLD would maintain the habitat for fish. Marten, Bear, and Deer creeks are used by special status fish species. The Proposed ACEC will have 63 percent of the lands in reserves. Fish-bearing streams receive 1-2 site potential width reserves. Non-fish-bearing streams have 25-50 foot streambank buffers and transition prescription. The MMLD provides longer rates of regeneration, more down wood, snags, and green tree retention than the NFP.

A recovery plan for bull trout is in preparation; it is anticipated a similar recovery plan will be developed for spring chinook. The Eugene District BLM is preparing an Aquatic Habitat Management Plan (HMP) for the aquatic habitat managed by the District in the McKenzie River basin that will provide additional information on proposed restoration activities. The proposed HMP is also consistent with the McKenzie Basin Management Plan developed by ODFW. Proposed management of aquatic and riparian habitat under the MMLA and HMP are consistent with the objectives of the Aquatic Conservation Strategy. Restoration methods in both plans are consistent with the Terms and Conditions of the Programmatic Biological Opinions for both spring chinook and bull trout. It is expected that the MMLA would maintain or enhance the outstanding and remarkable values for which the ACEC was nominated.

Conclusion – Special management under ACEC designation is not needed to maintain or enhance the relevant and important values related to fisheries. The proposed MMLA Plan meets the requirements of the Aquatic Conservation Strategy in the Eugene District Resource Management Plan and the Northwest Forest Plan by maintaining or enhancing aquatic habitat. Because the MMLA plan complies with the Aquatic Conservation Strategy and with the Programmatics for bull trout and spring chinook, it is expected to maintain or enhance the outstanding and remarkable values for which the ACEC was nominated.

5.6.3.4 Management of large blocks of low elevation lands for wildlife resources

Relevance

Tailed Frogs – Information on habitat, life history, and effects to the species is provided in ACS Objective # 9. Most known or suspected habitat is likely to occur on the east side of the planning area. Aquatic breeding and non-breeding habitats for larval, juvenile, and adult stages will be maintained with the MMLD. Terrestrial connectivity for adults will be maintained through reserves. The two most viable known populations on the District are

within the Bear Composite and Marten Creek 6th field watershed regions. Known locations for these populations are included within SBRs #5-8, which are both augmented by additional withdrawn areas and connected by Riparian Reserves. It is expected that locally viable populations at the Region/6th field watershed scale will be maintained and remain viable under the MMLD.

Cascade Torrent Salamander – Information on habitat, life history and effects to the species is provided in ACS Objective # 9. Aquatic breeding and non-breeding habitats for larval, juvenile, and adult stages will be maintained with the MMLD. This species is known or expected to occur in habitats that overlap the tailed frogs in SBRs # 5-8. These are augmented by additional reserves that include likely habitat and are connected by Riparian Reserves. Dispersal abilities are often slow and limited due to an avoidance of terrestrial habitats and open water. SBRs # 5-8, in particular, should provide excellent opportunities for dispersal through time. It is expected that locally viable populations, at the Region/6th field watershed scale will be maintained and remain viable under the plan.

Oregon Slender Salamander – This species has not been located, but could occur at all elevations within the planning area. Known locations are usually isolated or in scattered clumps (Brame 1964, Kirk 1991) and it is believed this salamander has a naturally spotty distribution with poor dispersal capabilities and limited gene flow between local populations (Applegarth 1994). Key habitat features include the mesic floor of coniferous forests with an abundance of snags and down logs (especially Douglas-fir in soft, later stages of decay) and moist rocky habitats with interstitial spaces, crevices etc. This salamander does not require riparian habitats, but can benefit from the associated surface and subsurface dampness created by ponds, lakes, and streams, especially during the warmer or drier times of the year. Individuals have been found in all forested seral stages, with a preference for old growth forests. This preference might be due to the abundance of late stage decay logs and moist complex microclimates on the forest floor and relatively long periods without disturbance. Limiting factors for healthy populations include the continued presence of key habitat features and minimally disturbed forested conditions for persistence and dispersal through time.

Terrestrial breeding and dispersal habitats for this species will be maintained under the MMLD. Down wood is generally limited in the planning area (especially on the east side) with the most current habitats for the species likely occurring in older forests throughout the planning area. Mid-mature age forests might be used if enough down wood is available. It is expected that many of the SBRs and other reserves represent current and future habitat, with most of this providing or accessing dispersal habitat over ridgetops or along riparian corridors. Management of higher (vs. the NFP) levels of down logs and snags (eventual down wood), Riparian Reserves, SBRs and other reserves, and increased vegetative complexity should provide adequate benefits to the species. It is difficult to fully analyze benefits and effects to this species due to incomplete knowledge of its life history and local occurrence combined with its naturally spotty distribution. If local populations are detected, ID Teams will develop management strategies based on local considerations to protect local individuals and their habitats (down woody debris, canopy closure, local hydrology of swamps, bogs, springs and intermittent streams and dispersal

habitat).

Northern Red-Legged Frog – Information on habitat, life history, and effects to the species is provided in ACS Objective #9. Known and potential breeding locations are generally at mid-lower elevations within all parts of the planning area. Much of the habitat in the MMLA probably exists west of the ACEC nomination area. All pond breeding habitats will be adequately maintained under the MMLD with design features for special habitats (ponds, swamps etc.) consistent with the NFP. Stream breeding habitats will be maintained with Riparian Reserves and SBRs. Requisite terrestrial access to aquatic habitats and other uplands for travel and dispersal will be maintained by SBRs and other reserves, increased down woody debris, and the infrequent rate of regeneration harvests. Older juveniles and adults will be able to disperse and forage through thinned areas immediately after harvest, with full recovery for dispersal within 40 years. Forage resources might improve in or near recently harvested areas. If breeding locations are located in the future, ID Teams will develop management strategies to maintain these habitats, including forested corridors between aquatic and terrestrial habitats.

> **Conclusion** – Special management under ACEC designation is not needed to maintain or protect the relevant values for Tailed Frogs, Cascade Torrent Salamander, Oregon Slender Salamander, or Northern Red-Legged Frogs within the Proposed ACEC included in the MMLA. See additional ID Team provisions under each species.

Northern Saw-Whet and Northern Pygmy Owls – These species can be found in young to late seral coniferous forests with high numbers of larger diameter snags. Nesting usually occurs in live and dead snag cavities. Both species rely on primary cavity excavators (e.g., woodpeckers) for creation of most of the available nesting habitat and are, therefore, dependent on the health of these species. Primary excavators depend on complex stands with sufficient snags and down wood (e.g., pileated woodpeckers depend on a large supply of both snags and down wood).

Both species have variable diets, with foraging often occurring in forest clearings, edges, and clear cuts as well as interior forest. SBRs and other reserves, especially spotted owl un-mapped LSRs, will benefit the species and provide mature and older age habitats through time. In areas that are in the regular harvest base, both owls and primary cavity excavators will benefit greatly from the managed levels of 8 snags and 300 linear feet per acre of down wood (beneficial to pileated woodpeckers) in thinning and regeneration harvest areas. Additional benefits will be provided by management for greater conifer species diversity, multi-tiered 2-3 cohort canopies, and less fragmentation , with greater amounts of contiguous habitat and interior forest conditions.

> **Conclusion** – Special management under ACEC designation is not needed to maintain or protect the relevant values for Northern Pygmy and Northern Saw-whet Owls within the Proposed ACEC included in the MMLA.

Mountain Quail – Habitat for this species in Oregon includes open forests and woodlands, burned areas, riparian hardwoods, meadow edges, and chaparral with an

avoidance of dense coniferous forests. Habitat in western Oregon and within the planning area is naturally limited and not a result of past management activities. Management under the MMLD is expected to be neutral or beneficial for the species.

> **Conclusion** – Special management under ACEC designation is not needed to maintain or protect the relevant values for the Mountain Quail within the Proposed ACEC included in the MMLA.

Harlequin Duck – Information on habitat, life history, and effects to the species is provided in ACS Objective #9. Harlequin ducks have been observed along the McKenzie River. Limited surveys were conducted in the nomination area in 1997. The only detection was a breeding pair within the proposed ACEC along Marten Creek. This species could breed anywhere within the MMLA planning area. Breeding habitats require clear, cold streams with adequate exposed boulder loafing sites and minimal noise or in-sight human disturbance. These streams should also support prey items such as caddis fly larvae, especially *Dicommoecus gilvipes*, which seems to have a correlation to successful use of streams for breeding.

The MMLD should maintain water quality for breeding by meeting ACS objectives and State water quality standards. Riparian Reserves and SBRs # 5-8 within the proposed ACEC will maintain current and future breeding habitats. Human disturbance in the area is low due to steep terrain and very low road density with most roads being on ridgetops. The nomination area is within a tier 1 key watershed where there will be no net increase in road mileage. Future road construction of permanent or temporary roads near riparian breeding areas will be rare.

> **Conclusion** – Special management under ACEC designation **is not** needed to maintain or protect the relevant values for Harlequin Ducks within the Proposed ACEC included in the MMLA. If breeding locations are detected in the future, ID Teams will develop management strategies to protect nests from noise and line-of-sight disturbance from March through July.

White-footed Vole – Information on habitat, life history, and effects to the species is provided in ACS Objective #9. This species is believed to use a variety of riparian habitats in all forest seral stages while utilizing a wide array of riparian hardwood, brush, and forb herbaceous food resources. Management activities are expected to have little effect on the species. Habitat created by openings near riparian areas and management to retain and enhance hardwood habitats will benefit these voles by providing additional forage areas. Dispersal habitats would not be affected by the MMLD.

> **Conclusion** – Special management under ACEC designation is not needed to maintain or protect the relevant values for the White Footed Vole within the Proposed ACEC included in the MMLA.

Northern Spotted Owl – See Section 5.4 : Federally Threatened and Endangered Species for further information on this species. Bear Creek was a spotted owl Habitat

Conservation Area (HCA) with 3 pairs and one single owl (4 site centers) within the area of the original ACEC nomination. HCAs are no longer a management designation for spotted owls. As of November 2000, there are 3 established pair sites with NFP unmapped-LSR core areas on BLM lands within the nomination area. At least 4 known sites (on private and BLM land) currently exist within 1 mile of the proposed ACEC boundary.

Current and future spotted owl sites will be managed consistent with the NFP and the Endangered Species Act for sites in Matrix lands, including all requirements to conduct consultation on projects that might affect owls or their habitat.

Table 5-12 shows that under implementation of the MMLD, the amount of suitable nesting habitat defined by age type (80 years old) will remain equal to or greater than currently existing conditions of roughly 5,480 acres.

Reserved and Withdrawn Areas – 4,820 acres (63%) of the nomination area will be in within withdrawn inclusions that are not part of the regular harvest base. Most of this area currently functions as suitable nesting habitat. The quality of this habitat for nesting will only improve through time as stands age and naturally develop late successional characteristics. SBRs # 5, 7 and 8 (2,355 acres) include the 3 known pair sites and currently contain roughly 70 percent mature or older age stands. These SBRs will significantly increase the likelihood these sites will persist through time. Benefits provided by Aquatic Reserves and withdrawn areas will exceed those expected under the NFP.

Areas Included in the Harvest Land Base – The remaining 2,830 acres (37 %) of the nomination area will be regeneration harvested at an average rate of 11.1 acres per year. At any time, portions of the area will function as nesting or dispersal habitat. Under implementation of the MMLD, these habitats would provide greater benefits to owls, when compared to NFP commercially harvested Matrix lands, including: improved conifer species diversity-including shade tolerants, multi-tiered 2-3 cohort canopies, greater amounts of down logs and snags, less fragmentation with greater amounts of contiguous habitat, and interior forest conditions and overall habitat structure that more closely mimics natural conditions.

> **Conclusion** - Overall, implementation of the MMLD will provide benefits to spotted owls similar to natural conditions and greatly exceeding those expected under the NFP. Special management under ACEC designation is not needed to maintain or protect the relevant values for the Northern Spotted Owl within the Proposed ACEC included in the MMLA.

Pine Marten and Pacific Fisher – Martens utilize mid to late seral forests at all elevations and are more common than fishers. Although often associated with mature and late seral forests, martens will use many forest types if adequate food and cover is available. Scattered smaller forest openings less than 10 acres, can benefit this species. Diet mainly consists of small mammals plus occasional birds, fish, invertebrates, berries,

and carrion. Closed canopy forests with adequate amounts of large diameter down logs and snags, especially near streams, are essential for this species.

Fishers are generally scarce in Oregon but are known to use lower elevation habitats more frequently than martens. Habitat is commonly described as large tracts of continuous-canopy coniferous forests at low-mid elevations. Diet mainly consists of small mammals plus occasional birds, fish, invertebrates, amphibians, berries, fungi, and carrion. Key habitat features include larger tracts of closed canopy forest with high amounts of large diameter down logs and snags, especially near streams and other forest wetlands. Availability of these features near streams and other forested wetlands are essential for this species.

Surveys and Known Sightings – Although there are no known conclusive historical records for these species occurring in the area, historically, both species probably were present. Reliably applying adequate survey and monitoring techniques for these species is difficult and lacking in the area. Carnivore camera surveys were conducted within the nomination area in the winter of 1994. These studies did not provide evidence of martens or fishers in the area, but are considered inconclusive due to being conducted only one year. Overall, there are inconclusive survey or other observational evidence regarding whether these species currently occur in the planning area.

Habitat – The most important habitat components to consider for management of the area for these species, in the absence of known use areas and more specific local information, is the availability of contiguous and closed canopy forests with adequate amounts of large diameter snags and down logs.

Roughly 4,820 acres (63%) of the nomination area is in forested mature or older stands in SBRs and other withdrawn inclusions (i.e., spotted owl cores, BEHAs). Most of these acres, especially those described in the Bear Marten WA as "interior habitat", will continue to provide habitat for these species, especially as the stands age and recruit more coarse woody debris. Any treatment in these areas will be directed by ecological or restoration objectives to maintain the designated values for that inclusion.

The remaining 2,830 acres (37 %) of the nomination area is subject to regeneration and thinning harvests as part of the regular harvest land base. Portions of this area will provide suitable habitat for these species and some treatments will augment habitat in reserves by creating nearby forage opportunities, managing for 8 snags per acre and 300 linear feet per acre of down logs, and increasing conifer species diversity (see discussion under 4 B - Wildlife Diversity) below. Overall, there is inconclusive information regarding known local habitat requirements for these species or the potential effects from management activities.

Based on current knowledge, there is a moderate chance that fishers or martens could occur in the AMA planning area or the ACEC nomination (now or in the future) due to 1. the availability of large blocks of contiguous, closed canopy, interior forests, and 2. the contiguous USFS Mt. Hagen LSR that connects to higher elevation habitats to the

northeast. Implementation of the MMLD is expected to provide a moderate amount of habitat benefits for the species that would be similar to those expected under natural conditions or ACEC management. Overall habitat quality and amounts available under the MMLD will be sufficient to allow for continued or future use of the area by fishers or martens.

Conclusion - The lack of local information on these species' occurrence or specific habitat suitability/needs within the planning result in difficulties in fully addressing how the MMLD might affect these species. Further survey and monitoring should be conducted to provide reasonable confidence whether these species are using the area and to assess local habitat requirements and function is they are located. The MMLD should maintain enough habitat for these species at least until these issues can be addressed. Special management under ACEC nomination designation is not needed to maintain or protect the relevant values for fishers or martens within the Proposed ACEC, included in the MMLA, at this time. If either species is known to be using habitats in the area in the future, ID Teams will develop management options to maintain these species and their habitats.

Importance

Wildlife Diversity – Also see sections 5.6.3.2 and 5.6.2. The nomination area will maintain the current population of tailed frogs (see discussion below). Fishers and martens have a moderate chance of occurring in the nomination area, now or in the future. Overall habitat quality and amounts available under the MMLD should be sufficient to allow for continued or future use of the area by fishers or martens (see discussion above). An estimated 4,820 acres (63%) of the nomination area is currently in forested mature or older stands in SBRs and other reserves (i.e., spotted owl cores, BEHAs). These acres will remain mostly undisturbed (relative to management activities) under the MMLD. Most of these acres, including those described in the Bear Marten WA as "interior habitat", will continue to provide habitat for species benefitting from larger and/or interior tracts of forests. These stands should improve as wildlife habitat as they age and recruit more coarse woody debris and overall structural diversity. Any treatment in these areas will be directed by ecological or restoration objectives.

The remaining 2,830 acres (37 %) of the nomination area are subject to regeneration and thinning harvests. Thinning prescriptions result in less effects with quicker recovery versus regeneration harvests for species requiring larger blocks of intact forests. The following MMLD design features for all harvests will greatly reduce potential effects due to fragmentation for species requiring larger tracts of intact forests :

- **green tree retention** – improves short and long-term quality of harvested patch, reduces microclimate and edge effects due to sharp contrasts between harvest patches and adjacent forests;
- **2-3 cohort stands** with increased conifer and hardwood species (including shade tolerant species);
- **greater canopy diversity and overall stand complexity** – improves resiliency of habitat in short and long-term, providing for quicker use of habitat after harvest and

greater species diversity;

- **management for 300 linear feet of down logs and 8 snags per acre** – provides persistence habitat for some invertebrates, amphibians and small mammals, bats and birds by maintaining physical habitat and reducing microclimate effects while decreasing recovery period when some species return to the stand
- **Riparian Reserves** – maintains riparian habitats and persistence refugia for species with low vagility and connective/travel corridors for more mobile species.
- **Large landscape blocks** – reduces isolation of forested patches resulting in less created edges and fragmentation, which in turn reduce effects to microclimate, edge creep (e.g., chronic wind throw), competition between interior and edge species, nest predation, and parasitism of bird nests
- **Relatively longer regeneration rates** (100 or 180 years) – reduces frequency of effects due to regeneration harvests and allows more time for adjacent stands to recover
- **No net increase in roads** (in key watersheds) – creates no additional effects associated with edges; roads densities are currently very low in the nomination area.

At stand and landscape scales, heterogeneity will more closely resemble natural conditions. The health of many local populations will be much greater when compared to the NFP, thereby improving their resiliency to stand changes due to effects from harvest activities. Stands within the nomination area should remain connected with the adjacent USFS Mt. Hagen LSR.

Tailed Frogs – See the Discussion for this species under ACS Objective # 9 and under Relevance Criteria in this section. The populations of tailed frogs in Marten Creek and Bear Composite 6th field watersheds represent the largest known viable populations on the Eugene District. The species current range is in coastal and interior mountains from southern British Columbia to northern California and interior in the Blue Mountains of Oregon and the Rocky Mountains of Idaho and western Montana.

Healthy populations in habitat that provides suitable aquatic breeding and terrestrial dispersal and genetic flow opportunities are rare on the Eugene District and are generally scarce in western Oregon, especially at lower elevations. The populations within the nomination area should be considered important both locally and at larger Physiographic Province scales. Management for the species will continue to be consistent with its BLM Special Status designation that directs the BLM to manage for a species so as to "avoid contributing to the need to list" the species.

Implementation of the MMLD is expected to maintain tailed frog aquatic and terrestrial habitats within the Marten Creek and Bear Composite 6th field watersheds. Maintenance includes managing for both viable persistence and dispersal in and out of the area to nearby streams in the BLM AMA planning area and possibly into the adjacent USFS Mt. Hagen LSR.

Some surveys of the local population have occurred since the nomination. Surveys should continue to further define the scope and composition of the current population and

monitoring should be initiated to track the population. If it is determined that local populations are not provided for under the MMLD, alternative management strategies will be developed in the future.

Acknowledgments

This design was based on concepts from the Blue River Landscape Study. A special thanks to the Blue River Landscape Team for developing many of the concepts in this plan. We look forward to future collaboration efforts. A very special thanks to John Cissel for his input and time in helping us with the development of this plan.

Appendix A
Summary of Landscape Blocks and Regions Acres

Table A1 – Summary of Landscape Blocks/acres

Landscape Area 1 Acres	# of Blocks/ Total Acres	% of Landscape Area 1 consisting of identified block sizes (BLM 6,446 ac.)
Blocks less than 100 acres	39/1,696 ac.	26.2% of the area is made up of block sizes less than 100 acres
Blocks between 100-200 acres	18/2,468 ac.	38.0% of the area is made up of block sizes between 100-200 acres
Blocks greater than 200 acres	9/2,282 ac.	35.1% of the area is made up of block sizes greater than 200 acres
Landscape Area 2 Acres	**# of Blocks/ Total Acres**	**% of Landscape Area 2 consisting of identified block sizes (BLM 10,209 acres)**
Blocks less than 100 acres	75/4126 ac.	40.3% of the area is made up of block sizes less than 100 acres
Blocks between 100-200 acres	28/3,821 ac.	37.4%of the area is made up of block sizes between 100 - 200 acres
Blocks greater than 200 acres	9/2,262 ac.	22.2% of the area is made up of block sizes greater than 200 acres

Table A2 – Summary of Block Sizes

Block Sizes	LA-1 -- 6,446 acres BLM	LA-2 – 10,209 acres BLM
100 acres or less	39/1,696 ac/26.2%	75/4,126 ac/40.3%
100-200 acres	18/2,468 ac/38.0%	28/3,821 ac/37.4%
200+ acres	9/2,282 ac/35.1%	9/2,262 ac/22.2%

Table A3 – Summary of Landscape Regions/acres

Landscape Area/ Landscape Region Name	Total # of Acres BLM only	% of Landscape Region with Blocks less than 100 Acres		% of Landscape Region with Blocks 100-200 Acres		% of Landscape Region with Blocks 200 Acres or greater	
Landscape Area 1		**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
Tom/Finn NE	1,062	368	34.6	366	34.5	328	30.9
North Gate	782	544	69.6	238	30.3	0	0
Tom/Finn N	51	51	100.0	0	0	0	0
South Fork Gate	450	450	100	0	0	0	0
Bear Composite N	4,101	283	7.0	1,864	45.4	1,954	47.6
Sub-Total	6,446						
Landscape Area 2		**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
Tom/Finn NW	1,391	845	60.7	546	39.3	0	0
Leaburg Canal N	327	60	18.3	267	81.7	0	0
Leaburg Canal S	761	262	34.4	267	35.1	232	30.5
Tom/Finn S	1,173	646	55.1	527	44.9	0	0
Marten	3,426	1,719	50.2	806	23.5	901	26.3
Bear Composite S	2,243	427	19.0	970	43.1	846	37.9
Deer	879	158	17.9	438	49.8	283	32.3
Ennis	9	9	100	0	0	0	0
Sub-Total	10,209						

Table A4 – Summary of Landscape Regions Ownership

Landscape Area/ Landscape Region Name	Total # of Acres (BLM & Private)	Total # of Acres BLM only	Percent BLM Land	Percent in Non-Reserves	Percent Total in Reserves
Landscape Area 1					
Tom/Finn NE	4,166	1,061	25	64	36
North Gate	18,456	781	4	71	29
Tom/Finn N	763	51	7	41	59
South Fork Gate	12,223	449	4	78	22
Bear Composite N	7,165	4,104	57	57	43
Sub Total	42,775	6,445	15	61	39
Landscape Area 2					
Tom/Finn NW	4,167	1,391	33	74	26
Leaburg Canal N	4,203	327	8	31	69
Leaburg Canal S	5,079	761	15	57	43
Tom/Finn S	4,204	1,174	28	80	20
Marten	9,808	3,426	35	48	52
Bear Composite S	2,416	2,264	94	45	55
Deer	9,834	879	9	24	76
Ennis	5,448	9	0	0	100
Sub Total	45,159	10,209	23	52	48

Appendix B
Small Basin Reserve Descriptions and Selection Information

SMALL BASIN RESERVE DESCRIPTIONS

There are nine small basin reserves in the planning area.

Finn - SBR 1
Indian - SBR 2
Minney - SBR 3
Bear/LSR Extension - SBR 4
Upper Bear - SBR 5
West Fork Deer - SBR 6
Upper Marten - SBR 7
Middle Marten - SBR 8
Gale - SBR 9

As a result of BLM ownership patterns, it should be noted that the Small Basin Reserves do not always consist of topographically complete basins.

FINN – The Finn Small Basin Reserve is 144 acres in size. Approximately one third of the reserve is in a mature-late successional stage. This reserve generally consists of 1st and 2nd order streams with good potential for large woody debris recruitment.

In particular, currently this reserve provides well-distributed patches of mature late-successional habitat on the west side of the planning area, and provides aquatic breeding and terrestrial dispersal habitats for red-legged frogs known to occur in the area.

INDIAN – The Indian Small Basin Reserve consists of 316 acres. Approximately half of this reserve is currently in the mature-late successional forest stage. The west border of the reserve is 1.25 miles of Indian Creek, which is fish-bearing. The northern portion of the reserve contains an area with high mass wasting potential.

In particular, this reserve provides current and future well distributed patches of mature late-successional habitat on the west side of the planning area.

MINNEY

The Minney Small Basin Reserve is 87 acres in size. Approximately one third of this reserve is currently in a mature late-successional forest stage. This reserve is immediately adjacent to 0.5 mile of a fish-bearing section of Minney Creek.

In particular, this reserve provides well distributed patches of mature late-successional habitat on the west side of the planning area, and provides habitat for Cascade torrent salamanders known to occur in the area. The reserve also includes a planned recreation site on North Fork Gate Creek.

BEAR/LSR EXTENSION

The Bear/LSR Extension Small Basin Reserve (SBR-4) consists of 39 acres immediately adjacent to a section of LSR managed by the Willamette National Forest. This entire reserve is currently in a mature late-successional stage.

In particular, this reserve provides undisturbed terrestrial headwall connectivity between subwatersheds in the Adaptive Management Area (AMA) and the adjacent Forest Service LSR. This reserve connects with the Upper Bear Small Basin Reserve and with land originally included in the ACEC nomination. The nature of the connection with the Upper Bear Reserve is primarily through Forest Service administered land. Since the nature of the direct connection with respect to BLM administered lands is small, this reserve is not considered part of the Upper Bear Small Basin Reserve. The entire reserve is within spotted owl critical habitat.

UPPER BEAR

The Upper Bear Small Basin Reserve consists of 1,221 acres. About 75 percent of this reserve is currently in a mature late-successional stage. Key habitat features include intermittent, interrupted, ephemeral, 1st, 2nd, and 3rd order non-fish-bearing streams and headwalls connected by moist, closed canopy, mature age stands with multi-storied old growth. Stream channels in this headwater basin are steep with interspersed areas that have been modeled as having high mass wasting potential. There are recent (i.e., 1996) sluiced areas and several large debris dams. Several miles of fish-bearing streams are included in this reserve.

In particular, this reserve provides key breeding and dispersal refugia for clouded salamanders, tailed frogs, and Cascade torrent salamanders known or suspected to occur in the area. Some special status invertebrates that may be sensitive to minor sediment and temperature fluctuations either in this area or farther downstream are expected to benefit. This reserve also provides aquatic and terrestrial connectivity with the McKenzie River and undisturbed terrestrial headwall connectivity between the subwatersheds in the AMA and the adjacent Forest Service LSR. This reserve is also expected to assist in implementing ACEC objectives. This reserve connects with the Bear/LSR Extension Small Basin Reserve and contains land originally included in the ACEC nomination. The nature of the connection with the Upper Bear Reserve is primarily through Forest Service administered land. In addition, the reserve provides aquatic and terrestrial plant and wildlife refugia in a subwatershed that is almost entirely contained within contiguous BLM managed lands. It includes spotted owl critical habitat and several large TPCC withdrawn areas, and also includes and augments an unmapped LSR spotted owl site core.

WEST FORK DEER

The West Fork Deer Small Basin Reserve consists of 298 acres. About 75 percent of this reserve is currently in a mature late-successional stage. Key habitat features include intermittent, interrupted, ephemeral, 1st, 2nd, and 3rd order non-fish-bearing streams and headwalls connected by moist closed canopy mature age stands. Most of these types of habitats are not buffered by other Aquatic Reserves or planned management. About one mile of fish-bearing stream is known to exist in the reserve.

In particular, this small basin reserve provides key breeding and dispersal refugia for clouded salamanders that are known to occur in the area. Several special status invertebrates that may be sensitive to minor sediment and temperature fluctuations in this area or farther downstream are expected to benefit. Tailed frogs and Cascade torrent salamanders have also been detected in the area. This reserve also provides aquatic and associated terrestrial connectivity with the McKenzie River and will assist in implementing ACEC objectives. It includes and augments a Bald Eagle Habitat Area, and has a ridge top connection with the Upper Marten Small Basin Reserve.

UPPER MARTEN

The Upper Marten Small Basin Reserve consists of 690 acres. About 75 percent of this reserve is in a mature late-successional stage. Key habitat features include intermittent, interrupted, ephemeral, 1st, 2nd, and 3rd order non-fish-bearing streams and headwall areas connected by moist closed canopy mature age stands. Over 1.5 miles of fish-bearing streams are included in the reserve.

In particular, this small basin reserve would provide key breeding and rearing refugia required by tailed frogs, Cascade torrent salamanders, clouded salamanders, and some special status invertebrates that may be sensitive to minor sediment and temperature fluctuations in this area or farther downstream. Survey efforts revealed that this area contains the highest known concentration of tailed frogs on the Eugene BLM District. In addition, this reserve should assist in implementing the ACEC. It includes and augments an unmapped LSR spotted owl core and a large TPCC withdrawn area, and connects with the West Fork Deer Small Basin Reserve.

MIDDLE MARTEN

The Middle Marten Small Basin Reserve consists of 444 acres. Over half of this reserve is in a mature late-successional stage. This reserve connects several areas of potential high mass wasting, and has large trees suitable for LWD stream structure in the event of a natural slope failure. It borders over a mile of fish-bearing stream, and tributaries contribute cold water to Marten Creek. Wildlife key features; and benefits are similar to Upper Marten with consideration for slightly lower elevation habitats.

In particular, this reserve includes a rock garden RMP Special Habitat Area with known populations of *Columbiadoria hallii, Githopsis specularioides, Romanzoffia thompsonii*, and *Viola sheltonii* plant species. This reserve would provide key breeding and dispersal refugia for clouded salamanders that are known to occur in the area, and also benefit several special status invertebrates that may be sensitive to minor sediment and temperature fluctuations. Cascade torrent salamanders and Harlequin ducks have been detected in the area. This reserve also

includes and augments an unmapped LSR spotted owl core and several TPCC withdrawn areas.

GALE

The Gale Small Basin Reserve consists of 230 acres. All of this reserve is currently in a mature late-successional stage. This reserve includes and augments an unmapped LSR spotted owl core.

COLLECTIVE OBJECTIVES OF THE SMALL BASIN RESERVES

As stated in the main body of the document (pp. xx), the small basin reserves described in individual detail above were designed to **collectively** meet the following objectives:

- To be distributed across drainages and elevations in areas of high aquatic habitat diversity
- To contain important stream junctions
- To contain headwaters areas
- To maintain cool microclimates and structure for sensitive species and invertebrate populations
- To encompass and adjoin LSR and/or maintain a distribution of LSR that serve as refugia for LSR dependent species
- To contain areas with concentrations of unstable slopes
- To connect high probability landslide debris flow source areas to the aquatic habitat
- To have high potential to contribute wood and other material through mass soil movements
- To protect areas critical for fulfilling life history requirements of sensitive species
- To be located for the benefit of aquatic and terrestrial plants

SMALL BASIN RESERVE SELECTION INFORMATION

A group of aquatic, wildlife, and botany specialists mapped the list of 16 reserve candidates. For inclusion individual reserve candidates were individually evaluated against a set of criteria. The selection criteria, listed below, and the candidate areas ***(areas considered for selection)*** are depicted with respect to the selection criteria in Table B1.

Criteria 1	Provide contiguous blocks of undisturbed habitat
Criteria 2	Located in areas of high aquatic diversity
Criteria 3	Contain important stream junctions
Criteria 4	Contain headwater areas
Criteria 5	Maintain cool microclimates and structure for sensitive amphibian and invertebrate species and populations; encompass or adjoin LSRs, and/or maintain a distribution of LSRs that serve as refugia for LSR dependent species
Criteria 6	Placed in potential slope instability areas
Criteria 7	Contain wetlands and/or ponds
Criteria 8	Use streamside reserves to connect high probability landslide debris source areas to important aquatic habitat, and has potential to contribute wood and other material through mass soil movements
Criteria 9	Directly protects areas that appear critical to fulfilling life history requirements of sensitive riparian dependent species.
Criteria 10	Located for the benefit of aquatic and terrestrial plants.

Table B1 – Criteria for Selection Small Basin Reserves

Candidate Area #	Basin Results	Notes	Criteria – (Y = yes; U = unknown; N = No)									
			1	2	3	4	5	6	7	8	9	10
1	SBR-8 – Middle Marten	Combined with Candidate Area 7 to become SBR-8	U	U	Y	U	Y	U	U	Y	U	U
2	Dropped	Small (40 acres) that did not fit with the small basin concept	U	U	Y	U	Y	U	U	U	U	U
3	SBR-5 – Upper Bear	All of this Candidate Area was incorporated into SBR-5. Note, this Candidate Area overlapped with Areas 8 and 11. Much of the dropped area includes TPPC and other already reserved areas.	U	U	Y	U	Y	U	U	Y	U	U
4	Dropped	This reserve was dropped to facilitate the creation of a large reserve in the headwaters of Bear Creek (SBR-5) immediately adjacent to Candidate Area 4.	U	U	Y	U	Y	U	U	Y	U	U
5	SBR-7 Upper Marten	Combined with CandidateArea 10 to become SBR-7.	Y	Y	U	Y	Y	Y	U	U	Y	Y
6	SBR-6 West Fork Deer	Became SBR-6	U	U	U	Y	Y	Y	U	U	Y	Y
7	SBR-8 Middle Marten	Combined with Candidate Area 1 to become SBR-8	U	U	U	Y	Y	U	U	U	Y	U
8	SBR-5 Upper Bear	Part of this Candidate Area was incorporated into SBR-5. Note, this Candidate Area overlapped with areas 3 and 8.	Y	Y	U	Y	Y	Y	U	U	Y	Y
9	SBR-4 Bear/LSR Ext.	Part of this Candidate Area became SBR-4.	Y	Y	U	Y	Y	Y	U	U	Y	Y
10	SBR-7 Upper Marten	Combined with Candidate Area 5 to become SBR-7	Y	Y	Y	Y	Y	Y	U	Y	U	Y
11	SBR-5 Upper Bear	All of this Candidate Area was incorporated into SBR-5. Note, this Candidate Area overlapped with areas 3 and 8.	Y	U	Y	Y	Y	Y	U	Y	U	Y
12	SBR-2 Indian	Provided spatial representation of small basin reserves in western part of the planning area.	U	U	Y	U	Y	U	U	U	U	U
13	SBR-1 Finn	Provided spatial representation of small basin reserves in western part of the planning area	U	U	Y	U	Y	U	U	Y	U	U
14	SBR-2 Minney		U	U	Y	Y	Y	Y	U	N	U	U
15	SBR-9 Gale		U	U	U	Y	Y	U	U	U	U	U
16	Dropped	This reserve was dropped to facilitate the creation of a large reserve in the headwaters of Bear Creek.										

- Candidate Area – Area considered for selection

In the evaluation process, it was discovered that the criteria were not especially useful for comparing the basins to each other for the purpose of making final selections. In general, the candidate areas either met the criteria or there was not enough information to make a determination. Since there was not enough information available to develop a reasonable set of new criteria to help **distinguish between** the candidate areas, a different approach was taken.

Three options, using various combinations of the candidate areas were developed. The philosophy behind the options was:

Option 1 – have a few larger reserve areas that are not well distributed;
Option 2 – have many smaller reserves that are well distributed; and
Option 3 – an option that focuses on developing Small Basin Reserves that are true hydrologic and topographic basins.

Option 2 was selected with a few minor modifications, and the results are shown in Table B-1. Option 2 provided the best opportunities for good spatial and elevational distribution of reserves. In addition, because of overlapping candidate areas, it was possible to combine some candidate areas to form larger reserves with more interior forested habitat than originally expected.

Option 3 was the least feasible of the options because the BLM ownership pattern was very limiting. Option 1 was basically one large reserve in Bear Creek and three smaller reserves that, overall, did not provide a spatial distribution that was acceptable.

Appendix C
Analysis Steps for Spatial and Temporal Projection

The following are the analysis steps used in developing the spatial and temporal projection of the landscape plan:

1. The GIS (Geographic Information System) and FOI (Forest Operations Inventory) information for the AMA was compiled, and the information was split into identified blocks (see section 2). Block information was then split into the portion of reserve and base for each block (Base acres are those not reserved and available for harvest.). Once this split was accomplished, each block and its age information was entered in spreadsheets and predictions of future progress were made by aging the stand. Because this is an area and not a volume control projection, the stands were aged in class but not changed in volumes. Only volumes typical of the age classes were used. When a stand shifted age, volumes for the new age class were used when needed. This is a simpler method than the more demanding volume control type of harvest scheduling used for this calculation during the RMP planning.

2. Harvest units were selected in accordance with the guidance criteria and returned to the first decade age class as they were harvested. At each decade, key indicators such as seral stage, age class distribution, and spatial relationships between harvest units and their surrounding blocks were evaluated against the criteria for harvest selection. This process was continued for 10 decades. In this document there are age class maps and tables showing age class distribution.

3. The purpose of this projection is to develop an understanding of the effects of the landscape plan on the spatial distribution of forest types that emerge from the application of this area control block patchwork. A pattern that emphasized the placement of harvest units so that they tended to avoid other harvest units was selected. For comparison purposes, a similar analysis was completed using a harvest schedule that applies the Eugene District RMP harvest system.

4. Finally, volume projections were run. The first step was to prepare a sample of stands to develop stand averages, which could be applied to treated acres, that came out of the area control projection. Over 2,000 acres have been harvested in the AMA in the last two decades. For this set of old timber sales, approximately 860 acres of sales have available stem diameter distributions. These distributions were used in calculations for volumes using typical single tree volume tables that were checked against the actual sale volumes to confirm the analysis results.

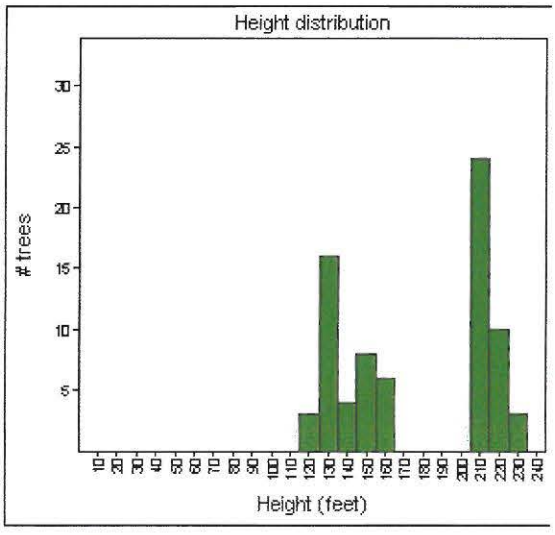
5. The individual stands were manipulated to determine estimates of volume produced under certain silvicultural prescriptions, crown closure, and other important stand parameters such as basal area, quadratic mean stand diameter, relative density, and average crown diameter. These important stand parameters were used to verify the predictions and outcomes of using the silvicultural prescriptions on stands along with knowledge of stand responses and published silvicultural research.

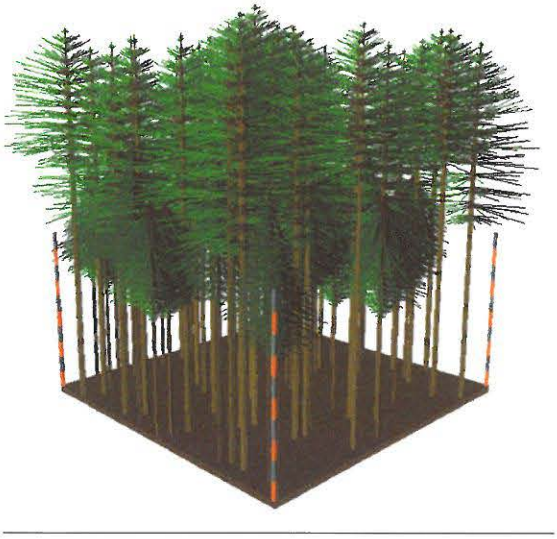
6. Finally, a composite stand **was built** using the sampled stands, and this composite stand was used to evaluate the results of the snag and CWD requirements, and to verify projections previously run on individual old sale unit cruise data. This was felt to be the most reliable modeling method as stand exam data did not exist, and forest inventory data was limited to a few plots.

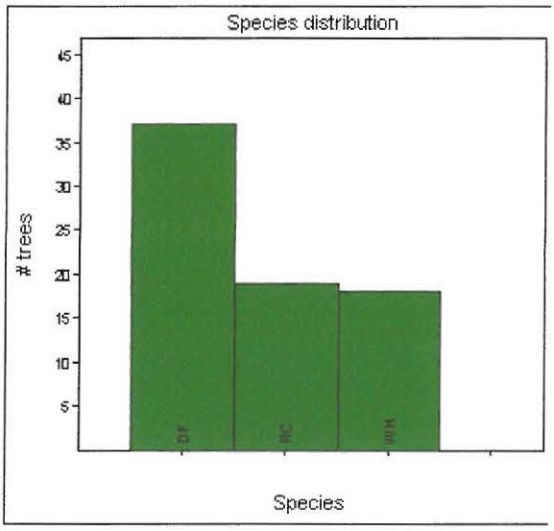
7. Once anticipated volume levels from treatments were developed, the total volume was estimated from the acres treated and the volume per acre by treatment. The treated acres were derived using the output from the temporal projection and the projected population of acres of the age classes where the silvicultural prescription proposed treatment. For example, the total volume for a decade would be the acres of regeneration harvest times the volume/acre for regeneration harvest, plus the volume for each of 3 thinning types, 40, 70, and 100 year times the acres for that decade in the proper age class.

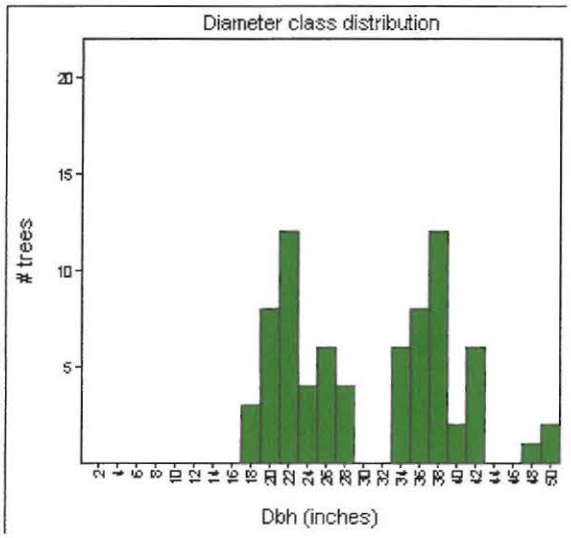
8. Not included in the analysis for volume are two types of possible treatments. First, some thinning may be desirable within reserve areas, where these actions will help to maintain or improve the values for which these areas were set aside. Next, initial thinnings of certain age classes prior to final harvest are not included. Both of these types of volume will be site specific, and may or may not be needed.

9. The figures below were developed using a model to project stand characteristics under the MMLD. The model was used to show whether under the MMLD, the desired stand complexity would occur.









Appendix D
Riparian Reserve Module Analyses

Table D-1 shows vertebrate species known or suspected to occur within the planning area and a brief description of their habitats.

Table D-2 describes BLM Special Status invertebrates known or suspected to occur within the planning area and a brief description of their habitats. These species were not fully analyzed in the Riparian Reserve Module and associated analyses due to lack of information on their habitat requirements and occurrence within the planning area.

Table D-3 describes how dependent species are on riparian habitats. Those that most benefit from and are most dependent on riparian habitats are highlighted in shaded blocks.

Table D-4 describes the ecological classification for species in the shaded blocks in Table D-3.

In the ecological classification of species for preliminary vulnerability assessment, some species were eliminated or reclassified in a category different from where they were found in the "Riparian Reserve Module" (*Riparian Reserve Evaluation Techniques and Synthesis document; Supplement to Section II of Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis (version 2.2)*. This was a result of additional biological or distribution information not available at the time the module document was written. For example, *Tritomaria exsectiformis*, defined as localized and rare and exclusive and restricted in this document, is now known to have a distribution beyond a single physiographic province and is included in the widely distributed and rare, exclusive and restricted category. *Kurzia makinoana*, a species included in the localized and rare and exclusive and restricted category in this document, was eliminated from the assessment because it was determined that it was not likely to be found within the AMA (J. Christy and D. Wagner, personal communications). *Prophysaon dubium* was defined as localized and rare, and exclusive and restricted. Survey information has determined this species is more common and not dependent on riparian habitats, and was excluded from riparian reserve analyses.

Table D-1

MMLD – Analysis of Species Associated with Riparian Reserves. Plant and Wildlife Species Dependent on or Benefitted by Riparian Reserves As Analyzed in the "Riparian Reserve Module" (*Riparian Reserve Evaluation Techniques and Synthesis document; Supplement to Section II of Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis (version 2.2)*).

Riparian Reserve Module List # [A]	SPECIES	Riparian Obligates [B]	Riparian Associates [C]	Presence in Planning Area D = documented S = suspected/ probable U = Unlikely	COMMENTS
			INVERTEBRATES		
3 SS	Special Status (18 species)	X		S – 16 species U – 2 species	Habitat requirements are generalized in Table D-2
			AMPHIBIANS & REPTILES		
1, 2	Cascade Torrent Salamander *(Rhyacotriton cascadae)*	X		D	Restricted to cold, well-oxygenated seeps, springs, and 1st-2nd order streams (≤ 13 deg. Celsius) below 4,000 feet. Generally associated with LSF. Larvae use intermittent and ephemeral streams. Vulnerable to local extinction from water quality decline (e.g., activities that contribute to silt or increased temperature in streams and loss of stream stability and vegetation), and forest fragmentation. Poor dispersal capabilities.
2	Northwestern Salamander *(Ambystoma gracile)*	X		D	Deep and shallow ponds for breeding. Some terrestrial habitats for dispersal and during rainy periods. Elevations below 6,000 feet.
2	Pacific Giant Salamander *(Dicamptodon tenebrosus)*	X		D	Low to mid order streams for breeding and larva protection. Larvae use intermittent and ephemeral streams and seeps. Some terrestrial habitats for dispersal/travel during rainy periods.
2	Rough-skinned Newt *(Taricha granulosa)*	X		D	
3 @ SS	Northern Red-legged Frog *(Rana aurora)*	X		D	Partially shaded quiet shallow ponds less than 3 meters deep, upslope or adjacent to streams for breeding. May use low gradient streams. Some terrestrial needs for dispersal and non-breeding habits. Vulnerable to bullfrog and introduced warm water fish predation. Usually below 2,000 feet. Uses terrestrial habitats when not breeding.

Riparian Reserve Module List # [A]	SPECIES	Riparian Obligates [B]	Riparian Associates [C]	Presence in Planning Area D = documented S = suspected/ probable U = Unlikely	COMMENTS
1, 2	Tailed Frog *(Ascaphus truei)*	X		D	Specialized adaptations to high gradient clean, cold, swift rocky streams (14-18 deg. Celsius) below 6,500 feet. May concentrate in low order streams if Pacific giant salamanders or salmonids present in same drainage. Vulnerable to increases in silt and water temperatures and forest fragmentation, including disturbance in riparian zones. Generally prefers LSF but found in mid to mature age forests. May inhabit stream edges and uplands in rainy periods. Dispersal/breeding connectivity through uplands.
3 SS	Western Pond Turtle *(Clemmys marmorata)*	X		S known locations east and west of planning area	Sunny locations in low gradient streams and ponds with emergent vegetation. Potential locations at lower elevations near McKenzie River. Vulnerable to bullfrog and warm water fish species predation, invasive riparian vegetation (e.g., Himalaya blackberries), and disturbance in nesting areas at all times of the year. Probably present at elevations under 2,000 feet.
3 SS	Cascades Frog *(Rana cascadae)*	X		U unlikely due to absence of higher elevation habitats	Cold (≤ 14 degrees Celsius) clear, quiet bogs, ponds, and low gradient streams with adequate sunlight for breeding; usually above 3,000 feet. Some stream and terrestrial habits for foraging and dispersal. Vulnerable to breeding habitat degradation and UV-B sunlight.
3 SS	Clouded Salamander *(Aneides ferreus)*		X	D	Large diameter conifer class 3+ dwd and rotten snags plus rocky outcrops in mesic conifer forests essential. Long-term presence of LSF components necessary for healthy populations but may be found in younger forests. Not directly dependent on streams or ponds for any part of life history but benefits from moist microclimates provided by healthy riparian corridors. Possible habitats at all elevations below 5,000 feet. Vulnerable to disturbances that reduce dwd or mesic microclimates.

Riparian Reserve Module List # [A]	SPECIES	Riparian Obligates [B]	Riparian Associates [C]	Presence in Planning Area D = documented S = suspected/ probable U = Unlikely	COMMENTS
3 @ SS	Oregon Slender Salamander *(Batrachoseps wrightii)*		X	S	Large diameter conifer class 3+ dwd and rotten snags plus rocky outcrops in mesic conifer forests essential. Long-term presence of LSF components necessary for healthy populations but may be found in younger forests. Not directly dependent on streams or ponds for any parts of life history but benefits from moist microclimates provided by healthy riparian corridors. Vulnerable to local extirpation due to current habitat fragmentation and suspected naturally patchy distribution and disturbances that destroy most/all woody debris or disrupt dispersal corridors. At elevations below 4,500 feet.
1, 2	Dunn's Salamander *(Plethodon dunni)*	X		D	Inhabits rocky or dwd edges of forest streams or permanently wet/moist talus.
			BIRDS		
3 TE	Northern Bald Eagle *(Haliaeetus leucocephalus)*		X	S known perch and forage locations, no known mid-winter roosts or nests	Mature to LSF near rivers and lakes/large ponds for roosting and nesting.
3 @ SS	Mountain Quail *(Oreortyx pictus)*		X	D	Grass-forb, shrub, and sapling pole stands, including recent burns.
3 @ SS	Northern Pygmy Owl *(Glaucidium gnoma)*		X	D	Mid to late-seral stands with high densities of large snags for nesting and roosting.
3 @	Northern Saw-whet Owl *(Aegolius acadicus)*		X	D	Mid to late-seral stands with high densities of large snags for nesting and roosting.
3 SS PB	Great Gray Owl *(Strix nebulosa)*		X	S	Mid to high elevation conifer forests (1500–5000 feet) adjacent to wet and dry meadows for foraging, and adequate snags for nesting in stands with at least 40% canopy cover. Probably more common above 3,000 feet.
2	Northern Spotted Owl *(Strix occidentalis)*		X	D	Contiguous tracks of mature to LSF with ample cwd, complex canopy structures, low brush, and suppressed canopy layers and high densities of live/dead snags for nesting and down wood for prey base.
3 SS	Peregrine Falcon *(Falco peregrinus)*		X	S suitable nesting structure available	Benefits from foraging in riparian areas.
1	Common Merganser *(Mergus merganser)*	X		D	Lakes. ponds, and larger streams in/near mature -Late seral forests

Riparian Reserve Module List # [A]	SPECIES	Riparian Obligates [B]	Riparian Associates [C]	Presence in Planning Area D = documented S = suspected/ probable U = Unlikely	COMMENTS
3 @ SS	Harlequin Duck *(Histrionicus histrionicus)*	X		D	Clear and cold low gradient streams with adequate sunlight and intact riparian vegetation and cover. Vulnerable to silt inputs affecting invertebrate populations and human disturbance April through July.
3 SS	Purple Martin *(Progne subis)*		X	S	Available nesting sites in dead/burned snags in/near open areas, meadows, and water for foraging.
		MAMMALS			
1, 2	Fringed Myotis *(Myotis thysanodes)*	X		D	**BATS IN GENERAL** (all species): As a group, all bats are SEIS Special Attention Species in the Northwest Forest Plan and the Eugene RMP (1995) and are in a unique category with additional management direction provided in these documents. Roosting, breeding, and hibernacula sites can be in snags, stumps, rock outcrops, caves, bridges and other human made structures near foraging resources (primarily water). The type and quantity of forage and roosts sites varies by species. All species are vulnerable to disturbance to maternity sites.
1, 2	Hoary Bat *(Lasiurus cinereus)*	X		D	
1, 2	Long-eared Myotis *(Myotis evotis)*	X		D	
1, 2	Long-legged Myotis *(Myotis volans)*	X		D	
1, 2	Pacific Pallid Bat *(Antrozous pallidus)*	X		S known to occur in McKenzie River watershed	
1, 2	Silver-haired bat *(Lasionycteris noctivagans)*	X		D	
1, 2	Yuma Myotis *(Myotis yumanensis)*	X		D	
3 see comments	Big Brown *(Eptesicus fuscus)*	X		S	
3 see comments	California Myotis *(Myotis californicus)*	X		S	
3 see comments	Townsend's Big Eared *(Plecotus townsendi)*	X		S	

Riparian Reserve Module List # [A]	SPECIES	Riparian Obligates [B]	Riparian Associates [C]	Presence in Planning Area D = documented S = suspected/ probable U = Unlikely	COMMENTS
1	Fisher *(Martes pennanti)*		X	U possible but unlikely due to rarity	Large tracts of interior, closed canopy forests from near sea level to alpine areas. Often in riparian corridors; occasionally use cut-over habitats. Naturally low densities. More common in mature LSF habitats. High amounts of large diameter cwd. Rare and less likely to occur in planning area than martens.
1	Marten *(Martes americana)*		X	S possible	Large tracts of interior, closed canopy forests from near sea level to alpine areas. May be more common in mature LSF habitats. High amounts of large diameter cwd. Naturally low densities.
2	Red Tree Vole *(Phenacomys longicaudus)*		X	S likely to occur	Mid, Mature, and LSF Douglas-fir dominated forests with ample free water (rain or fog drip), closed canopies, and suitable tree/crown structure for nests. Vulnerable to habitat fragmentation and local population isolation due to low fecundity and dispersal patterns plus patch size necessary for breeding colonies. Healthy populations more common in LSF forests.
1	Western Red-backed Vole *(Phenacomys albipes)*		X	S likely to occur	Moist mid to LSF conifer forests with large amounts of dwd. May use rock outcrops.
3 @ SS	White Footed Vole *(Phenacomys albpipes)*	X		D	Sapling pole to LSF with high densities of dwd in/near riparian habitats for most parts of life history. Apparent association with hardwoods and small streams. Uncommonly detected.
			LICHENS		
3	*Hypotrachyna riparia*		X	S	Newly described by McCune (1998); found growing on riparian hardwoods (one specimen was found on Oregon ash). Only two specimens have ever been found.
2	*Bryoria pikei*		X	S	Pendulous "forage" lichen, very rare, Western Cascades.
1	*Cetrelia cetraroides*		X	D	A foliose lichen species found in the riparian zone; most often growing on *Alnus rubra*, but occasionally on other hardwoods, and rarely on conifers.
1	*Dermatocarpon luridum*	X		S	Foliose lichen that grows on streamside or lakeside rocks where frequently wetted.
1	*Hydrothyria venosa*	X		U	Aquatic, foliose lichen growing in cold, clear streams that never flood (usually high elevations in the Cascades).

Riparian Reserve Module List # [A]	SPECIES	Riparian Obligates [B]	Riparian Associates [C]	Presence in Planning Area D = documented S = suspected/ probable U = Unlikely	COMMENTS
3	*Hypotrachyna revoluta*		X	U	Foliose lichen that grows on bark and rock; may be restricted to Coast Range.
1	*Leptogium rivale*	X		S	Aquatic, foliose lichen that grows on siliceous rocks.
1	*Leptogium cyanescens*		X	S	Small foliose lichen that grows on bark, rotten logs and rocks.
1	*Leptogium saturninum*		X	S	Small, foliose lichen that usually grows on bark of hardwoods, occasionally conifers, and rarely grows on rock.
3	*Pannaria rubiginosa*		X	S	Rare and scattered in the W. Cascades; found on bark and wood of both hardwoods and conifers.
1	*Usnea longissima*		X	D	Not uncommon, but with very patchy distribution, possibly because of dispersal limitations.
BRYOPHYTES					
3	*Sphaerocarpos hians*	X		S	Ephemeral, thalloid liverwort that grows on mud of receding streams and rivers. If in the AMA, it would be along larger order streams or the McKenzie River at lower elevations.
3	*Crumia latifolia*		X	S	Moss that forms dense cushions on wet rocks or cliff faces, usually calcareous. May be submerged in flowing streams or on cement.
3	*Plagiochila satoi*		X	S	Leafy liverwort reported from low elevation riparian forests, on cliffs, rocks and bark.
3	*Platyhypnidium riparioides*	X		S	Aquatic moss that grows attached to stones in or at the edge of streams.
3	*Racomitrium aquaticum*	X		S	Moss found on wet rocks along streams, above 660m elevation.
1	*Scouleria marginata*	X		S	Found on rocks in spray zones of streams and waterfalls where the water is clean and cold, from lowlands to 700m.
1	*Tritomaria exsectiformis*	X		S	Liverwort that grows on peaty or humic soil or rotting wood, often on creek banks, especially near spring heads. In Oregon it has been found on peaty soil near middle elevation, cold water streams.
VASCULAR PLANTS					

Riparian Reserve Module List # [A]	SPECIES	Riparian Obligates [B]	Riparian Associates [C]	Presence in Planning Area D = documented S = suspected/ probable U = Unlikely	COMMENTS
1, 2, 3	*Botrychium minganense* (BLM Bureau Assessment; S&M List1& 2)	X		S	Shady cedar (*Thuja plicata*) swamps; generally near water at mid-elevations, 1500–1800meters; Wallowa, Harney, Linn, Wasco, Douglas counties, OR Currently know from South Valley Resource Area, Eugene District BLM.
1, 2, 3	*Botrychium montanum* (BLM Bureau Assessment; S&M List 1 & 2)	X		S	Shady coniferous woods, edge of bogs, cedar swamps; 1500–1800 meters; N. Cascades, N. Rocky Mountains, Grant and Marion Counties, Oregon.
1, 2	*Allotropa virgata* (Survey and Manage 1&2)		X	D	Lower elevation coniferous forests, especially open, dry ridges, 75–3,000 meters; B.C. to California; found in all Eugene District Resource Areas.
1, 2	*Cimicifuga elata* (BLM Bureau Tracking/ (Interagency Conservation Strategy)		X	D	Moist shady woods, open canopy, at lower elevations, often found with big leaf maple in overstory; always dominant swordfern ground cover; north to northeast-facing steep slopes; mid-slope; sometimes near streams; S B.C to NW Oregon; Douglas, Lane, Linn, Marion, Multnomah, Polk, and Yamhill Counties. Found in all Eugene District Resource Areas.
1	*Asplenium trichomanes* ssp. *trichomanes* (Lane County Sensitive)	X		S	Rock cliff crevices and talus slopes where moist; around 200 meters; rare in California, Oregon, widespread in North America
1	*Botrychium virginianum* (Eugene District Review)		X	D	Moist wood and thickets; seldom in meadows: valleys to mid-mountain, swampy areas and edges, salt marshes near coast; West Cascades to west central California; found in all Eugene District Resource Areas.
1	*Carex acrta* (Lane County Sensitive)	X		S	Wet places, esp. sphagnum bogs; west slope of Cascades at mid/high elevations and on valley floor. Northern California to Western Canada; ½ mile S of Eagles Rest.
1	*Corallorrhiza trifida* (Lane County Sensitive)		X	S	Moist shaded areas; mountains to subalpine, often near creeks; 1400–1700 meters; Alaska to Labrador, S to N California, Idaho; McKenzie Pass at 1,700 meters
1	*Epilobium luteum* (BLM Tracking)	X		U	Moist ground, stream banks, meadows, mid to high elevations; Alaska to Oregon Cascades. Within the Eugene District occurs in South Valley Resource Area.

Riparian Reserve Module List # [A]	SPECIES	Riparian Obligates [B]	Riparian Associates [C]	Presence in Planning Area D = documented S = suspected/ probable U = Unlikely	COMMENTS
1	*Gymnocarpium dryopteris* (Lane County Sensitive)	X		S	Streambanks, moist shady woods, and wet cliffs, low to medium elevation; Oregon to Arizona, east to Virginia.
1	*Romanzoffia thompsonii* (BLM Bureau Sensitive)	X		D	Cliff seeps and wet meadows on south facing slopes; usually steep, open drainage slopes; 400– 1900 meters; Douglas, Jackson, Lane, Linn, Marion Counties; Within Eugene District occurs within McKenzie Resource Area.
1	*Carex gynodynama* (BLM Assessment)	X		S	Wet meadows; open forests; less than 600 meters; California; Eugene District, South Valley Resource Area.
1	*Carex mendocinensis* (Lane County Sensitive)	X		S	Moist to wet meadows; often serpentine; 150--1,600 meters; N California to S Oregon; South Valley and McKenzie Resource Areas.
1	*Epilobium luteum* (BLM Tracking)	X		S	Moist ground, stream banks, meadows, mid to high elevations; Alaska to Oregon Cascades; South Valley Resource Area.
1	*Epipactis gigantea* (Eugene District Review)	X		S	Sometimes in Carex patches along streambanks, lake margins, and near springs and seepage areas; back coastal dune wet areas, also on bare rocks; less than 2,500 meters; BC to N Mexico, W to Rocky Mts.
1	*Euonymus occidentalis* (BLM Tracking)		X	S	Woods, shady mixed-species riparian zone; less than 2000 meters; W Cascades, Lewis Co. WA to central CA; South Valley Resource Area
1	*Gymnocarpium dryopteris* (Lane County Sensitive)	X		S	Streambanks, moist shady woods, and wet cliffs, low to medium elevation; Oregon to Arizona, East to Virginia.
1	*Mimulus cardinalis* (Eugene District Review)	X		S	Riparian areas, seepage areas; less than 2,400 meters; S Willamette Valley to UT, AZ, CA; South Valley Resource Area.

Note: For many rare non-vascular plant species, the extent of the species' dependence upon riparian habitat is unknown.
For the purpose of this table, only aquatic and semi-aquatic species were considered riparian obligates (B).

Notes for Table D-1:

A. Riparian Reserve Scenario from Riparian Reserve Module List # :

1 = List 1 – Species Benefitting from Riparian Reserve Scenario 1 (Species may or may not pass the 80% screen):

Fish Bearing Streams	2 Site Potential Trees – all watersheds
Non-fish Perennial Streams	1 Site Potential Tree – all watersheds
Intermittent Streams	1 Site Potential Tree

2 = List 2 – Species Protected by Riparian Reserve Scenario 2 (Species passed the 80% Screen);

Fish Bearing Streams	2 Site Potential Trees – all watersheds
Non-fish Perennial Streams	1 Site Potential Tree – all watersheds
Intermittent Streams	Tier 1 Key Watershed – 1 Site Potential Tree,
	Tier 2 Key Watershed – ½ Site Potential Tree
	All Other Watersheds – ½ Site Potential Tree

3 = List 3 – Additional local species of concern not addressed in the Riparian Reserve Module vers. 2.2

@ = Species in original ACEC nomination within the planning area

Contributing reasons why List 3 species were included in riparian analyses:

TE = Federally listed threatened or endangered species
SM = Survey and Manage species
PB = Protection Buffer species
SS = Bureau Special Status species

B. Species is Riparian dependent for most/all life history needs.

C. Uses/benefits from Riparian Areas but not dependent for Most/All Life History Needs

DWD = down woody debris
CWD = coarse woody debris
LSF = late-successional forest/characteristics

Table D-2 – Survey & Manage and BLM Special Status Invertebrate Species in the MMLA These Species (except for Survey & Manage Mollusks) Were Not Analyzed in the Riparian Reserve Module Due to Insufficient Information					
SPECIES	**Presence in Planning Area** **D** = documented **S** = suspected/ probable	**Riparian Obligates** [B]	**Riparian Associates** [C]	**Upland Associated**	**COMMENTS**
Coleoptera (beetles)					
Acneus beeri	S	X			permanent shaded 1st order streams
Nebria piperi	S	X			large stream banks
Hemiptera (bugs)					
Boreostolis americana	S	X			clean, relatively cold and rocky streams
Hoplistoscelis heidemanni	S	X			stream banks
Odonata (dragonflies)					
Tanypteryx hageni	S	X			bogs and ponds
Trichoptera (caddisflies)					
Apatania tavala	S	X			clean, relatively cold streams
Ceraclea vertreesi	S	X			clean, relatively cold streams
Eobrachycentrus gelidae	S	X			clean, permanent, shaded and cold 1st order streams/seeps
Farula reapiri	S	X			permanent and shaded 1st order streams/seeps
Limnephilus atercus	S	X			sun warmed ponds/streams with aquatic vegetation
Ochrotrichia alsea	S	X			clean and relatively cold rocky streams
Ochrotrichia vertreesi	S	X			clean and relatively cold rocky streams
Oligophlebodes mostbento	S	X			clean and relatively cold rocky streams
Rhyacophila fenderi	S	X			clean and relatively cold rocky streams
Rhyacophila unipunctata	S	X			permanent and shaded 1st order streams/seeps
Tinodes siskiyou	S	X			clean and relatively cold rocky streams
Mollusca (slugs & snails)					
Pristine springsnail *Pristinicola hemphilli*	S	X			Clean, spring fed and rocky 1st order streams/seeps with permanent shade
Pristoloma crateris arcticum	unlikely based on local knowledge	X			Suspected habitats: leaf litter under brush in/near riparian zone communities

Table D-2 – Survey & Manage and BLM Special Status Invertebrate Species in the MMLA These Species (except for Survey & Manage Mollusks) Were Not Analyzed in the Riparian Reserve Module Due to Insufficient Information					
SPECIES	**Presence in Planning Area** D = documented S = suspected/ probable	**Riparian Obligates** [B]	**Riparian Associates** [C]	**Upland Associated**	**COMMENTS**

B Species is Riparian dependent for most/all life history needs.
C Uses/benefits from Riparian Areas but is not dependent for Most/All Life History Needs

Summary of Invertebrates by Habitat Types		Comments on Habitat
Invertebrates (1)		**Invertebrates (1)**
Apatania tavala, Cascade	Apatanian Caddisfly	Very clean and cool, often rocky streams, especially 1st – 3rd order. Presence of tailed frogs may be one indicator of suitable habitat.
Ceraclea vertreesi	Vertrees's Ceraclean Caddisfly	
Hoplistoscelis heidemann	Heidemann's Nabid (bug)	
Nebria piper	Piper's Gazelle Beetle	
Ochrotrichia alsea	Alsea Ochrotrichian Microcaddisfly	
Ochrotrichia vertreesi	Vertrees's Ochrotrichian Microcaddisfly	
Oligophlebodes mostbento	Tombstone Prairie Oligop. Caddisfly	
Rhyacophila fenderi	Fender's Rhyacophilan Caddisfly	
Tinodes siskiyou	Siskiyou Caddisfly	
Invertebrates (2)		**Invertebrates (2)**
Eobrachycentrus gelidae	Mt Hood Prim. Brachycent Caddisfly	Shaded perennial 1st order stream, springs, and seeps.
Earula reapiri	Tombstone Praire Farulan	
Rhyacophila unipunctata	One-spot Rhaycophilan Caddisfly	
Invertebrates (3)		**Invertebrates (3)**
Pristoloma arcticum crateris	Crater Lake Tightcoil (snail)	Damp riparian zone vegetation
Prophysaon coeruleum	Blue-gray Tail-dropper (slug)	
Prophysaon dubium	Pappillose Tail-dropper (slug)	
Limnephilus atercus	Fort Dick Limnephilus Caddisfly	
Tanypteryx hageni	Montane Bog Dragonfly	**Invertebrates (4)**
Invertebrates (4)		Small to medium size bogs, ponds (natural or constructed), or slow moving streams with some sun and vegetation.
Limnephilus atercus	Fort Dick Limnephilus Caddisfly	
Tanypteryx hageni	Montane Bog Dragonfly	

Table D-3 –Analysis of Wildlife, Lichens, Bryophytes and Vascular Plant Species, Associated with Riparian Reserves in the MMLA
Ecological Classification of Species for Preliminary Vulnerability Assessment (Riparian Reserve Module)

	Localized and Rare	Widely Distributed and Rare or Localized and Common	Widely Distributed and Common
Exclusive and Restricted	**Lichens and Bryophytes** *Hypotrachyna riparia* 3 *Sphaerocarpos hians* 3 **Vascular Plants** *Botrychium montanum* (BLM Assessment)	**Amphibians & Reptiles** Tailed Frog Red-legged Frog Western Pond Turtle Cascade Frog Cascade Torrent Salamander White-footed Vole Dunn's Salamander **Lichens and Bryophytes** *Bryoria pikei* 2 *Cetrelia cetraroides* 1 *Crumia latifolia* 3 *Dermatocarpon luridum* 1 *Hydrothyria venosa* 1 *Leptogium rivale* 1 *Leptogium cyanescens* 1 *Leptogium saturninum* 1 *Pannaria rubiginosa* 3 *Plagiochila satoi* 3 *Platyhypnidium riparioides* 3 *Racomitrium aquaticum* 3 *Scouleria marginata* 1 *Tritomaria exsectiformis* 1 *Usnea longissima* 1 **Vascular Plants** *Botrychium minganense* (BLM Assessment) *Romanzoffia thompsonii* (BLM Bureau Sensitive) *Asplenium trichomanes ssp. trichomanes* (Lane County Sensitive) *Mimulus cardinalis* (Lane County Sensitive) *Epipactus gigantea* (Eugene District Review	**Bats** Little Brown Myotis Yuma Myotis **Amphibians** Pacific Giant Salamander Northwestern Salamander **Vascular Plants - none**
Exclusive and Broad	None in planning area	**Birds** Harlequin Duck **Vascular Plants** *Carex gynodynama* (BLM Assessment) *Carex arcta* (Lane County Sensitive) *Epilobium luteum* (BLM Tracking) *Carex mendocinensis* (Lane County Sensitive)	**Birds** Common Merganser **Amphibians** Rough-skinned Newt **Lichens and Bryophytes** *Lobaria hallii* 3 **Vascular Plants - none**

	Localized and Rare	Widely Distributed and Rare or Localized and Common	Widely Distributed and Common
Supplemental and Restricted	*Hypotrachyna revoluta* 3	**Mammals-Including Bats** Fisher Marten Red Tree Vole Western Red-backed Vole **Lichens and Bryophytes** *Alectoria lata* 2 *Alectoria vancouverensis* 2 *Brotherella roellii* 3 *Bryoria tortuosa* 3 *Cladonia cenotea* 2 *Cladonia norvegica* 3 *Cladonia bacillaris* 2 *Collema nigrescens* 1 *Diplophyllum albicans* 3 *Douinia ovata* 1 *Hypogymnia duplicata* 3 *Hypogymnia oceanica* 3 *Leptogium burnetiae* var. *hirsutum*1 *Leptogium gelatinosum* 2 *Leptogium teretiusculum* 1 *Lobaria linita* 3 *Nephroma bellum* 3 *Nephroma parile* 3 *Nephroma occultum* 3 *Pannaria leucostictoides* 3 *Pilophorus clavatus* 2 *Pilophorus acicularis* 2 *Platismatia lacunosa* 1 *Pseudocyphellaria rainierensis 3* *Psoroma hypnorum* 2 *Ramalina thrausta* 1 *Tetraphis geniculata* 3 *Thamnobryum neckeroides* 2 *Tholurna dissimilis* 3 *Xylographa vitiligo* 2 **Vascular Plants** *Allotropa virgata* (Survey and Manage) *Cimicifuga elata* (BLM Tracking) *Euonymus occidentalis* (BLM Tracking) *Gymnocarpium dryopteris* (Lane County Sensitive)	**Lichens and Bryophytes** *Antitrichia curtipendula* 1 *Bryoria glabra* 2 *Bryoria friabilis* 2 *Cladonia bellidiflora 2* *Cladonia macilenta* 2 *Ichmadophila ericitorum* 2 *Lobaria oregana 3* *Lobaria pulmonaria* 3 *Lobaria scrobiculata* 3 *Nephroma helveticum* 3 *Nephroma laevigatum* 3 *Nephroma resupinatum* 3 *Pannaria saubinettii* 3 *Peltigera pacifica* 3 *Peltigera collina* 3 *Peltigera neckeri* 3 *Pilophorus acicularis* 2 *Ps. anthraspis* 3 *Ps. crocata* 3 *Pseudocyphellaria anomala* 3 *Sticta limbata* 3 *Sticta fuliginosa* 3 *Xylographa abietina* 2 **Vascular Plants** *Botrychium virginianum* (Eugene District Review) *Corallorrhiza trifida* (Lane County Sensitive)

	Localized and Rare	Widely Distributed and Rare or Localized and Common	Widely Distributed and Common
Supplemental and Broad	**None in planning area.**	**Amphibians** Clouded Salamander Oregon Slender Salamander **Birds** N. Bald Eagle N. Spotted Owl Great Gray Owl N. Pygmy Owl N. Saw-whet Owl Peregrine Falcon **Bats** Fringed Myotis Hoary Bat **Lichens and Bryophytes** *Usnea scabrata* 2 **Vascular Plants - none**	**Birds** Mountain Quail **Bats** Big Brown Bat California Myotis Long-eared Myotis Long-eared Myotis Pacific Pallid Bat Silver-haired bat Purple Martin **Lichens and Bryophytes** *Alectoria sarmentosa* 2 *Bryoria capillaris* 2 *Bryoria pseudofuscescens* 2 *Usnea filipendula* 2 **Vascular Plants - none**

BLM Special Status Invertebrates are not included in this table due lack of sufficient biological or local information to analyze these species. See Table D-2.
Survey and Manage Invertebrates were not included in this table because they are not dependent on riparian habitats. See section 5.4.
Shaded cells represent species most benefitting from, and potentially affected by, riparian habitat management. These species are discussed in greatest detail in the main document under ACS Objectives.

Analysis of Species Associated with Riparian Reserves in the MMLA ;
Ecological Classification of Species for Preliminary Vulnerability Assessment
(Riparian Reserve Module)

Explanation of Categories Used in Table D-3

Population Ecology – Describes the ecological roles played by Riparian Reserve habitats and the categories of habitats required for each of these roles.

Source Habitat – Riparian Reserves provide habitats that allow for survival and reproduction at a level that can contribute to survival of populations.

Exclusive Source – Source habitat for population persistence of the species occurs exclusively or nearly exclusively within Riparian Reserves.

Supplemental Source – Source habitat for the species occurs primarily in upland sites or other allocations such as LSRs, but is augmented by habitats in Riparian Reserves.

Dispersal Habitat – An ecological role of habitats within Riparian Reserves is to support movements by individuals of a species. This can include both permanent or periodic movements by individuals of any age class.

Restricted Dispersal – Individuals of a species have either inherently low mobility, or their movements can be hindered by clearings, roads, or other landscape features.

Broad Dispersal – Individuals of a species have inherently high mobility, and their movements are not hindered by clearings, roads, or other landscape features.

Geographic Distribution – Describes if the species is relatively localized in distribution or widely distributed over the area covered by the NFP.

Distribution

Localized – These species occur over a relatively small portion of the NFP. Species that are restricted in distribution to a physiographic province or smaller areas may be considered localized.

Widely Distributed – These species occur over a large portion of the area covered by the NFP. Species that occur in multiple physiographic provinces may be considered widely distributed, even if endemic to the Pacific Northwest region.

Abundance

Rare – Species that are generally found in relatively low numbers are considered rare. Species occurring in small numbers fall into this category.

Common – Species that can often be found in large numbers may fall into this category.

Table D-4 – Analysis of Wildlife Species and Vascular Plants Associated with Riparian Reserves in the MMLA : Species Ecological Classification.								
SPECIES	**Late - Succes-sional**	**Riparian Zone Terrestrial**	**Aquatic - Lotic**	**Aquatic - Lentic**	**Seeps, Springs**	**Rock Outcrops**	**Other Special Habitats**	**Comments**
AMPHIBIANS								
Cascade torrent salamander		X	X		X	X		Although not obligated, benefits from late seral forests / characteristcs.
Dunn's salamander	X	X				X		Although not obligated, benefits from late seral forests / characteristics
Red-legged frog		X		X				Lotic for breeding. Uses terrestrial habitats near all aquatic habitats.
Tailed frog		X	X		X			Although not obligated, benefits from late seral forests / characteristcs. Requires terrestrial habitats.
Cascades frog		X	X					Unlikely to occur in planning area.
Western pond turtle		X		X				Dependent on undisturbed sunny ponds & slow water for breeding and nearby terrestrial habitats for egg laying.
BIRDS								
Harlequin duck	X	X	X	X				Although not obligated, benefits from late seral forests/characteristics.
MAMMALS								
White-footed vole		X						
VASCULAR PLANTS								
Botrychium montanum							X Cedar Swamps ; Bogs	
Botrychium minganense							X Cedar Swamps / Wet Meadows	
Romanzoffia thompsonii					X	X		

Table D-4 – Analysis of Wildlife Species and Vascular Plants Associated with Riparian Reserves in the MMLA : Species Ecological Classification.								
SPECIES	**Late - Succes-sional**	**Riparian Zone Terrestrial**	**Aquatic - Lotic**	**Aquatic - Lentic**	**Seeps, Springs**	**Rock Outcrops**	**Other Special Habitats**	**Comments**
Asplenium trichomanes ssp. trichomanes						X		
****Mimulus cardinalis***		X						
****Epipactus gigantea***		X						
Carex gynodynama							X Wet Meadows	
Carex arcta							X Bogs	
Epilobium luteum						X	X Wet Meadows	
Carex mendocinensis							X Wet Meadows	

- Only species associated with riverine systems will be evaluated under ACS. Other species are associated with Special Habitats and will be protected and managed under Inclusions.

Appendix E
ACEC Relevant and Important Factors

The following table outlines relevant and important factors that were identified as valid under the Proposed ACEC screening process. The text was taken directly from the ACEC screening results in 1994. Additional or clarifying information may be found in *italics* in this table or in the discussion and evaluation of these factors in section 5.6.

Key Issues	Relevance	Importance
1. South Bank Scenery	The Proposed ACEC is part of an 11-mile stretch of the McKenzie River that is eligible and suitable for Wild and Scenic River Designation. Scenic resources have been identified as one of the Outstanding Remarkable Values in this 11-mile stretch of river.	Although only a portion of the Proposed ACEC is within the Proposed Wild and Scenic Designation, the area outside the Proposed Designation but still within the Proposed ACEC is equal in scenic quality and is considered to have more than local significance.
2. Large Blocks of Low Elevation Land	**Riparian Community** – The riparian system over the length of Bear Creek, Rough Creek, and lower Marten Creek exhibit the following: 1) unfragmented riparian systems; 2) riparian communities in a mature seral stage; 3) stream channels in good condition; 4) water quality in excellent condition for fish and other beneficial uses; 5) invertebrate communities in unusually good condition.	**Riparian Community** – The area exhibits largely unfragmented riparian communities in excellent condition that contribute to excellent water quality.
	Vegetation – BLM portion of Marten Creek Watershed is predominantly uniform, even-aged older forest with pockets of old growth and/or residual old growth structural components. Along the streams are remnants of older forest. The area also serves the following: 1) wildlife diversity for species using lower elevation forests and; 2) linkages to higher elevation USFS lands to support plant, animal, fungal, and microorganism communities and to allow unique biological, genetic, and energy flows from low to high elevations.	**Vegetation** – Marten Creek exhibits relatively undisturbed forest stands in mature even-aged with some scattered old growth stands that are unique on the District.

Key Issues	Relevance	Importance
		Ecosystem – Most of the Proposed ACEC is under 2,000 feet in elevation with a range of 1,200 to 2,800 feet. There are few minimally disturbed blocks of public land under 2,000 feet on the east side of the Willamette Valley.
3. Fish Resources - Known or suspected within the Proposed ACEC	**Bull Trout** – The area is within the historic range of the McKenzie River Bull Trout population. **Cutthroat Trout** – Bear Creek contains isolated populations of cutthroat trout. ***Resident Salmonids*** *– Bear Creek contains a genetically isolated population of cutthroat trout. Bear, Marten, and Deer creeks provide spawning and rearing habitat for native cutthroat and rainbow trout.* **Anadromous Salmonids** – Steelhead utilize both Bear and Marten creeks; Chinook salmon have used Marten Creek; both streams are spawning habitat by native cutthroat trout.	**Bull Trout** – Past management practices have placed an emphasis on managing probable or potential habitat areas. *Bull trout were listed in 1999 as a Federally-listed Threatened species.* **Cutthroat Trout** – The isolated populations of cutthroat trout are sensitive to adverse change. ***Resident salmonids*** **–** The isolated population of cutthroat trout is *managed to maintain its genetic uniqueness. Both the resident cutthroat and rainbow trout are considered to be sensitive species.* ***Spring Chinook*** *– Spring chinook were listed in 2000 as a Federally-listed Threatened species.*
4. Wildlife Resources – known or suspected within the Proposed ACEC		**Wildlife Diversity** – The Proposed ACEC area and the adjacent Mt. Hagan Roadless Area (*Mt. Hagen LSR*) are important in preventing fragmentation of habitat important for wildlife species dependent on large intact forest environments such as pine marten and tailed frogs.
	Northern Spotted Owl - Documented – Bear Creek was an owl Habitat Conservation Area (HCA) and 3 pairs and one single owl, equaling 4 site centers, existed within the area of the original ACEC nomination. *HCAs are no longer a management designation for spotted owls. As of November 2000, there are 3 established pair sites with NFP unmapped–LSR cores on BLM land within the original AMA nomination and at least 4 known sites (on private and BLM land) within 1 mile of the ACEC boundary.*	

Key Issues	Relevance	Importance
	Tailed Frog – Documented – Bear and Marten creeks have viable populations of tailed frogs. Tailed frogs forage from the riparian zone to the ridge top. *At the time of writing, tailed frogs are known to exist in Bear, Rough, Marten and Deer creeks and their tributaries.*	**Tailed Frogs** – The presence of tailed frogs provides a unique opportunity to measure effects of disturbance because Bear and Marten Creek Watersheds are in the center of this species' distribution and range. This species can be vulnerable to adverse change and is found in drainages that are minimally disturbed. Timber harvest and road building have been detrimental in some areas for this species. *These drainages provide habitat for the largest known populations on the Eugene District.*
	Cascade Torrent (formerly Olympic) Salamander - Documented – The salamanders have been found on Hatchery and Marten creeks. They require cold, clear trickles of stable perennial 1st order streams in the transient snow pack zone *(roughly 1,000–3,000 feet in the local area).* Buffered 1st order streams are thought to be critical for this species. *This species has also been located on Deer , N. Gate, and Rough creeks*	
	Oregon Slender Salamander – Suspected – Species only occurs in mature fir and old growth forests. Species utilizes fallen trees and bark from snags. Logging exposes the forest floor, creating unsuitable dry conditions.	
	Northern Red-Legged Frog –Documented – Species occurs in ponds and low-gradient streams; adults utilize uplands. Overstory vegetation and rodent burrows provide suitable damp places. Logging exposes the forest floor creating unsuitable dry conditions. *This species has been located in scattered locations within the planning area, with many being outside of the proposed ACEC boundaries.*	

Key Issues	Relevance	Importance
	Northern Saw-Whet Owl - Documented – The owl can be found primarily in young, mature, and old growth seral stages in coniferous forest. Snags must be present; forest conversion into grass/shrub-seedling series does not support this species. Species is not supported in large areas of uniform stands. Benefits from retention of all vegetation and snags in the riparian zones.	
	Northern Pygmy Owl -Documented Species habitat not entirely known, but has been recorded in numerous types and age classes in Oregon. Species utilizes tree cavities created by woodpeckers that in turn are dependent on a supply of large diameter decaying trees. Conversion of mixed-age forest stands to young trees is expected to be detrimental.	
	Mountain quail – Documented – Species believed to forage in early seral stages and use conifer stands for cover, including mature and old growth.	
	Harlequin Duck – Documented – Nesting habitat variable. Species does not tolerate destruction of riparian areas along streams, watershed stability, alterations in stream flow, mining, roads, timber harvest, or recreational disturbance in breeding areas. *A suspected breeding pair was located in Marten Creek in 1997.*	
	White-footed vole – Suspected – Species found in a variety of forest conditions including logged, burned, and mature coniferous forest – habitat information lacking.	

Key Issues	Relevance	Importance
	Pacific fisher – Possible – Species requires dense, mature, and old growth forest stands are believed to constitute optimum habitat, although study results vary by region. Species known to use second growth and even clear cuts after cover is established. Timber harvest is not considered compatible with maintenance of maximum fisher numbers in most areas, resulting in isolated habitat areas that are too small to sustain viable populations.	
	Pine Marten – Possible – Pine martens have been detected on nearby USFS land. The species utilizes mature mixed conifer forests and avoids areas without overhead cover while using the edges for forage. Limited logging in mature forest does not harm marten populations if clear cuts are small and ground cover becomes established quickly.	

1.0 Coarse Woody Debris (Snags and Down Logs)

Standing and down dead woody materials are essential components in coniferous forests of the Pacific Northwest. They provide numerous processes and functions including nutrient cycling, carbon stores, and habitat for a myriad of vertebrate, invertebrate, and plant species (Brown 1985, and Bull et al. 1997). Specific mortality agents such as fire, disease, insects, natural suppression, and wind refer to the diverse range of size and decay classes of Coarse Woody Debris (CWD) present in a forest at any given time. CWD takes on many forms in forested ecosystems and may be present as either snags (standing dead trees) or down logs (above or below ground). Levels of CWD accumulation after natural disturbance, such as fire, typically are much greater than levels present after a timber harvest or pre-commercial thin (Spies et al. 1988). Larger and more decayed snags and logs are generally a limiting factor in many managed forests. Managing for levels of CWD more similar to those present under natural disturbance regimes would provide for greater diversity, abundance, and survival of biotic organisms and abiotic processes dependent upon these features.

The Northwest Forest Plan (NFP) provides specific direction to address CWD and develop management recommendations based on additional information and local conditions (NFP ROD pg. C-40). An objective of this Landscape Design is to maintain and/or create CWD quality and quantity more closely resembling those found in natural forests as compared to the interim levels described in the NFP.

The amount of carryover and recruitment of CWD that occurs during natural succession is not realized in many managed forest regimes. Historic clear cut harvest and broadcast burning treatments removed most potential carryover wood that would be found in naturally regenerated stands that followed natural disturbances. Harvest and thinning operations often damage or destroy existing snags and down wood and salvage practices remove much of the wood that would be present from natural disturbance mortality. Pre-commercial and commercial thinning events minimize the number of trees that would die from suppression mortality in the later stages of forest development. To manage for quality and quantity of CWD more closely resembling that typical in natural stands it will be necessary to periodically maintain and create dead wood throughout the development of forest stands managed for wood products. CWD will be managed according to the western hemlock plant series which is 93 percent of the federal lands in the planning area. The Douglas-fir series is represented in most of the remaining 7 percent of the federal lands.

1.1 Snags

Snags are an important structural component in forest communities and many wildlife species depend on them for survival. They are used for a variety of functions such as nesting, foraging, perching, and roosting. Of the nearly 100 species of wildlife that use snags, over half are dependent on cavities for at least 1 of 18 life cycle needs, at least 4 that relate to nesting (Thomas et al. 1979, Nietro et al. 1985 in Brown Chapter 7). Examples of cavity-nesters that may occur in the Bear Mt. AMA include pileated, hairy, and downy woodpeckers (primary cavity nesters), brown creepers, red-breasted nuthatches, American martens, northern flying squirrels, and several owl species (secondary cavity-nesters). Examples of non-cavity-nesting wildlife that potentially occur in this region and that are dependent on snags for some part of their life cycle include up to 15 bat species. Most species require specific ranges of snag diameter, height, and decay. Thus it is important to maintain and/or create a diversity of snag types in a managed landscape. In addition to vertebrate wildlife habitat, snags provide essential habitat for many invertebrates and a suitable growing environment for many species of fungi, epiphytic mosses,[1]

and lichens.

1.1.2 Existing Conditions of Snags

Little data have been collected on existing conditions of CWD in the planning area. The immediate and future availability of snags depends on their current size and stage of decay (Neitro et al. 1985). Data collected within northern spotted owl home ranges is shown in **Table F-1.** These indicate that the majority of the snags existing within the AMA Bear Marten Watershed are less than 15 inches in diameter, which is below the minimum of 16–20 in diameters required by most species of primary cavity-nesting birds and mammals.

Of the three age classes depicted, 80-119 year stands had the greatest number of snags ≥ 15" dbh (11/acre). Past salvage activities in older stands and harvest in younger stands, as well as differences in fire history, may account for the low densities of large snags in these age classes. Stage of decay of snags >15" were predominantly class 2 and 3 (as described by Cline, 1980). Snags of later stage of decay are used by more species than snags in early stages of decay. Sound snags are immediately available to fewer species.

Table F-1 – Existing Snags within the AMA

Average snag densities for 3 age and size classes estimated from data collected on 277 snags within home range of northern spotted owls in the Bear Marten Watershed within the AMA. Average decay of measured snags is class 2 and 3 (Irwin et al. from Bear/Marten Watershed, McKenzie Resource Area, 1998).

Age Classes (years)	Size Class (inches)	# Snags/ size class	Avg. DBH (inches)	Avg. Ht. (feet)	Avg. Densities (approx. #/acre)	Average # of Snags > 16 inch diameter (all decay classes)
< 80	≤ 15	46	7.1	37.9	51	
(managed)	16-19	1	16.1	6.5	1	
	≥20	**7**	**23.2**	**19.7**	**2**	**3**
	≤ 15	95	8.6	41.4	40	
80-119	16-19	15	16.4	38.1	5	
(unmanaged)	**≥20**	**66**	**30.7**	**30**	**6**	**11**
	≤ 15	37	7.7	37.1	41	
≥ 120	16-19	0	0	0	0	
(unmanaged)	**≥20**	**10**	**31.3**	**52.8**	**2.5**	**2.5**

Snag Conditions for Forests Similar to the Planning Area – The three data sets shown in **Table F-2** are from studies within and near the planning area that include information on large (> 16 inch), decay class 1-3 snags and represent the average number of snags in four age classes. The average level of snags in stands between 20 and 150 years is 9.8 (8.1–13.2) snags/acre.

Table F-3 shows composites of data for large diameter (> 16 inch), decay class 1-2 snags included in Table F-2 plus data from other western Oregon habitats similar to those in the planning area. The average level of snags in stands between 20 and 150 years is 8.5 (8.1– 8.8) snags/acre.

Table F-2 – SNAGS - Data Sets in or Near the Middle McKenzie AMA

		Early (~ 21-50 yrs.)	Early - mid (~ 21-79 yrs.)	Mature (~ 80 - 150 yrs.)	Old Growth (~ > 150 yrs.)	Reference # and Comments

Series	Size Class (Diam in Inches Length in Feet)	Avg Decay Class (1 - 5)	Avg. Density (# / Acre)	Avg Density Total (# / Acre (> 16 in Diam)	Avg Decay Class (1 - 5)	Avg. Density (# / Acre)	Avg Density Total (# / Acre (> 16 in Diam	Avg Decay Class (1 - 5)	Avg. Density (# / Acre)	Avg Density Total (# / Acre (> 16 in Diam	Avg Decay Class (1 - 5)	Avg. Density (# / Acre)	Avg Density Total (# / Acre (> 16 in Diam	
PSME TSHE	16-19 in	2-3	1.1					2-3	5.4		2-3	0		1 early = 25 - 79 yrs mature = 80 - 119 og = 120+
	≥ 20 in	2-3	2.0	**3.1**				2-3	5.8	**11**	2-3	2.5	**2.6**	
PSME	≥ 16 in	1-3		**13.2**	1-3		**13.2**	1-3		**8.3**	1-3		**11.4**	2 early = 25 - 79 yrs mature = 80 - 119 og = 120+
TSHE	≥ 20 in ≥ 20 ft									**3** (0-5)			**12** (11-21)	3 ( ) = 25 & 75 % quartile ranges
PSME	≥ 20 in ≥ 20 ft									**10** (11-21)			**23** (13-42)	
Average # of Snags/Acre > ~ 19 in. diam in decay class 1-2				**8.2**			**13.2**			**8.1**			**12.2**	

1 Irwin et al. 1998 (NCASI) in the Bear Marten WA, p 4-67. Includes data collected in test and random vegetation plots within the home ranges of spotted owls, and in random plots throughout the Bear Marten AMA. Amounts are higher when the entire data set is included (reference # 2). Most data were in unmanaged stands that experienced a high-severity fire approx. 90 years ago. Most remnant snags created from the fire event had decayed at time of study.

2 Irwin et al. 1998 (NCASI) . Data collected in test and random vegetation plots within the home range of spotted owls and random plots throughout the Bear Marten AMA plus Fall Creek and Mohawk watersheds. Includes some managed stands.

3 Mid-Willamette LSR Assessment, 1998, Appendix F, pages 20 and Chapter 2, page 30. Data from CVS plots are in existing stands. Data was transformed. Data were pre and post stratified (for inclusion in the LSR Assessment) based on if the random CVS plot was determined to be representative of the series for that stand.

Table F-3 - Snag Data Summary (Includes data in Table F-2)
Most data are for decay class 1-2 for large snags in Oregon, west slope of the Cascade Ranges in habitats similar to those in the AMA planning area. All data are for plant series Douglas-fir and/or western hemlock unless noted. Some data sets were transformed to estimate size and decay class criteria and are estimates only. No data are included for stands less than 20 years after a major disturbance event.

		Average Densities – # > 19 in. diam. snags/acre			Reference
Series	**Size Class diam = in. length = ft.**	**Early (~ 20–60 years)**	**Mature (~ 80–150 years)**	**Old Growth (~ > 150 years)**	
	> 20 in.	10 (< 80 yrs)			Spies et al. 1988
	> 20 in.		7.9 (> 70 yrs)		Hemstrom and Logan 1987
	> 20 in.		15 (> 70 yrs)		South Cascades LSR Assessment 1998, Ecology Plots
	16 -19 and > 20 in.			7 (> 200 yrs)	South Cascades LSR Assessment 1998, Ecology Plots
	> 20 in.		6 (80 - 200 yrs)		Spies et al. 1988
	> 17 in.		4.4 avg. 117 yrs)		Ohman et al. 1994, western Oregon and Washington.
	> 20 in.			10 (> 200 yrs)	Spies et al. 1988
	> 20 in.			4.8 (> 200 yrs)	Little River WA, 1995
	> 17 in.			13.7	Ohman et al. 1994, western Oregon & Washington.
western OR, WA conifer/ mixed hdwd			7.2	12.7	*Wildlife Habitat Relationships in Oregon.* (in prep, Ch. 24)
PSME TSHE	≥ 16 in.	3.1	11	2.5	Irwin et al. 1998 from Bear Marten WA AMA data only.
PSME	≥ 16 in.	13.2	8.3	11.4	Irwin et al 1998 McKenzie & Mohawk watershed data.
TSHE	≥ 20 in. ≥ 20 ft.		3	12	Mid Willamette LSR Assessment 1998
PSME	≥ 20 in. ≥ 20 ft		10	23	Mid Willamette LSR Assessment 1998
Average # Large Snags/Acre > ~ 19 inch in decay class 1-2		**8.8**	**8.1**	**10.8**	*See main reference page for references.*

1.1.3Snag Management

1.1.3.1 Introduction

Developing recommendations for snag amounts through analyses of data are subject to the inherent variability within the data and the natural variability found at any location within a forest stand at a given time based on stand disturbance history, plant series, conifer size, moisture, topographic position, and stand age. The volume of all coarse wood (snags and down logs) typically present the first three decades after a major disturbance is significantly higher than amounts to be managed for after harvest due to operational feasibility, fuel fire concerns, and the objective to remove wood products. Much of this volume is composed of small length or diameter pieces that are less limiting to wildlife and most easily recruited through natural processes. Management will focus on maintaining/creating diameter and lengths in lower decay classes that are more important to biotic and abiotic processes and also less likely to be naturally recruited in managed stands.

The prescribed snag level requirements attempt to approximate the quality and amount within the natural variation that would be expected to occur within the planning area while considering constraints such as those mentioned above.

1.1.3.2 General Objectives

Snag creation and retention will be managed at each regeneration or commercial thinning entry occurring roughly between stand ages 30–100 years in Landscape Area 1 and 30–180 years in Landscape Area 2. The main objective is to manage for a consistent supply of large, hard snags throughout the life of the stand that is closer to levels expected to occur in natural stands of the western hemlock plant series on the west slope of the Cascade Range in Lane County. Large and hard snags are defined as those > 16 and 20 inches in diameters in decay class 1-2.

Snags in older decay classes or those known to be important to local plant, fungal, or wildlife populations will also be managed for based on project ID Team considerations.

Management recommendations for stand entries for restoration or as a result of unplanned disturbances (such as fire, major windthrow, etc.) and additional recommendations for riparian zones will be developed later.

1.1.3.3 Specific Snag Objectives

- Maintain and create snags throughout the stand rotation to more closely mimic quality and amounts typical in western hemlock series forests on the western slope of the Cascade Range.
- Maintain and create snags with a diversity of heights, diameters, and stages of decay with a focus on large diameter sound snags.
- Distribute snags throughout the landscape in patterns representative of a mixed-severity fire regime (combination of aggregates and individual dispersed snags). Snag density and distribution should emulate natural patterns seen in different topographic slope positions (i.e., after regeneration harvest, create/retain more snags in upslope positions). These considerations should be balanced with factors such as safety and operational limitations and the realization that snags in downslope positions may remain standing longer or be more usable for some wildlife and plant/fungal species.
- Leave enough snags and green trees in patches so that at any given time there will be some live trees and some snags within the landscape block. Multiple live tree/snag patches maximize the functionality of the area for foraging and nesting areas as well as microclimate.
- Provide nesting, foraging, roosting, and refugia habitat for cavity-nesting birds, and for bat, mammal, amphibian, and invertebrate species throughout the stand rotation.
- Provide host substrate for vascular and non-vascular plant species throughout the stand rotation.

1.1.3.4 Management Guidelines (Table F-4) Management guidelines are specified for 3 potential treatment types: regeneration harvest, pre-commercial, and commercial thinning. Snags will be described as:

- "sound" (i.e., hard) refers to early stages of decay in decay class 1-3 and;
- "decayed" (i.e., soft) refers to later stages of decay in decay class 4-5 as described by Cline 1980.

The number of prescribed large sound snags was generated from data gathered in natural stands similar to those in the planning area (Table F-3). Snag levels prescribed are for age classes where harvest treatments are expected to occur. Details on attaining the snag requirements are described following the table.

Table 3-7 (= Table F-4 in Appendix F)
Snag Requirements and Specifications by Treatment Type and Age Class

Harvest Treatment	Snag Requirements	Snag Creation/Retention Specifications	Retention and Creation Methods For Harvest Areas (See creation methods in Appendix F)
Regeneration (any age)	≥ 8 /acre	All ≥ 50 ft tall All ≥ 16"dbh 50 % ≥ 20" dbh 50 % ≤ Decay class 1-2	Retain all existing decayed and sound snags to the extent possible. Create snags if retention levels are below Snag Requirement levels. *If stand must stabilize after regen, create at least half of the snags at regen and remaining snags within 10 - 15 yrs..*
Precommercial Thinning - A (15 - 35 yrs) ***For stands with previous harvest implemented PRIOR TO MMLD***	Depends on availability and needs.	None	Retain all existing decayed and sound snags. Create snags from existing overstory/leave trees if possible, based on availability.
Precommercial Thinning - A (15 - 35 yrs) ***For stands with previous harvest implemented UNDER MMLD***	≥ 8/acre	None (unless creation treatments not yet completed from regen)	Retain all existing decayed and sound snags. Any remaining green trees dedicated for snag creation at time of regeneration harvest not yet treated should be treated before or during this entry.
Commercial Thinnings (30 - 80 years in LA 1 30 -110 years in LA 2)	≥ 8/acre	Stands < 80 yrs: All ≥50 ft tall All ≥ 16 " dbh 50% ≥ 18-20 " dbh (if available) 50 % ≤ Decay class 1-2 Stands ≥ 80 yrs: ≥ 70 ft. tall All ≥ 16"dbh 50 % ≥ 20" dbh 50 % < Decay class 1-2	Retain all existing decayed and sound snags to the extent possible. Create snags if retention levels are below Snag Requirement levels. If the stand does not contain enough live trees of the appropriate diameters, create "living snags".

1.1.3.5 Attaining Snag Requirements (Table F-4)

Snag Requirements

The prescribed levels can be met by retention and/or creation of snags in all harvest treatments. Only conifer species count towards snag requirements. Snag quality generally increases with increased diameters and heights.

All created/maintained logs should be conifer species ≥ 20 in. diameter at breast height , and ≥ 50 foot length, and ≥50% must be sound (decay class 1 or 2).

Snag Retention

- Retain all existing decayed and sound snags in the harvest unit to the extent possible.
- Prioritize the retention of larger snags (all decay classes) and snag aggregates.
- For existing sound snags to count towards the required levels, they must meet the size specifications and be protected during harvest activities. If damaged during harvest activities, these should be replaced by creating new snags *(Damaged is defined as diameter or length reduced below minimum requirements).*

Snag Creation

- If new snags are necessary to meet specification levels, create sound snags after harvest. For commercial thinning harvests, snags should be created within 10 years after harvest. For regeneration harvests, some snags will be created after harvest and some after the stand has stabilized. Snags should be created within 10 years after harvest.

- Ground girdling is the quickest and least expensive method to create snags from live trees but often results in snags that remain standing and usable for less time. Where feasible, some snags should be created by the following methods:
  --Top live trees at heights greater than 50 feet by chainsaw or blasting.
  -- Low girdling is most appropriate only at the time of the last commercial thinning entry or within riparian reserves to minimize safety hazards and should be implemented above 25 feet where possible.
  -- "Living snags" may be created by topping live trees and retaining a minimum of nine live limbs (from the top of the crown).
  -- Innoculants should be considered to increase the rate of decay in created snags.

  - Attempt to create snags at a variety of heights to mimic natural diversity.
  - Retain dead and dying limbs where possible to provide perching and resting sites for cavity-nesters.
  - Do not create snags exclusively from overstory remnant (legacy) trees.
  - Mark all created snags with permanent wildlife signs and map for future monitoring and harvest retention.

Snag Distribution

- Where possible, clump some green trees around areas with high creation/retention snag densities to reduce the chance they will pose a safety hazard or be damaged during harvest.
- When possible, aggregate snags in clumps of 5–10+ snags over 25-50% of the area to be harvested. Disperse the remainder of the snags throughout the harvest unit.
- Where possible and consistent with other resource concerns, to increase efficiency of operational procedures, and to protect clumps from mechanical damage, maintain these aggregates within green tree retention areas or other reserves.
- Create some of the aggregates on ridge-tops for bat habitat. Where possible, sound snags should be topped in these exposed areas to reduce the chance of windthrow.
- Consider the expected needs of existing populations of wildlife, plant, and fungal species in or near a harvest. Provide for minimal disturbance to snag habitats while maximizing down log habitat retention and creation.

Future Snag Recruitment

Snag recruitment will occur naturally through the life of a stand. This was considered when developing the target levels for creation/retention. Remaining green trees not used for snag creation may contribute to future snags and/or down wood, but no specific amounts for future recruitment are recommended.

Riparian Reserves – Management activities within Riparian Reserves will meet the Aquatic Conservation Strategy Objectives. Recommended levels of snags will be determined based on local site conditions and further recommendations may be developed as needed (see Table 3-9: *Stream Side*

Management Prescriptions for Harvest, GTR, CWD and LWD in sec 3.4.4).

1.2 Down Logs

Down logs are an important functional component of both terrestrial and aquatic forest ecosystems. They reduce erosion, affect soil development, intercept and stabilize water in upslope habitats, are a major source of energy and nutrients, serve as a seedbed for vascular plants and surface for lichens and bryophytes, and provide habitat for a broad array of organisms - including microbes, plants, invertebrates, and vertebrates (Harmon et al. 1986 and Maser and Trappe 1984). Down logs provide habitat for insects and fungi that, in turn, provide food for many species of birds, mammals, reptiles, amphibians, and fish. Logs also provide shelter, protective cover, nesting sites, travel corridors, and thermal protection for a variety of wildlife species; for example, large hollow logs provide potential den sites for martens, bears, and other carnivores and smaller logs provide hiding cover and travel corridors for small mammal species such as red-backed voles and for amphibian species such as clouded salamanders. In addition, large logs provide habitat complexity and cover within streams for many fish species. In-channel large woody debris regulates channel processes by slowing water flow, decreasing width-to-depth ratio, enabling flood plain connection/side channel development, and creates habitat for fish and other aquatic dependent species.

The distribution and orientation of logs influence use by wildlife and plant species (Harmon et al. 1986 and Bull et al. 1987). Under a natural disturbance regime, logs are unevenly distributed across the forest (Spies and Cline 1988) and both aggregates and single logs may be found. Wood is often present in clumps as a result of small disturbance events such as insect infestation, root pathogens, blowdown patches, or patchy fire. Additionally, the large overstory trees that contribute heavily to the dead wood supply are irregularly distributed (Harmon 1986). In relatively continuous forested stands that developed from a hot fire, wood may be distributed more evenly. Both patterns of distribution are beneficial to forested ecosystems. Even distribution of wood provides spatial and temporal continuity of habitat that may be important to the survival and migration of invertebrate and small vertebrate species. Log aggregates may provide refugia or nesting sites for wildlife and suitable microclimate for plant germination. Logs that lie on the contours of a slope may be used more by wildlife than logs oriented across contours especially on steep slopes. Soil and organic debris that accumulate along the upslope side of a log encourage seedlings to establish and grow and, in turn, provide a more diverse habitat for both invertebrates and small vertebrates to inhabit (Maser and Trappe 1984).

1.2.1Existing Conditions of Down Logs

Little data have been collected on existing conditions of CWD in the planning area. Log data were recorded by age and size class within spotted owl home ranges in the Bear Marten Watershed within the AMA planning area (**Table F-5**). The majority of the logs were smaller than 20" in diameter. These logs were probably added to the stand by suppression mortality. The greatest quantity of wood was in the 80-120 year stands. The average linear feet per acre of logs > 20" in diameter in this age class was 414 with an average decay class of 3.4. It can be interpreted from these data that many of the larger logs were recruited from the previous stand. In stands > 120 yrs, average linear feet per acre was 161 with the majority of the logs being in late stages of decay. These logs will not persist throughout the rotation period of the stand; thus it will be necessary to create a source of new CWD when older stands are entered so that future CWD will be available. Lowest quantities of wood were seen in stands < 80 years; the average linear feet/acre for logs > 20" diameter was 122. These quantities appear low when compared to numbers typically found in similar naturally regenerated stands of this age class (Table F-7). The average for stands less than 120 years was 268 (122–414).

Table F-5– Existing Log Data Within the AMA

(Average log measurements for 3 age classes and 2 size classes estimated from data collected within home ranges of Northern Spotted Owls in the Bear Marten Watershed, within the AMA (1998). Stands greater than 80 years are naturally regenerated.)

Age Classes (yrs)	Size Class (in.)	# Logs tallied/ size class	Avg. small diam (in.)	Avg. large diam (in.)	Avg. Length	Avg. Decay Classes[A]	Linear Feet per Acre[B]	Linear Feet / Acre of large logs[B]
< 80	< 20	124	5.8	7.8	21.5	2.4	1,565	
< 80	≥20	7	20.8	24.7	29.5	3.4	122	**122**
80-119	< 20	682	8.3	10.2	19.9	2.9	2,384	
80-119	≥20	73	23.1	31.2	32.4	3.4	414	**414**
≥ 120	< 20	144	8.1	9.6	15.7	3.7	1,130	
≥ 120	≥20	18	25.6	29.1	17.8	4.4	161	**161**

[A] Decay class 1 - 3 are in early stage of decay (sound) and decay class 4 - 5 are highly decayed (soft). Hard and soft as defined by Fogel et al. 1973 and Sollins 1982.

[B] Linear feet extrapolated from log volume.

The data shown in **Table F-6** are from studies within a nearby planning area and includes reported or transformed data for large (> 19 inch diameter) sound (decay class 1-2) logs. The average linear feet/ acre of large sound logs for stands between 21–150 years was 319 (312–366).

Table F -6 : DOWN WOOD - Data Sets In or Near the BLM AMA Planning Area
(Lf = linear feet)

			Early	Early-Mid	Mature	Old Growth	Reference # and Comments
Series	**Size Class (Diam in inches**	**Avg Decay Class (1 - 5)**	**Avg Density (Lf/Acre)**	**Avg. Density (Lf/ Acre)**	**Avg. Density (Lf/Acre)**	**Avg. Density (Lf/Acre)**	
TSHE, PSME	> 19.7 in	2-3		**121**	**414**	**161**	1 early - mid = 24 - 79 yrs mature = 80-119 yrs og = 120+ yrs
TSHE, PSME	> 19.7 in	est. 1-2	**354**	**411**	**375**	**479**	2 early = 24 - 59 yrs, mid = 60- 79 yrs, mature = 80-119 yrs, og=120+ yrs dc 1-2 estimated from total x 0.29 [A]
TSHE	> 21 in				**190**	**159**	3 dc 1-2 reported in data set #s are lower since > 21 in. used
TSHE, PSME	est. > 20in	est. 1-2		**405**			4 405 = estimated amount of total down wood that was > 20 in diam and in dc 1 - 2. Calculated from total x 0.65 x 0.29 [A]
Average Linear Feet of *large logs > 19.7 inch in decay class 1-2*.				**312**	**326**	**266**	

References and Footnote.

1 Irwin et al. 1998 (NCASI) Eugene BLM from Bear Marten WA, p 4-67. Data collected in test and random **vegetation plots** within the home range of spotted owls and random plots throughout the **Bear Marten AMA**. Includes only plots within the AMA planning area. Amounts are higher when entire data set is included (reference # 2). Many were in unmanaged stands that experienced a high-severity fire approx. 90 years ago.

2 Irwin et al. 1998 (NCASI) Eugene BLM p27. Data collected in test and random **vegetation plots** within the home range of spotted owls and random plots throughout the **Bear Marten AMA plus Fall Creek and Mohawk watersheds.** Includes some managed stands.

3 Mid-Willamette LSR Assessment Appendix F, p 20, and Chapter 2, p 30. Data from **CVS plots** (log transformed data) in existing stands. Data were pre and post stratified (for inclusion in the LSR Assessment) based on if the random CVS plot was determined to be representative of the series for that stand.

4 Butts, 1997. Study done on Weyerhaeuser and BLM lands west of I - 5. Approximately half of the **grids** were in/near the AMA planning area.

A Conversion factors from observations in Wright, P.J., 1997 data where approximately 29 % of log volume was in decay class 1-2 in a douglas fir / western hemlock mixed severity fire regime; and from Augusta Creek data (provided by Jane Kertis) where approximately 65 % of log diameter size was > 20 inches. These estimates are subject to variability but are assumed to be conservative.

Table F-7 shows composites of data for large (≥ 19 inch diameter) sound (decay class 1-2) logs in Table F-6 plus other studies in similar habitats, mostly in western Oregon. The average linear feet / acre of large sound logs for stands between 21 - 119 years was 392 (383-400)

Table F-7– Down Log Data Summary

Data for decay class 1 -2 large logs > 19 inch diameter at small end, in Oregon, west slope of the Cascade Range in habitats similar to those in the AMA planning area. All data is for plant series Douglas-fir and/or western hemlock unless noted. Some data sets were transformed to estimate size and decay class criteria and are estimates only. No data are included for stands immediately after a major disturbance event.

Average Densities: Linear Feet / acre of > 19 inch diameter logs in decay class 1 - 2			Reference
EARLY - MID (~ 25 - 69 yrs)	MATURE (~ 70 - 119 yrs)	OLD GROWTH (>~ 120 yrs)	
648	786	1136	*Wildlife Habitat Relationships in Oregon.* (in prep, Ch. 24)
406 (51-60 yrs)			Butts, 1997
336 (< 80 yrs)	438 (80-119 yrs)	375 (> 120 yrs)	Irwin et al. 1998 in Bear Marten, Mohawk, and Fall Creek watersheds.
	197 (80-200 yrs)	197 (80-200 yrs)	Spies et al. 1998
		428 (> 200 yrs)	Spies et al. 1998
121 (24-70 yrs)	414 (80-119 yrs)	161 (≥ 120 yrs)	Irwin et al. 1998 in AMA
354 (24-59 yrs) 411 (60-79 yrs)	375 (80-119 yrs)	479 (≥ 120 yrs)	Irwin et al. 1988 in McKenzie, Fall Creek. and Mohawk watersheds
	190	159	Willamette LSR Assessment. 1998 (CVS Data) (western hemlock series)
			Willamette LSR Assessment. 1998 (CVS Data) (Douglas-fir series)
405 (50-60 yrs)			Butts, 1997 BLM
383	**400**	**419**	**Average Linear Feet/Acre of Down Wood in Large Logs > 19 inch diameter in decay class 1-2.**

C. SIZE and DECAY CLASS: All log volumes were either reported in the size classifications shown or transformed from the reported volume and/or diameter to estimate amounts in a mixed intensity fire regime in the Douglas-fir series.

B. SERIES: All data sets are in Douglas-fir and/or western hemlock series forests, unless noted.

1.2.2 Down Wood Management

1.2.2.1 Introduction

Developing recommendations for down log amounts through analyses of data are subject to the inherent variability within the data and the natural variability found at any location within a forest stand at a given point in time based on stand disturbance history, plant series, conifer size, moisture, topographic position, and stand age. The volume of all coarse wood (snags and down logs) typically present the first three decades after a major disturbance is significantly higher than amounts to be managed for after harvest due to :

- operational feasibility

- fuel fire concerns
- the objective to remove wood products, and
- the assumption that stands will naturally recruit logs, even with disturbance from harvest entries.

Much of the volume in the first three decades is composed of small length or diameter pieces that are less limiting to wildlife and most easily recruited through natural processes. Management will focus on maintaining/creating larger diameter and length logs in lower decay classes that are more important to biotic and abiotic processes and also less likely to be naturally recruited in managed stands. Down logs in older decay classes or those known to be important to local plant, fungal, or wildlife populations will also be managed for based on project ID Team considerations.

The prescribed down log levels attempt to approximate the quality and amount within the natural variation that would be expected to occur within the planning area while considering constraints such as those mentioned above.

1.2.2.2. General Objectives

Snag creation and retention will be managed at each regeneration or commercial thinning entry occurring roughly between stand ages 30–100 years in Landscape Area 1 and 30–180 years in Landscape Area 2. The main objective is to manage for a consistent supply of large, sound logs throughout the life of the stand that is closer to levels expected to occur in natural stands of the western hemlock plant series on the west slope of the Cascade Range in Lane County. Large and sound logs are defined as those > 16 and 20 inch in diameter, > 20 feet long, in decay class 1-2. Snags in older decay classes or those known to be important to local plant, fungal, or wildlife populations will also be managed based on project ID Team considerations.

Management recommendations for stand entries for restoration or as a result of unplanned disturbances (such as fire, major windthrow, etc.) and additional recommendations for riparian zones will be developed later.

1.2.2.3 Specific Down Log Objectives

- Maintain and create logs throughout the stand rotation to more closely mimic the quality and amounts typical in western hemlock series forests on the western slope of the Cascade Range.
- Maintain and create down logs with a diversity of lengths, diameters, and stages of decay with a focus on large diameter, longer length, sound logs.
- Snag density and distribution should emulate natural patterns seen in different topographic slope positions (i.e., after regeneration harvest, create/retain more down logs in upslope positions).

- Create refugia and nesting habitat by maintaining or creating clumps of logs over part of the harvest area.
- Where possible, maintain or create dispersal corridors to ridge tops and riparian areas for small mammals and amphibians by connecting clumps of logs with evenly dispersed pieces.
- Attempt to provide adequate foraging, hiding, thermal cover, and nesting habitat for birds, mammals, amphibians, and invertebrates throughout the stand rotation.
- Provide seed beds for conifers and host substrate for vascular plants, fungi, and lichens.

1.2.2.4 Management Guidelines (Table F-8)

Management guidelines are specified for 3 potential treatment types: regeneration harvest, pre-commercial, and commercial thinning (Table F-8). Logs will be described as

- "sound" (early stage of decay in decay class 1-3) and
- "decayed" (late stages of decay in decay class 4-5) as described by Fogel (1973) and Maser et al. (1979). See Table F-10

Table 3 - 8 (= Table F-8 in Appendix F)
Down Wood Requirements and Specifications
by Harvest Treatment for a Mixed-severity Fire Regime in the MMLD

Harvest Treatment	Down Log Requirements [1] In Linear Feet/Acre	Down Log Specifications [2]	Retention and Creation Methods **Maintain all existing decayed and sound logs, ≥ 16 inch diameter, on the forest floor to the extent possible for all harvest treatments AND:**
Regeneration **(any age)**	300 lf / ac.	All created/retained logs that contribute to achieving 300 lf / ac should be : conifer species AND ≥ 20 in. diameter at small end and ≥ 20ft. length [2] AND > 50% must be sound (decay class 1 or 2) [2]	Retain and/or create down logs to meet the required amounts by falling trees that meet the specifications. *Create a minimum of 240 lf at regen (see exceptions in 3.4.3 section)* *If stand must stabilize after regen, create remaining logs within 10-15 yrs.*
Precommercial Thinning - A **(15-35 yrs)** ***For stands with previous harvest implemented PRIOR to MMLD***	300 lf / ac.		Retain and/or create down logs to meet the required amounts by falling existing trees that meet the specifications, if available and/or Maintain future reserve trees for the next commercial thinning.
Precommercial Thinning - B **(15-35 yrs)** ***For stands with previous harvest implemented UNdER MMLD***	NONE if target amounts created during regeneration harvest		Any remaining untreated green trees, dedicated for down logs at the time of the previous regeneration harvest, should be treated during this entry.
Commercial Thinnings **(35 - 80 yrs in LA 1;** **35 - 110 yrs in LA 2)**	300 lf / ac.		Retain and/or create down logs to meet the required amounts by falling trees that meet the specifications. Used trees with diameters ≥ 16 inch and ≤ 20 inch only when trees ≥ 20 inch diameter are not available.

[1] See Table F-9 in Appendix F fFor # logs required based on d.b.h. to meet linear feet requirements.

[2] Exceptions to this requirements are permitted when doing so would be an advantage to local wildlife, or plant/fungal species. For example, creating or maintaining smaller down logs in an area known to be used by clouded salamanders or *Allotropa virgata*.

1.2.2.5 Attaining Down Log Requirements

Down log requirements can be achieved by applying one or both of the following methods:

(1) Maintain all existing down wood by protection during harvest activities.

Sound wood of the specified size will count towards requirements. Inventory and mapping of existing down logs should be implemented to track the volume, decay, and location of existing wood (if possible). Sampling methods could be developed and implemented during stand exams to complete these tasks.

Maintenance of existing logs would minimize the number of green-trees required for down log creation, minimize disturbance to existing habitats and wildlife, plant or fungal species and provide more variability in decay class. However, in some stands it will still be necessary to fall green-trees to meet the linear feet/acre log requirements.

(2) Create the required linear feet of down logs by falling green trees during and/or within 10 years after harvest activities.

It will be assumed that no down logs of the appropriate size are present and no pre-harvest inventory will be required. This method would increase the number of green trees that will be dedicated for coarse woody debris while decreasing or eliminating the amount of pre-harvest log sampling and marking.

Under both methods, additional wood will need to be added periodically during stand development because of the long rotation periods proposed in the Landscape Plan, and the knowledge of decay rates of down logs. Therefore, a method for tracking the input, presence, and maintenance of down logs throughout stand rotation should be developed. Incorporation of such a tracking system as part of the planning process will likely increase the efficiency of interdisciplinary teams and facilitate monitoring of down logs if desired.

Down Log Requirements

All created/maintained logs should be conifer species $\geq$ 20 in. diameter at small end, $\geq$ 20 ft. in length, and $\geq$ 50% must be sound (decay class 1 or 2) . See exceptions for local plant and wildlife concerns.

Log Distribution

Snag density and distribution should attempt to emulate natural patterns seen in different topographic slope positions (i.e., after regeneration harvest, create/retain more down logs in upslope positions). These considerations should be balanced with factors such as safety and operational limitations and the realization that down logs in downslope positions may be more usable in the future for some wildlife and plant/fungal species.

Specific distribution of down wood should be determined on a site-level basis by planning teams to accommodate local needs. General guidelines are:

- Distribute 50-75% of the logs evenly over the treatment units to maintain

continuity of wood on the forest floor.

- Clump the remaining 25-50% within the treatment units.
- Protect down logs from mechanical damage by creating log clumps within green tree retention areas and snag clusters.
- Consider the expected needs of existing populations of wildlife and plant/fungal species: provide for minimal disturbance while maximizing down log habitat retention and creation for these species. Local species concerns may warrant variations in these recommendations.

Down Log Retention and/or Creation

- Retain all existing decayed and sound logs, $\geq$ 16 inches diameter, on the forest floor to the extent possible.
- Only sound logs $\geq$ 20" DBH and 20 ft. in length may count towards down log requirements for retention/creation. At least 50% of these must be in decay class 1 or 2. Those damaged during harvest activities should be replaced. *(Damaged is defined as size reduced below minimum requirements).*
- Consider the expected needs of existing populations of wildlife and botany species. Provide for minimal disturbance while maximizing down log habitat retention and creation. This should be evaluated on a site-specific basis and used to meet the length, diameter, or decay class requirements where appropriate.
- Prioritize retention and protection of some large diameter down logs, highly decayed logs, and areas with high concentrations of down logs (clumps) where this would be a benefit to wildlife, plant, or fungal species. This should be evaluated on a site-specific basis and used to meet the length, diameter, or decay class requirements where appropriate.
- Create 240 linear feet/acre at time of harvest with the remainder of wood created within 10 years. This delay is suggested to allow for windthrow mortality.
- If new logs are necessary to meet the required totals, create new sound down logs by falling trees > 20" diameter (see Table F-9 to determine the number of trees needed to meet the average linear feet/acre requirement).
- Only conifer species may be used to meet log creation requirements. Species mix should be representative of that existing in the stand overstory (e.g., if the dominant overstory species is Douglas-fir and the under or mid-story is dominated by a large number of western hemlocks, the majority of the down wood created should be of Douglas-fir). In positions adjacent to fish-bearing streams, emphasis should be placed on the creation of cedar logs.
- Do not create logs exclusively from overstory remnant (legacy) trees.
- Consider marking and mapping all created logs for tracking or retention purposes.

Riparian Areas – See direction in Snag management in Riparian Reserves

Table F-9– The number of 20-foot log segments available in trees of various diameters and the number needed to meet various down log requirements (linear feet/acre)					
DBH	Height (ft.)	# Pieces 20 ft. Long	# Trees/acre needed to create 240 linear feet/acre	# Trees/acre needed to create 300 linear feet/acre	# Trees/acre needed to create 400 linear feet/acre
20	20	1	12	15	20
22	20	1	12	15	20
24	20	1	12	15	20
26	40	2	6	7.5	10
28	60	3	4	5	7
30	60	3	4	5	7
32	80	4	3	3.8	5
34	80	4	3	3.8	5
36	100	5	2.4	3	4
38	120	6	2	2.5	3.4
40	120	6	2	2.5	3.4
42	120	6	2	2.5	3.4
44	140	7	1.6	2.2	2.7
46	140	7	1.6	2.2	2.7
48	140	7	1.6	2.2	2.7
50	140	7	1.6	2.2	2.7

Table F-10 – Description of Snag Decay Classes

A 5-class system of snag decomposition based upon work done on Douglas-fir in Western Oregon (reproduced from Maser et al. 1988, adapted from Cline et al. 1980)

	Stage of Deterioration (Decomposition class)				
Snag Characteristics [B]	1	2	3	4	5 [A]
Limbs and branches	All present	Few limbs, no fine branches	Only limb stubs	Few of no stubs	None
Top	Pointed	Broken			
Diameter, broken top	Increases at decreasing rate				
Height	Decreases at decreasing rate				
Bark remaining (%)	100	Varies	Varies	Varies	>20
Sapwood presence	Intact	Sloughs	Sloughs	Sloughs	Gone
Sapwood condition	Sound, incipient decay, hard, original color	Advanced decay, fibrous, firm to soft, light brown	Fibrous, soft, light to reddish brown	Cubical, soft, reddish to dark brown	
Heartwood condition	Sound, hard, original color	Sound at base, incipient decay in outer edge of upper stem, hard, light to reddish brown	Incipient decay at base, advanced decay throughout upper stem, fibrous, hard to firm, reddish brown	Advanced decay at base, sloughing from upper stem, fibrous or cubical, soft, dark reddish brown	Sloughing, cubical, soft, dark brown, fibrous , very soft, dark reddish brown, encased in hardened shell

[A] Mostly remnant snags

[B] Characteristics of a snag at each of the 5 stages of deterioration

Appendix G
Steps in the development of the Middle McKenzie Landscape Design

Appendix ?? Steps in the development of the Middle McKenzie Landscape Design

- Bear Marten Watershed Analysis was completed April 1996
- Public Meeting to discuss the watershed analysis held in Spring 1996
- Middle McKenzie Landscape Design started Fall 1998
- An article on the Middle McKenzie Landscape Design was included in the Eye to the Future, the Eugene District planning newsletter on April 1999, July 2000, and February 2001 issues
- An article on the Middle McKenzie Landscape Design was included in the Central Cascades Adaptive Management Area Newsletter in the Winter 1999/2000, Fall 2000 and Summer 2001 issues
- Middle McKenzie Landscape Design draft was completed April 2001
- Copies of the Draft given to selected Researchers and Agency personnel for comments
- Field trip with members from the Level 1 Fish Consultation Team on July 2001
- Document finalized on January 2002

REFERENCES

Applegarth 1994, USDI BLM, March 1994, Special Status Amphibians and Reptiles of the Eugene District - A Guide for Their Conservation Eugene District Office.

Applegarth 1995, USDI BLM, December 1995, Invertebrates of Special Status or Special Concern in the Eugene District, Eugene District Office.

Brown, E. R., tech ed. 1985. Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington. Part 1- chapter narratives. 332 pp. Part 2 - appendices. 302 pp. USDA Forest Service, Pacific Northwest Region, Portland, Oregon.

Brown, M., Kertis, J. and M. Huff. *In prep.* The Warner Creek Burn: Structure and Composition of Forests in the Oregon Cascades 1-2 and 6-7 Years After a Fire..

Bull, E. L., C. G. Parks, and T. R. Torgersen. 1997. Trees and Logs Important to Wildlife in the Interior Columbia River Basin. Companion to General Technical Report, PNW-GTR-390. USDA Forest Service, PNW Research Station.

Butts, S. R. 1997. Association of Forest Floor Vertebrates with Coarse Woody Debris in Managed Forests, Western Oregon Cascades. 60 pp. MSc Thesis, Oregon State University.

Christy, J.A. 2000. Personal communication.

Christy, J.A. and D.H. Wagner. 1996. Guide For the Identification of Rare, Threatened or Sensitive Bryophytes in the Range of the Northern Spotted Owl, Western Washington, Western Oregon, and Northwestern California. Bureau of Land Management, Oregon-Washington State Office, Portland, Oregon.

Cissel, J.H., Swanson, F.S., Weisberg, P.J. 1998. Landscape Management Using Historical Fire Regimes:Blue River Oregon. USDA Forest Service Willamette National Forest and Pacific Northwest Research Station and Department of Forest Science, Oregon State University.

Cline, S. P., Berg, A. B., Wight, H. M. 1980. Snag characteristics and dynamics in Douglas-fir forests, western Oregon. J. Wildl. Manage. 44(4):773-786.

Fogel, R., M. Ogawa, and J. M. Trappe. 1973. Terrestrial decomposition: A synopsis. Coniferous Forest Biome Report. University of Washington, Seattle. 135 pp.

Franklin, J. F., and Waring, R. H. 1980. Distinctive features of the Northwestern coniferous forest: Development, structure and function, *in* Forests: Fresh Perspectives from Ecosystem Analysis. Proceedings 40th Biology Colloquium (1979). R. H. Waring, ed. Pp 59-85. Oregon State University Press, Corvallis.

Harmon, M. E., and J. Sexton. 1996. Guidelines for measurement of woody detritus in forest ecosystems. Publication No. 20. U.S. LTER Network. Office: University of Washington, Seattle, WA, USA. 73 pp.

Harmon, M. E., J. F. Franklin, F. J. Swanson, P. Sollins, S. V. Gregory, J. D. Lattin, N. H. Anderson, S. P. Cline, N. G. Aumen, J. R. Sedell, G. W. Lienkaeemper, K. Cromack, and K. W. Cummins. 1986. Ecology of Coarse Woody Debris in Temperate Ecosystems. Advances in Ecological Research, Vol. 15. 302 pp.

Hemstrom, M. A., S. E. Logan, and W. Paviat. 1987. Plant Association and Management Guide, Willamette National Forest. USDA Forest Service, PNW R6-Ecol 257-B-86. Portland, Or. 312 p.

Holthausen, R. H., R. Anthony, K. Aubry, K. Burnett, N. Fredricks, J. Furnish, R. Lesher, E. C. Meslow, M. Raphael, R. Rosentreter, and E. E. Starkey. Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl. Appendix J2 - Results of Additional Species Analysis. UDSA-FS, USDI-BLM, 1994.

Irwin, Larry

Keon, D. 2000. Personal communication.

Maser, C., R. Anderson, K. Cromack Jr., J. T. Williams, and R. E. Martin. 1979. Dead and down woody material *in* Wildlife Habitats in Managed Forests, the Blue Mountains of Oregon and Washington. J.W. Thomas, ed. USDA Forest Service. Agriculture Handbook. 553 pp. Washington Office, Washington D.C.

Maser, C. and J. M. Trappe, tech eds. 1984. The seen and unseen world of the fallen tree. PNW-GTR-164. Portland, OR; USDA Forest Service, PNW and Range Experiment Station. 56 pp.

Maser, Z., C. Maser and J.M. Trappe 1985. Food habits of the northern flying squirrel (*Glaucomys sabrinus*) in Oregon. Canadian Journal of Zoology 63: 1084-1088.

McCune, B. 2000. Personal communication.

McCune, B. 1998. *Hypotrachyna riparia*, a new lichen from western North America. The Bryologist 101(3): 448-450.

Morrison, P. H. and F. J. Swanson. 1990. Fire History and Patterns in a Cascade Mountain Landscape. USDA Forest Service, Pacific Northwest General Report, PNW-GTR-254. 77 p.

Neitlich, P.N. and B. McCune. 1997. Hotspots of epiphytic lichen diversity in two young managed forests. Conservation Biology 11(1): 172-182.

Nietro, W. A., R. W. Mannan, D. Taylor, V. W. Binkley, B. G. Marcot, F. F. Wagner, and S. P. Cline. 1985. Snags (Wildlife Trees) *in* Management of Wildlife and Fish Habitats in Forests of Western Oregon and Washington. Part 1- chapter narratives. 332 pp. Brown, E. R., tech ed. 1985. USDA Forest Service, Pacific Northwest Region, Portland, Oregon.

Ohmann, J. L., W. C. McComb, and A. A. Zumrawi. 1994. Snag abundance for primary cavity-nesting birds on nonfederal forest lands in Oregon and Washington. Wildlife Society bulletin. Winter 1994. v. 22 (4) p. 607-620.

Oregon Department of Environmental Quality, 1998. 1998 303(d) Water Quality Limited Bodies List

Peck, J.E. 1997. The association of commercially harvestable bryophytes and their host species in northwestern Oregon. The Bryologist 100: 383-393.

Peterson, E.B. 2000. Analysis and Prediction of Patterns in Lichen Communities over the Western Oregon Landscape. Ph.D Dissertation, Oregon State University, Corvallis, Oregon.

Pettersson, R.B., J.P. Ball, K. Renhorn, P. Esseen and K. Sjoberg, K. 1995. Invertebrate communities in boreal forest canopies as influenced by forestry and lichens with implications for passerine birds. Biological Conservation 74: 57-63.

Rosso, A.L. 2000. Shrub Epiphyte Communities in Relation to Stand Management in Forests of Western Oregon: Effects of Overstory Thinning. Ph.D Dissertation, Oregon State University, Corvallis, Oregon.

Ruchty, A and B. McCune. 2000. The association of epiphytic lichens and bryophytes with riparian stand types along a valley continuum, Oregon Coast Range. Manuscript in progress.

Sollins, P. 1982. Input and decay of coarse woody debris in coniferous stands in western Oregon and Washington,. Canadian Journal of Forest Research 12:18-28.

Spies, T. A. and J. F. Franklin. 1991. The structure of natural young, mature, and old-growth Douglas-fir forests in Oregon and Washington. Pages 91-109 in L.F. Ruggiero, K. B. Aubry, A. B. Carey, and M. H. Huff, eds. Wildlife and vegetation of unmanaged Douglas-fir forests. USDA Forest Service PNW-GTR-285.

Spies, T. A. and S. P. Cline. 1988. Coarse Woody Debris in Forests and Plantations of Coastal Oregon *in* C. Maser, R. F. Tarrant, J. M. Trappe, and J. F. Franklin, eds. From the Forest to the Sea: A Story of Fallen Trees. USDA Forest Service, PNW-GTR-229, Portland, OR.

Spies, T. A., J. F. Franklin, and T. B. Thomas, 1988. Course woody debris in Douglas-fir forests of western Oregon and Washington. Ecology 69(6):1689-1702.

Thomas, J. W., R. G. Anderson, C. Maser, and E. L. Bull. 1979. Dead and Down Woody Material *in* Wildlife Habitats in Managed Forests, The Blue Mountains of Oregon and Washington. J. W. Thomas, tech editor. USDA Forest Service. Agriculture Handbook No. 553.

USDA & USDI, 1995. Little River Watershed Analysis. Unpublished analysis files, Umpqua National Forest, North Unpqua Ranger District, Glide, OR.

USDI BLM. July 1998. Bear/Marten Watershed McKenzie Resource Area. Eugene District Office.

USDI BLM. 1996. Vida/McKenzie Watershed Analysis McKenzie Resource Area. Eugene District Office.

USDA Forest Service, Blue River Ranger District, 1997. Blue River Landscape Project, Willamette National Forest,

USDA Forest Service and USDI Bureau of Land Management. 1994. Record of Decision for amendments to Forest Service and Bureau of Land Management Planning Documents within the range of the northern spotted owl. Standards and Guidelines for management of habitat for late successional and old-growth related species within the range of the northern spotted owl. USDA Forest Service, Bureau of Land Management. 74 pp.

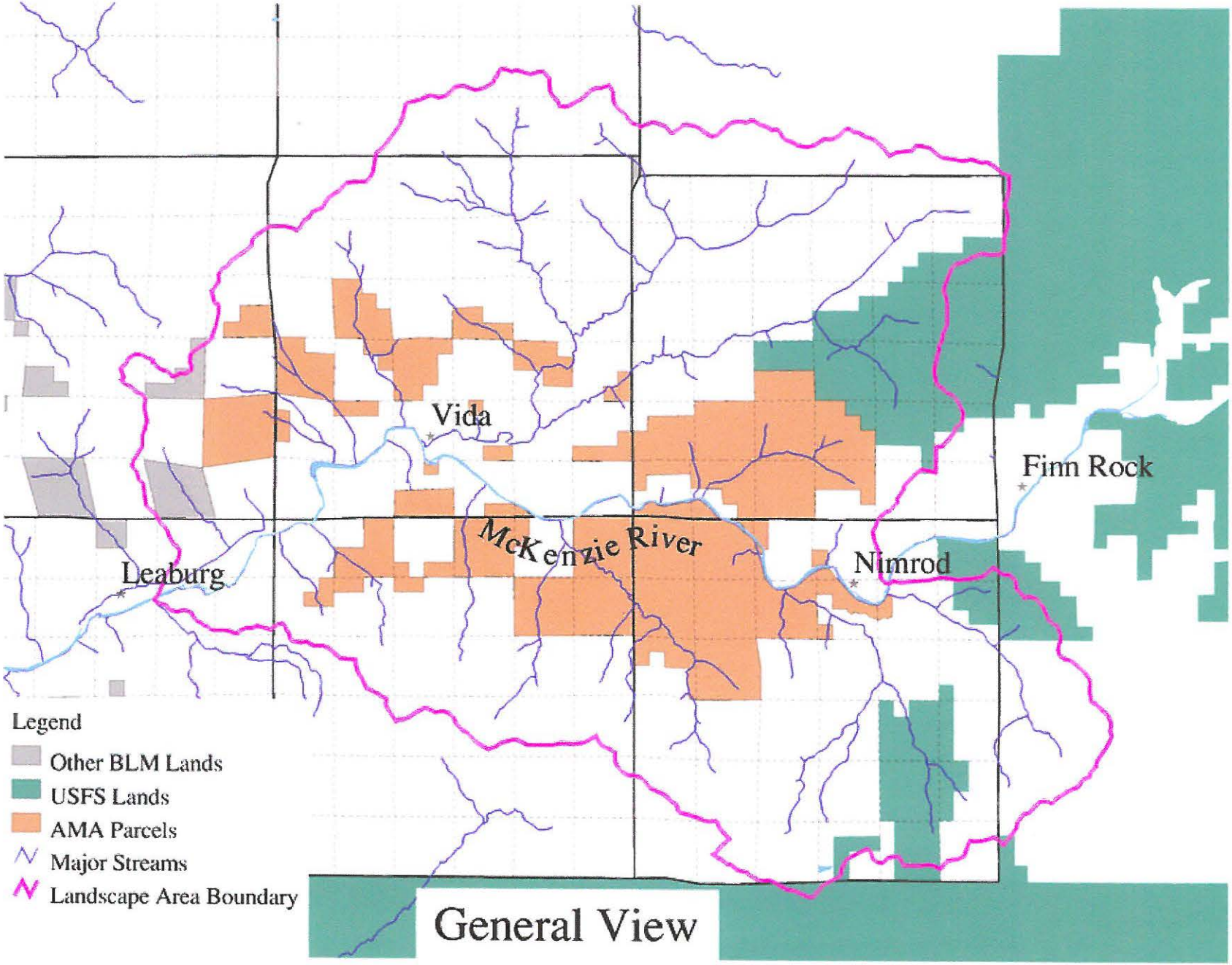
USDA Forest Service, USDI BLM, USDI USFWS. 1998. South Cascades Late-Successional Reserve Assessment, Umpqua National Forest.

USDA Willamette National Forests, USDI Salem District BLM, USDI USFWS OSO. 1998. Willamette Late-Successional Reserve Assessment.

Weisberg, P. J. 1997. Fire History and Fire Regimes of the Bear-Martin Watershed and Some Relationships with Contemporary Stand Structures. Final report to the BLM, Eugene District.

Weisberg, Peter, J. 1998 - was this personnel communication

Wright, Pamela J. 1998. The Effect of Fire Regime on Coarse Woody Debris in the West Central Cascades, Oregon. M.S. Thesis, Oregon State University.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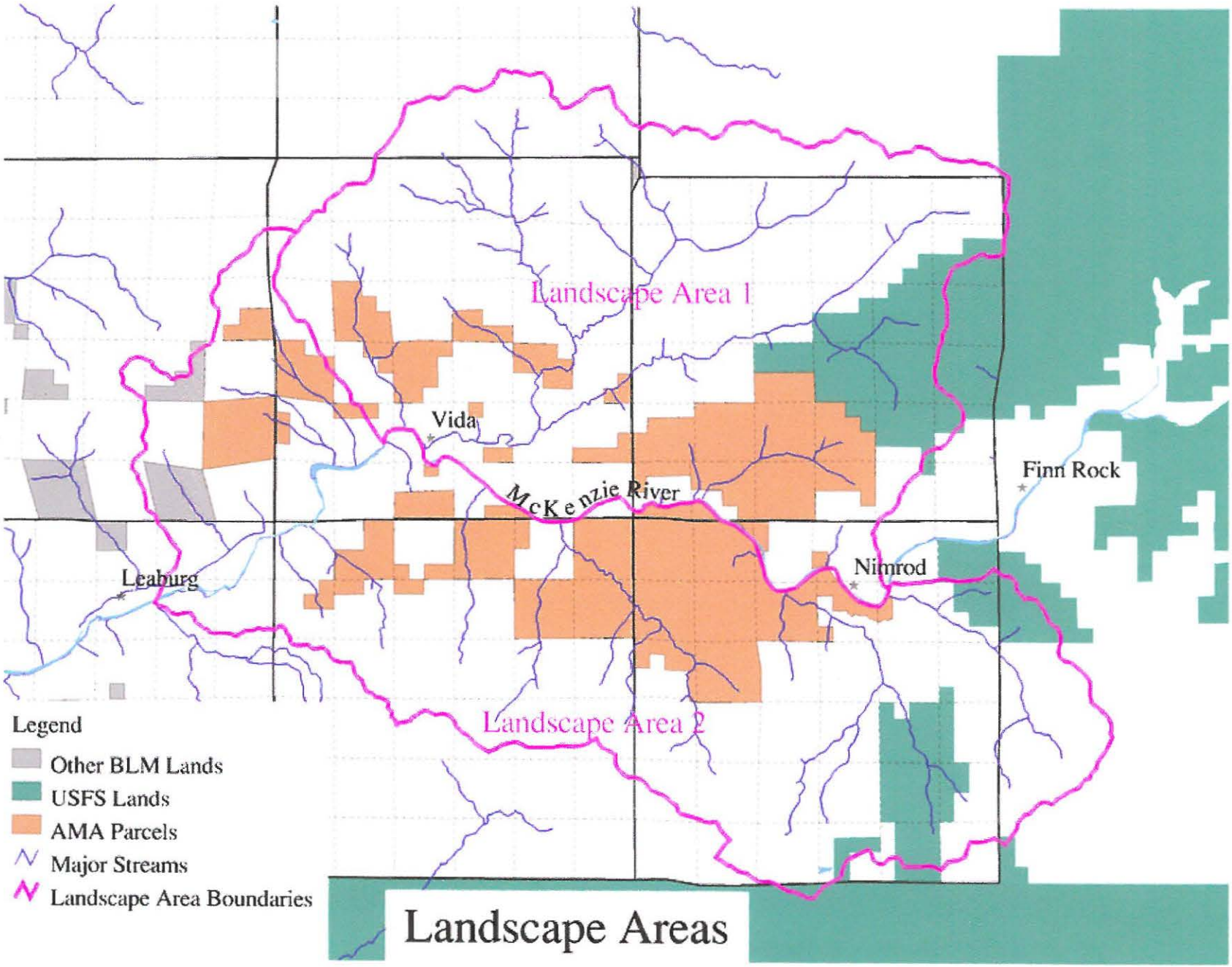
General View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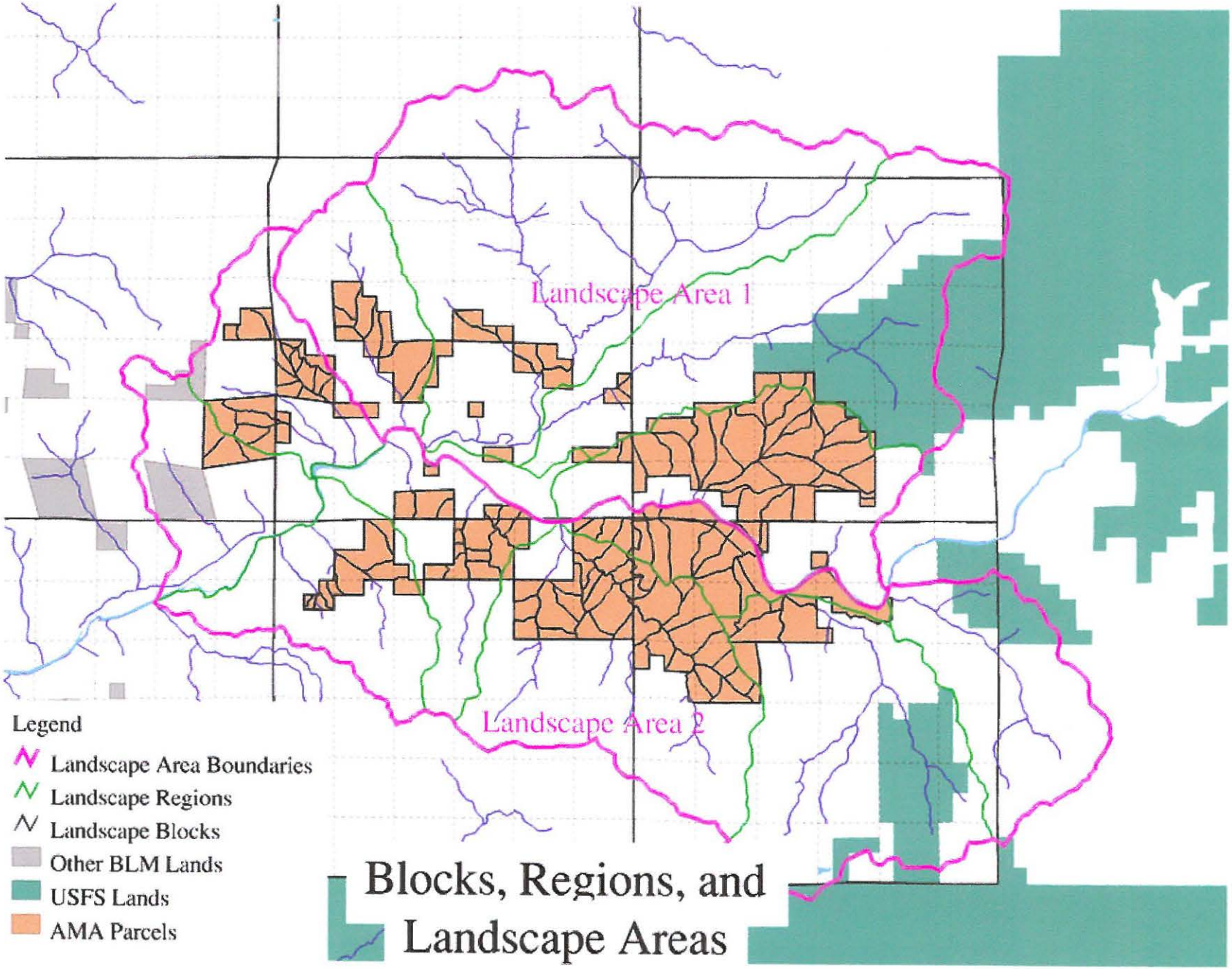
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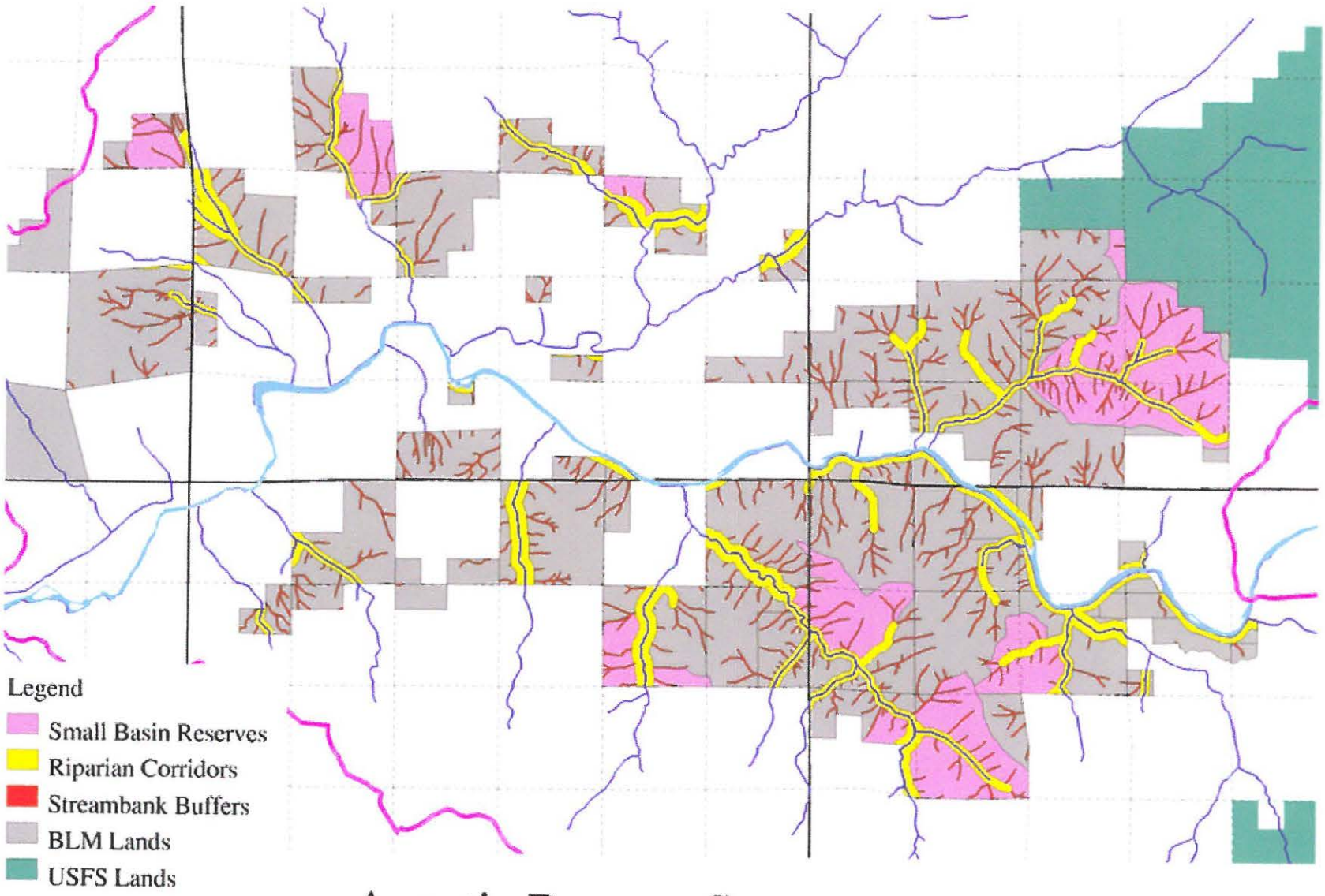

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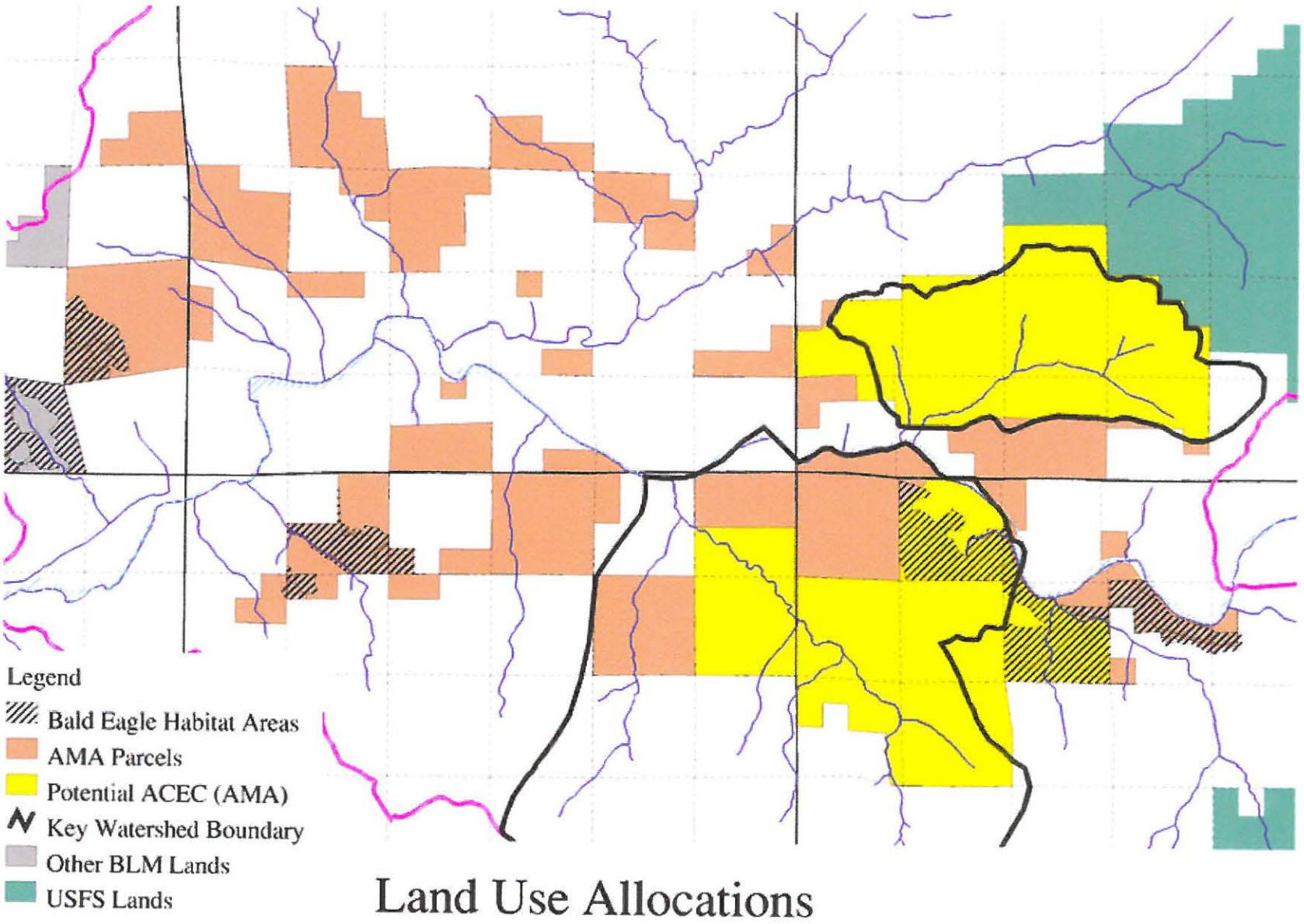

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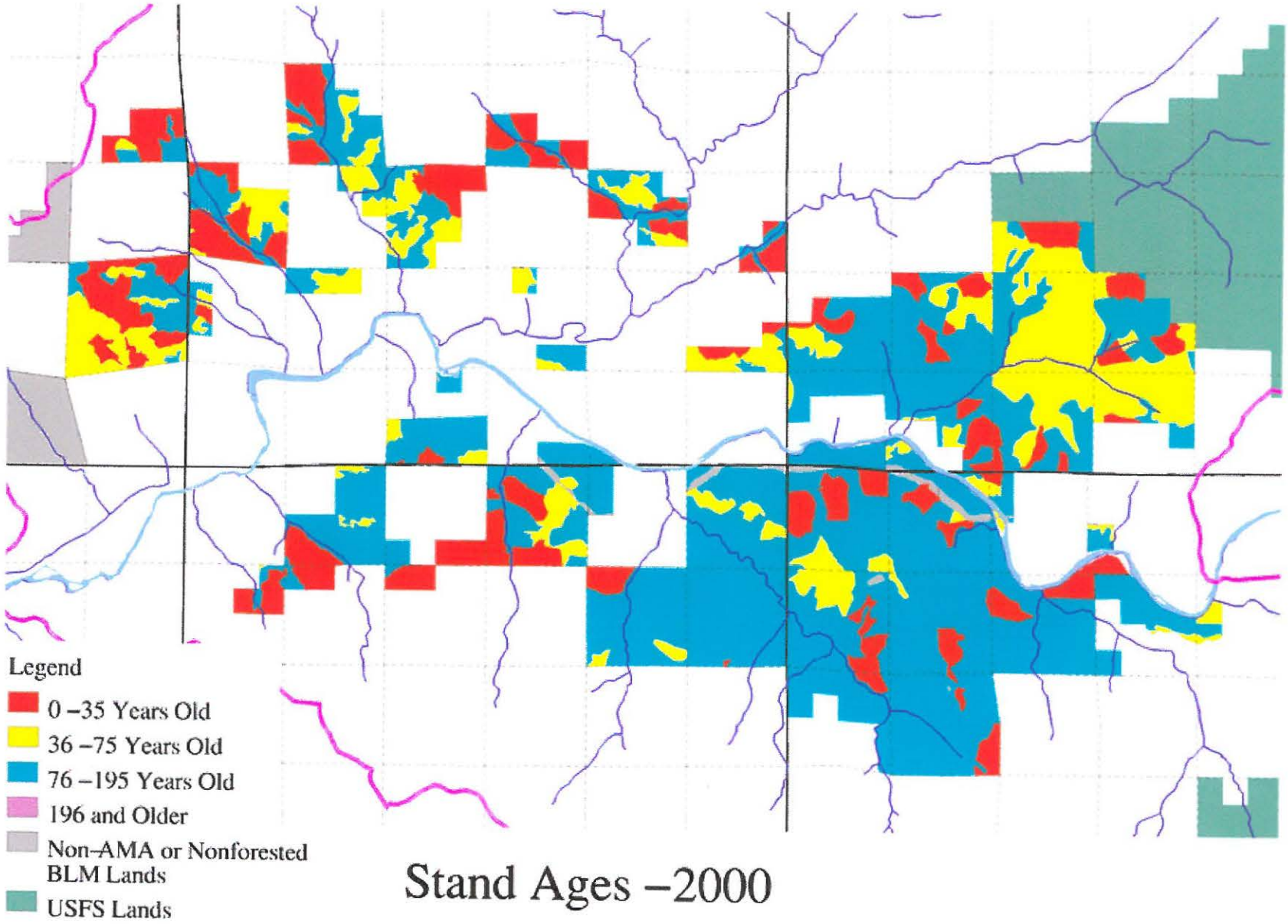

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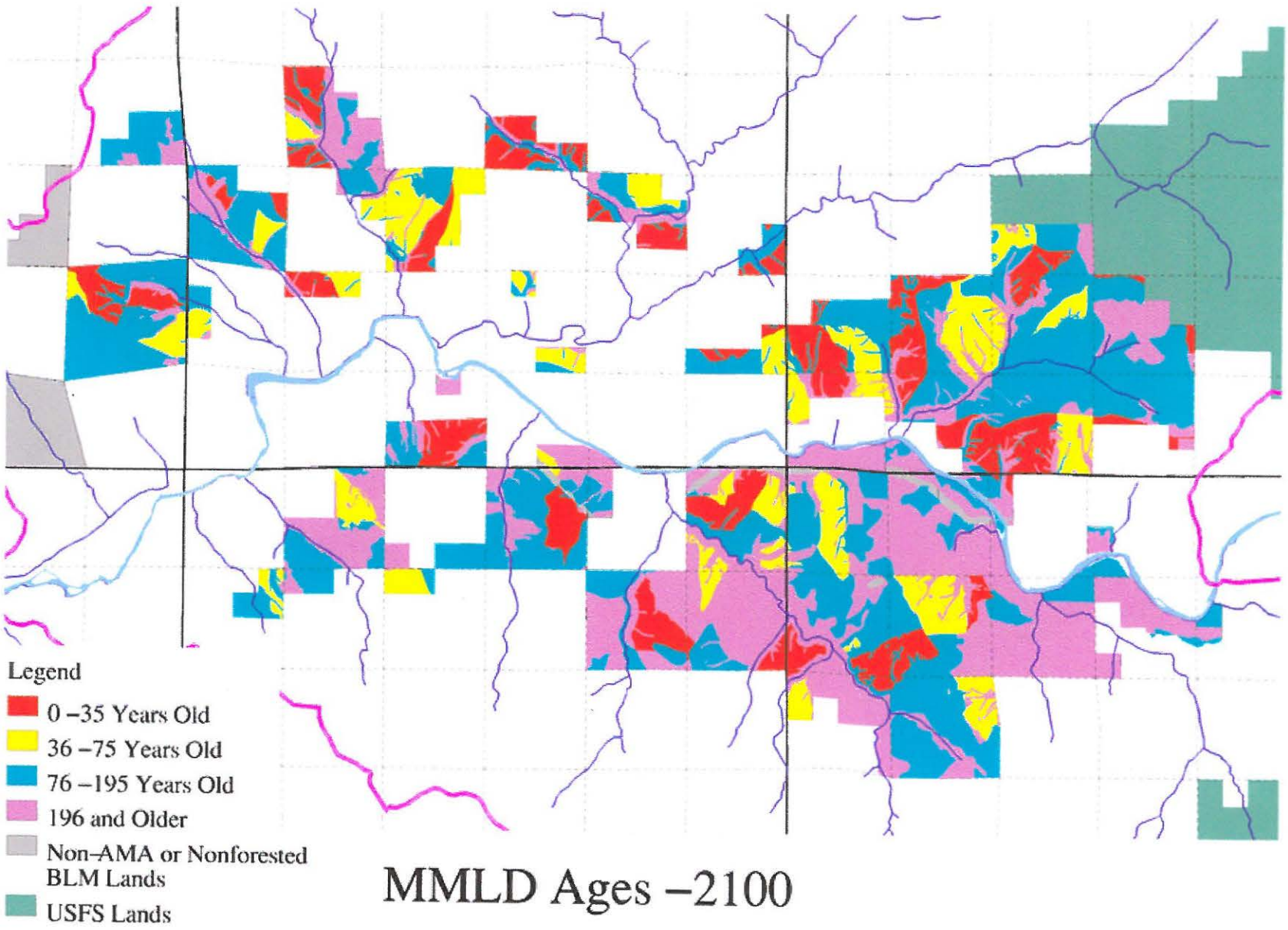

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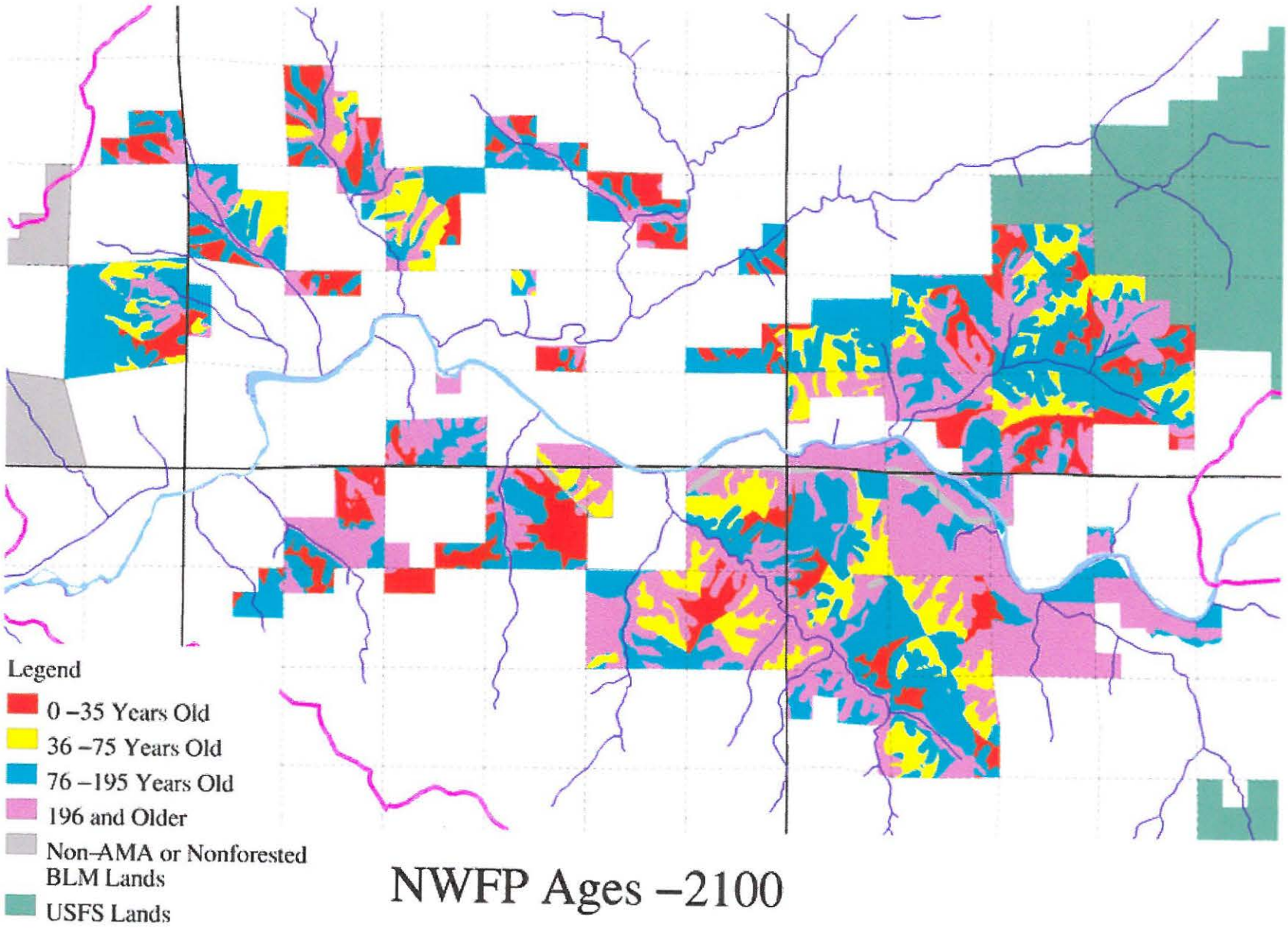

NWFP Ages –2100