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# THOMAS CREEK
# WATERSHED ANALYSIS

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The analysis portion of this project was done in 1996. This is an iterative document and will be updated periodically as new information becomes available. The data in this document was the best available at the time the analysis was completed. Management opportunities for this watershed must be considered in light of the checkerboard land ownership pattern of BLM administered lands.

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**VERSION 1.0**

**December 1996**

# Executive Summary

**The executive summary focuses on key components and findings of the analysis.**

**Finding:** A scarcity of older forest habitats exists in the watershed.

**Recommendations:** Implement density management prescriptions in Riparian Reserves, Late-Successional Reserves, and Connectivity to develop and maintain older forest stand characteristics in younger age classes.

**Finding:** A scarcity of snags and down logs occurs, especially larger material in the early stages of decay (large, hard material). These provide habitats for a variety of plant and animal species.

**Recommendations:** Implement Resource Management Plan Record of Decision standards and guidelines for green tree retention for the creation, recruitment and development of snags and down logs and to contribute to the development of older forest stand characteristics and long-term soil productivity. Create large, hard standing/down dead in stands deficient in this type of material.

**Finding:** Some Late-Successional Reserve boundaries delineated by the Salem District Resource Management Plan follow legal boundaries (section lines) rather than ecological features.

**Recommendations:** Adjust boundaries of Late-Successional Reserves to make them more ecologically sound and to protect special habitats and wildlife values in Thomas Creek and adjacent watersheds.

**Finding:** Snow Peak Ecosystem, and Park Creek Meadows are priority special habitats in the watershed.

**Recommendations:** Emphasize older forest near special habitats. Protect the Snow Peak Ecosystem by adjustment of the Late-Successional Reserves boundaries. Protect stands adjacent to Park Creek Meadows.

**Finding:** Certain special status/special attention and species of concern are associated with older forest habitats (including the northern spotted owl, *Oxyporus nobilissimus*, *Pseudocyphellaria rainierensis*, *Corydalis aquae-gelidae*) and standing dead/down logs identified as habitats of concern.

**Recommendations:** A temporary 600-acre reserve protects the only known sites of *Oxyporus nobilissimus* and *Corydalis aquae-gelidae* in the watershed. *Pseudocyphellaria rainierensis* is in the middle of its range. Maintain this population to ensure the continued viability of the species throughout its range.

**Finding:** A loss of soil productivity is occurring within the watershed.

**Recommendations:** Continue communication with private landowners to develop alternatives to reduce erosion into Thomas Creek through cooperative means. Manage for recruitment and long-term maintenance of coarse woody debris. Maintain soil duff cover. Mitigate compaction.

**Finding:** Currently, the average total road density across the Thomas Creek Watershed is estimated at over five miles per section, which is considered high.

**Recommendations:** Close approximately 13 miles of existing BLM-administered road to protect critical wildlife, botanical, soil and water quality values and reduce open road densities on federal lands. Identify and replace failing and under-designed drainage structures. Develop a comprehensive transportation management plan.

**Finding:** Water quality within this watershed needs improvement to ensure proper functioning condition of riparian, aquatic, and wetland ecosystems.

**Recommendation:** Use interim Riparian Reserve widths identified in the ROD standards and guidelines until a project level, site-specific analysis is done by an interdisciplinary team.

**Finding:** Very little recent fish habitat inventory data is available for the Thomas Creek Watershed.

**Recommendation:** The BLM should cooperate with ODFW and other partners if the opportunity arises to complete additional fish habitat inventories in the watershed. Opportunities should be explored for collecting information on aquatic invertebrates.

**Finding:** Available data indicates a scarcity of large woody debris in the stream channels, especially large, key pieces of wood.

**Recommendation:** Provide for adequate amounts and distribution of coarse woody debris in riparian areas to maintain physical stream complexity and stability.

**Finding:** Recruitment potential for new large woody debris is very limited along most streams.

**Recommendation:** Density management in riparian areas would increase recruitment potential.

**Finding:** Stream habitat restoration opportunities are limited on federal lands.

**Recommendation:** BLM lands need to be surveyed to decide if appropriate sites exist for habitat restoration.

**Finding:** Mass earth movement in the Silt Creek drainage is providing fine sediment and turbidity to Thomas Creek. Water quality and fish habitat are affected over short time periods.

**Recommendation:** Explore opportunities to trap and store sediment in Silt Creek before it reaches Thomas Creek.

**Finding:** Areas exist with a high potential sensitivity for rural interface concerns.
**Finding:** Visual resource concerns may also be present in areas of the watershed.

**Recommendation:** Mitigate potential impacts associated with timber harvest activities or other potentially disturbing actions in sensitive rural interface areas and areas with visual resource concerns.

**Finding:** Recreational demands will increase in the roaded natural and roaded modified settings that dominate the Thomas Creek Watershed.

**Recommendation:** Develop a GIS inventory of dispersed campsites and off-highway vehicle activity in the Neal Creek Corridor and Snow Peak area. Explore potential for providing non-motorized and motorized trail use in the Neal Creek Corridor.

**Finding:** Illegal dumping, vehicle abandonment, long-term occupancy, equipment and sign vandalism, wildlife poaching, unauthorized removal of forest products and growing and manufacturing of illegal drugs occur to varying degrees in Thomas Creek Watershed. The closing of public access to private lands may increase the incidence of these uses on public lands with access.

**Recommendation:** Continue to work with the Linn County Forest Protective Association and contribute toward funding the Linn County Forest Sheriff to the extent that budget constraints allow.

# Chapter 1 Introduction

Watershed analysis is ecosystem analysis at the watershed scale. This analysis is a principal analysis for implementation of the Aquatic Conservation Strategy (ACS) as described in the Northwest Forest Plan Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl (ROD, p. B-11) and the Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional Forest Related Species Within the Range of the Northern Spotted Owl (SEIS, February 1994). It is a principal means used to meet ecosystem management objectives identified in the Salem District Resource Management Plan/Final Environmental Impact Statement (RMP/FEIS). The purpose of a watershed analysis is to provide a federal agency with a comprehensive and systematic analysis of a landscape to guide planning and management of federal lands and analyze cumulative effects of past, present and future activities on all lands. This tailors management objectives outlined in the Northwest Forest Plan to this individual watershed.

By developing and documenting a scientifically based understanding of the processes and interactions occurring within a watershed, an interdisciplinary team may attempt to establish geomorphically and ecologically appropriate Riparian Reserves. This understanding would also provide a common framework for evaluating and managing the federal land within the landscape. The watershed analysis will serve as the basis for developing site-specific proposals, and monitoring and restoration needs for a watershed. Even though the Federal watershed analysis process is in no way intended to regulate non-Federal lands, analysis teams, as guided by responsible officials, will consider the interactions of various land ownerships in the watershed. Consideration of these interactions is important to an overall understanding of ecological functions and processes. Cooperative approaches to watershed analyses that cross jurisdictional and ownership boundaries are encouraged. However, the analysis is designed as a tool for federal agencies and is not meant to be used to direct other owners on the management of their lands.

Watershed analysis is an ongoing, dynamic process. It is intended to be revised and updated as conditions, assumptions, or resource plans change and new information becomes available. This document summarizes a large quantity of information and detailed analysis of complex issues and interrelationships. Full reports and any new information will be added to the Thomas Creek Watershed Analysis file, maintained in the Cascades Resource Area, Salem District Office.

Watershed analysis is not a decision making process; it is a stage-setting process. The results can be used to:

* Assist development of ecologically sustainable programs to produce water, timber, recreation, and other commodities.
* Facilitate program and budget development by identifying and setting priorities for social, economic, and ecological needs within and among watersheds.

*	Establish a consistent, watershed-wide context for project-level National Environmental Policy Act (NEPA) analyses, management activities evaluation, Endangered Species Act implementation, and water quality issues.

The document is based on the *Ecosystem Analysis at the Watershed Scale, Federal Guide for Watershed Analysis August 1995.*

**Executive Summary -** Summarization of the findings of this watershed analysis.

**Chapter 1 - Introduction.** Overview of the what and whys of analysis and management direction.

**Chapter 2 - Characterization.** A brief description of the watershed ecosystem.

**Chapter 3 - Issues and Key Questions.** The issues and concerns considered when doing this analysis.

**Chapter 4 - Historic Conditions.** A historical perspective of the past influences and processes that occurred in this ecosystem.

**Chapter 5 - Current Conditions.** What the current conditions of the resources of the watershed are, described according to terrestrial, aquatic, and human uses.

**Chapter 6 - Potential Conditions and Trends.** What are the possible future trends of ecosystem processes with implementation of resource management plans and assumptions on private land management? This incorporates the synthesis and interpretation of all available data and information about the watershed.

**Chapter 7 - Management Recommendations**. Guidelines for ecosystem management within this watershed based on the findings of the analysis.

**Chapter 8 - Data Gaps, Inventory, Monitoring.** A list of where information gaps were found during the analysis, what information should be collected and over what time frames.

**Appendices.** Includes additional reports by specialists, tables, charts and maps that are not specific to the issues but may provide other useful information.

# Scoping

The issue identification and scoping process took two approaches.  The first approach involved scoping through the Interdisciplinary Team (IDT) within the Cascades Resource Area.  A second approach involved sending questionnaires to watershed landowners, local, county, state and federal agencies, and the posting of information gathering posters.  These individuals, groups, and organizations were encouraged to complete our questionnaire and return it to our office. Continuing public involvement was dependent on returning the questionnaire.  ( See Appendix B for summary of the comments received.)

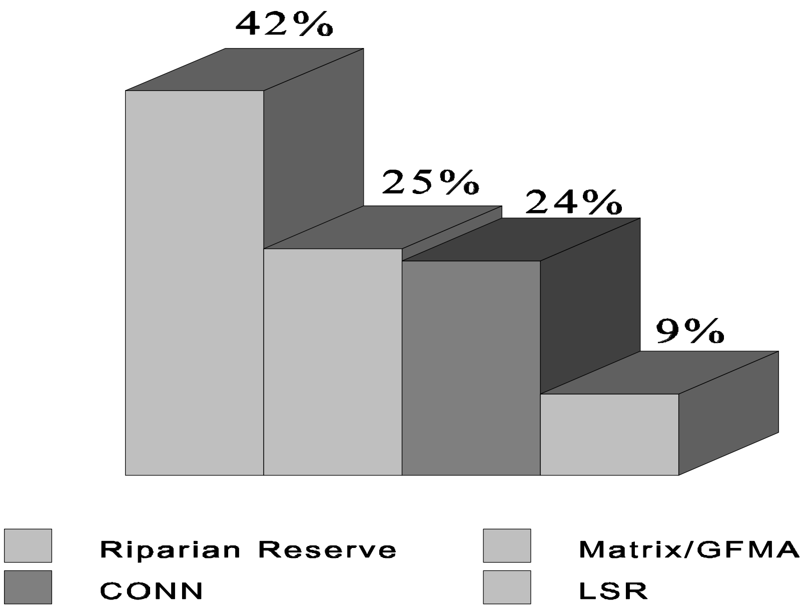
# Management Direction - Federal Land Use Allocation

Under the standards and guidelines of the RMP there are seven land use allocations for federal lands.  Four of these allocations, Riparian Reserves, General Forest Management Area Matrix (GFMA), Connectivity Matrix (CONN), and Late-Successional Reserves (LSR), are represented in the Thomas Creek Watershed.

A brief description and the number of acres follow.  More detailed objectives and management actions/direction for these land allocations are discussed on pages 7 to 22 of the RMP and within the SEIS/ROD.  Seventeen percent of the Thomas Creek Watershed is in federal lands.

When discussing these land use allocations, the inclusion of Riparian Reserve acres sometimes presents a better overall picture of the functions and processes occurring on that particular area of the watershed.   The following discussion reflects both riparian acres as a separate allocation and then includes them into the other allocations for a different view.

Within all the land use allocations, Riparian Reserves have been identified along all standing and flowing water, intermittent stream channels and ephemeral ponds and wetlands.  Their purpose is to contribute to the attainment of the Aquatic Conservation Strategy Objectives as stated in the Northwest Forest Plan.  The reserves were designated to help maintain and restore riparian structures and functions, benefit fish and riparian-dependent nonfish species, enhance habitat conservation for organisms dependent on the transition zone between uplands and riparian areas, improve travel and dispersal corridors for terrestrial animals and plants and provide for greater connectivity of late-successional forest habitats.  The width of the protection buffer varies depending on stream class and the site potential.  All fish bearing streams have a minimum width that is the average height of two site potential trees.  On intermittent or nonfish bearing streams this width is the average height of one site potential tree. Since not all of these streams are mapped, some adjustments will be made as site-specific areas are mapped.  For this watershed analysis site tree height was designated as 220 feet for the lands less than 1500 foot elevations, 200 feet for between 1500 and 3000 feet  and 180 feet for all elevations about 3000.  Riparian Reserves for all federal lands in Thomas Creek account for 5,506 acres or 42 percent.



Portions of three sections within the Thomas Creek Watershed were designated as LSR under the Northwest Forest Plan. These include BLM lands in T.10S., R.2E., sections 11, 15 and 23. This LSR, called the Thomas LSR, totals 1440 acres in size. The Quartzville-Crabtree LSR to the southeast is more than 80,000 acres in size. Portions of this LSR are on the southeast edge of the watershed on the north side of Harry Mountain Ridge (T.11S., R.4E., section 4). Besides these mapped LSRs, there are five core areas on BLM lands for known spotted owl sites (KOSs) established before January 1, 1994. These core areas are to be managed as LSRs. Management objectives are to protect and enhance old-growth forest conditions. Total LSR acres outside Riparian Reserves are 1,162. The total with riparian acres is 2,232 acres.

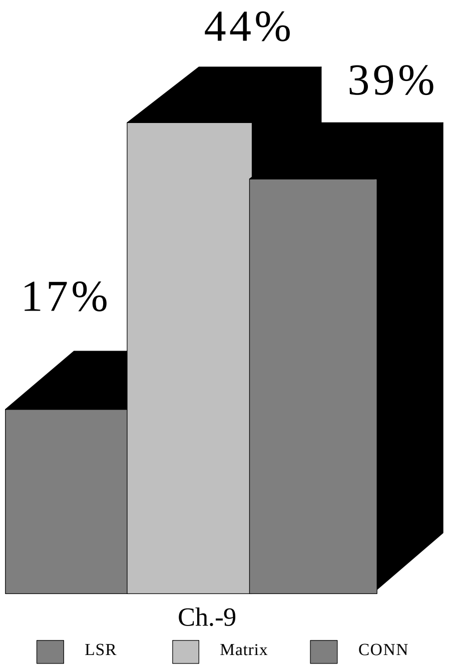
Contained within the Thomas Creek Watershed are portions of Connectivity blocks identified during the Resource Management Planning Process. Outside Riparian Reserves this allocation totals 3,073 acres. These blocks are in T.9S., R.2E., section 31 (Lower Thomas Connectivity Block); T.10S., R.1E., sections 25, 35, 36; T.10S., R.2E., sections 19, 31; T.11S., R.2E., sections 3, 5 (Neal Creek Connectivity Block); T.10S., R.2E., sections 17, 21, 13, 25 (Thomas Connectivity Block); and T.11S.,R.3E., section 4 (Upper Thomas Connectivity Block). According to the Salem District RMP, this allocation allows timber management but late successional forests are to be maintained. Intensive management practices are permitted on a 150-year rotation while maintaining 25 to 30 percent of each block in older forest conditions at any one point in time. Regeneration harvest will retain 12 to 18 green trees per acre.

The remaining federal ownership in the watershed is in the GFMA, which totals 3,236 acres. According the Northwest Forest Plan, these lands are to be managed to produce a sustainable supply of timber and other forest commodities while emphasizing ecosystem management.

Forest Service lands with the Thomas Creek Watershed total 301 acres at the eastern head of the watershed. There is one acre of LSR and the remaining 300 acres are classified as Matrix. Riparian acres within this Matrix total 108. These Matrix lands fall under the similar management guidance as the BLM GFMA/Matrix lands.

Riparian Reserve acres can also be expressed within the other three land use allocations. The following table shows the riparian acres within LSR, CONN, and GFMA and the total for all the allocations.

| Land Use Allocation | Riparian Acres | Outside Riparian | Total Acres |
|---|---:|---:|---:|
| LSR | 1,070 | 1,162 | 2,232 |
| Matrix / GFMA | 2,472 | 3,245 | 5,717 |
| CONN | 1,964 | 3,073 | 5,037 |
| Total | 5,506 | 7480 | 12,986 |



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# Chapter 2 Characterization

The characterization identifies the dominant physical, biological, and human processes or features of the watershed that affect ecosystem functions or conditions. This narrative is intended to give the reader a quick overview of this watershed and these processes and features. A more detailed condition analysis is in Chapter 5.

| Ownership | Acres |
|---|---|
| Private Industrial | 37,623 |
| Private Non-forest | 21,617 |
| BLM | 12,684 |
| State | 1,921 |
| Private Woodland | 920 |
| USFS | 301 |
| Totals | 75,066 |

**Table 2. Ownership Acres**

The Thomas Creek Watershed is in northwest Oregon, two miles east of the community of Scio. The analysis area begins in the Willamette Valley where Richardson's Gap Road crosses Thomas Creek at the Shimanek Bridge, elevation 360 feet, and extends east to the headwaters of Thomas Creek at an elevation of 4200 feet. It is in Linn County and includes the community of Jordan. Federal ownership in this watershed is less than 20 percent scattered among several blocks. Several major forest industrial landowners own significant blocks of land. Thomas Creek is a tributary to the South Santiam River that converges with the North

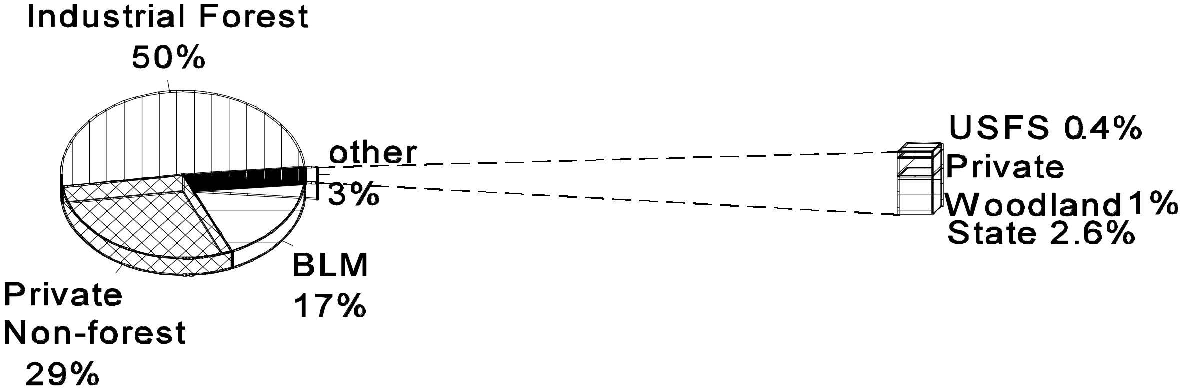


**Figure 1. Ownership Percentages of Thomas Creek Watershed**

Santiam River near Jefferson, Oregon to form the Santiam River. The Santiam River flows into the Willamette River. The Willamette River Basin is part of the Columbia River Subregion.

The Thomas Creek Watershed, which covers more than 75,000 acres, includes Thomas Creek and its tributaries, Indian Prairie Creek, Ella Creek, Criminal Creek, Hall Creek, Neal Creek, and Burmester Creek. The northern boundary is the ridge extending from McCully's Mountain to Tom Rock, while the southern boundary extends past Snow Peak and Indian Prairie and follows along the Harry Mountain Ridge.

To the north are the North Santiam River drainage and its many tributaries, the towns of Mehama, Lyons, and Mill City, and high rural interface zones. To the west are the Willamette Valley and the towns of Scio and Stayton. To the south, Crabtree Creek exhibits the same scattered federal ownership patterns, while more to the east, the Quartzville drainage is a high-use recreation and older forest area dominated by federal ownership. This large Quartzville federal land block found immediately to the south and east is an LSR. A small block of LSR land is eight miles to the north in the Abiqua Butte Watershed with the larger Table Rock Wilderness LSR ten miles to the northeast.

**Figure 2. High Rocks on North Edge of Watershed**

Geologically, the basic parent material of the watershed basin is layered igneous (volcanic) rock that can be classified into two main groups: hard, weather resistant rock such as basalt or andesite and softer pyroclastic rocks. The alternating layers of basalt/andesite and pyroclastic rocks can create unstable slope conditions that are apparent in the upper Thomas Creek drainage. Chronic mass soil movement is an ongoing process, though some landslide activity has been accelerated by forest management activities, especially road building in the last forty years. The upper headwater of the watershed has been chronically unstable for many decades. The winter of 1994-1995 with a high rainfall produced a significant increase in the sediment output from the Silt Creek drainage that flows into Thomas Creek. Sediment from this tributary has impacted the water quality of Thomas Creek to the boundaries of the watershed.

The climate within the watershed is characterized by warm, dry summers and cool, wet winters. Annual precipitation ranges between 60 and 100 inches, predominantly as winter rain in the lower reaches, transient or intermittent snow at mid-elevations, and rain with persistent winter snow in the upper reaches of the basin. Snow in the upper elevations is an important factor because rain on snow events can have significant impacts on the water flows in the basin.

The Willamette Valley at the west end of the watershed supports a limited woodland of Oregon white oak and Douglas-fir with bigleaf maple, Oregon ash, and red alders, especially in the riparian areas. This area is mainly used for farmland or small rural homesites. From the edge of this valley bottom land up to approximately 3000 feet, the western hemlock (*Tsuga heterophylla*) zone (Franklin & Dyrness, 1988) is dominated by Douglas-fir, western hemlock, and western red cedar. Above 3000 feet the cooler Pacific silver fir zone (*Abies amabilis*) is composed of mixed stands of noble fir, silver fir, Douglas-fir and western hemlock. Because of the proximity to the Willamette Valley, the Thomas Creek Watershed Basin exhibits ecological characteristics of the Willamette Valley and the western Oregon Cascades. The watershed has many special habitat areas and some older forests. All the water, plants, animals, land, and people within this diverse area make up the watershed ecosystem.

Historically, the lower portions of Thomas Creek and the Neal Creek Basin were harvested earlier in the century and now have scattered blocks of recently harvested forest mixed with some mid age and older age forests. The upper reaches were unroaded older forests that were commercially harvested beginning in the late 1950s. Most of this upper basin is therefore in a younger vegetation age class for the private lands with federally owned lands having more of the remnant older forest types.

Native wildlife species and habitats are typical of the western Oregon Cascades Province. As previously stated, the western portion of the watershed is primarily rural residential and agricultural with some elements (habitats and species) typical of the Willamette Valley Province.

Winter steelhead and spring chinook salmon are the anadromous fish native to the Willamette River above Willamette Falls. Thomas Creek is considered a key production area for winter steelhead, however, the wild spring chinook run may no longer exist. The Oregon Department of Fish and Wildlife is releasing South Santiam stock spring chinook in Thomas Creek. Resident populations of rainbow and cutthroat trout are found throughout the watershed. Several warmwater fish species are found in Thomas Creek, but they are generally found below the town of Scio. Fish populations and fish habitat in Thomas Creek may have been severely impacted by the February 1996 storm.

A variety of human uses occur in the Thomas Creek Watershed. The predominant uses include industrial timber production, agricultural and livestock raising, residential occupation and recreational use.

Almost half of the watershed is dominated by private industrial forest land, most of which occurs in the eastern two-thirds of the watershed. Much of the agricultural and livestock raising use and residential occupation occurs at the lower elevations in the western portion of watershed. Some BLM-administered lands in the watershed are intermixed with both agricultural and residential lands. Forest management and other activities on BLM-administered lands located adjacent to or near private non-forest uses, especially residential dwellings, can create potential private landowner concerns. Approximately 600 acres of BLM-administered lands were identified as having a high potential for private landowner interest and concerns.

The Thomas Creek Watershed also offers a variety of recreational opportunities. Most opportunities occur in a Roaded Modified setting, characterized by a forested environment in varying states of seral stage development. The natural setting on private and public lands has been significantly modified in many areas by timber harvest activities and high road densities. Several of the access roads to private industrial forest lands are gated off, limiting much of the recreational use to BLM-administered lands. With no developed recreation sites in the watershed, recreational activities are dispersed in nature, including camping, target shooting, hunting, and off-highway vehicle use. Recreational use on public lands in the watershed occurs mostly in the Neal Creek and Snow Peak areas.

# Chapter 3  Issues and Key Questions

The watershed analysis team began the process by identifying the following ecosystem components as significant issues. These issues are addressed by asking key questions. These questions focus the analysis on cause-and-effect relationships and on conditions as they relate to the ecological processes occurring in the watershed. The questions have been grouped into three categories:

- -Terrestrial
- -Aquatic
- -Human

An attempt to answer these questions is done by gathering the information available (Current Condition) or identifying data gaps. Considerable overlap and interaction occur among these ecosystem components. For instance, sedimentation is an erosional process but it affects the water quality. The grouping into categories was used as an organizational aid for facilitating analysis and promoting easier reading.

## Terrestrial

### Age Class/ Late-Successional/Seral Stage/Soils

*What is the present seral stage distribution and vegetation pattern within the Watershed? How does this relate to adjacent and larger ecosystems? How do current seral stages, amounts and distribution, special habitats, and vegetation patterns influence the landscape structure, functions, and processes? What are the predominate matrices, patches, and fragments? How will land use objectives and management guidelines in the ROD, the RMP, and on privately managed lands influence future landscape structures, functions, and processes?*

### Roads and Transportation

*How are roads influencing wildlife habitat quality and effectiveness, native plant communities, water quality, and watershed condition?*

### Natural Disturbance Processes

*What is the past and current role of natural disturbance processes in the watershed? What erosion processes are dominant within the watershed? Where have they occurred or are they likely to occur? What are the current conditions and trends of the dominant erosion processes prevalent in the watershed? What are the historical erosion processes within the watershed and where have they occurred? What are the natural and human causes of changes between historical and current erosion processes in the watershed? What are the influences and relationships between erosion processes and other ecosystem processes?*

## Special Status Species

### Plants, Animals, T&E, Invertebrates, Fish

*What Special Status Species (SSS), SEIS Special Attention Species (SSAS), and Species of Concern (SOC) are known or suspected to occur in the watershed? How will land use objectives and management guidelines in the SEIS, the Salem District ROD, and on privately managed lands influence future habitat for SSS, SSSA, and SOC? What species of fish inhabit the watershed and what is their distribution? Are any fish stocks presently considered to be "at risk" of extinction?*

## Aquatic

### Water Quality

*What beneficial uses dependent on aquatic resources occur in the watershed? Which water quality parameters are critical to these uses? What are the current conditions and trends of beneficial uses and associated water quality parameters? What were the historical water quality characteristics of the watershed? What are the natural and human causes of change between historical and current water quality conditions? What are the influences and relationships between water quality and other ecosystem processes in the watershed?*

### Hydrology

*What are the dominant hydrologic characteristics and other notable hydrologic features and processes in the watershed? What are the current conditions and features of the dominant hydrologic characteristics and features prevalent in the watershed? What are the historical hydrologic characteristics and features in the watershed? What are the natural and human causes of change between historical and current hydrologic conditions? What are the influences and relationships between hydrologic processes and other ecosystem processes?*

### Riparian Condition

*What is the current functioning condition of riparian areas within the watershed? How does this condition compare to historic conditions and the expected range of natural variation? What are the limitations on riparian areas to achieving proper functioning condition? Are these limitations within the BLM's control to change? What and where are the restoration opportunities to improving functioning condition within the watershed?*

### Fish Habitat Condition

*What is the current condition of fish habitat in the watershed? Is there evidence that fish habitat conditions have changed from historic conditions? Have changes occurred in the amount and distribution of large woody debris? Have management activities and/or natural processes affected fish habitat conditions, such as the supply of large wood or the amount of quality pool habitat? Are there opportunities to improve fish habitat conditions? If so, where do these opportunities occur?*

## Human Uses

> *What are the major human uses in the Thomas Creek Watershed? Where do they generally occur in the watershed? What are the current conditions and trends of the relevant human uses in the watershed? What makes this watershed important to people?*

Not all issues initially identified were carried through the analysis process. Some issues were deferred due to lack of information. Other issues were not addressed because they are not covered by federal law or jurisdiction.

# Chapter 4  Historic Conditions

Ecosystems are not static, but vary over time and space.  This dynamic nature exemplifies the need for us to consider ranges of conditions under natural disturbance regimes, rather than single points in time.  A key assumption of this concept is that when systems are “pushed” outside the range of natural variability, maintenance of biological diversity and ecological function are at a substantial risk.

The following narrative explains how ecological conditions have changed over time because of human influences and natural disturbances.  This information is used to understand and explain existing conditions and predict potential trends.

## Geologic History

Construction of the Cascade Mountains generally and Thomas Creek Watershed specifically began some 40 million years ago during the Eocene era.  The curved oceanic Farallan plane began underthrusting the North American continental plate.  Early volcanism followed from this and flowed from a volcanic chain found immediately east of the Pacific continental margin.  These small, low volcanoes spaced along a northwest/southeast belt deposited thick accumulations of andesitic tuffs and lava flows that form the base of the western Cascade Mountains.  This broad belt indicates that the subducting Farallan plane was undercutting the continental plate at a shallow angle and at a rapid rate (three inches/year).  During the Eocene period (53.5 to 37.5 million years ago) and the Oligeocene period (37.5 to 22.5 million years ago),  the coastline angled in this northwest/southeast direction through the Willamette Valley to just west of the volcanic vents of the western Cascades.  Volcanic ash was flushed out of the vents into marine basins along the coast.  Upper continental shelf sands were the final marine sediments to be deposited along the retreating shoreline.  During the Oligeocene period, many eruptions of andesitic lavas and siliceous tuffs are interspersed with oceanic sediments in the eastern margins of the valley.  (Orr et al, 1992) (Heilman & Anderson 1981).

During the mid-Miocene periods (22.5 to 5 million years ago), more tilting and folding from subduction were followed by volcanic lava flows along with the development of the western Cascades volcanic arc.  The growth of this range was modest as the volcanic accumulations sank almost as fast as they piled up.  Concurrently with other areas of Oregon, violent eruptions from volcanic cones 13 to 9 million years ago left accumulations unmatched today.  However, by seven million years ago, the belt had narrowed to a band as wide as the present High Cascades Range.  Cascade volcanism is the result of tectonic forces deep in the crust.  On the North America plate, the western Cascades were rotated clockwise into their present position.  As the rotation began and the angle of the Farallan descending slab became flatter, volcanic activity occurred from west to east.  This is illustrated by the fact that the oldest rocks in the Cascades are 42 million years old and the youngest are 10 million years old on the west edge of the High Cascade Range.  Over time, more than six times as much material has erupted in the west Cascades as in the east.  Convergences are slowing from three to one-half inch per year with more slanting angles and less subducting.  This slowing down began in the Miocene period and continues to this day.  Additional uplift, mild folding, and faulting began 4.5 million years ago during the Pliocene period.  (Orr et al, 1992) (Heilman & Anderson 1981)

## Disturbance Regimes and Ecological Effects

Many disturbance factors operate within this watershed. These factors include wind, fire, floods, insects, disease and humans. Humans are the agents of greatest disturbance. However, when human population levels were low (before 1900) fire was the primary disturbance. Occurring naturally from lightning and in planned fires from Native Americans, fire affected a broad range of ecosystems.

Native Americans recognized the benefits of fire and became accomplished practitioners of prescribed fire. The Kalapuya Indians burned the Willamette Valley for thousands of years before Euro-settlement. Fire, used to manipulate their environment, was concentrated in the Willamette Valley but extended up major river drainages (such as the Santiam River) and burned into the foothills of the Cascades and Coast Range (Boyd 1985). This prescribed fire maintained an oak-savannah ecosystem, which began changing back to a forested ecosystem (if not plowed) after settlers halted the Indian burning culture in the 1850s.

A number of fire history studies have been done on the H.J. Andrews Experimental Forest on the Blue River Ranger District, Willamette National Forest (Teensma 1987, Swanson and Morrison 1980). The H.J. Andrews is approximately 40 air miles SSE of the Thomas Creek Watershed. The

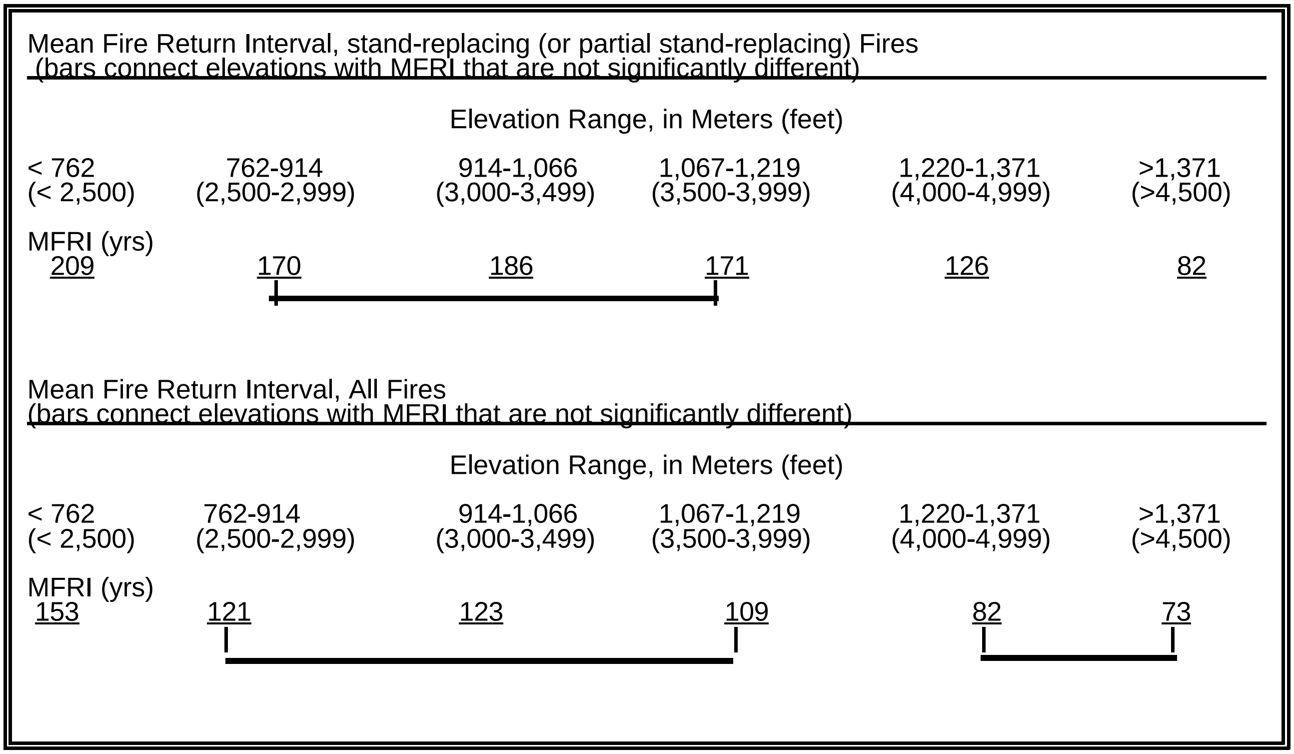
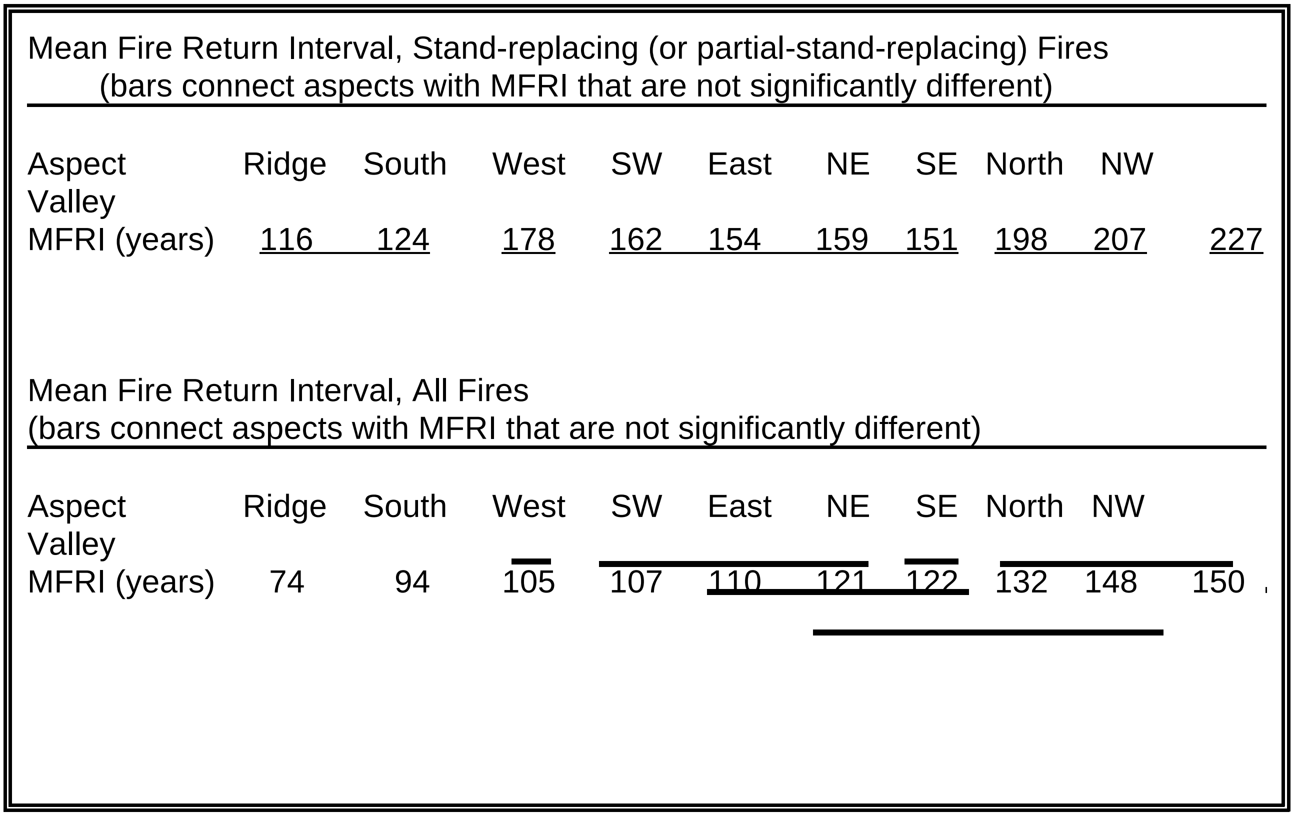


**Figure 5. Comparison of Mean Fire Rotation Intervals by Elevation.**

Results from the H.J. Andrews studies correlate well with Thomas Creek. Table 3 and Figures 5 and 6 (Teensma 1987) give a picture of overall fire frequency, fire frequency based on elevation and fire frequency based on aspect.



Mean Fire Return Interval, Stand-replacing (or partial-stand-replacing) Fires
(bars connect aspects with MFRI that are not significantly different)

| Aspect | Ridge | South | West | SW | East | NE | SE | North | NW | Valley |
|---|---|---|---|---|---|---|---|---|---|---|
| MFRI (years) | 116 | 124 | 178 | 162 | 154 | 159 | 151 | 198 | 207 | 227 |

Mean Fire Return Interval, All Fires
(bars connect aspects with MFRI that are not significantly different)

| Aspect | Ridge | South | West | SW | East | NE | SE | North | NW | Valley |
|---|---|---|---|---|---|---|---|---|---|---|
| MFRI (years) | 74 | 94 | 105 | 107 | 110 | 121 | 122 | 132 | 148 | 150 |

**Figure 6. Comparison of Mean Fire Return Intervals by Aspect.**

| Cultural Period | Interval (range of dates) | Ratio | Estimated by Planimeter | Average |
|---|---|---|---|---|
| Pre-Anglo | 1435-183O | 102 | 89 | 96 |
| Transition | 1831-1850 | 36 | 30 | 33 |
| Pre-fire Suppression | 1851-1909 | 102 | 71 | 87 |
| Suppression | 1910-1986 | 768 | 587 | 587 |
| "Natural Fires" | 1435-1909 | 95 | 80 | 88 |
| Immediate Pre-Anglo | 1772-1830 | 86 | 69 | 78 |
| Total for Length of | 1435-1986 | 108 | 91 | 100 |

**Table 3 Natural Fire Rotation by Period**

Fire was the primary disturbance factor (before 1940s logging boom) and caused the greatest ecological effects over space and time. Understanding fire ecology terminology is helpful in understanding forest ecology from a historical perspective. Fire regime is a generalized description of the role fire plays in an ecosystem. It is the combination of fire frequency, predictability, intensity, seasonality, and extent characteristics of fire in an ecosystem. Many fire regimes are described, but the one used here is based on fire frequency and fire intensity (Agee 1981, Heinselman 1981). Fire frequency is the return interval of fire. Fire intensity/severity is the ecological impact of a fire, such as mortality of plant or animal species, changes in species composition, and other ecosystem characteristics.

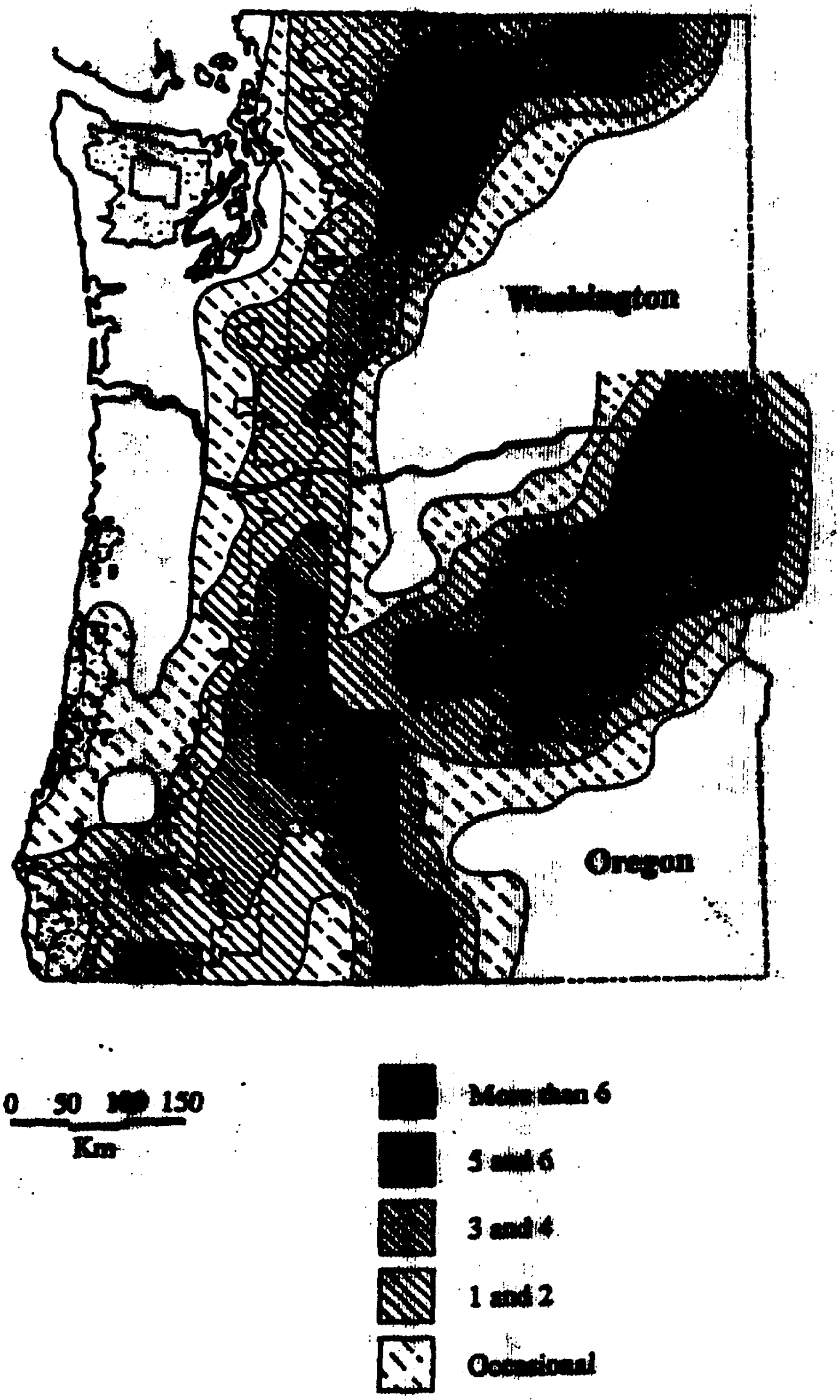
The Thomas Creek/Neal Creek Watershed occupies the mesic to dry Douglas-fir zone in the western hemlock plant association. Multiple fire regimes occur in this Douglas-fir zone that are based on the physical factors of elevation, aspect, orientation of land forms on the landscape, climate and weather patterns. These factors have significant effects on fire behavior (fire regimes) and therefore fire history (Teensma 1987). These multiple fire regimes are varied: 1) infrequent severe surface fires (more than 25 year intervals), 2) long return interval crown fires and severe surface fires in combination (more than 300 year rotation return intervals). The source of fire ignitions comes primarily from lightning and humans.

Lightning occurrence or patterns are determined by regional climate, land forms, elevation, aspect, and fuel type. Map A gives a reference to regional annual lightning patterns. Lightning is the primary source of wildfire ignitions in the Pacific Northwest. Human-caused ignitions are a result of industrial activities (logging, welding, road building, etc.), arson, carelessness (debris burning, escaped prescribed burns, campfires), and structural fires in the forested landscape. In the Thomas Creek Watershed lightning starts are low and human-caused ignitions are the primary source of wildfires. Once a fire starts, the on-site characteristics help determine the fire regime.

An infrequent severe surface fire burns on the soil surface and active burning does not involve the tree crowns. This fire regime would typically occur in places prone to fire starts and low fuel accumulations (ridges and south slopes). The effects could include these results: maintaining Douglas-fir as primary tree species by removing thin barked trees and promoting thick barked trees, maintaining low amounts of downed wood because of fuel consumption with more frequent burning, and maintaining brush species that sprout and can live under a tree canopy. This fire regime is less dependent on changes in weather patterns (drought) than other fire regimes.

Crown fires and severe surface fires every 100 to 300 years are more dependent on changes in weather patterns. In this instance the forest ecosystem accumulates fuel over time. Wind and disease interact more often and contribute to patch dynamics. Legacy trees from the previous disturbance and natural mortality help create a multi-storied canopy. Intolerant tree species dominate the lower canopy. As the stand ages, more sunlight reaches the forest floor and the shrub and herb layer diversifies. Under normal conditions fire starts cannot develop enough energy to do

Map A. Regional Annual Lightning Patterns on National Forests of Oregon and Washington. These patterns are an index to lightning fire activity and show number of storms per 40,000 ha per year. (From Morris 1934)



extensive damage to the landscape. This is because of the required energy to evaporate the high amounts of internal water in the combustion phase of burning carbon-based fuels. With drought conditions and less water to evaporate, fire energy levels are much higher and the outcome has many effects over a wider geographical area. Fire effects may include these outcomes: 1) total tree mortality, 2) elimination of the duff and litter layers, 3) reduction of the downed woody component, especially logs in later stages of decay, 4) increased erosion and sedimentation of water courses, and 5) formation of new snags.

Fire history research has done two things. It has shown that fire has occurred more often than earlier believed. Additionally, old growth stands have multiple age classes that are not easily discernable. This helps collaborate aerial photo interpretation (1956) and written historical records about the watershed (survey notes, 1851, 1875, 1881, etc.).

Historically, disturbance in Thomas Creek has been dominated by fires that left large quantities of standing dead and down wood, important components of wildlife habitats. Fires left a mosaic of forest types, fine grained age classes and seral stages across the landscape resulting in greater within stand diversity. Induced high contrast edges were uncommon and less habitat isolation occurred. Large blocks of older forest dominated most of the watershed, especially the upper end. Oak savannah and mixed hardwood /conifer dominated the lower end, much of which was open canopied. The watershed was unroaded until recently and direct influences from human disturbance were minimal. Fragmentation was less and connectivity of habitats was higher, resulting in better wildlife dispersal capabilities across the landscape.

Historically, this watershed was well timbered with some prairie. The west end prairie ecosystem (lower elevations) was influenced by aboriginal burning as were main river corridors (Santiam River, Thomas Creek). In all likelihood the agriculture land of today was a prairie at the time of settlement. The aboriginal burning of the landscape before settlement influenced the ecology of the foothill forests and valley floors. Indians burned the prairie/forest ecotones to provide safety from warring tribes, better game forage and ease of travel. The oak savannah (prairie) was burned to maintain foodstuffs, game management, safety and ease of travel.

Looking at the 1956 photos, there was a correlation to the results of Teensmas' fire history study in the H.J. Andrews. Some correlations are as follows: 1) high ridge tops and south slopes burned more often. This corresponds to young age classes at these locations where tree species are dense and more uniform in age. 2) east, west aspects at high/mid elevation are next in fire frequency. Forest age, composition and structure are more diverse and complex than ridge tops and south slopes. 3) north slopes, valley bottoms, riparian areas and lower elevations have the longest fire frequency. This part of the forest is older with the greatest age class distribution, highest species composition and greatest structural diversity. This forest is stable in that it can absorb a great deal of disturbance before its basic character changes.

On a watershed basis, the matrix forest cover type was older forest. Age distribution ranged from the silver fir zone at 500 to 700 years old to early seral stages of brush and young conifers with every conceivable variation between. A 1881 survey general description of T.10S. R.2E. was as follows: "This township is very broken possessing but a small portion of level ground. It is well-watered abounding in springs, brooks and rivulets of the purest water. The southern part possesses timber of the highest quality consisting of fir and hemlock with small groves of larch and some scattering cedar.  Fire having gone through the interior portion of this township many years ago and deadened the timber, it now lies prostrate upon the ground, and has a dense growth of young fir, hemlock, vine maple and brush of various kinds has sprung up all of which makes the work of surveying slow and fatiguing."  Also the words of the following survey are from the same township but corner common to sections 19, 20, 29, and 30.  "Land rolling, soil 3rd rate.  Timber 2nd rate, Fir and Hemlock. Much fallen timber understory very dense, fir hemlock, whortleberry (huckleberry) and salal."

Timber harvest has changed the forest to a less complex diversified system.  Fire has been virtually eliminated from the ecosystem.  Since 1910, the fire return interval has increased from 95-114 to more than 585 years (extrapolating current data into the future) because of the current fire suppression policy.  Species diversity has been simplified from many tree species to monocultures of Douglas-fir.  Age class distribution has gone from 2.3 age classes per site (Teensma 1987) to one. Older forests are now young to early mid-age (50-100 years).  Structural complexity is minimal. Areas that maintained the oldest, most complex ecosystems (primarily riparian areas) were logged first and support our transportation network.

Timber harvest activities during the last 50 years have resulted in higher intensity and more frequent disturbance regimes in the watershed.  Much of the oak savannah and open mixed conifer hardwood stands have been converted to dense conifer stands, or agricultural/farm lands.  With the harvest of trees, late seral stage, standing dead and down log components of wildlife habitat have decreased. As a result, within stand diversity has decreased.  As roads and clearcutting have increased, so have induced high contrast edges and isolation of remaining older forest patches.  Harvest patterns along property boundaries have disrupted travel corridors and decreased connectivity of habitats, resulting in poorer wildlife dispersal capabilities, especially for the less-mobile species.  The predominate matrix has been transformed from late seral to early/mid seral stage conifer stands.  Because of commercial forestry, the regeneration period has been shortened and the late seral stages have been truncated, resulting in proportionately more mid seral stages across the watershed.

Wind also has the capacity to disturb large areas of the landscape and has done so approximately every 25 years (Teensma 1987).  The last extensive large wind event in Oregon was the Columbus Day storm of 1962, which blew down 11 billion board feet of timber in Oregon and Washington, 98 percent of which was west of the Cascade crest.  Other major wind events occurred in March 1963, February 1958, April 1957, November 1953, January 1921 and January 1880.  (Lunott and Cramer 1966, Henstrom and Logan 1986).  Wind has more influence on coastal forest dynamics than on the forests of the Cascades.  Wind is also associated with patch size disturbances over the landscape as are insects and disease.  These three disturbance factors add small complex changes over large spatial and temporal scales and have direct and indirect influences on fire ecology.

This departure from historic disturbance regimes has affected the abundance and distribution of wildlife species in the Thomas Creek Watershed.  Species that find their optimum habitat in components of late seral stages have been adversely affected.  These species include the clouded salamander, Oregon slender salamander, pileated woodpecker, and the spotted owl.  However, species whose primary habitats are edge and open areas in the forest environment are favored.  These species include black-tailed deer, mountain quail, great horned owls, red-tailed hawks and the golden eagle.

Some species that were present during historic times have been greatly reduced or extirpated due to direct human impacts. These species include the fisher, gray wolf, and the western rattlesnake. Nonnative species have recently displaced some native species. Non-native species include the bullfrog, starling, house sparrow, opossum, Norway rat, eastern cottontail and nutria.

Disturbance has many implications on the present watershed forest. Species composition is more uniform in age and species. Disease could cause greater widespread problems. Fire has large expanses of uniform fuel types to burn in. If burning conditions are met and an ignition source is available, larger than normal fires could occur. Fire would also have a larger burning window because of dryer conditions created by pre-commercial thinning or manual release. The federal policy of dispersed smaller clearcuts has created dryer conditions in the remaining older forests making them more susceptible to fire than under natural conditions. The dryer conditions are a result of increased forest edge exposed to the drying effects of sun and wind penetrating into the once interior forest. The opening of the canopy has also accelerated the blowdown of timber. This contributes extra fuel to the fuel bed.

Fire left a legacy of structural diversity with multiple age classes, snags, and downed wood. This created multi-layered canopies, nesting sites (snags), travel corridors (downed logs), foraging sites (snags, downed logs), germination sites (downed logs), nutrient/water storage (downed logs), mycorrhizal activity (downed logs) and an establishment phase that lasted 20-100 years. It has been hypothesized that long establishment periods (brush>hardwoods>conifers) helped control root rots. Timber harvest in the past eliminated a majority of the structural diversity components. Where fire gave diversity and complexity yielding stableness, timber harvest gave the forest simplicity and unstableness.

The tree species present are the result of the weather and disturbance factors. From the fire aspect Douglas-fir develops thick bark, attains great height and a deep rooting habit. These characteristics allow tree survival of light to moderate intensity fires. Today’s Douglas-fir forests, especially industrial forest on short rotation, are young trees with thin bark that will not resist a moderate intensity ground fire.

There is very little documentation on the historical presence, abundance, and distribution of today’s rare plant and fungal species in western Oregon. For this discussion a widely accepted assumption, that species’ presence and distribution is directly related to the presence and distribution of suitable habitat has been made.

Before fire suppression and European settlement, when the west end of the watershed had more land in oak savannahs and the foothills and higher elevations were dominated by mature coniferous forests, there was more available habitat for the species we describe as rare today. Species such as, Bradshaw’s lomatium, howellia, Nelson’s sidalcea, golden paintbrush, peacock larkspur, and Willamette daisy inhabited Willamette Valley prairies and wetlands before European settlement and modern land management practices began. As the Willamette Valley turned into an urban and agricultural center, the amount of available habitats for these species decreased dramatically.

Today, oak savannahs and undisturbed low elevation wetlands are the rarest habitats in the Thomas Creek Watershed and western Oregon. It follows that the species which require these habitats have also become rare.

Oregon's native vegetation evolved with fire.  Some rare species are more dependent on fire as a natural disturbance than others.  Those species which require fire to create and maintain optimal habitat conditions have lost habitat as a result of fire suppression.  It is believed that tall bugbane and Bradshaw's lomatium as well as several other rare Willamette Valley and Cascade foothill species have lost habitat because of fire suppression.

The rare species which occupy higher elevation forested habitats include cold-water corydalis, noble polypore fungus, and fir club-moss.  It is reasonable to believe that these species were more abundant when there was more high quality suitable habitat available.  High quality habitat for these species could be described as mature forested habitats with a high degree of connectivity, minimal fragmentation and soil disturbance, and a natural fire frequency.

Habitat for the native vegetation began to degrade with fire suppression.  The logging boom in the 1940s and timber harvest activity up to the present time progressively degraded the habitat.  This was done by fragmenting the forests, altering hydrological processes through road construction, creating seed beds for exotic species by disturbing soil, and providing travel corridors and seed vectors for exotic plant species.   Human activity along the roads and in the clearcuts has provided excellent opportunities for invasive exotic plant species to infest the ecosystem which, in turn, reduced the quality and amount of available habitat for native vegetation.

Historically, only winter steelhead trout and spring chinook salmon could migrate over Willamette Falls into the upper Willamette Valley.  The majority of these fish spawned in the Santiam River and Mckenzie River subbasins.  Both species utilized Thomas Creek for spawning and rearing.

The Santiam subbasin provided the majority of the winter steelhead production  in the Willamette Basin (Wevers, et al.1992).  Perhaps two-thirds of the Santiam subbasin steelhead production occurred in the upper portions of the North and South Santiam rivers. The remaining production occurred in the lower, foothill tributaries such as Thomas Creek, Crabtree Creek, and the Little North Santiam.  Thomas Creek probably produced large numbers of steelhead historically, however, these runs had been reduced substantially by the 1950s.

The Santiam subbasin produced about 33 percent of the spring chinook salmon production in the upper Willamette Basin (Wevers et al. 1992).  About one-third of these fish were produced in the South Santiam system (Willis et al., 1960).  Historically, about 85 percent of the spring chinook production in the South Santiam system occurred in the Middle Santiam and upper South Santiam rivers (Wevers et al. 1992).  Thomas Creek and Crabtree Creek provided most of the remaining spring chinook production on the South Santiam, or about two percent of the upper Willamette Basin production.

Anadromous and resident salmonids existed in streams that would have had an abundance of large, persistent wood in the channels, particularly in the tributary streams.  Log jams were likely common, particularly in the flat gradient (less than two percent gradient) sections.  Wood, in single pieces and jams, trapped spawning gravel and created rearing pools.   Woody debris provided instream cover and helped to dissipate flood flows.  Channels would have had a diversity of substrate types, for spawning and invertebrate production, as floods routed landslide debris throughout the system. Stream channels would have been complex, with water flowing around boulders and large pieces of wood. Side channels and off channel habitats were common.

Riparian areas in the lower portion of the watershed were likely composed of mixed hardwoods and conifers. Above the point where the valley begins to constrict, riparian areas would have been dominated by older conifer forests, with some alder and maple along the stream corridor.

Downstream of Jordan Creek, the mainstem of Thomas Creek had considerable areas of mud and silt substrate. Between Jordan Creek and Hall Creek, Thomas Creek contained bedrock, cobble and boulders with numerous pockets of gravels. Above Hall Creek, the mainstem would have become progressively more boulder dominated. The lower tributary streams (Mill Creek, Neal Creek, and Jordan Creek) may have had gravel substrates in the low gradient portions adjacent to Thomas Creek, changing to more bedrock and boulders in their headwaters. Above Bear Creek, the Thomas Creek canyon narrows and deepens considerably and the tributary streams are generally steep and constricted. Boulders would have dominated these tributaries.

Stream temperatures were likely to be cool in summer. Spring chinook entered the Santiam subbasin in May and held in large mainstem and tributary pools until they spawned in fall. They required deep, coldwater pools for holding during summer months. Periodic fires, often followed by landslides, would have had a negative effect on salmonids due to increased sedimentation and increases in water temperature. However, due to the diversity of fire in the landscape, there was likely to be places where some fish could escape the impacts of these events.

Unlike many Santiam River streams, there was very little log driving on Thomas Creek. A somewhat unsuccessful log drive occurred around 1907, and a pulpwood drive occurred in 1915 (Farnell, 1981).

The Scio diversion dam was a concrete and plank dam 148 feet long and 6 feet high. It also had temporary flash boards. The dam was located 8.5 miles above the mouth of Thomas Creek, near the town of Scio. The dam diverted water into a 15 feet wide 3 feet deep canal which provided water to a mill. The dam was provided with a passable, but inefficient, fishway and the diversion was unscreened. The dam was breached in 1952 or 1953 and the diversion became inoperative (Willis et al. 1960; McIntosh et al. 1994).

Jordan Dam, located 18 miles above the mouth, was a concrete and plank dam 163 feet long and 15 feet high. The dam diverted water into a four foot wide flume which provided water to the Mountain States Power Company plant located about 1.0 mile downstream. A wooden fish ladder may have been inoperative for many years, at least under certain flow conditions. The diversion flume was unscreened, but did have a bar grating that prevented some fish entry into the flume. During low flow nearly all of the flow in Thomas Creek was diverted into the flume. Jordan Dam was breached in 1953 (Willis et al. 1960, McIntosh et al. 1994).

The Scio and Jordan dams may have been responsible for decreasing the size of the anadromous fish runs in Thomas Creek (Willis et al. 1960). Due to inoperative fish ladders, they were at least partial barriers to upstream migration. Spring chinook were probably more affected by the dams because of the lower flows in the river when they are migrating upstream.  Steelhead can jump higher than chinook, and also they migrate in mid-winter/early spring when the streamflows are higher.  The unscreened diversions were detrimental to chinook and steelhead.  Chinook and steelhead smolts would have been diverted with the water and killed in the generators or were unable to return to the main stream.

The upper portion of Thomas Creek was unroaded until recent times.  A stream survey completed in 1945 indicates that the road up Thomas Creek ended at approximately Indian Prairie Creek (McIntosh et al. 1994).

# Chapter 5  Current Conditions

## Introduction

The Thomas Creek Watershed is within the Western Oregon Cascades Physiographic Province. Elevations range from 350 feet in the western portion to approximately 4500 feet on the ridge peaks. Prominent topographic features include Snow Peak and Anthus (4298 feet), Thomas Carin (4330 feet), Harry Mountain (4495 feet), Kinney Peak (4359 feet), High Rock (4095 feet), and Tom Rock (3486 feet).

The Thomas Creek Watershed was stratified into 27 subbasins. These were consolidated into five sub-watersheds basins (SWB) which are delineated on the Streamflow map. Area and percent are displayed in Figure 7.

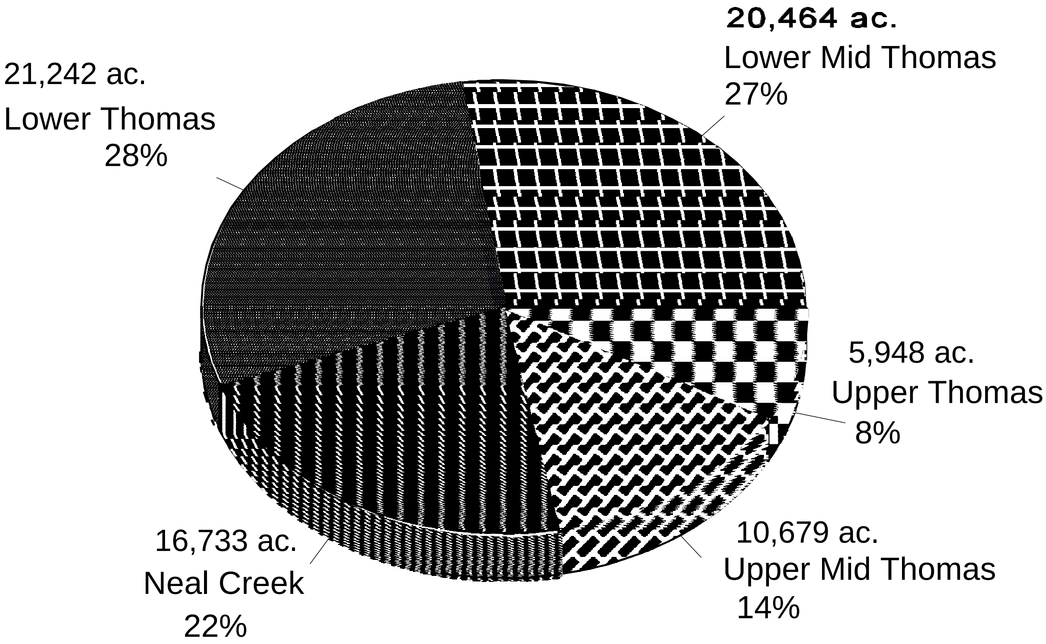


**Figure 7. Sub-watersheds basins.**

The watershed is also stratified into three precipitation zones: rain-dominated, transient snow, and snow dominated zones.

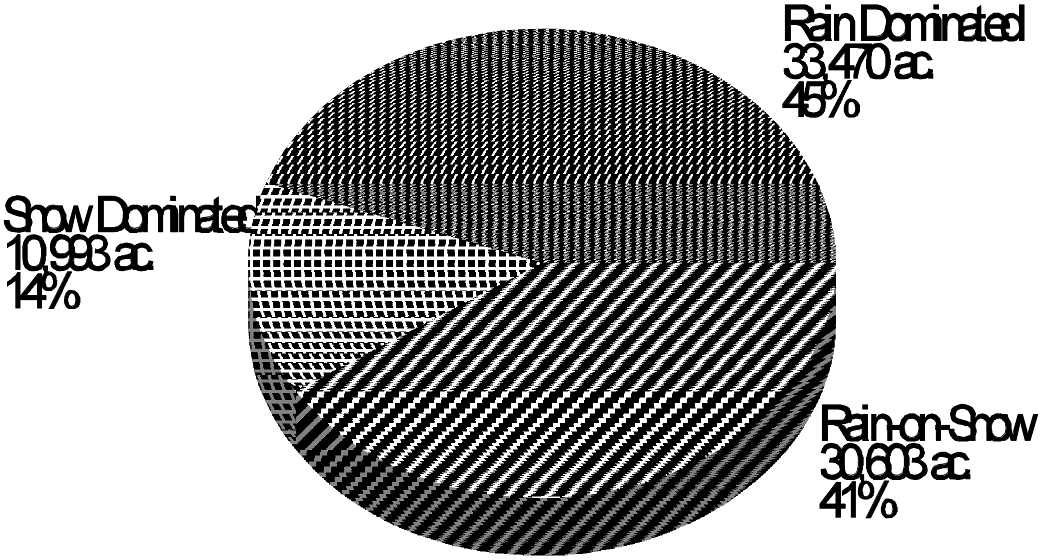


**Figure 8. Precipitation Zone Stratification**.

# Terrestrial

## Vegetation Patterns/Seral Stage

> ***What is the present seral stage distribution and vegetation pattern within the watershed? How does this relate to adjacent and larger ecosystems? How do current seral stages, amounts and distribution, special habitats, and vegetation patterns influence the landscape structure, functions, and processes? What are the predominate matrices, patches, and fragments? How will land use objectives and management guidelines in the ROD and the RMP and on privately managed lands influence future landscape structures, functions, and processes?***

Age class distribution is an important component in describing the overall structure of the watershed as an ecosystem. Age class distribution in the Thomas Creek Watershed has been categorized into age class bands corresponding to vegetative seral stage development. This grouping was done to develop a clearer mental image of the watershed. Old growth is considered 200 years and older, mature is 75 to 200 years, closed sapling is 35 to 74 years, open sapling/brush is 15 to 34 years, and grass/forb is zero to 14 years. See Seral Stage map, and Tables and Figures 9, 10 and 11. Seral Stage Amounts by Ownership.

Information on vegetative conditions was derived from a variety of sources. BLM Forest Operations Inventory (FOI) records (1993) were used to depict vegetative conditions on BLM lands. Vegetative condition on private lands was determined from aerial photographs

| Seral Stage | Acres |
|---|---|
| Old Growth | 1,857 |
| Mature | 2,493 |
| Closed Sapling | 1,825 |
| Open Sapling/Brush | 3,829 |
| Early-Grass/Forb | 2,448 |
| Nonforest | 534 |

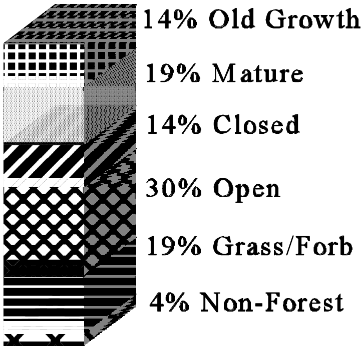


**Figure 9. Seral Stage for Federal Ownership.**

| Seral Stage | Acres |
|---|---|
| Old Growth | 1,423 |
| Mature | 1,527 |
| Closed Sapling | 16,802 |
| Open Sapling/Brush | 21,896 |
| Early-Grass/Forb | 6,853 |
| Nonforest | 13,539 |

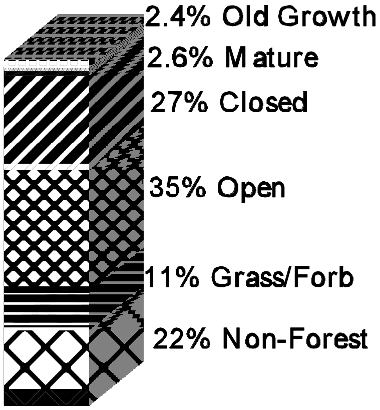


**Figure 10. Seral Stage for Other Ownership.**

| Seral Stage | Acres |
|---|---|
| Old Growth | 3,280 |
| Mature | 4,020 |
| Closed Sapling | 18,627 |
| Open Sapling/Brush | 25,725 |
| Early-Grass/Forb | 9,301 |
| Nonforest | 14,073 |

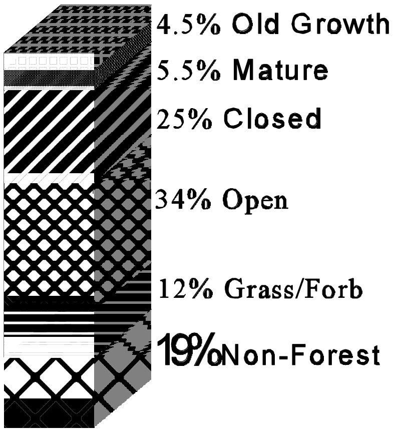


**Figure 11. Seral Stages for All Lands.**

interpretation using 1988 and 1993 coverages, and from Oregon Department of Revenue forest cover maps. This information was developed for the evaluation of seral stage distribution and habitat conditions across the watershed. All estimates of vegetative cover and stand conditions are expressed as existing in the summer of 1993. Harvest and other management activities conducted since then were not evaluated in this analysis.

The Thomas Creek Watershed is in the western hemlock zone characterized by forests with western hemlock in the overstory during the climax seral stage and Douglas-fir as the sub-climax overstory species. It is also in the Pacific silver fir zone characterized by forests with Pacific silver fir dominating during the climax seral stage. Three major upland plant groupings are in the watershed. At low elevations below about 1500 feet in the foothills is the Douglas-fir/ocean spray/herbs and grasses (D/OS/H) plant grouping. At mid elevations, forests in the Douglas-fir/Mixed Brush/Salal (D/B/SA) plant grouping dominates. At higher elevations above about 3500 feet, there is a true fir/rhododendron-ceanothus/beargrass (TF/RH/H) component. In addition, mixed hardwood stands consisting mostly of big leaf maple and red alders with some Oregon white oak and Oregon ash comprise a minor component at low elevations and in riparian zones of larger order streams.

Approximately 76 percent of the Thomas Creek Watershed are conifer types consisting mostly of Douglas-fir and western hemlock. Approximately 5 percent are hardwood types consisting primarily of red alder and big-leaf maple. About 19 percent consists of nonforest types. These include roads, quarry developments, rural residential and agricultural lands in the watershed. Meadows, rock cliff/talus, and other natural openings in the forest environment are also included as nonforest types.

Large blocks of older forest designated as LSRs are immediately to the south and east of the watershed in the Crabtree and Quartzville drainages. According to forest planning maps, this LSR covers the BLM ownership just north of Harry Mountain in the Thomas Creek Watershed. To the north and east eight to 10 miles, a large LSR in the Molalla River and Little North Santiam drainages surrounds the Table Rock and Bull of the Woods Wilderness areas. An LSR to the east near the crest of the Cascades surrounds the Jefferson Wilderness. The crest of the Cascade Mountains is 26 miles to the east. The Willamette Valley Physiographic Province lies immediately to the west of the watershed. The Thomas Creek Watershed exhibits some ecological characteristics of the Willamette Valley due to its proximity.

The structure and pattern of vegetation or habitats within an ecosystem, such as the watershed, can be characterized in terms of patches, corridors and a background matrix. The patterning of patches, matrix and corridors across the landscape strongly influences the ecological characteristics, processes and energy flows (Forman and Gordon 1986).

The landscape matrix is the most connected portion of the landscape in terms of vegetative cover and plays a dominant role in landscape function. The predominant matrix across all ownerships in the Thomas Creek Watershed consists of sapling pole stands in mid successional stages between 20 and 60 years of age. In the Lower Thomas and Neal Creek sub-watershed basins, there is a significant nonforest matrix consisting of agricultural and rural residential and also closed sapling pole stands between 40 and 74 years of age. In the Lower Mid sub-watershed basin, a mixture of open to closed sapling pole stands 15 to 74 years of age predominate. Open to closed sapling pole stands 15 to 34 years of age are dominant in the Upper Mid and Upper sub-watershed basins. This age class distribution follows a general harvest pattern from lower to higher elevations in the watershed over time.

Patches are definable vegetative types that differ in their habitat characteristics from their surroundings. Patches vary in size, shape, type, heterogeneity and the vegetative types that surround them. The most common patch element is the early seral stage, zero to 14 years of age, which comprises 12 percent of the watershed.

Patches of mature and older forest more than 75 years of age comprise about 10 percent of the watershed. The largest existing patches of mature forest are close to the Thomas LSRs and CONN, Neal Creek CONN and Harry Mountain Ridge, primarily on BLM lands. Less than 5 percent is in old-growth forests more than 200 years old.

Seral stage amounts and distribution were further analyzed on federal lands and categorized by land use allocation (LUA). See Table 4, Seral Stage by LUA on federal lands, below. Patches of older forest comprise about 33 percent of the federal ownership in the watershed. Most older forest is in LSRs than in the Matrix. Sixty-four percent of LSRs are in older forest conditions compared with 31 percent in CONN and 23 percent in General Forest Management Areas. Approximately 14 percent of the federal ownership in Thomas Creek Watershed is in old-growth forests more than 200 years of age.

| Seral Stage | Matrix | | | | LSR | |
|---|---|---|---|---|---|---|
| | GFMA | | CONN | | | |
| | Ac. | % | Ac. | % | Ac. | % |
| Nonforest | 194 | 4 | 195 | 5 | 145 | 6 |
| Early-Grass/Forb | 1,322 | 23 | 1,018 | 20 | 107 | 5 |
| Open Sapling/Brush | 1,818 | 32 | 1,573 | 31 | 439 | 20 |
| Closed Sapling | 1,048 | 18 | 659 | 13 | 119 | 5 |
| Mature | 536 | 9 | 1,024 | 20 | 933 | 42 |
| Old Growth | 800 | 14 | 568 | 11 | 488 | 22 |
| Totals | 5,718 | | 5,037 | | 2,231 | |

**Table 4. Seral Stage by Land Use Allocation (Federal Lands only)**.

The drainages and their associated riparian/streamside vegetation provide corridors for wildlife movement. Generally, they flow from the east higher elevations through the Thomas Creek Watershed to the Willamette Valley Province to the west. The higher elevation ridge top areas connecting the Snow Peak area, Sewell Peak, and Harry Mountain on the southern boundary and Tom Rock, High Rock and Kinney Peak on the northern boundary also serve as flow corridors. Generally the flow of more mobile species of wildlife into, through and out of the landscape is from higher elevation to lower elevation in the fall/winter and to higher elevation in the spring. This corresponds to a poorly defined northeast/southwest flow across the watershed, presumably along drainages and ridgetops. Vegetation in natural corridors has been altered over time due to past harvest patterns, roads, and mixed ownerships.

### Special Habitats

A special habitat is a habitat that has a function not provided by plant communities and successional stages (Brown et al 1985). Special habitats are usually nonforest types such as meadows, wetlands, rock outcrops, cliffs, and talus slopes.

Thomas Creek is rich in special habitats compared with other watersheds in the west Cascades. Some more significant special habitat complexes in the Thomas Creek Watershed include Snow Peak and the Anthus, Thomas Carin, Waldo Peak, Indian Prairie, Eleanor (Indian Prairie) Lake, High Rocks, Devil's Den, and the Upper Slash.

Snow Peak and the Anthus, Thomas Carin and Waldo Peak are four of the highest peaks in the watershed. They are found on the south boundary of the watershed at the head of Neal, Indian Prairie and Ella creeks. There has been harvest activity in the past and most of the area is in early seral stages with some late successional forest, particularly to the south on BLM lands. Near the peaks are many dry meadows, rock outcrops, cliffs and talus slopes. At the base of the peaks are topographic bowls within which are wetlands, wet meadows, brush patches and a lake. To the northwest of Snow Peak on BLM lands are the Neal Creek wetlands. To the north of Snow Peak is Eleanor Lake, which is on private and BLM lands. North and east of Thomas Carin on private land is Indian Prairie wetland. This habitat complex is the headwater of Indian Prairie Creek, consisting of open/high water areas, a wet meadow, brush, talus and cliffs. To the northeast of Waldo Peak are Ella wetlands, which are on private lands. This habitat complex is the headwater of Ella Creek, consisting of high water areas, wet meadows, brush, talus and cliffs. The southern divide between Thomas Creek and Crabtree Creek bisects this ecosystem. There are significant special habitats on the south side of Snow Peak in the Crabtree Watershed that are part of the same ecosystem. These habitats are found on BLM lands and include Snow Peak Meadows.

High Rocks is along the northern boundary of the watershed, on the divide with Rock Creek to the north. This higher elevation ridge mostly on state and private land runs roughly east/west and connects Tom Rock, High Rock, and Kinney Peak at elevations of 3000 to 4000 feet. Along this ridge, there are many rock outcrops, cliffs, talus and dry meadows, especially near High Rock. Past harvest activity has occurred and most of the stands are in younger age classes.

Devil’s Den is found near the center of the watershed in T.10S., R.2E., sections 11, 12, 13, 14 and 15. Along Devil’s Den Creek there are a number of wetlands, mostly on private lands. The lower portion of Devil’s Den on BLM lands is where there is a steep drainage which flows into Thomas Creek. There is a good component of late successional forest in the Devil’s Den.

The Upper Slash is located on BLM lands in T.11S., R.3E., section 4. There is a large active slide area which includes a late successional stand with old-growth Douglas-fir and western red cedar. Within this stand there are two streams, a wet meadow and a red alder wet area. A number of rock outcrops and cliffs surround the stand.

Park Creek and Erica Meadows are located on BLM and private lands south of McCully Mountain in the lower end of the watershed. They consist of a series of meadows, grassy balds, cliffs and rock outcrops surrounded by mid to late successional forests of Douglas-fir, western hemlock, big-leaf maple, Oregon white oak, and madrone. Adjacent to Park Creek Meadows on BLM lands is one of the last remaining stands of older forest in the Lower Thomas Creek sub-watershed basin.

Other smaller special habitats occur across the watershed including a number of small oak/madrone openings at lower elevations (mostly private), Jordan Creek Wetlands (private), Jordan Butte (private), Ruth Meadow (private), Redrock Lake (BLM), Cedar Meadows (private), and Criminal Meadows (BLM/private).

## Standing Dead and Down Logs

Data from inventory plots and stand exams were used to estimate the amount of standing dead and down logs in the watershed. Estimates of the amount and condition of standing dead across the watershed were correlated with Neitro et al. 1985 to estimate existing percent of potential cavity nesting bird populations. Estimates show that the Thomas Creek Watershed is between the 20 to 30 percent level. The standing dead component was found to consist mostly of material in more advanced stages of decay.

Estimates of the amount and condition of down logs was compared to the Salem District RMP standard of 240 lineal feet per acre of hard material over 20 inches on the small end. It is estimated that the watershed’s condition is at less than 10 percent of this standard. In many cases, the amount of down log material exceeds 200 lineal feet per acre across all age classes, however most of the large material is in more advanced stages of decay.

The standing dead and down log components were found to be lacking in large material in the early stages of decay. This large, harder material will persist longer than the existing softer material in advanced stages of decay. This material is important for future habitat and nutrient capital. These elements are important in streamside areas and in the vicinity of special habitats.

## Habitat Quality

Harvest patterns, road building and natural disturbance have created a mosaic of patches of older forest scattered across the watershed. Where an older forest patch is surrounded by younger age classes, the edges of the patch exhibit habitat conditions that are different from the interior of the patch. As older forest patches decrease, and more edge and open areas increase, species which are associated with older forest habitats will be adversely affected and species that are associated with edge and open areas will be favored. The amount of **interior** older forest habitat in relation to total older forest habitat gives some indication of the quality of the remaining habitat and the influence of edge effects. Edge effect on the remaining older forest was modeled to determine the amount of interior older forest and the influence of the edge effect. As a result of this analysis it was found that 23 percent of the remaining 7,300 acres of older forest is considered to be in the high quality interior forest condition. The majority of remaining interior older forest habitat is found in the Lower Mid and Neal creek sub-watershed basins. The largest patches are found in the Thomas Creek LSRs, Thomas Creek CONN, Neal Creek CONN, and on Harry Mountain Ridge.

Road locations were then mapped to estimate the effect of roads on existing interior older forest habitat. This analysis indicates that the older forest in the Thomas Creek Watershed is fragmented due to edge effects and much of it is not functioning as interior older forest. Much of this fragmentation was created by past harvest and road construction.

Inputs from the age class analysis were used to calculate the habitat effectiveness for cover using the Wisdom Model (Wisdom et al.). Presently, there is an estimated 5 percent optimal cover, 30 percent thermal and 35 percent hiding cover in the watershed. The habitat effectiveness for cover quality is currently at .25 which is limiting for elk. The habitat effectiveness for forage quality is estimated to be at or near .30, which is also limiting for elk.

## Soils/Site Productivity

The selection, growth and survival of vegetation is influenced by a combination of factors that are natural and management-related. The natural site productivity factors are water-holding capacity, potential evapotranspiration, type of parent material, aspect, slope position, and elevation. Inherent soil characteristics such as effective soil depth, thickness of the surface soil, and bulk density are also important in determining soil productivity. Management related factors include surface removal and soil compaction.

Productivity of forest lands is largely defined in terms of site quality in general and site index specifically. Site productivity is Site Class 2 or 1 in the foothills, floodplains, and lower part of the western Cascades Range (less than 1500 foot elevation) where the silty clays, silty clay loams and clay loams predominate. At mid elevations (1500 foot to the cryic soil zone) the stony loams and gravelly loams predominate with Site Class 3 productivity. In the snow dominated zone (cryic soil zone), the gravelly loams and gravelly silt loams predominate and the Site Class is a low 3 to high 4.

The only nonforest land in these areas (other than the withdrawn land from the TPCC) is the areas of hydric soils in the floodplains. The timber production capability classification (TPCC) classification of FN indicates fragile soil conditions due to low soil nutrient capability. These areas generally occur in the Cryic/Udic zone, which is the snow dominated zone and the area of lowest productivity in Thomas Creek.

Under natural conditions, duff thickness is 0.5 to 1.0 inches in the rain dominated zones and increases to several inches in various forest stands in the snow dominated zone. This is due to slower biochemical reactions which occur in colder conditions in the snow dominated zone and the slower reactions result in slower break down of the litter and duff layer. Observations comparing natural stands and managed stands show that there is no significant difference in duff/litter layer thickness.

Soils in the Thomas Creek Watershed can be classified to moisture/temperature regimes. These are given in Table 5. All of the soils in the Mesic/Xeric zone plus 8,000 acres of the silty clays and silty clay loams in the Mesic/Udic zone in the western Cascades are in the rain dominated zone. The sandy loams and silty loams on the floodplains are deep to very deep (40 to 60+ inches), moderate to high productivity, moderate available water holding capacity, and moderately susceptible to compaction. The silty clay loams, clay loams, and silty clays make up the soils in the foothills, and on flatter areas in the western Cascades. These soils are deep to very deep (40 to 60+ inches), highly productive, high available water holding capacity, and highly susceptible to compaction. The hydric soils are generally not considered forest soils. The soils in the remainder of the Mesic/Udic zone (silty clay loams, clay loams, stony and gravelly loams) and the soils in the frigid zone are in the transient snow zone. The clay loams and silty clay loams have been addressed above. The stony and gravelly loams are moderately deep to deep, have a moderate to high productivity, moderate to high available water holding capacity, and moderate to low susceptibility to compaction. The very gravelly loams and gravelly silt loams in the Cryic/Udic zone are in the snow dominated zone. These soils are moderately deep, low to moderate productivity, moderate to low available water holding capacity, and have a moderate to low susceptibility to compaction.

In the managed stands of Thomas Creek, the primary cause of site productivity loss is soil compaction. Compaction has been identified on a significant portion of BLM lands - greater than 50 percent in many of the subbasins. Soils which are susceptible to compaction make up about 75 percent of the watershed. Soil compaction data from yarding activities on federal lands is available from the TPCC data.

Productivity has been reduced or eliminated on areas occupied by roads.

| Soil Moisture - Temperature Regime | Soil Textural Class | Acres | % |
|---|---|---|---|
| Mesic - Xeric | Silty Clay Loam (Foothills) | 18,294.9 | 24.0 |
| Mesic - Xeric | Silty Clays and Silty Clay Loams (Hydric) (Floodplains and stream terraces) | 2,975.7 | 4.0 |
| Mesic - Xeric | Sand & Silt Loams and Silty Clay Loams (Floodplain and stream terraces) | 2.6 | 0.0 |
| Mesic - Xeric | Silt Loams and Silty Clay Loams (Terraces) | 4,248.9 | 6.0 |
| Mesic - Udic | Silty Clay Loams (Western Cascades) | 25,748.8 | 34.0 |
| Mesic - Udic | Clay Loams, Stony Loams, and Gravelly Loams (Western Cascades) | 10,135.1 | 13.5 |
| Frigid - Udic |  | 2,667.3 | 3.5 |
| Cryic - Udic | Gravelly Silt Loams, Very Gravelly Loams and Gravelly Loams | 10,992.9 | 15.0 |
| Total |  | 75,066.2 | 100.0 |

**Table 5. Soil Acres by Precipitation Category and Soil Texture Class.**

## Roads and Transportation

***How are roads influencing water quality, watershed condition, native plant communities and wildlife habitat quality, and effectiveness?***

The existence of roads have obvious physical effects on the ecosystem. The land area taken up in roads does not contribute to forest or nonforest habitats. A total of 624 acres are considered as out for roads (see Transportation map). The existence of roads causes edge effects and micro climatic changes that affect plant communities and wildlife. Open roads and road maintenance activities create disturbance effects through soil disturbance, traffic and increased human intrusion. This can disturb wildlife and inadvertently cause the spread of noxious weeds and exotic species. Roads may also act as travel corridors for species that normally would not be present without roads. Edge species such as the great horned owl or barred owl may capitalize on these corridors to expand their range into spotted owl habitat.

As part of the analysis, total miles of road across the watershed were calculated. There are 586 roaded miles on all ownerships within the Thomas Creek Watershed. Approximately 4 percent of the watershed consists of road surface and permanently disturbed cut and fill slopes. Of the total, 102 miles are on federal lands. Average total road density on federal lands is estimated at 5+ miles per section which is considered high. Road densities range from a low of 3.5 to 4.5 miles per section in the Lower Thomas and Neal Creek sub-watershed basins, to a high of 6.2 miles per section in Upper Mid Thomas sub-watershed basin. The habitat effectiveness index derived from open road densities for BLM lands is at or near .35, which is limiting for elk.

There are several gates in the watershed which limit access and some of the roads are over grown or blocked. Approximately 3 percent of the total road miles in the watershed are effectively gated or otherwise undrivable. An additional 44 percent are at least seasonally closed. Open (accessible) road densities across the watershed are estimated at 2.75 miles per section, which is considered to be low to moderate. Open (accessible) road densities on federal lands average 3.75 miles per section, which is considered to be moderate. Inputs from the road density analysis were used to derive a habitat effectiveness index from open road densities using the Wisdom Model. The habitat effectiveness index derived from open road densities for the watershed is currently at or near 0.4, which according to the Wisdom Model is viable for elk.

Roads collect surface water and subsurface water (intercepted by road cuts) and transport it to streams especially in watersheds where road densities are high, or where roads are in close proximity to the stream. Roads within 200 feet of streams run a high risk of sediment delivery due to funneling of concentrated surface water and interception of shallow ground water to downslope surfaces. Outside 200 feet, probability of sediment supply to streams from roads is greatly reduced. The surface of the road can be important as rutting can occur on unsurfaced roads. During wet weather, heavily used roads can produce substantial amounts of sediment. Most road construction sediment is produced within the first three years of the life of the road but may continue at a reduced rate for long periods. (Burroughs and King 1989) (Ketcheson and Megahan unpublished) (Megahan 1974) (Reid and Dunne 1984) (Sullivan and Duncan unpublished). Off-highway vehicle road usage has not been a major surface erosion problem in Thomas Creek.

There are 2,368 road/stream intersections in the Thomas Creek Watershed. These are classified into potentially unstable, stable, and unstable based on underlying soil properties. Of all the intersections, only 14, for a total of 6.7 miles (1.1 percent) have been classified as either potentially unstable or unstable. So while the roaded miles per section is high, those roads most likely to deliver sediment to the stream, appear to have good stability.

## Natural Disturbance and Erosion Processes

> ***What is the past and current role of natural and human disturbance processes in the watershed? What erosion processes are dominant within the watershed? Where have they occurred or are they likely to occur? What are the current conditions and trends of the dominant erosion processes prevalent in the watershed? What are the historical erosion processes within the watershed and where have they occurred? What are the natural and human causes of changes between historical and current erosion processes in the watershed? What are the influences and relationships between erosion processes and other ecosystem processes***

The Thomas Creek Watershed is characterized by mountainous terrain divided by narrow valleys, foothills of the western Cascades, and stream terraces and floodplains. Soils in the first area are developed from colluvium derived from igneous rock and volcanic ash. Soils in the foothills are also developed from colluvium derived from igneous, sedimentary, and tuffaceous rock. Soils in the terraces and floodplains developed from both old and recent alluvial deposits. The soils on slopes greater than 70 percent, where the soils in the first group are found, are particularly subject to raveling and soil erosion. The soils derived from tuffaceous rock can become very unstable and are particularly subject to mud and debris flows such as those that happened at Silt Creek.

Upland conditions that affect erosional and hydrologic processes can impact the aquatic system significantly. Soil erosion and ravel are primarily found on steep slopes and erosion rates are generally highest during the first five years after a stand replacement - whether by fire or tree harvest. In the transient snow zone, rain -on-snow events in stands five years or less can cause significant soil erosion. In this watershed, 17,267 acres or 23 percent are in this group. After five years, the erosion hazard is greatly reduced.

Landslides and debris torrents have occurred in few places in Thomas Creek but have been major events when they have occurred. A major landslide just above Silt Creek, Upper Slash, has deposited massive amounts of silt and clay in Silt Creek that in turn has caused major sedimentation in Thomas Creek. Below this area, on private land, this unstable area continues to slide at different locations along Silt Creek. This entire area appears to have been unstable for decades and even hundreds of years. It has been suggested that the northward turn that Thomas Creek takes after a downstream direction of west is the result of the unstable land gradually moving the creek over a period of years. The cause for this unstable condition is the component of the parent material that contains pyroclastic material. This pyroclastic material, when moist, degrades to clay which can easily slide off the underlying material.

In the past five years, on the opposing side of the ridge from where the major slide occurred, timber stands have been harvested. Though the aspect and topography of these harvest sites are toward the east into Slash Creek, the higher than average precipitation and snowfall in the area may have triggered a slide at the top of the ridge. In addition, while the eastern side of the ridge has not been actively unstable, back wasting on this opposing side is occurring.

# Special Status Species (SSS) ....

***What Special Status Species (SSS), SEIS Special Attention Species (SSAS), and Species of Concern (SOC) are known or suspected to occur in the Watershed? How will land use objectives and management guidelines in the SEIS, the Salem District ROD, and on privately managed lands influence future habitat for SSS, SSSA, and SOC? What species of fish inhabit the watershed and what is their distribution? What is their current status and has their status changed from historic levels? Are any fish stocks presently considered to be"at risk" of extinction?***

## Plants

### Special Status Species, Special Attention Species, and Species of Concern

There are three known populations of BLM special status plant species populations in the Thomas Creek Watershed. Two of those are also Survey Strategy 1 SEIS Special Attention Species (SSAS). Based on a literature review of the habitat requirements of the SSS known to occur in the province, a list of potential species has been identified for the Thomas Creek Watershed and its special habitats (Appendix D.1.). This list includes Federal Endangered, Federal Threatened, Federal Proposed Threatened, and Bureau Sensitive species. Included in Appendix D-2 is a list of Survey and Manage Species known to occur in the Cascades Resource Area, which is based on Table C-3 of the Standards *and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl.*

*Oxyporus nobilissimus,* the noble fir polypore fungus, is a Bureau Sensitive species and an SEIS Special Attention Species. It is known from only eight locations in the region ranging from the Olympic Peninsula south to the Thomas Creek Watershed. This long lived butt rot fungus grows on the roots and bases of old-growth noble fir and Pacific silver fir trees, snags and stumps. Little else is known about the habitat requirements and life history of this species. A management area of 600 acres of BLM land has been defined around the population in the Thomas Creek Watershed until the area can be thoroughly surveyed and site-specific measures can be prescribed.

*Corydalis aquae-gelidae*, cold-water corydalis also has a dual status as a Bureau Species of Concern and an SEIS Special Attention Species. *C. aquae-gleidae* is a species restricted to cold, flowing springs, seeps and streams ranging from the west slopes of the southern Washington Cascades down to the west slopes of the central Oregon Cascades. In Thomas Creek one population is known to occur on private and BLM land.

*Horkelia congesta ssp. congesta*, shaggy horkelia, a Federal Candidate 2 species is a Willamette Valley species known to occur in open sandy, rocky or wooded areas in Benton, Douglas, Lane and Linn counties. The one known *H. congesta* var. *congesta* population in the Thomas Creek Watershed is on private land and is threatened by weed invasion.

*Pseudocyphellaria rainierensis,* Rainier pseudocyphellaria lichen, is a Survey Strategy 1 SSAS. This epiphytic species inhabits moist old growth coniferous forests in Oregon and Washington, primarily on the west slope of the Cascades. There is one known population in the Thomas Creek Watershed that is centrally located within the species range. This population is within an LSR, so timber management will not be a disturbance factor. Other natural disturbances, such as landslides and the filling in of wetlands from massive quantities of silt could alter the micro environment and make it unsuitable for *P. rainierensis* in the long-term.

Exotic and Introduced Species of Concern

Noxious weeds and exotic species may threaten native plant communities and wetlands, replace forage for wildlife, create fire hazards, reduce recreational enjoyment, compete with crops and poison livestock. Noxious weeds usually do not become established in native plant communities, until there is disturbance. Some weed species become established after a disturbance and may become extremely tenacious.

Noxious weeds spread primarily along roads, through the spreading of infested gravel, and through other ground disturbing actives such as the yarding of timber.

There are no known sites of Priority 1 (potential new invaders) noxious weed species in the Thomas Creek Watershed. There are several known populations of meadow knapweed, a Priority II noxious weed (eradication of new invaders), located low in the Neal Creek drainage along a major travel route. Priority species definitions are discussed in the Salem District 1992-1997 Noxious Weed Control Program Environmental Assessment.

There are several known occurrences of the Priority III noxious weeds such as Canadian thistle, St. Johnswort, tansy ragwort and Scotch broom in the Thomas Creek Watershed. Established infestations are widespread throughout the landscape. Additional Priority III species populations are expected to be found in the analysis area.

Biological control agents have been released to contain infestations throughout the state for Priority III species and to prevent further spread. Biological control agents will reduce, but not eradicate noxious weed populations. Increased miles of roads and disturbed ground on private lands will increase the suitable habitats for noxious weeds.

Besides noxious weeds, there are several exotic species in the watershed. Although these species are not classified as noxious, they compete with the native vegetation and often have negative ecological impacts. In areas where the soil has been disturbed, such as road cuts, gravel pits, and clearcuts, exotic species have become common. Nonnative species are found in almost every type of habitat throughout western Oregon.

## Animals

Special Status Species, Special Attention Species, and Species of Concern

As part of the Thomas Creek analysis, the occurrence of wildlife species in the watershed was analyzed. A list of vertebrate wildlife species known or highly likely to occur was compiled using BLM Wildlife and Oregon Natural Heritage (ONHP) databases, various wildlife field guides and texts, and knowledge of the habitats present gained through air photo interpretation, GIS information and field reconnaissance. The resulting list is included in Appendix C.1. This list of species was then cross referenced to ONHP's August 1993 publication and the BLM Special Status Species Policy to determine federal, state and bureau status of each species with status. The resulting list of special status species known or highly likely to occur and their habitat preference is included in Appendix C-2. This list includes two Federal Endangered, two Federal Threatened, thirteen Federal Species of Concern, five Bureau Sensitive species, three assessment species and ten tracking species. Species documented to occur in the watershed are denoted with a “D” in Appendix C-2.

There are no known survey and manage sites in Thomas Creek Watershed of any of the animal species or animal groups listed in table C-3 of the ROD. One Survey and Manage mammal species, the red tree vole, is suspected to occur in the Thomas Creek Watershed. Besides the red tree vole, three bats identified as protection buffer species are suspected to occur. They are the long-eared myotis, long-legged myotis and the silver haired bat.

For the purposes of this analysis, all special status, survey and manage or species associated with older forests, standing dead and/or down logs were considered species of concern in the Thomas Creek Watershed. In addition, the golden eagle is a species of concern in the watershed. The golden eagle, a species more typical of open areas east of the Cascades, is known to occur and highly suspected to be a breeding species in the watershed. In western Oregon, they frequently nest in large trees rather than on cliffs, and hunt in recently harvested areas.

Threatened and Endangered Species

Threatened and endangered species habitat was analyzed separately in the watershed analysis process. The peregrine falcon, a Federally Endangered species, is highly likely to occur as a rare migrant, and could possibly occur in the watershed during the breeding season. There are many cliffs that qualify as suitable habitat in terms of cliff height in the Snow Peak, High Rocks and Harry Mountain areas. However, they lack good ledge structure, and are great distances from the nearest large body of water. Bald eagles are suspected as rare migrants in the Thomas Creek Watershed. Due to their hypothetical occurrence as a rare migrant, bald eagle habitat was not analyzed.

The overall habitat condition for northern spotted owls was analyzed across the watershed. Age classes and forest types were classified as suitable for nesting, foraging and roosting; dispersal; or non-suitable habitat. The results are displayed on the Spotted Owl Habitat Class (SOHC) Map, and Table 6, SOHC by Ownership.

Approximately 10 percent of the watershed is considered suitable habitat for nesting, foraging and roosting, 24 percent is dispersal and 66 percent is non-suitable habitat. Of the non-suitable habitat present in the watershed, 71 percent could grow into habitat suitable for spotted owls.

| | BLM/FS | | Private/State | | Total | |
|---|---|---|---|---|---|---|
| | Acres | % | Acres | % | Acres | % |
| Nesting | 3,281 | 25 | 1,750 | 3 | 5,031 | 7 |
| Foraging | 1,343 | 11 | 1,239 | 2 | 2,582 | 3 |
| Dispersal | 1,550 | 12 | 16,762 | 27 | 18,312 | 24 |
| Capable | 6,276 | 48 | 28,749 | 46 | 35,025 | 47 |
| Non-capable | 535 | 4 | 13,539 | 22 | 14,074 | 19 |
| Totals | 12,985 | | 62,039 | | 75,024 | |

**Table 3. Spotted Owl Habitat by Ownership**.

| | Matrix | | | | LSR | | Total | |
|---|---|---|---|---|---|---|---|---|
| | GFMA | | CONN | | | | | |
| | Ac. | % | Ac. | % | Ac. | % | Ac. | % |
| Nesting | 932 | 16 | 1250 | 25 | 1101 | 49 | 3283 | 25 |
| Foraging | 536 | 9 | 392 | 8 | 413 | 19 | 1341 | 10 |
| Dispersal | 917 | 16 | 609 | 12 | 24 | 1 | 1550 | 12 |
| Capable | 3139 | 55 | 2590 | 51 | 546 | 24 | 6275 | 49 |
| Non-capable | 194 | 3 | 196 | 4 | 147 | 7 | 537 | 4 |
| | 5718 | 99 | 5037 | 100 | 2231 | 100 | 12986 | 100 |

**Table 4. Spotted Owl Habitat on federal lands by Land Use Allocation.**

Spotted owl habitat was further analyzed on federal lands and categorized by LUA. See Table 7, Spotted Owl Habitat on Federal Lands by LUA. Approximately 36 percent of the federal land in the watershed is considered suitable habitat for nesting, foraging and roosting, 12 percent is dispersal and 52 percent is non-suitable habitat. Of the non-suitable habitat present on federal land, 92 percent could grow into habitat suitable for spotted owls over varying lengths of time. The Thomas Creek Watershed provides some dispersal to/from the known owl sites south and east. Dispersal of spotted owls is severely limited by the Willamette Valley to the west and the North Santiam River corridor, the cities of Lyons, Mehama, and Mill City to the north. The majority of dispersal between known spotted owl sites in the Cascade physiographic province takes place between the large LSRs east of the watershed. The Thomas Creek Watershed is on the periphery of the Cascade Province, adjacent to the Willamette Valley. For these reasons, the Thomas Creek Watershed was found not to be critical for the dispersal of spotted owls within the Cascade physiographic province.

Portions of three sections within the Thomas Creek Watershed were designated as LSR under the Northwest Forest Plan. These include BLM lands in T.10S., R.2E., sections 11, 15 and 23. This LSR, called the Thomas LSR, totals 1440 acres in size. The Quartzville-Crabtree LSR to the southeast is more than 80,000 acres in size. Portions of this LSR are found on the southeast edge of the watershed on the north side of Harry Mountain Ridge. In addition to these mapped LSRs, there are five unmapped LSRs (core areas) on BLM lands. To the north and east 8 to 10 miles, there is a large LSR in the Molalla River and Little North Santiam drainages, which surrounds the Table Rock and Bull of the Woods Wilderness areas. There is an LSR near the crest of the Cascades surrounding the Jefferson Wilderness, 20 to 25 miles to the east. There are BLM lands in the watershed designated as Critical Habitat for the northern spotted owl (CHU-14). These areas include T.11S., R.4E., sections 4, 5 and 6; T.11S., R3E., sections 2, 4, 6, 9, 10 and 11 and total 2357 acres. According to the Northwest Forest Plan, these lands are in the Matrix (see Land Use Allocation Map).

Once the habitat conditions were analyzed across the watershed, individual known spotted owl sites (KOS) were analyzed. There are eight active KOS site centers in the watershed. In addition, there are five active KOS site centers found just outside the watershed. The KOS were established by buffering the site center with the provincial home range radius for the northern spotted owl. The provincial home range radius for the Cascade province is 1.2 miles. Once the KOSs were established, the habitat within each was classified as either suitable, dispersal, or non-suitable for the spotted owl. The results were compared with U.S. Fish and Wildlife Service guidelines for determining incidental take, for estimating current site viability. A known owl site that has an intact 70 to 100 acre core area, and the equivalent of 40 percent suitable habitat within its provincial home range radius is considered viable.

Of the eight active known spotted owl site centers in the watershed, none were found viable. The two best sites in terms of amount of suitable habitat are on BLM lands in the Thomas LSR. Although analysis indicates they are not viable, they have a long survey history (10 + years) and they seem stable. Both sites have a mapped core area on BLM lands, within the Thomas LSR.

Of the other six KOSs, five are on BLM lands in the Matrix and have an unmapped LSR (core area) associated with them. One is on adjacent private land. These sites were discovered within the last six years. Surveys thus far indicate that two of the six are stable.

There have been an increasing number of sightings of barred owls in the Thomas Creek Watershed, especially in the Lower and Neal Creek sub-watersheds. A pair is consistently present in the Neal Creek sub-watershed.

There are five active known owl site centers found just outside of the Thomas Creek Watershed. Based on past surveys of these sites and due to their location, surrounding topography, and past harvest patterns, the Thomas Creek Watershed appears not to contribute significantly to the viability of any of the five. Three of them are immediately to the south of the watershed in LSRs and represent the closest viable KOSs. All three are over the main Thomas Creek and Quartzville/Crabtree divide. Current conditions of spotted owl habitat and KOSs on federal lands were estimated and the results are shown in Table 8.

### Exotic and Introduced Species of Concern

| | Total | Total Protected | Total Unprotected |
|---|---|---|---|
| **Acres within Boundary** | **75,026** | **6,563 (9%)** | **68,463 (91%)** |
| **Acres of Federal** | **12,986** | **6,563 (51%)** | **6,423 (49%)** |
| **Federal Spotted Owl Habitat Capable Acres** | **12,450** | **6,261 (50%)** | **6,189 (50%)** |
| **Total Suitable Spotted Owl Habitat Acres** | **7,613** | **2,767 (36%)** | **4,846 (64%)** |
| **Federal Suitable Spotted Owl Habitat Acres** | **4,624** | **2,767 (60%)** | **1,857 (40%)** |
| **Total Spotted Owl Sites** | **8** | **2** | **6** |
| **Spotted owl sites (>40%)** | **0** | **0** | **0** |
| **Spotted owl sites (30-40%)** | **2** | **1** | **1** |
| **Spotted owl sites (20-30%)** | **2** | **1** | **1** |
| **Spotted owl sites (<20%)** | **4** | **0** | **4** |

**Table 5. Current Status of the Spotted Owl and Its Habitat Within the Thomas Creek Watershed**

There are four introduced wildlife species that are of concern. The bullfrog is found at lower elevations in the watershed and is known to prey on and displace native species such as the red-legged frog and western pond turtle. The European starling and house sparrow are known to displace cavity nesting birds such as violet-green swallows, purple martins, and bluebirds. They are found at lower elevations in the watershed, usually near human settlements, although the starling has been observed at mid to high elevations. The eastern cottontail is thought to have displaced the native brush rabbit at lower elevations in the watershed.

## Invertebrates

Virtually nothing is known about the occurrence of the various invertebrate species in the Thomas Creek Watershed. No attempt was made to develop a list of invertebrate species that could occur in the watershed due to lack of information.

There are ten special status species aquatic invertebrates: eight caddisflies (Trichoptera) species and two beetles, that may occur in the Thomas Creek Watershed (Appendix F.2). Most of these species are only known from only one or two locations in Oregon. None are known to occur in Thomas Creek or any of its tributaries. However, their assumed habitats and distributions indicate that there is a possibility of their occurrence in the Thomas Creek Watershed. The species that may occur in the watershed are those that occur in streams and springs on the west slope of the Cascade Range or within the Willamette Valley. Specific aquatic habitat requirements for most of these species are unknown. Several species in Appendix F.2 have only been recorded at elevations higher than those that occur in the Thomas Creek Watershed. However, they have been included because their known distributions are unknown due to a lack of sampling.

Since many aquatic insects have flying adult life stages, they can disperse across watersheds to areas with suitable habitat conditions. Many immature aquatic insects also drift downstream. These dispersal mechanisms provide for dispersed populations that protect the species from extinction should a particular stream or habitat be altered or destroyed. These dispersed populations often provide individuals for recolonizing areas where local populations may have been destroyed (provided suitable habitat exists). However, some species may have evolved at a single location and the alteration of that habitat may result in extinction of the species.

Habitat for aquatic invertebrates may be affected by floods, debris torrents, sediment, changes in water temperature, drying of springs, and alteration of food supply (e.g., riparian stands that were dominated by conifer species may now be dominated by deciduous species). The impact of these kinds of disturbances to the aquatic invertebrate communities in the Thomas Creek Watershed is unknown. Observations along Thomas Creek in June 1996 indicate that aquatic invertebrate populations and diversity were severely impacted by the February flood. Mayfly and caddisfly larvae should be common to abundant on cobbles found in riffle habitats; however, observations of stones in June showed that few, and usually no, mayflies or caddisflies were present. Wood cased caddisflies were observed on silty substrates in some pool habitats. Riffle and pool habitats were embedded in fine sediments. It is likely that streambed substrates were moved during the flood. Shifting substrates can dislodge and crush benthic invertebrates.

## Fish

At Risk Stock Anadromous Fish

## Salmonid Species Assessment and Distribution

Much of the most productive habitat in the Santiam subbasin has been blocked by dams on the North and Middle Santiam rivers. Detroit Dam and the downstream Big Cliff Dam, constructed in 1953 on the North Santiam, and Foster and Green Peter dams, constructed in 1953 on the South and Middle Santiam rivers, have blocked anadromous fish passage to important upstream spawning and rearing areas. As a result of these dams, wild anadromous fish production is now restricted to lower mainstem and tributary streams, such as Thomas Creek.

Hatchery production of spring chinook was increased as mitigation for the dams on the South Santiam. Hatchery releases are derived primarily from native South Santiam stock. No releases were made into Thomas Creek before 1994. Skamania stock summer steelhead were introduced into the South Santiam River in 1969 (Wevers et al., 1992). There are no hatchery releases and no documented production of summer steelhead in Thomas Creek.

The February 1996 flood appears to have affected Thomas Creek. Spawning gravels might be heavily embedded with fine sediment; increased fines have been associated with increased mortality of eggs and alevins in the gravels. ODFW snorkelers observed numerous young-of-the-year steelhead during surveys conducted in August 1996. These fish are the progeny of steelhead that spawned one to two months after the February 1996 flood. Those fish would have spawned in gravels with elevated amounts of sediment. Egg survival was likely enhanced by 1) gravels in the redds (egg nests) were cleaned during redd construction, and 2) streamflows after spawning occurred were not high enough to move in-channel sediment. However, survival to emergence was still probably lower than before the flood.

### Winter Steelhead Trout

Status: Depressed

The Santiam River subbasin provides the majority of the winter steelhead production in the Willamette Basin. Runs of Willamette Basin early-run and late-run winter steelhead have been declining since the late 1980s and are at or near record low numbers. In 1996, a record low number of 1,322 late-run winter steelhead were counted at Willamette Falls. Early-run fish are of hatchery origin, while native fish make up the late-run. In February 1994, the National Marine Fisheries Service received a petition to list Willamette River winter steelhead under the Endangered Species Act. In August 1996, the National Marine Fisheries Service determined that Upper Willamette River steelhead did not warrant listing (Federal Register 1996).

Thomas Creek, managed as a wild steelhead fishery by ODFW, is considered a key area for late-run, wild fish production. ODFW spawning surveys in Thomas Creek and Neal Creek indicate wild steelhead escapement has been declining since the late 1980s (Table 9). Sport catch data for Thomas Creek (Table 10) also indicates a downward trend starting in 1990.

Steelhead are found in approximately 24 miles of streams in the watershed. Most of this habitat is confined to the mainstem of Thomas Creek, below a falls at river mile 31.5. The lowest portions of Bear, Devils Den, Indian Prairie, Ella, and Hortense creeks may also be used by steelhead. Steelhead are also found in the lower four miles of Neal Creek.

Little information is available concerning hatchery releases of winter steelhead in the Thomas Creek Watershed. Wevers et al. (1992) show only that 223,889 winter steelhead fry were released into Thomas Creek in 1980.

Observations of numerous steelhead between river miles 29 and 31.5 in August 1996 indicate fish survived the February flood. Survival would have been highest in areas where fish could find refugia from high water velocities and shifting bedload. Likely refugia include: off-channel habitats, inundated riparian vegetation, areas behind large boulders and large woody debris.

Chinook Salmon

Status: Fall Chinook - Introduced, incidental occurrence only
Spring Chinook - native run maybe extinct.

Spring-run and fall-run chinook salmon may be found in Thomas Creek

Any fall chinook found in Thomas Creek are incidental strays from the North Santiam River (J. Haxton, personal communication). Documented spawning has occurred in the lower 12 miles of Thomas Creek, below the analysis area.

It is likely that the native run of spring chinook into Thomas Creek is extinct and that most of the present run of wild spring chinook are strays from the McKenzie River (J. Haxton, personal communication). As much as 85 to 95 percent of the spring chinook run in the Willamette River, above the falls, is hatchery produced. These hatchery fish are derived primarily from native Willamette stock. In 1994, ODFW released 25,000 - 30,000 smolts (South Santiam stock) into Thomas Creek in an attempt to restore a wild run. The first returns of adults from fish stocked in Thomas Creek were expected in spring of 1996, with most returns occurring in 1997 and 1998. In August 1996 ODFW observed 15 spring chinook adults in the three miles below the falls at river mile 31.7.

Spring chinook spawn and rear in Thomas Creek from Jordan Creek to the falls just below Hall Creek (approximately 12.5 miles). Spring chinook do not utilize tributary streams.

**Table 6. Winter steelhead redds per mile in Thomas Creek and Neal Creek.** (Wevers, et al, 1992; W. Hunt, ODFW, pers. communication).

| Stream | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Thomas Creek. | 25 | NS | 22 | NS | 14 | 3* | NS | 14 | 16 | 10 | NS** |
| Neal Creek. | 50 | NS | 26 | 20 | 12 | 6* | 20 | 5 | 3.8 | 12.5 | 5 |

NS - no survey
* - high water year, redds were obliterated
** - no survey due to high turbidity

**Table 10. Winter steelhead sport catch in Thomas Creek.** (ODFW, unpublished data)

| 1982-83 | 1983-84 | 1984-85 | 1985-86 | 1986-87 | 1987-88 | 1988-89 | 1989-90 | 1990-91 | 1991-92 | 1992-93 | 1993-94 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 24 | 51 | 72 | 27 | 25 | 41 | 29 | 61 | 12 | 8 | 0 | 0 |

Resident Trout
Status: Unknown

Resident rainbow trout and cutthroat trout are found in the mainstem of Thomas Creek below the falls at river mile 31.7, in Indian Prairie Creek, and in Neal Creek above the falls at river mile 5.0. Above the falls on Thomas Creek (river mile 31.7), only cutthroat trout are found. It is assumed that all Thomas Creek tributaries that support resident fish contain cutthroat trout. There is about 91 miles of habitat for resident trout.

# Aquatic

## Water Quality

> ***What beneficial uses dependent on aquatic resources occur in the watershed? Which water quality parameters are critical to these uses? What are the current conditions and trends of beneficial uses and associated water quality parameters? What were the historical water quality characteristics of the watershed? What are the natural and human causes of change between historical and current water quality conditions? What are the influences and relationships between water quality and other ecosystem processes in the watershed?***

Water quality in Thomas Creek is managed to protect recognized beneficial uses. The *Oregon Department of Environmental Quality (DEQ) 1988 Oregon Statewide Assessment of Nonpoint Sources of Water Pollution* identified the lower reach of Thomas Creek as impacted by nonpoint source pollution. Water quality problems identified by the DEQ included moderate problems for overall water quality and water quality affecting fish and aquatic habitat. Information used by the DEQ for the streams in the watershed was based on data for lower Thomas Creek and on observation in upper Thomas Creek. Thomas Creek is the only stream in the watershed designated by DEQ as water quality limited.

In the lower reaches of the watershed the probable cause of changes in water quality is surface erosion while in the upper reaches the causes are surface erosion, landslides, and road runoff. Alterations for the lower Thomas Creek include water withdrawal and baseflow depletion. Associated land uses include forestry, irrigation, grazing, and road construction and transportation.

Nutrient information is not available for the Thomas Creek Watershed.

Baseline information to assess the current status of ground water quantity or quality is not available. Recent years of below normal rainfall (1985-1994) have reduced recharge of ground water stores. However, higher than average precipitation during the past two winters has partially replenished the stores. The number of water rights issued for ground water supplies has increased over the years mostly for irrigation.

Water bodies in the Thomas Creek Watershed include wetlands, smaller wet areas, lakes, ditches, and streams. Wetlands in this watershed may be identified by the U.S. Fish and Wildfire Service in their National Wetlands Inventory and are classified as riverine or palustrine (marsh). Wetlands in this inventory are large enough to be seen on aerial photographs. Additional wetlands may be

| Water Bodies | |
|---|---|
| Streams - 1st order | 351 miles |
| 2nd order | 149 miles |
| 3rd order | 78 miles |
| 4th order | 31 miles |
| 5th order | 18 miles |
| 6th order | 16 miles |
| 7th order | 5 miles |
| Lakes | 267 acres |
| Perennial streams | 297 miles |
| Fish bearing streams | 91 miles |

**Table 11. Water Bodies**

found during a site-specific project. Nearly 3,000 acres of the watershed occur on floodplain and areas with hydric soils that may be wetland areas. Additional wet areas may be identified on BLM lands by the TPCC rating of FW areas. FW refers to the areas with a high water table that have standing water during portions of the year and occur on hydric soils. There are approximately 648 miles of stream in the Thomas Creek Watershed

These include 91 miles of fish-bearing streams, and approximately 206 miles of permanently flowing nonfish bearing streams and 351 miles of intermittent streams. Sixty-three lakes totaling 267 acres also occur in the watershed. Limited inventory of nonfish-bearing streams has been conducted to decide whether they are permanently flowing or intermittent. See Stream Order map.

Turbidity was identified as a nonpoint source pollution type by the Oregon DEQ report. An excess of fine sediments such as silt or clay can cause turbidity, suspended sediments, and buried cobbles and gravels. Sedimentation is generally associated with storm activity and is generally highest in the fall and winter. However, heavy sedimentation in Silt Creek began in the winter of 1994/1995 and continued throughout the year. It caused Thomas Creek to run turbid from Silt Creek downstream. Before this period local residents do not remember such high levels of turbidity

Accelerated rates of upland erosion from logging and road building, can often contribute to increased sedimentation. One long-term monitoring project on a timber sale area within this watershed, McCully's Last Stand, is giving baseline data on pre, during and post logging sedimentation and water temperatures. This project is not completed and the data collected thus far has yet to be completely analyzed. The results will indicate how similar areas respond to logging activities and water quality.

Older roads with poor locations, inadequate drainage, maintenance, and surfacing can erode and cause sedimentation in stream habitats. In 1992 the uphill side of the culvert on road no. 10-2-7.2 was plugged by a rock. This caused the water flow pattern to shift to the impervious layer below, resulting in the road sliding out. The slide area has since stabilized after depositing significant amounts of sediment into Thomas Creek.

Temperature affects all aspects of water quality, particularly those influenced by biological activity. Many different factors influence stream temperatures in the Thomas Creek Watershed. Low summer flows and high summer air temperatures combine to cause stream temperatures that can be detrimental to aquatic life. Some stream reaches in Thomas Creek have low gradients (see Table 16). Lack of riparian vegetation (see riparian condition discussion) and high width to depth ratios can also cause high stream temperatures. Natural disturbances like droughts and floods also influence stream temperature. Human disturbances include water right appropriations and removal of riparian vegetation.

Low dissolved oxygen levels have been identified by the DEQ as a nonpoint source pollution type in Thomas Creek. Dissolved oxygen concentrations are inversely related to water temperature, so low levels of dissolved oxygen would be related to high stream temperatures.

## Hydrology

> ***What are the dominant hydrologic characteristics and other notable hydrologic features and processes in the watershed? What are the current conditions and trends of the dominant hydrologic characteristics and features prevalent in the watershed? What are the historical hydrologic characteristics and features in the watershed? What are the natural and human causes of change between historical and current hydrologic conditions? What are the influences and relationships between hydrologic processes and other ecosystem processes?***

Hydrologic processes include interception, transpiration, infiltration, subsurface flow, and stream flow. Increased magnitude and frequency of peak flows, reduced base flow, increased sedimentation, disruption of subsurface flow, and reduced infiltration rates are potential effects that can occur from changes in upslope vegetation and soil conditions.

Streamflows fluctuate with seasonal variation in precipitation and with variation in rain-on-snow events in transient snow zone areas. Approximately 80 percent of the annual water yield occurs between November and April although this percentage decreases in years with unusually moist summers such as 1995. Rain-on-snow events generally occur in March and April. The lowest streamflows generally occur in August through October. (USGS reports).

Natural disturbances can affect upslope and instream conditions. Winter storms have brought the most devastating floods to the stream courses of northwestern Oregon. The floods of recent history took place in 1964 and 1996.

Low summer rainfall results in low summer stream flows. Many streams, while not drying up, do exhibit low flow. Along with this baseflow depletion, human disturbances contributing to low flows are water withdrawal. This becomes critical downstream with water rights users for irrigation, livestock watering, domestic use, and others. Many of these uses come during the year when streamflow is lowest. A list of downstream beneficial uses and present water rights is given in Appendix E.2.

Timber harvesting, road building, and soil compaction are the primary upslope human disturbances affecting hydrologic processes in this watershed. Roads and soil compaction due to timber harvesting and other land management related activities reduce infiltration, accelerate erosion and change the surface and sub-surface flow patterns. Proximity of roads and compacted areas to water bodies influences the magnitude of the impact. These same activities, especially timber harvest in the transient snow zone areas, also affect the timing and magnitude of peak flows.

Vegetation removal temporarily reduces interception and transpiration and allows more precipitation to reach the soil surface and drain into streams or become ground water. Conversely, densely vegetated areas have high interception and transpiration rates, therefore the quantity of water reaching ground and surface water bodies is decreased. Distribution of vegetative condition classes provides some insight as to vegetative cover and hydrologic response. Acres of vegetation by condition class are available for BLM and non-BLM ownership. Some sub-watershed basins have areas of recent vegetation removal on federal and non-federal lands. The percentage of lands in the various vegetative condition classes has been given in previous sections and will be used with hydrologic precipitation classes to determine hydrologic recovery index.

Soil compaction resulting from yarding corridors also affects the hydrology within a watershed by reducing the infiltration rate. Reduced infiltration rates result in increased surface runoff. Soil compaction on BLM lands is identified though the TPCC mapping. The FSR2 rating denotes fragile soils with low moisture due to compaction. Twenty-four percent, 2,998 acres, of the BLM ownership is identified as compacted. This land is mostly in the S1/2 of T. 10 S., R. 1E., T. 10 S., R. 2 E., and T. 11 S., R. 2 E., and also in minor acreages in other areas of the watershed. Sixty-eight percent of the watershed acreage contains soils that are highly compactable (clay loams, silty clay loams, and silt clays). Nearly all entries made in these areas with any kind of heavy machinery would cause compaction. Vegetation removal increases water available to the stream because of the temporary loss of the transpiration pump from the standing trees. In the transient snow zone timber harvest can alter streamflow regime and cause increased peak flow levels especially during rain-on-snow events. This effect can be significant as 41 percent of the watershed lies in the transient snow zone.

Hydrologic recovery after vegetation removal can take decades to complete depending on the precipitation zone and the inherent productivity of the forest. For the purposes of this analysis, the hydrologic recovery rates are listed in Table 12 along with values for Thomas Creek. The combined effect of human disturbances in the watershed is not fully understood

| Zone | Hydrologic Recovery | | Hydrologic Recovery Stage | Thomas Creek | |
|---|---|---|---|---|---|
| | Conifer | Hardwood | | Acres | % |
| Rain | 20 yrs | 30 yrs | Mature | 38,102 | 51 |
| Transient Snow | 30 yrs | 40 yrs | Transition | 19,658 | 26 |
| Snow Dominated | 40 yrs | 50 yrs | Maximum Erosion | 17,267 | 23 |

**Table 12. Hydrologic Recovery**

The Thomas Creek Watershed has 41 percent of the land in the transient snow zone extending through many sub-watersheds. Therefore, rain-on-snow events can impact peak flows during the late winter and early spring. The Washington Department of Natural Resources developed a precipitation enhancement index as part of watershed assessment method (Draft 1.2). This index incorporates vegetation condition and precipitation zone to come up with a hazard index for peak flows. A modification of this method was devised for the Hamilton Creek Watershed Analysis. A preliminary analysis was worked out for Thomas Creek, which received a moderate enhancement index, 4.6 on a scale of 1-9.

## Riparian Condition

> ***What is the current functioning condition of riparian areas within the watershed? How does this condition compare with historic conditions and the expected range of natural variation? What are the limitations on riparian areas to achieving proper functioning condition? Are these limitations within the BLM's control to change? What and where are the restoration opportunities to improving functioning condition within the watershed?***

Stream zones are areas of significant physical, chemical and biological functions and processes. These functions and processes are included in the checklist for “Properly Functioning Condition.” (USDI/BLM, 1993) The three main components of riparian areas are the vegetation, hydrology, and soil erosion/deposition. Thirteen processes and functions within these components make up “Properly Functioning Condition.” Good riparian conditions provide adequate riparian habitats, high levels of potential large woody debris and long-term large woody debris recruitment, and structure for dissipation of stream energy. Riparian condition can be divided into three main categories: properly functioning condition, functioning at risk (upward or downward trend) and nonfunctional. The definitions for functioning condition are listed in the *BLM Riparian-Wetland Initiative for the '90's* and the various technical publications that support it. It seeks to have 75 percent of stream reaches on BLM land in properly functioning condition by 1997. Considering inventory and restoration still to be done, this initiative should be extended another ten years into a Riparian/Wetland Initiative for 2000.

Eight miles of riparian surveys were completed during the summer of 1995. The results of this survey were as follows:

| Functioning Condition | Perennial/Fish Bearing | Perennial/Non-fish Bearing | Non-perennial/Non-fish Bearing |
|---|---|---|---|
| Properly Functioning Condition | 13.7% | 20.8% | 1.3% |
| Functioning at Risk (upward trend) | 36% | 28.2% | |

**Table 13. Functioning Condition of Surveyed Streams**.

Assuming the results of the survey hold true for the watershed, most of the stream reaches and associated riparian vegetation are functioning-at-risk with an upward trend. Riparian conditions in Thomas Creek have deteriorated in nearly all sub-watersheds due to heavy logging, road building, and debris flows and landslides triggered by recent heavy precipitation, flood events, and human activities.

Flowing water follows a meandering course producing areas of deposition and erosion. This stream measurement is termed the sinuosity index and ranges from a low of one, a simple, well-defined channel, to a high of four, a highly meandering channel. Sinuosity, has been low in all stream reaches, based on riparian surveys done in the summer of 1995 (before the flood). Intermittent and perennial fish bearing reaches nearly all had sinuosity values of less than 1.2.

Coarse woody debris was also inventoried in the survey. The results are shown below:

| LWD Sizes | Number of Pieces per Mile | | |
|---|---|---|---|
| | 12 - 24 Inches | 24 - 36 Inches | 36+ Inches |
| Intermittent | 70 | 30 | |
| Perennial | 51 | 29 | 21 |
| Fish Bearing | 32 | 17 | 21 |

**Table 14. Coarse Woody Debris**

Streambank class was variable throughout all stream reaches. Bare cobble and vegetatively stable were the two most common classes used.

The riparian vegetation in the Thomas Creek Watershed encompasses many different age classes. They are shown in Table 15.

| Age Classes | Acres | % |
|---|---|---|
| 0-10 years | 356 | 4 |
| 11-20 years | 497 | 5 |
| 21-30 years | 718 | 8 |
| 31-40 years | 659 | 7 |
| 41-50 years | 285 | 3 |
| 51-100 years | 656 | 7 |
| 101-200 years | 1701 | 18 |
| Non-forest | 4524 | 48 |
| Total | 9394 | |

**Table 15. Riparian Vegetation by Age Class.**

In the upper stream reaches of Thomas Creek, past riparian logging has created riparian areas characterized by dense, young conifer stands or dense stands of hardwoods and brush. In these areas, a lack of a diverse age/size structure and a diverse composition of vegetation present will result in a lack of large woody debris necessary for stream structure. Road construction has also impacted riparian vegetation as evidenced by 2,368 road/stream intersections. This averages about 160 intersections for every square mile of riparian habitat

Riparian vegetation is a source of coarse woody debris for stream channels, floodplains, and riparian zones and, in headwaters, may be the only source. Some reaches of Thomas Creek, Jordan Creek, and Neal Creek lack adequate quantities of large woody debris. The stream/riparian surveys done in the summer/fall of 1995 indicated that lack of large woody debris now and in the future was the major factor in riparian reaches evaluated as functioning at risk, especially in Neal Creek.

## Fish Habitat Condition

> ***What is the current condition of fish habitat in the watershed? Is there evidence that fish habitat conditions have changed from historic conditions? Have changes occurred in the amount and distribution of large woody debris? Have management activities and/or natural processes affected fish habitat conditions, such as the supply of large wood or the amount of quality pool habitat? Are there opportunities to improve fish habitat conditions? If so, where do these opportunities occur?***

### Habitat

There is little fish habitat data available for the Thomas Creek Watershed. The mainstem of Thomas Creek, from Jordan Creek to just above Hall Creek, was surveyed by ODFW in 1992. The distance surveyed is about 12.5 miles. No inventory has been completed on Thomas Creek above the falls (approximately 10 miles). About 1.3 miles of Neal Creek has been surveyed, all of which is above falls that are impassable to anadromous fish. The BLM surveyed about 0.8 miles of Ella Creek. At the time of writing, the effects of the February 1996 flood on the recorded fish habitat conditions have not been documented.

Thomas Creek and Neal Creek were surveyed in the 1940s and 1950s. However, only narrative information is available for Thomas Creek mainstem above Jordan Creek and for Neal Creek (Willis et al. 1960; McIntosh et al. 1994).

## Pool Habitat

Pools are a critical habitat element for many fish species, and especially for salmonids.
Deep pools provide cover for fish, holding and rearing habitat for juvenile and adults fish, refuge from high flows and may provide cold water refugia when water temperature increases occur.

The surveyed reaches of Thomas Creek mainstem have good pool quality. Above Criminal Creek, the mainstem of Thomas Creek is constrained by adjacent hillslopes. Pools that develop in large-order, constrained channels tend to be large and deep and are anchored geomorphically. These large pools may be relatively insensitive to management activity effects, being affected more by flow and geology (USDA-FS 1994). Numerous deep pools exist between Criminal Creek and Hortense Creek. There were no pools in Thomas Creek with large woody debris, LWD, however, given the size of Thomas Creek (51 to 93 feet wide active channel width), little LWD in the pools is not unusual. The deep pools in the mainstem can provide summer holding habitat for adult spring chinook and winter holding habitat for winter steelhead adults.

The surveyed (approximately two miles) tributary streams, Neal Creek and Ella Creek, have fair pool quality. Overall, the tributary streams have high stream gradients and abundant deep pools would not be expected. Low levels of LWD in the tributaries are likely a factor contributing to lower pool quality (see LWD section). Excessive sedimentation in Silt Creek has filled-in most of the pools in this stream. However, it is not known if this stream was fish-bearing.

While no post flood data is available, the quantity and quality of pools in Thomas Creek have probably changed. The presence of fine sediments and what appears to be new gravel/cobble bars indicate that the channel configuration may have changed considerably with the flood. Channel changes would be the greatest in low gradient, unconfined reaches where bedload deposition and aggradation could occur. The likely sources of new substrate materials are landslides, debris torrents, and erosion of streambanks.

## Spawning Gravel Quantity and Quality

The available data suggested that Thomas Creek had relatively good quantities and quality of spawning habitat before the February 1996 flood. Between river miles 19 and 30.5, there is about two miles of riffle habitat with a gradient of 1 to 2 percent, which provide good spawning habitat, particularly for chinook salmon.

Gravel in the surveyed tributaries is limited. These tributaries, for the most part, are not available to anadromous fish. Ella Creek is typical of the upper tributaries to Thomas Creek because it is a relatively high gradient stream with little riffle habitat. Several tributaries in the upper portion of the watershed have been impacted be debris torrents and probably contain limited quantities of gravels.

Instream gravels can be highly affected by flood events. High streamflows may completely flush gravels out of the channel to floodplains and downstream areas. High flows can cause bank erosion and landslides that can be either detrimental or positive for spawning habitat. Erosion and slides can negatively impact spawning gravels by depositing large amounts of fines in spawning areas; however, they may also be beneficial if they introduce new gravels into channels that are lacking gravel.

Gravel quality was significantly degraded by the February 1996 flood. Observations in June 1996 indicated that spawning gravels are heavily embedded and cemented with fine sediment. A heavy layer of silt and sand-covered slackwater areas along the channel margin and in backwater pools. The source of this sediment is the many landslides within the drainage.

Mass earth movement in Silt Creek sent considerable fine sediment into Thomas Creek. While this slide caused high turbidities in Thomas Creek during high and low flows, its effect on spawning habitats in Thomas Creek is unknown, particularly to anadromous spawning which occurs several miles downstream from the confluence of Silt Creek and Thomas Creek. In August 1996, ODFW snorkelers observed young-of-the-year steelhead in Thomas Creek, indicating that some spawning has been successful below Silt Creek (John Haxton, ODFW, personal communication).

## Off-Channel Habitat

Off-channel habitats include side (secondary) channels and backwater habitats. These habitats can be critical rearing areas for newly emergent salmonid fry. Off-channel habitats may also provide lower velocity refugia for fish during high flows. Secondary channels are more likely to develop in unconstrained and moderately constrained, low gradient reaches.

From Jordan Creek to the confluence of Criminal Creek (6.4 miles), Thomas Creek generally flows through a broad valley and has a flat gradient (0 to 2 percent). Secondary channel habitat, comprising 21 percent of the total stream area, is abundant. For the next six miles, Thomas Creek continues to have a low gradient (0-4 percent), but flows through a moderately constrained channel. Secondary channels make up less than 3 percent of the total available habitat.

## Large Wood Debris (LWD) in Streams

In-channel LWD: LWD is an important element in stream habitat for fish. Functionally, LWD helps to dissipate stream energy, retains gravels, increases stream sinuosity and length, provides diversified habitat for fish and other aquatic organisms, and slows the nutrient cycling process. LWD not only provides a direct source of instream and overhead cover, but it also functions as an instream agent to provide and maintain quality pools, surface turbulence, and locations for catchment of small woody debris.

It has been recommended that “key” LWD pieces should be at least 24 inches in diameter and greater than 50 feet in length (USFS and BLM 1994). The recommended density of LWD is 80 pieces/mile.

The 1996 flood had an unknown effect on the amount of LWD in the stream channels. Large flood events move much of the LWD downstream, particularly in mainstem channels. LWD in tributary streams may be flushed downstream by high flows or debris torrents or it may remain if flows are not high enough to float the larger pieces. Landslides that occur during storm events are also one primary source of new LWD.

Before the flood, Thomas Creek had little instream LWD. Densities for key LWD pieces for reaches 1, 2, and 3 were 5.3, 10.7, and 11.2 pieces/mile, respectively. All reaches had less than the 80 pieces/mile recommended level. Thomas Creek is a seventh order stream below Neal Creek (river mile 17) and a sixth order stream upstream to Hall Creek (river mile 31). LWD is most abundant in third and fourth-order streams that have intermediate sized channels. In fifth-order and larger streams, the channel widths become wider than the length of a typical piece of LWD. LWD is most likely to be stable, i.e., remain in the stream, when its length is longer than the active channel is wide. Mean active channel widths in Thomas Creek range from 51 to 93 feet wide (reaches 1-3). Reach 1, with the widest active channel width ( 93 feet), had the lowest amount of LWD (5.3 pieces/mile). In wide channels, LWD is more likely to be found along the channel margin where it has less influence on the thalweg and influences temporary storage of sediment and side-channel/off-channel habitats along the stream’s edge. Cursory observations in June 1996 indicated that LWD was still limited, though a couple new accumulations were observed on gravel bars next to the channel.

In larger streams, the morphology of the channel influences the distribution of LWD. LWD is likely to be less abundant in constrained channel reaches and more abundant in unconstrained reaches. Low gradient reaches are likely to have more LWD than steeper reaches. Low gradient, unconstrained reaches are depositional areas where LWD is more likely to interact with the stream and/or its floodplain.

In 1995, the BLM collected LWD data from several tributary streams to Thomas Creek. Two streams surveyed, which also contain resident fish, are Criminal Creek and upper Neal Creek. These surveys inventoried all LWD within the active channel that was greater than 12 inches in diameter and longer than the active channel width. Both streams had less than desirable amounts of LWD. There were 19 to 40 key pieces/mile (diameter greater than 24 inches), much less than the recommended 80 pieces/mile.

<u>Potential for LWD input</u>: Recruitment of LWD into a particular stream reach can occur when wood is floated downstream from an upstream reach, or when trees next to the stream fall into the channel. However, either way, the ultimate source for inchannel LWD is the adjacent riparian forest. The potential for suitable LWD input is partially dependent on the size and health of trees in the riparian area. Trees in young stands ( less than 40 years) may be too small to affect stream morphology. Trees in the 40 to 80 year age classes may have adequate size. However, these stands are vigorous and little mortality is likely to occur for several decades. Coniferous wood is preferred to deciduous wood because it is longer lasting in the aquatic environment.

Agricultural lands are considered to have a low potential whatever the tree species present or tree age. This is because the riparian areas are constricted to a narrow corridor, often only one or two trees wide, on each side of the channel. Any large trees that may fall into the channel are likely to be removed to prevent bank erosion and the loss of agricultural land.

In the watershed, 66 percent of the riparian areas have a low potential to provide LWD to streams, 26 percent have a moderate potential, and only 8 percent have a high potential. There are two primary factors causing the high percentage of riparian acreage with low potential: 1) the large number of acres with young conifer stands, and 2) the large number of acres rated as nonforest (much of this is agricultural land).

The highest amounts of nonforest riparian areas occur in the Lower Thomas and Neal Creek subwatersheds (Appendix F.4). Riparian areas with young (less than 40 years) conifer stands are common in all sub-watersheds, but are particularly prevalent in the Lower Mid Thomas, Upper Mid Thomas, and Upper Thomas sub-watersheds (Appendix F.4). The poor recruitment potential of these upper sub-watersheds (Figure 12) is of particular concern because these areas provide most of the fish habitat in the watershed, and are the main source areas for LWD that could float down to lower stream reaches. Riparian areas in the Lower Mid Thomas sub-watershed have the highest potential to provide LWD to streams because there are more than 600 riparian acres with conifers older than 80 years.

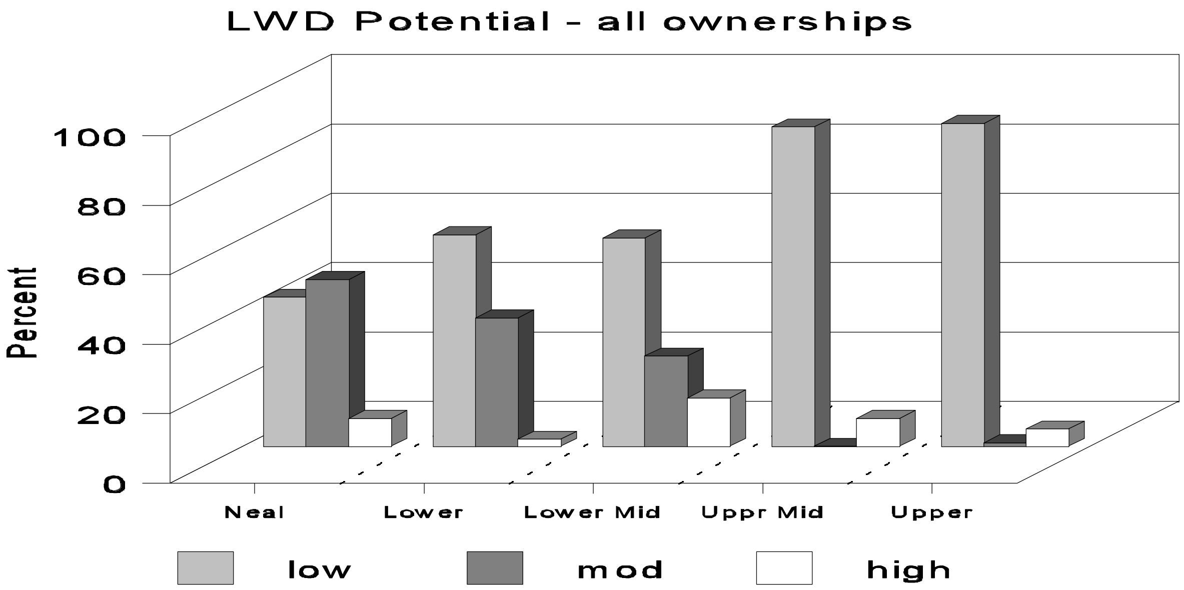


**Figure 12. Potential for LWD recruitment for all ownerships.**

LWD recruitment potential for only the BLM/FS lands is shown in Figure 13. Overall, 52 percent of the federal lands have a low potential, 19 percent have a moderate potential, and 30 percent have a high potential for LWD recruitment. Historic timber harvest on federal lands affects the age-class distribution of trees in the riparian areas. In the Neal Creek, Lower Thomas, and Lower Mid Thomas sub-watersheds have highest amount of riparian areas rated as “moderate potential.” This

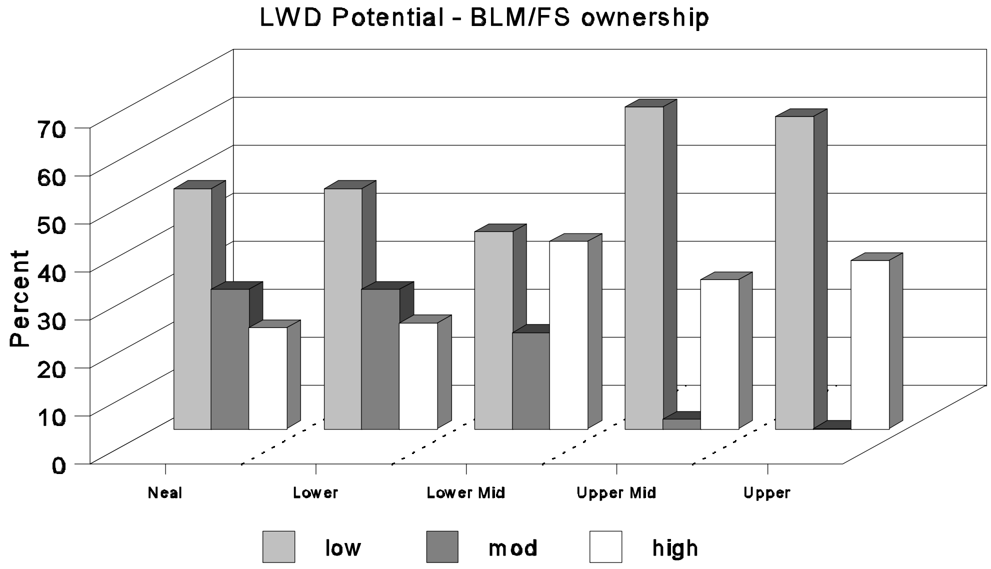


**Figure 7. Potential LWD on BLM/FS Lands.**

is because these lower elevation areas were partially logged 40 to 60 years ago and timber regrowth has occurred. Timber harvest on federal lands in the Upper Mid Thomas and Upper Thomas sub-watersheds has occurred more recently so the riparian areas are either young (low potential) or older, unmanaged stands (high potential) (Appendix F.4). In terms of actual acres available, the sub-watersheds with the greatest amount of riparian areas rated a “high potential” are the Neal, Lower Mid Thomas, and Upper Mid Thomas sub-watershed basins (Appendix F.4).

### Stream Gradient and Habitat Potential

The fish habitat capability of a stream is influenced by many factors, one of which is gradient. In natural systems, flat (0 to 2 percent) and low (2 to 4 percent slope) gradient reaches, from now on called low gradient reaches, typically support more diverse fish populations and account for a high percentage of the fish production. Low gradient reaches are areas where the channel widens, large wood accumulates, and water velocities are lowered. Floodplains, which dissipate high flow energy and provide crucial quiet water habitat for juvenile fish during floods, are often associated with unconfined low gradient reaches. Low gradient reaches are sensitive to increases in sediment and temperature, and decreases in large wood.

Low gradient reaches are abundant in the lower portions of the Thomas Creek Watershed. Lower Thomas Creek (84 percent) and Neal Creek (50 percent) sub-watersheds are dominated by low gradient streams flowing through broad valleys (Table 16). The Thomas Creek mainstem and significant portions of Jordan Creek, Neal Creek, South Fork Neal Creek, and Burmester Creek have flat stream gradients (0 to 2 percent). Generally, these streams provide less favorable habitat for salmonids, though Neal Creek is an important steelhead spawning stream. Thomas Creek, downstream of the confluence with Neal Creek, has considerable areas of mud and silt substrate, and has water quality problems relating to sediment and dissolved oxygen. South Fork Neal Creek and Burmester Creek have little potential for anadromous fish production.

Between Jordan Creek and Indian Prairie Creek, Thomas Creek has a flat gradient constrained between broad valley terraces that are presently used for fields and pastures. A floodplain has developed between these terraces on which secondary channels have formed. These secondary channels may provide important side-channel and off-channel habitats.

The upper portions of the watershed (Lower Mid Thomas, Upper Mid Thomas, and Upper Thomas sub-watersheds) are characterized by the generally low gradient Thomas Creek mainstem fed by short, steep tributary streams. Thomas Creek is constrained by adjacent hillslopes and there is little floodplain development. Tributary streams from the north side of the sub-watersheds and the headwaters are typically very steep while those on the south have moderate to steep gradients; most tributaries are constrained.

| Gradient Class | Percent of Stream Miles | | | | |
|---|---|---|---|---|---|
| | Neal Creek. | Lower Thomas Creek. | Lower Mid Thomas Creek. | Upper Mid Thomas Creek. | Upper Thomas Creek. |
| 0-2% | 40 | 69 | 18 | 0 | 0 |
| 2-4% | 10 | 15 | 6 | 23 | 20 |
| 4-8% | 16 | 7 | 21 | 17 | 13 |
| 8-12% | 11 | 0 | 25 | 12 | 18 |
| 12-20% | 19 | 1 | 22 | 37 | 9 |
| 20+% | 4 | 8 | 8 | 11 | 40 |

**Table 16. Percent of stream miles in each Thomas Creek sub-watershed within each of six gradient classes based on a sample of 129 stream miles.**

Channel morphology can be used to estimate the potential habitat quality for anadromous and resident trout and salmon (Washington Forest Practices Board, 1993). Generally, unconstrained and moderately constrained channels up to gradients of 4 percent can provide good spawning and winter rearing habitat for anadromous species, while gradients more than 8 percent usually provide poor conditions. Spawning and winter habitat for resident trout is potentially good in streams with gradients up 12 percent if the channels are not constrained. For summer rearing, stream gradients up to 8 percent, for anadromous species, and gradients to 12 percent for resident species, are considered good. Constrained channels generally have lower habitat potential when compared with unconstrained and moderately constrained channels.

Almost the entire anadromous fish habitat in the Thomas Creek Watershed is limited to low gradient, constrained portions of Thomas Creek. These reaches have the potential to provide fair spawning and winter rearing habitat, and good summer rearing habitat, for salmon and steelhead.

The low gradient portions of Thomas Creek and Neal Creek provide potentially good year-round habitat for resident trout. Tributary reaches with gradients of 4 to 12 percent can potentially provide fair-to-good spawning and winter rearing habitat, and good summer rearing habitat, for resident trout. Tributary streams with the best potential for resident trout include Neal Creek, Criminal Creek, Avery Creek, Indian Prairie Creek, Devils Den Creek, Ella Creek, Hortense Creek, Hall Creek, and an unnamed tributary entering Thomas Creek from the south at river mile 32.5.

Unconstrained and moderately constrained channels with gradients up to 4 percent provide the highest potential salmonid habitat and are therefore the most important reaches to consider for habitat restoration. Very little of this habitat is on federal lands, most of which occurs in upper Neal Creek and Criminal Creek; these reaches likely contain only resident fish. There is about 2.5 miles of Thomas Creek that has suitable gradient and is accessible to anadromous fish; however these areas need to be reviewed for channel constraint before any instream work is considered.

An analysis of 1967 aerial photos indicates that several tributary streams may have been impacted by debris torrents, probably in the 1964 storm. These include Ella Creek and Hall Creek, in the Lower Mid Thomas Creek sub-watershed, and several unnamed tributaries in the Upper Mid Thomas Creek and Upper Thomas Creek sub-watersheds.

Debris torrents degrade fish habitat by carrying LWD downstream and scouring channels to bedrock and boulders. Most of the tributaries affected by debris torrents were high gradient systems (greater than 12 percent slope) and had poor potential for fish habitat. The affected reaches of Ella Creek and Hall Creek included reaches of moderate gradient (4 to 12 percent slope) which may have potentially been good/fair habitat for resident fish. Channels affected by debris torrents should remain in a degraded condition for many years.

# Human Uses

> ***What are the major human uses in the Thomas Creek Watershed? Where do they generally occur in the watershed? What are the current conditions and trends of the relevant human uses in the watershed? What makes this watershed important to people?***

Human use is the predominant disturbance factor in the Thomas Creek Watershed. It is therefore important to have some understanding of the types and extent of human uses in the watershed. Much of the influence human use has had on ecological processes in the watershed are discussed in the terrestrial and aquatic sections of this chapter. This last section will more fully describe the relationship between human uses and the landscape, the social environment and concerns associated with those uses.

### General Socioeconomic Environment

Before discussing specific human uses in the Thomas Creek Watershed, it is important to provide a general socioeconomic context surrounding and including the watershed. Linn County was selected as the scale of analysis because it includes all of the lands in the Thomas Creek Watershed and most of the communities within the zone of influence to those lands.

The Thomas Creek Watershed lies entirely within the northwest portion of Linn County. The major source of the socioeconomic information provided is the 1996, Regional 4 Economic Profile, prepared by the Oregon Employment Department. Region 4 includes Linn, Benton, and Lincoln counties.

The closest incorporated communities to the Thomas Creek Watershed are Lyons and Scio. In 1994, population was estimated to be 950 people in Lyons and 650 people in Scio. The small unincorporated community of Jordan is located in the northwest corner of the Thomas Creek Watershed. The larger population centers in proximity to the watershed are Salem, Albany, and Lebanon.

### Population and Demographics

With Linn County's proximity to the I-5 travel corridor and the relatively high quality of life it offers, migration into the county is expected to be the major driving force of expected increases in the county's population. The population of Linn County was 96,300 in 1994 and is expected to increase 10 percent to 106,688 by the year 2000. From the year 2000 to 2010, an increase of 13 percent is expected for a total population of 122, 592. While most of the increases in population would be expected to occur near the major population and economic centers in the county, additional residential pressure will be felt by rural areas. The Thomas Creek Watershed is at the fringes of the Willamette Valley and is within commuting distance to several larger economic centers such as Salem, Albany and Lebanon, potentially making private lands in the watershed desirable for residential activities.

The median population age for Linn County is also most likely to increase as the “baby boomers“ of the 1950s and 1960s become older. Already, the U.S. Census figures rank Oregon’s population as fourth nationally, for the oldest median age at 35.8. It is even higher in Linn County at 39.6. Ethnic diversity is also increasing in Linn County. Census data from the 1980 survey showed that three percent of those surveyed identified themselves in a nonwhite category. This increased to five percent in the 1990 Census survey. The largest growth occurred in the Asian/Pacific Islanders and the Hispanic categories.

## Economy

Linn County's economy and employment have historically been dominated by agricultural, lumber/wood, and rare metals industries. The largest industry shift has been seen in the lumber/wood industry. In the 1970s, lumber products production accounted for one in every four nonfarm payroll jobs in Linn County. By 1994 lumber products accounted for only one in every ten jobs. Part of this is due to a reduction in the timber supply on federal forests and technological improvements. Between 1979 and 1987, the mechanization of mills and other increases in efficiency resulted in a 40 percent reduction in the number of workers required for a given level of production. It is estimated a total of 2,100 jobs in the lumber products industry were lost in Region 4 between 1989 and 1994.

One factor helping to mitigate the economic effect of the losses in Linn County is the growth in the manufacturing of mobile homes. The manufacturing of mobile homes is a fast growing business in the same industry designation as logging and lumber mills. In 1995 Palm Harbor Homes opened a Millersburg plant, providing 300 jobs.

The rural communities in the North Santiam Canyon and Linn County realize they can no longer depend on the wood products industry as their sole economic provider. Many communities are cooperating to develop strategic plans for diversifying their economies. Several locally-based organizations have been started to help these communities plan for their future. Some examples include the North Santiam Canyon Economic Development Committee, The East Linn County Economic Development Association, the North Santiam Mainstreet Program, the Linn County Tourism Coalition, and the North Santiam Canyon Tourism Coalition. Common objectives of the smaller communities in the North Santiam Canyon and Linn County include increasing the number of family wage jobs (both through new business and business expansion), improving infrastructure, improving education and workforce job skills, maintaining and improving quality of life, and improving human resource services.

One of the major challenges smaller communities face is infrastructure requirements for major manufacturing. As part of a federal effort to aid these timber dependent communities, special funding has been provided through existing agencies as grants and low interest loans. This money has helped fund such projects as the construction of the Canyon Life Museum, the development of a special forest products inventory modeling system, infrastructure feasibility studies, community park improvements, etc. Until the needed infrastructure upgrades can be completed, some of these communities are exploring the feasibility of retrofitting old timber mills for other manufacturing activities, tourism/retail businesses, value-added wood manufacturing, cottage industries, and telecommuting. Another is supporting the establishment of a locally-based cooperative business, associated with the collection and marketing of special forest products such as tree boughs, bear grass, ferns, and firewood.

While Linn County faces some economic challenges in the short term, the long term picture is encouraging. With the county's proximity to I-5, it is a prime location for future business development. This is beginning to pay off, as firms and businesses look further south into the Willamette Valley for relocation and expansion. Linn County's neighboring counties are growing, providing jobs within commuting distance for many Linn County residents (Region 4 Economic Profile).

The Thomas Creek Watershed’s major potential for contributing to Linn County's socioeconomic health is tied most closely to providing wood products, meeting water supply needs, and providing dispersed recreation opportunities. The extent to which Thomas Creek provides for each of these resources is discussed in more detail in the following sections of this analysis.

## Forest Products

### Industrial Timber Lands

Private industrial forestry is the predominant land use in the Thomas Creek Watershed. Approximately 50 percent (37,623 acres) of the lands in the watershed are managed by large private timber companies for the primary purpose of providing commercial timber products. One percent (920 acres) of the lands in the watershed are owned by small private woodlot owners.

Most private industrial forest companies seek to meet the economic objectives of their firm, while managing their lands on a sustained yield basis. However, changes in economic factors and differences in individual company policy can significantly affect harvesting levels and practices in the short and long term. Therefore, general assumptions about the management of private industrial forest lands in the Thomas Creek Watershed must be made. These assumptions are based on observed past and present management practices, verified by local contacts and other available information. For the purposes of this analysis it is assumed private industrial forest land in the Thomas Creek Watershed will continue to be managed for commercial timber products on a sustained yield basis, with an average rotation age of 50 to 60 years.

Management practices among small private woodlot owners also vary. For this reason, and the fact that there are such a small percentage of small woodlot owners in the watershed, it is assumed that these lands would be managed similar to private industrial forest land. Private industrial and small woodlot owners are required to meet standards and guidelines provided in the Oregon Forest Practices Act. These assumptions would be subject to any new information gathered in the future.

### State of Oregon Administered Lands

The state of Oregon manages approximately 2.6 percent (1,921 acres) of land in the Thomas Creek Watershed. These are in the lower and upper mid Thomas Creek sub-watershed basins (see Ownership Map). These lands are managed to provide a continued source of revenue to counties and the state general fund on a sustained yield basis. They also provide for other public uses when appropriate. For the purposes of this analysis it is assumed that state lands would be managed similar to private industrial forest lands with an average rotation age of 50 to 60 years. Management of state lands is also required to comply with the Oregon State Forest Practices Act.

### BLM-Administered and Other Federally Managed Lands

The BLM manages approximately 17 percent (12,684 acres) in the Thomas Creek Watershed. The U.S. Forest Service manages 0.4 percent (301 acres). Timber management activities on BLM administered lands are tied to the land use allocation specified in the Salem District Resource Management Plan (RMP). The timber management activities on federal lands would meet or exceed the requirements of the Oregon State Forest Practices Act.

| Land Use Allocation | Acres | Percent |
|---|---|---|
| Matrix/General Forest Management Area | 3,053 | 24% |
| Connectivity | 3,073 | 24% |
| Late Successional Reserve | 1,161 | 9% |
| Riparian Reserves | 5,398 | 43% |
| **Total** | **12,685** | **100%** |

Note: Does not includes 301 acres managed by the U.S. Forest Service.

**Table 2. Land Use Allocations for BLM lands in the Thomas Creek Watershed.**

The previous table is a summary of the land use allocation distribution of federally managed lands in the Thomas Creek Watershed. The following table is the current age class distribution within each land use allocation.

## Special Forest Products

The collection of Special Forest Products (SFP's) for personal and commercial use is allowed on BLM-administered lands in the Thomas Creek Watershed according to the guidelines identified in the RMP. No inventory data on the type and amount of SFP's in the Thomas Creek Watershed is available. Permits for the collection of SFP's are issued in response to requests. Based on past permits issued, some SFP's most likely collected in the Thomas Creek Watershed include fir boughs, mosses, mushrooms, transplants, burls, edible plants and floral and greenery, and non-sawtimber wood products like firewood. The collection of moss is the most popular commercial SFP in the Thomas Creek Watershed. Authorized and unauthorized collection of similar SFP's probably occurs on private land too.

The North Santiam Canyon Economic Development Committee is working with Musselman and Association Inc., a consultant firm, to develop an efficient methodology for determining the volume of a given SFP present in a given area and its market value. The model they are developing will also be field tested on lands managed by the Oregon Department of Forestry. Studies such as this may provide opportunities for private and public land managers to determine more accurately the cost and amount of SFP's available on their lands.

| | **Matrix/GFMA** | | **Connectivity** | | **LSR** | | **Riparian Reserve** | |
|---|---|---|---|---|---|---|---|---|
| **Years** | **Acres** | **Percent** | **Acres** | **Percent** | **Acres** | **Percent** | **Acres** | **Percent** |
| Nonforest | 103 | 3% | 91 | 3% | 93 | 8% | 247 | 5% |
| 0-20 | 1,248 | 41% | 940 | 30% | 213 | 18% | 1,634 | 30% |
| 30 | 451 | 15% | 701 | 23% | 38 | 3% | 800 | 15% |
| 40-70 | 640 | 21% | 422 | 14% | 240 | 21% | 1,009 | 19% |
| 80-190 | 137 | 4% | 639 | 21% | 332 | 29% | 868 | 16% |
| 200 and up | 474 | 16% | 280 | 9% | 245 | 21% | 840 | 15% |
| Totals | 3,053 | 100% | 3,073 | 100% | 1,161 | 100% | 5,398 | 100% |

Note: Does not include 301 acres managed by U.S. Forest Service.

**Table 3. Forest age class distribution of BLM lands by land use allocations.**

## Major Concerns

With the increasing regulation and restriction of forest management activities on private and public forest lands, private industrial forest landowners are concerned with maintaining their ability to manage their lands according to the companies' objectives,. This is a general concern that applies to many areas, not just the Thomas Creek Watershed. Because of the mixed ownership pattern in the Thomas Creek Watershed, access rights across BLM lands and other lands is also a concern. Other general concerns are associated with public use such as illegal dumping, equipment damage, vandalism, fire danger, long term occupancy, and the unauthorized removal of forest products. Due to problems with long term occupancy and fire concerns, access to private lands along Thomas Creek Road are already being gated off. Many of these same access and public use concerns would be applicable to the other land owners and managers in the watershed.

In contrast to the landowner concerns, there are individuals and organizations at the local, regional, and national level, that are concerned about the impacts on overall forest and ecosystem health, resulting from timber harvest on private and public lands. The Northwest Forest Plan and the Salem District Resource Management Plan has attempted to address many of these concerns for BLM-administered lands in the Salem District. It is hoped that the data gained in this watershed analysis will also help identify and address more site specific concerns before project planning begins.

### Residential and Agricultural Uses

Because of the BLM's patchwork pattern of ownership, BLM-administered lands in the Thomas Creek Watershed are interspersed with residential dwellings and non-forest uses such as farming or livestock raising. Many of the residences are directly linked with the agricultural and livestock raising uses. Much of the non-forest use is located at lower elevations in the Lower Thomas Creek and Neal Creek sub-watershed basins (see Vegetation Map). Most of the agricultural use is associated with grass hay and seed production. Forest management activities on BLM-administered lands located adjacent to or near private non-forest uses, especially residential dwellings, can create potential concerns for the BLM and the residential property owners. To address these concerns early in the project planning process, areas with a potential for high sensitivity were identified in the RMP as Rural Interface Areas (RIA's). The RIA's include areas where there are residential dwellings or zoning within 1/2 mile of BLM-administered lands.

The Thomas Creek Watershed has 2,580 acres of BLM-administered lands located within a 1/2-mile buffer RIA. Most of the RIA's are located in the western third of the watershed in the Lower Thomas Creek and Neal Creek sub-watershed basins (see Rural Interface Areas Map). The residential concentration around most of the RIA's is low and is associated with farming or the raising of livestock. Timber management activities on private industrial forest lands occurs adjacent to or near many of the RIA's.

The three primary private land zoning classifications in the watershed are Exclusive Farm Use, Farm/Forest Use, and Forest Conservation Use. All of these zones require a minimum lot size of 80 acres. If this zoning continues, replacement of agricultural or industrial forest lands with residential uses near the RIA's would be slow. The only lands zoned for rural development are in the community of Jordan and the area between State Highway 226 and Thomas Creek in T. 10 S. R. 1 E. Sections 7 and 8 (see County Zoning Map). There are no BLM-administered lands within 1.5 miles of either rural zone.

The expected intensity of forest management activities within the RIA zones is guided by the Land Use Allocation listed in the RMP. All of the RIA's in the Thomas Creek Watershed fall into one or more of three Land Use Allocations (LUA). The four LUA's include General Forest Management (GFMA), Connectivity (CONN), Late-Successional Reserves (LSR), and Riparian Reserve (See Land Use Allocation/Riparian Reserve Map). The intensity of forest management activities would be greater in for RIA's in GFMA than CONN. Expected timber harvest activities in Riparian Reserves are generally low. Riparian Reserves are intermixed with the GFMA and CONN, so they may help provide buffers depending on the specific project proposal and site characteristics.

For the Thomas Creek Watershed Analysis, the RIA's were divided into separate areas by Township, Range and Section. Table 19 provides a summary description of each RIA. Only BLM-administered lands within RIA's greater than five acres are included in the acreage estimates.

### High Sensitivity Rating

RIA # 1 was rated as having high sensitively due to its proximity to the community of Lyons and because residents close to the area have expressed concerns about the removal of mature forest in that area (FY 1991 McCully's Last Stand Timber Sale File). The concerns were associated with impacts to water quality, wildlife, visual and recreation resources. RIA #3 was rated as having high sensitivity due to its proximity to more concentrated residential dwellings along Rogers Mountain Loop Road.

### Moderate To Low Sensitivity Rating

The major determining factor between moderate to low ratings, was the concentration and proximity of residential dwellings to BLM-administered lands. Those RIA's with several residences nearby received the higher sensitivity rating than those with one or two residence. Those RIA's with low ratings, also tended to have more of a buffer private forest land between BLM-administered lands and private residences. No complaints or concerns from nearby property owners have been documented in the past for any of these RIA's.

| RIA # | Location | Acres | LUA* | Sensitivity |
|---|---|---|---|---|
| 1 | T. 9 S., R. 2 E., Sect. 31 | 302 | CONN | High |
| 2 | T. 10 S., R. 1 E., Sect. 1 | 235 | GFMA | Moderate |
| 4 | T. 10 S., R. 1 E., Sect. 19 | 364 | GFMA | High |
| 5 | T. 10 S., R. 1 E., Sect. 21 | 156 | GFMA | Moderate |
| 6 | T. 10 S., R. 1 E., Sect. 23 | 470 | GFMA | Low/Moderate |
| 7 | T. 10 S., R. 1 E., Sect. 25 | 352 | GFMA | Low/Moderate |
| 8 | T. 10 S., R. 1 E., Sect. 27 | 106 | GFMA | Low/Moderate |
| 9 | T. 10 S., R. 1 E., Sect. 29 | 108 | GFMA | Low |
| 10 | T. 10 S., R. 2 E., Sect. 7 | 162 | GFMA | Low/Moderate |
| 11 | T. 10 S., R. 2 E., Sect. 19 | 325 | CONN | Low/Moderate |

Note: Riparian Reserves not shown in Table.

**Table 19. Summary of Rural Interface Areas within 1/2-mile buffer.**

### Major Concerns

Many of the public use concerns described for the industrial forest owners would apply to the residential and agricultural landowners as well. Since the majority of these landowners are down stream from the forest lands, they have concerns about the potential for negative impacts of timber management activities on water quantity and quality, visual aesthetics and recreational resources and disturbances associated with timber harvest activities (noise, smoke, etc.).

### Recreation Existing Situation and Analysis

The Thomas Creek Watershed offers a variety of dispersed recreation opportunities in pastoral settings of the Willamette Valley, and forested settings in the foothills of the Cascade Mountain Range. Public, federal, and state lands make up only 20 percent of the watershed, 17 percent of which is administered by the BLM. The public lands are intermixed in a patchwork of ownership (see Ownership Map) with private lands, primarily owned by commercial timber companies.

### Recreation Opportunity Spectrum

To more clearly classify the recreational experience, the Recreation Opportunity Spectrum (ROS) planning system was used to inventory the recreation resources on private and public lands in the Thomas Creek Watershed. In classifying recreation opportunities, ROS considers access, remoteness, naturalness, facilities and site maintenance, social encounters, visitor impacts, and visitor management. There are seven major categories which progress from the most primitive to the most developed which consist of primitive, semi-primitive non-motorized, semi-primitive motorized, roaded natural, roaded modified, rural, and urban (see Appendix H.1). The two predominant ROS classifications identified in the Thomas Creek Watershed were Rural and Roaded Modified.

### Thomas Creek Watershed Rural Setting and Recreational Activities

***ROS Rural Setting Characterization****: Characterized by an environment that is culturally modified to the point that it is dominant feature. Cultural modifications are usually associated with agricultural activities, residential activities, and utility corridors. Moderate social interaction is expected.*

Approximately 28 percent (21,000 acres) of the land in the Thomas Creek Watershed is classified under the rural setting. Most of these lands are located in the Lower Thomas Creek and upper portion of the Neal Creek sub-watersheds (see Vegetation Map). The primary cultural modifications are associated with pasture lands, crop fields, farm and residential dwellings, and public facilities (fire stations, covered bridges). Though the cultural modifications dominate the landscape, the pastoral setting of this part of the watershed is very scenic in several areas. The majority of the rural lands are under private ownership and public access is limited primarily to public roads.

#### Existing Developed Recreation Facilities

There are no developed recreation facilities in the rural setting in the Thomas Creek Watershed. The closest developed recreation site is Larwood County Park located along Roaring River, near the southwest edge of the watershed boundary. Larwood County Park is a popular day-use area with parking, vault restrooms, and picnic facilities.

#### Recreation Activities

With no developed recreation sites, and little public access to private land, recreational activities within the rural setting are primarily limited to those which occur on public roads, such as scenic driving and bicycle riding. Some scenic driving and bicycle riding most likely occurs due to the promotion of a covered bridge tour by Linn County.

#### Significant Features

The most significant feature in the rural setting is the Hannah covered bridge. Located on Camp Morrison Drive, this bridge crosses Thomas Creek and is part of a covered bridge tour promoted by Linn County. Just outside of the watershed boundary, the Larwood covered bridge adjacent to Larwood Park and the Shimanek covered bridge located on Shimanek Bridge Drive are also part of the tour.

### Thomas Creek Watershed Roaded Modified Setting and Recreational Activities

***ROS Roaded Modified Setting Characterization:*** *Forest or other natural environment, with* *obvious modifications such as logging or mining activities, road access and limited facility development, within an open space context. Moderate social interaction is expected.*

The remaining 72 percent (54,000 acres) of the lands in the Thomas Creek Watershed are classified as Roaded Modified. Most of the Roaded Modified lands in this watershed are characterized by a forested environment in varying states of seral stage development (see Seral Stage Map). The natural setting on private and public lands has been significantly modified in many areas by timber harvest activities and high road densities. Most of the on-site controls of recreational use on private lands are associated with gates and restrictive signing. There are very few on-site controls on BLM-administered lands. There are small pockets of Roaded Natural (less than 500 acres) however, they are not large enough to warrant a distinction from the dominant Roaded Modified setting.

### Existing Developed Recreation Facilities

There are no developed recreation facilities open to the general public in the Roaded Modified setting. There is a boy scout facility called Camp Morrison along Neal Creek in T. 10 S., R. 1 E., Section 24. There is also a Linn County Mounted Rescue Team training camp in T. 10 S., R. 2 E., Section 8.

### Recreational Activities

Most of the recreational use occurring on public lands in the Thomas Creek Watershed is in the Neal Creek, Thomas Creek, and Snow Peak areas. Most of Neal Creek Road is paved and offers easy access for the average vehicle to adjacent public lands. Evidence of dispersed camping such as fire rings, gun shells and other recreational litter, were found at several old logging landings at the end of gravel spur roads leading off of Neal Creek Road and Thomas Creek Road. Many of the dispersed campsites in the Neal Creek area offer scenic views of the Willamette Valley and the Cascade Mountain Range. Camping and other dispersed recreational activities along Thomas Creek should decrease since private land owners in the area have begun seasonally gating Thomas Creek Road and prohibiting camping. Old rock quarries on private and public lands are being used for target shooting. There is also evidence of target shooting in many of the dispersed campsites. Other uses in the watershed include hunting, mushroom picking, fishing, bicycle riding, and nature study.

Several of the roads in the Roaded Modified setting of the watershed are rock surfaced and passable by the average vehicle (see Road Surface Type Map). There are also several lower maintained roads and spur roads that offer more challenging driving experiences. Indications of low to moderate levels of off-highway vehicle (OHV) use are observable, on and off existing roads, especially in the Neal Creek and Snow Peak areas. As private lands in the surrounding area are closed, providing OHV opportunities in public lands may become more important.

### Significant Features

The Neal Creek and Snow Peak areas are significant recreational features for a roaded modified setting, due to the ease of access from relatively large populations in Salem, Albany, Corvallis, and Lebanon. McCully Mountain is also a popular area to many of the local residents in the Mehama and Lyons area.

## Visitor Use Estimates

There is no quantitative field-based recreation visitation data available for the Thomas Creek Watershed. Limited field observation indicates that visitation to this watershed is low to moderate, with most of the moderate use occurring in the Neal Creek Corridor and Snow Peak area. The Thomas Creek Watershed falls within the Cascades Extensive Recreation Management Area (ERMA). The Salem District's Recreation Management Information System database indicates that BLM-administered lands in the Cascades ERMA receive 23,700 visitors annually and that each of these visitors usually participate in at least two different activities (i.e. hunting and camping). This estimate is based on the Statewide Comprehensive Outdoor Recreation Plan (SCORP) use estimates for Region 8 which encompasses Yamhill, Polk, Marion, Linn, Benton counties and most of Lane County. BLM-administered lands in the Thomas Creek Watershed make up 12 percent of the total BLM-administered lands in the Cascades ERMA. If 12 percent of the visitation to the Cascades ERMA is attributed to the Thomas Creek Watershed, this would equal approximately 2,850 visitors annually.

## Recreation Demands

Besides estimating current and projecting future visitation levels, SCORP also analyzed the supply and demand relationship between ROS settings and recreational activities. While the same activity can occur in several different ROS settings, an individual's experience is expected to vary by class. A category of currently "Used" ROS setting was compared to a "Preferred" amount of use for a recreational activity in each ROS setting. Those activities that show a higher "Preferred" than "Used" suggests that there may be an inadequate supply of that setting for a particular activity in that region. The SCORP data indicates that there is a shortage of primitive and semi-primitive settings for most of the activities in Region 8. This is also true for most of the other regions in Oregon. While the Thomas Creek Watershed offers only a limited potential for providing a semi-primitive or primitive setting, the lack of these settings means that the recreational demand must be met in the more modified settings.

Public access to forest lands is decreasing as more industrial forest lands are either seasonally or permanently closed off. This makes the Thomas Creek Watershed, which provides roaded natural and roaded modified settings close to population centers, important to meeting overall recreational demand for dispersed recreational activities

## Visual Resources

Though not a direct human use, the viewshed surrounding a particular area is an important resource to those residing in or visiting an area. Much of the viewshed in the Thomas Creek Watershed has been modified by human use associated with residential activities, agricultural use, and timber management activities. While these modifications are evident, they often blend with the general characteristics of the landscape.

The current condition of this watershed analysis will address primarily BLM-administered lands, for which a visual resource inventory has been completed. The Visual Resource Management (VRM) classification system was used to inventory all of the BLM-administered lands in the Salem District. There are four classes within the VRM system Management, with Class 1 being the most outstanding and protected and Class 4 being in areas generally less seen with less modification restrictions. The RMP provides guidance for each VRM classification. Below is a summary of the VRM classes on BLM-administered lands in the Thomas Creek Watershed.

| Class I | Class II | Class III | Class IV |
|---|---|---|---|
| 2 acres | 0 acres | 3,806 acres | 8,877 acres |

**Table 5. VRM Classifications in the Thomas Creek Watershed.**

**Class I Lands**

*"Provide for natural ecological changes in visual resource management class I areas. Some very limited management activities may occur in these areas. The level of change to the characteristic landscape should be very low and will not attract attention. Changes should repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape."*

The two acres of Class I lands are made up of three waterfalls (see Visual Resource Management Classification Map). There is no developed access to the waterfalls. All of the falls are located within a Riparian Reserve which should provide an adequate buffer from any future adjacent projects.

**Class II Lands**

*"Manage visual resource management class II lands for low levels of change to the characteristic landscape. Management activities may be seen but should not attract the attention of the casual observer. Changes should repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape. "*

No Class II lands were identified in the Thomas Creek Watershed.

**Class III Lands**

*"Manage visual resource management class III lands for moderate levels of change to the characteristic landscape. Management activities may attract attention, but should not dominate the view of the casual observer. Changes should repeat the basic elements of form, line, color, texture, and scale found in the predominant natural features of the characteristic landscape."*

A brief field review of all the Class III lands was conducted to further identify sensitivity and potential key observation points.  The sensitivity ranking is within the Class III category only. These sensitivity rankings are just a general guide.  Impacts to visual resources will vary depending on the specific project proposal and a number of mitigating factors such as the presence and location of Riparian Reserves, roadside vegetation buffers and vegetation buffers around residences.  A summary of the Class III lands is shown in Table 21.  Parcels less than five acres were not analyzed.

### Moderate to High Sensitivity Class III Areas

The lands with moderate to high sensitivity in Class III are located in T. 10 S., R.1 E, Sections 1, 19, and 21.  They were rated as moderate to high due to the close proximity to residential dwellings.  The sensitivity will vary depending on the specific area and the proposed project.

### Low to Moderate Sensitivity Class III Areas

Most of the Class III lands received a low to moderate sensitivity ranking.  These are areas where there may be some nearby residential dwellings or potential key observation points, but no specific concern was identified.

### Low Sensitivity Class III Areas

The Class III lands receiving a low sensitivity ranking were those where there was no residential dwellings in close proximity to the area and where no specific key observation points were identified.

### Class IV Lands

*"Manage visual resource management class IV lands for moderate levels of change to the characteristic landscape.  Management activities may dominate the view and be the major focus of viewer attention.  However, every attempt should be made to minimize the effect of these activities through careful location, minimal disturbance, and repeating the basic elements of form, line, color, and texture*

<table>
<tr><th colspan="4">Township 10 South, Range 1 East</th></tr>
<tr><th>Section</th><th>Acres</th><th>LUA</th><th>Potential Key Observation Points</th></tr>
<tr><td>19</td><td>159</td><td>GFMA</td><td>Moderate to High Sensitivity - Rogers Mountain Loop (Road 641 and 642), 834 and 835.  Not observable from Hwy. 226.</td></tr>
<tr><td>21</td><td>162</td><td>GFMA</td><td>Moderate to High Sensitivity - Burmester Road, Road 834 and 835.  Not observable from Hwy. 226.</td></tr>
<tr><td>23</td><td>472</td><td>GFMA</td><td>Low to Moderate Sensitivity -  Neal Creek Road , Road 833 and 834.  Not observable from Hwy. 226.</td></tr>
<tr><td>25</td><td>418</td><td>GFMA</td><td>Low to Moderate Sensitivity - Neal Creek Road, Camp Morrison.</td></tr>
<tr><td>27</td><td>170</td><td>GFMA</td><td>Low to Moderate Sensitivity - Neal Creek Road, Road 833 and 834.</td></tr>
<tr><td>29</td><td>153</td><td>GFMA</td><td>Low to Moderate Sensitivity - Rogers Mountain Loop (Road 641 and Road 642), and Larwood Drive.</td></tr>
<tr><td>33</td><td>11</td><td>GFMA</td><td>Low Sensitivity - No specific points identified.</td></tr>
<tr><td>36</td><td>35</td><td>CONN</td><td>Low to Moderate Sensitivity - Neal Creek Road.</td></tr>
<tr><th colspan="4">Township 10 South, Range 2 East</th></tr>
<tr><td>7</td><td>152</td><td>GFMA</td><td>Low to Moderate Sensitivity - Thomas Creek Road and McCully Mountain Road. Not observable from Hwy 226.</td></tr>
<tr><td>9</td><td>90</td><td>GFMA</td><td>Low to Moderate Sensitivity - Thomas Creek Road.</td></tr>
<tr><td>17</td><td>271</td><td>CONN</td><td>Low to Moderate Sensitivity - Thomas Creek Road.</td></tr>
<tr><td>19</td><td>158</td><td>CONN</td><td>Low to Moderate Sensitivity - Road 830.</td></tr>
<tr><td>31</td><td>476</td><td>CONN</td><td>Low to Moderate Sensitivity - High elevation,  no specific points identified.</td></tr>
<tr><td>33</td><td>39</td><td>GFMA</td><td>Low to Moderate Sensitivity - Proximity to Indian Prairie Lake.</td></tr>
<tr><th colspan="4">Township 11 South, Range 2 East</th></tr>
<tr><td>4</td><td>158</td><td>LSR</td><td>Low - High elevation, with management activities potentially seen in background from lower elevations near valley.</td></tr>
<tr><td>5</td><td>635</td><td>CONN</td><td>Low -  High elevation, with management activities potentially seen in background from lower elevations near valley.</td></tr>
</table>

**Table 6.  Summary of VRM Class III land in the Thomas Creek Watershed.**

The lands with the highest sensitivity in Class IV are located in T. 9 S., R. 2 E. Section 31. Section 31 was rated as having high sensitivity due to its proximity to the communities of Lyons and Mehama. Concerns were expressed by adjacent land owners about visual and other resource impacts from past timber management activities on these lands.

A field review was not conducted on other Class IV lands. These lands were found to have low sensitivity and fell into the “seldom seen” category in the Salem District VRM inventory. Impacts to visual resources on these lands should be evaluated on a project by project basis.

## Other Human Uses

Other uses are those uses or resources associated with human use that do not dominate the landscape, but should be mentioned.

### Water Rights

The streams in the Thomas Creek Watershed do not directly supply any municipal water sources. However there are 254 existing water rights on streams in this watershed. The streams with water rights on them include Jordon Creek, Thomas Creek, Neal Creek and McCully Mountain Pond. Irrigation is the predominate water right use (66 percent). Other water rights include livestock (17 percent) and domestic (7 percent) water uses.

### Lands and Minerals

The primary mining activity on public and private lands in the Thomas Creek Watershed are associated with rock quarries for road building. There are no known placer mining claims and only on load claim in the watershed. Communication with the claim holder indicate that it is unlikely that the claim will ever be commercially developed.

There are no known gas leases, utility corridors, communication sites, land withdrawals, or rights-of-way other than road involving public use of BLM-administered lands in the Thomas Creek Watershed.

### Prohibited Uses

Prohibited uses on public and private lands generally involve illegal dumping, vehicle abandonment, long term occupancy, equipment and sign vandalism, wildlife poaching, unauthorized removal of forest products, and growing or manufacturing illegal drugs.

In addition to the work done be the Salem District’s Law Enforcement Officer, an organization called the Linn Forest Protective Association was formed to try and resolve these issues for public and private forest lands in Linn County, including those lands in the Thomas Creek Watershed. The Linn Forest Protective Association is made up of state, local and federal agency, and private industrial timber company representatives. They meet on a regular basis to discuss and try to cooperatively resolve these prohibited uses. One of the outcomes has been the cooperative funding of a Linn County Sheriff in 1995, whose sole responsibility is to patrol forest lands in Linn County. The BLM started contributing in 1996. This has been a very successful program to date.

## Cultural Resources

The prehistoric and historic use of lands in this watershed has been discussed in detail in Chapter 2 of this analysis. This section summarizes the actual prehistoric and historic artifacts and sites that have been documented in the Thomas Creek Watershed. Little or no analysis of these sites have occurred. An individual listing of the sites can be found in Appendix H.2.

### Prehistoric Resources

The Thomas Creek Watershed was used by Native Americans over a long period of time. Ten archaeological sites, one aboriginal trail and two isolated finds occur within the watershed boundaries, with numerous other sites and finds in the surrounding watersheds. With very few exceptions, these sites have not been evaluated beyond initial recording.

Although only a few artifacts have been recorded, these indicate that the sites span a time range starting around 6000 years ago and extending up to the historic period around 250 years ago. Primary activities at the sites appear to be hunting although tool manufacture and maintenance is also indicated. Raw material on the sites is predominantly from local jasper sources, but obsidian is also present at most sites. This would suggest that the sites' inhabitants spent part or much of the year living on the east side of the Cascades.

### Historic Resources

Thomas Creek is named for the early homesteaders, John and Mary Jane Thomas, who filed a Donation Land Claim on the creek on November 4, 1852. The earliest recorded historic use of the Thomas Creek Watershed dates to homesteaders' access trails developed in the 1850s. Starting in 1911, a number of trails were built and/or maintained for use by the Linn County Fire Protection Association (LCFPA) to access lookouts and fire camps in the Monument Peak and Snow Peak area. The LCFPA built and annually maintained a phone line along the Old Mill City to Snow Peak trail to provide communication with the Snow Peak lookout. The LCFPA used Cougar Camp from 1911 into the 1950s with the Civilian conservation Corp (CCC) building three cabins there in the 1930s. Most of these LCFPA trails went out of use in the 1940s and 1950s as they were replaced by roads. The phone line became unnecessary in the 1950s as radios were used to provide communications between fire camp, headquarters and lookouts.

# Chapter 6  Potential Conditions and Trends

Lands within the Thomas Creek Watershed are managed by many landowners under a variety of management objectives.  Future management of the federal lands was discussed in Chapter 1.

The existing conditions of the terrestrial domain, and the processes affecting those conditions have been dramatically altered because of the human processes that now dominate the ecosystem within the Thomas Creek Watershed.  Natural processes affecting the terrestrial domain operate almost uniformly over the entire watershed.

## Terrestrial

### Vegetation Patterns/Seral Stages

The current proportion of forest/non-forest types is expected to remain approximately the same at 75 percent conifer types, 20 percent nonforest types and 5 percent hardwood types.  The nonforest types in the rural residential/agricultural area may increase slightly over present conditions.

The amount of older forest habitat on private/state lands is expected to decrease under future management.  Assuming an average 60-year rotation on private/state lands, approximately a third of the acreage would be distributed between each of the 20-year age classes (0 to 20; 20 to 40; and 40 to 60 years of age).  Forest Practices Act (FPA) buffers on private/state lands would contribute to older forest habitat in the watershed.

On federal lands the amount of older forest habitat is expected to increase under the RMP. The distribution of older forest habitat would generally follow Riparian Reserves and would include LSRs and the 25 percent older forest in CONN blocks.   As LSRs and Riparian Reserves are allowed to develop over time, approximately 50 percent of the federal lands in the watershed have the potential to become older forest habitats within 80 years under current management.

On all lands currently about 10 percent of the watershed is in older forest habitats.  With Riparian Reserves and LSRs on federal lands and FPA buffers on private/state lands, the entire watershed (all ownerships) has the potential to support **10 to 12 percent** older forest habitat within 80 years under current management.   A shift in the *distribution* of  older forest to federal lands would occur.  However, the *total amount* of older forest would remain approximately the same.  This is due to the small total percentage of federal lands (less than 20 percent) that limits how much federal lands can contribute to older forest conditions in the Thomas Creek Watershed over time.

Ultimately, the matrix across all ownerships in the watershed will be evenly divided between early seral stages zero to 15 years of age, 15 to 40 years of age, and mid seral stages 40 to 60 years of age.  The patch elements of the watershed will continue to be older forests 80 to 200 years plus. The distribution of older forest habitats will include the LSRs and will follow Riparian Reserves on federal lands.  With 50 percent of the federal ownership in either Riparian Reserves or LSRs, the 15 percent older forest retention and the 25 to 30 percent CONN retention would be represented entirely within LSRs and Riparian Reserves in the long term.  Distribution and connectivity of the older forest habitat will be disrupted by the highly scattered federal ownership in the watershed, although the development of corridors along FPA stream buffers on private/state lands would provide some degree of connectivity in the future.

**Special Habitats**

Park Creek Meadows and the adjacent streams would be protected with Riparian Reserves.  The resulting buffers would leave small, unprotected areas near the meadows that could be affected.  These impacts would be inconsistent with managing the meadows as an ecosystem.  Most of the meadow is on BLM lands, which would facilitate management of Park Creek Meadows as a special habitat feature.  To the west is Erica Meadows, which is on private lands and would be managed under the FPA.

The Snow Peak Ecosystem is on the edge of the watershed and is divided by the watershed boundary with Crabtree Creek to the south.  An LSR was identified in T.11S., R.2E., sections 4 and 9, which is also divided by the watershed boundary.  Section lines were used to delineate the boundaries of the LSR.  Much of the greater ecosystem is on adjacent private lands in younger age classes, including Eleanor Lake, Indian Prairie wetlands, Ella wetlands, and Waldo Peak.  Significant special habitats are found on the south side of Snow Peak in the Crabtree Watershed that are part of the same ecosystem.  These habitats are on BLM lands and include Snow Peak Meadows.  Part of the BLM portion of the ecosystem would be protected by the LSR and Riparian Reserves.  Portions of the ecosystem are across section lines in the matrix, including the Anthus and Snow Peak.

**Standing Dead/Down Logs**

The number of snags is expected to decline in the short term as material in more advanced stages of decay decomposes.  Over the long term, the amount of standing dead on federal lands is expected to approach 60 percent of potential cavity dwelling wildlife populations as older forest develops in LSRs and Riparian Reserves and green tree retention guidelines are implemented.  A slight increase of standing dead would occur on private/state lands as new FPA requirements for standing dead continue to be implemented.  In addition, FPA buffers would help contribute to the standing dead resource on private lands.

Down log material is expected to decline in the short term as material in more advanced stages of decay decomposes.  Over the long term, down log material on federal lands is expected to increase as older forest develops in LSRs and Riparian Reserves and green tree retention guidelines are implemented.  The FPA requirements for down logs and buffers would help contribute to down log material on private/state lands.

**Habitat Quality**

The estimated future amount of interior forest habitat was modeled 80 years into the future. Interior older forest habitat is expected to increase on federal lands as LSRs and Riparian Reserves develop into older forest. Interior forest habitat on private/state lands is expected to decrease as older forest is harvested. Future harvest and road construction will continue to alter the quality of interior older forest across the watershed.

Habitat effectiveness for cover (HEc) for the watershed would remain about the same as current conditions at 0.25, which is limiting for elk. HEc on federal lands would increase substantially and become viable for elk. Habitat Effectiveness for forage quality (HEf) is expected to remain limiting for elk.

## Soils and Site Productivity

Natural bulk density has been increased by mechanical means. Soil compaction, which decreases site productivity, is not duplicated in nature, except on larger scale events such as glacial and sediment loading. Reference conditions for compactions would be no compaction because of human caused disturbances. The extent of compacted areas is high, 50 percent, although far below the level in Hamilton Creek. Most of the compacted areas are in the lower sub-watersheds and in gentler topography which favor ground-based machinery. Compaction from aerial and cable systems seldom exceeds 5 percent of the proposed treatment area and generally does not decrease site productivity significantly depending on time of year and moisture content of the soil. On federal lands, highly compacted areas (usually designated by the FSR2 TPCC rating), 24 percent, will be treated where feasible. Various means are available, such as a winged subsoiler, which can be used on restoration opportunities to reduce soil compaction. These future treatments should minimize compaction.

## Roads and Transportation

Road densities are expected to increase across the watershed as additional roads are constructed for harvest. The habitat effectiveness index derived from open road densities is at or near 0.40, which is a threshold value between viable and limiting for elk. However, a high percentage of roads are seasonally closed which helps reduce disturbance to wildlife, particularly on private lands. Open road densities on federal lands were more limiting, with a habitat effectiveness index of 0.35.

## Natural Disturbance and Erosion Processes

Surface erosion, landslides and debris flows, and weathering are hillslope processes occurring naturally in the watershed, especially after a wildfire and flooding. Landslides occur primarily because of breccia and tuffaceous material decomposing to clay in moist conditions. Landslides and mud flows such as those along Silt Creek on public and private land have significant effects on soil erosion and sediment loading. Ravel and soil erosion occur naturally on the steeper slopes and in areas where stand replacement events have occurred in the past five years. Rain-on-snow events in these areas can also trigger major erosion events. These natural processes will continue to occur at unpredictable intervals.

Human disturbances, such as timber harvest and road construction, can accelerate the disturbance process. This human disturbance is a more regulated event. In the short term, the upper portion of the watershed will have a decreased amount of human disturbance as the young stands grow while the lower portion will be increased. When the stands in the upper portion of the watershed with its more unstable areas reach harvestable age in 30 to 60 years, better engineered roads and harvesting techniques may help reduce new erosion events.

Sediment delivery in Thomas Creek has increased above the range of natural variation from logging activity next to unstable areas and higher than average snowfall and rainfall over the past two years. A major debris flow hazard area in Silt Creek has delivered large amounts of sediment to Thomas Creek at various times. Although this slide is essentially a natural occurrence, it may result in unacceptable impacts to fish, downstream residents and beneficial users. Logging activity on the other side of Slash Mountain, which forms one boundary of the watershed on the south side, did not cause the debris flow but did influence the timing, location, and magnitude of the flows. Aerial surveys have shown that a new scarp has slid off Slash Mountain and deposited on the flat below. This new debris flow has not continued down Silt Creek into Thomas Creek. However, a major precipitation event could cause a major pulse of sediment from this source into the creek. Continued levels of timber harvest and road construction from adjacent landowners can also result in increased sediment delivery. Lower down this drainage most of this property is geologically unstable as well and the private industrial owner does not consider this as commercial forest land. They have expressed interest in working with the BLM to reduce sediment delivery to the stream. This area may be too unstable for human intervention to stabilize and may continue to evolve over the long term.

Sediment delivery in the rest of the watershed may decrease in the watershed in the aftermath of the flood and implementation of the Northwest Forest Plan and new FPA standards. On federal lands, guidelines such as no net gain in roads and designation of Riparian Reserves and reserved unstable lands, will decrease sediment delivered to the stream. Nevertheless, these lower elevation sub-watersheds may also experience increases in agricultural and recreational development with greater requirements for water extraction. Decreased flows and increased water temperatures plus increases in sediment from vegetation clearing in riparian areas can further degrade fish habitats.

## Special Status/Special Attention Species

## Plants

Three Special Status/Special Attention Species plant and fungi species known to occur in the Thomas Creek Watershed are associated with late seral forests: *Oxyporus nobilissimus*, *Corydalis aquae-gelidae,* and *Pseudocyphellaria rainierensis*. All are found in the Pacific silver fir zone at the higher elevations in the watershed. The known sites for these species are in the Connectivity LUA. *C. aquae-gelidae* is a species that always inhabits cool, wet environments and therefore its potential habitat would increase as Riparian Reserves mature into old growth.

Potential habitat for *Pseudocyphellaria rainierensis* is along the southern boundary of the watershed and on north facing slopes in mature coniferous stands.  The known site is in CONN. Potential future habitats will be in the Riparian Reserves, CONN, and LSR's.  Significant portions of the present and future potential habitat for this species are in the Matrix in sections 5 and 6, T.11S., R.4E; sections 2 and 6, T.11S., R.3E; section 2, T.11S., R.1E that have stands of old growth timber.  The overall habitat condition for this species will degrade in the future, until the Riparian Reserves mature in this part of the watershed.

*Oxyporus nobilissimus* depends on the presence of large noble fir trees, snags and stumps.  Like *Pseudocyphellaria rainierensis,* the best potential habitat for this species is along the southern edge of the watershed within the Pacific silver fir zone.  Riparian Reserves and LSR's would provide potential habitats for this species in this area, if  noble firs are in the stand.  This species has been found in very young plantations, 30-year-old, 60-year-old and managed mature stands with old growth components and in old growth stands.  It inhabits stands with high quantities of blowdown and stands that have had catastrophic fires.   Overall future habitat conditions will improve for this species.

Willamette Valley species habitat conditions will probably continue to degrade due to lack of protective or active management mechanisms on private lands.

## Animals

Habitat conditions for older forest species of concern are not expected to improve significantly in the long term because of  the less than 20 percent of federal lands in this watershed.  This small amount limits how much federal lands can contribute to older forest conditions over time.  A shift in the *distribution* of  older forest to federal lands would occur, however, the *total amount* of older forest would remain approximately the same.

Habitat conditions for early and mid seral stage species are expected to remain approximately the same or improve slightly over time.

Habitats for priority species that use snags and/or down logs are expected to decrease in the short term and increase in the long term with increased retention requirements on federal, state and private lands.

### Threatened and Endangered Species (spotted owls)

Suitable habitat for the northern spotted owl is expected to follow the same trends as described previously for older forest habitat and species.  Overall habitat condition for the spotted owl is expected to decline in the short term then stabilize in the long term.  The Thomas Creek Watershed will continue to provide for some dispersal to/from the known owl sites south and east.  However, dispersal of spotted owls is severally limited by the Willamette Valley to the west and the North Santiam River corridor, the cities of Lyons, Mehama, and Mill City to the north. The distribution of suitable and dispersal habitat will follow Riparian Reserves on federal lands, and will include the LSRs and the 25 percent older forest in the CONN Blocks.  Distribution and connectivity will be disrupted by the highly scattered federal ownership in the watershed.

Of the eight active KOSs in the Thomas Creek Watershed, none are currently considered viable. Due to the lack of suitable spotted owl habitat and fragmented federal ownership, none of these KOSs are expected to be viable in the long term. Of the four KOSs considered stable presently, two are expected to remain stable in the long term. These are the two KOSs that are found within the Thomas LSR.

| | **Total Watershed** | **Total Protected (%)** | **Total Unprotected (%)** |
|---|---|---|---|
| **Acreage within Boundary** | **75,026** | **6,563 (9%)** | **68,463 (91%)** |
| **Acreage of Federal** | **12,986** | **6,563 (51%)** | **6,423 (49%)** |
| **Federal Spotted Owl Habitat Capable Acres** | **12,450** | **6,261 (50%)** | **6,189 (50%)** |
| **Total-Federal Suitable Spotted Owl Habitat** | **6,261** | **6,261 (100%)** | **0 (0%)** |
| **Total Spotted Owl Sites*** | **8** | **2** | **6** |
| **Spotted owl sites (>40%)** | **0** | **0** | **0** |
| **Spotted owl sites (30-40%)** | **1** | **1** | **0** |
| **Spotted owl sites (20-30%)** | **1** | **1** | **0** |
| **Spotted owl sites (<20%)** | **6** | **0** | **6** |

**Table 22. Potential future status of the spotted owl and its habitat within the Thomas Creek Watershed.**
*** estimates of individual sites are based on current known owl sites at current locations.**

Future conditions of spotted owl habitat and KOSs on federal lands were estimated and the results are shown in Table 22.

## Fish Populations

Anadromous fish populations in the Willamette River Basin have declined to near record low numbers. Factors influencing these populations occur in freshwater and marine habitats. Ocean conditions that are thought to have had a negative influence on early ocean smolt survival have been affecting anadromous fish populations along the northeastern Pacific rim since 1977. As long as ocean conditions are unfavorable, it is likely that anadromous fish populations, including those in the Willamette Basin, may not improve appreciably. However, freshwater habitats are critical for healthy populations of these species. Substantial improvements in freshwater habitat conditions are not likely in the short term.

The native spring chinook run into Thomas Creek is thought to be extinct. The success of ODFW's reintroduction efforts is unknown at this time as most returning fish will arrive in 1997 and 1998. First adult returns of this reintroduction effort were observed in August 1996. Hatchery practices, harvest, ocean conditions, and instream habitat are all factors that will influence the long-term success of this effort. Degraded spawning habitat conditions, resulting from the February 1996 storm, will negatively affect survival of eggs and emerging fry that result from these returning fish.

Winter steelhead typically rear in freshwater for two years before they migrate to the ocean. Generally, the longer a fish must rear in freshwater, the more important the freshwater habitat conditions are to its survival. Fish populations from streams in healthy condition will experience higher fry-to-smolt survival rates than populations from streams in poor condition. Higher freshwater survival will make the population more robust in the face of poor ocean rearing conditions.

The status of resident fish populations in the Thomas Creek Watershed is unknown, however, these fish populations are influenced primarily by habitat conditions. Streams with poor habitat quality will have lower populations than streams of similar habitat potential with good habitat quality. Due to past timber harvesting activities and storm related damage, it is likely that much of the present habitat for resident fish is degraded and not supporting fish populations at levels that existed under the reference conditions.

Anadromous and resident fish populations in the mainstem of Thomas Creek may have been negatively affected by the February 1996 storm. Local fish populations maybe devastated by high flood flows that wash juvenile and adult fish downstream or onto floodplains, or crush them with bedload materials. The effects of this storm could affect multiple year-classes of anadromous and resident fishes. Fine sediment in spawning gravels may affect spawning success for many years. Spawning that occurred after the flood probably experienced increased mortality because of the higher levels of fine sediment in the gravels. The cutthroat trout population in Thomas Creek will slowly increase with recruitment of trout (adult, juvenile and fry) from tributary streams. Fish productivity will be affected by the reduced availability of food organisms as long as aquatic invertebrate populations are depressed.

# Aquatic

### Water Quality

Beneficial uses in the watershed are domestic water supply, municipal water supply, industrial water supply, livestock watering, irrigation, fisheries, recreation, wildlife, aesthetics, and power development. (Oregon Department of Water Resources) (ODEQ 1988) Thomas Creek was identified in the 1988 Oregon Statewide Assessment of Nonpoint Sources of Water Pollution as having impacted beneficial uses. Water quality problems included summer temperature, turbidity/sedimentation, low dissolved oxygen, and low flows.

Water temperatures were measured in Thomas Creek near Scio from October 1962 to September 1975. In that time the highest temperature recorded was 28.0 degrees C on three days, August 1967, August 1971 and July 1975. The minimum recorded was freezing point on February 1972. These summer temperatures are extremely high and are the result of lower baseflows. These lower baseflows are because of increases in water rights appropriations and loss of riparian vegetation. Because this is a result of human activity, an assumption can be made that once, when water appropriations were non existent and riparian vegetation was in place, stream temperatures were much lower than today.

No data on water temperatures in the forested sections of Thomas Creek has been recorded except in the streams adjacent to the McCully's Last Stand timber sale, where water monitoring has been done for the past three years. This data has not yet been synthesized.

Before Euro-American settlement, water quality was good in the watershed with low turbidity, lower water temperatures in summer due to adjacent riparian vegetation and acceptable dissolved oxygen and other parameters. The arrival of the Euro-American in the 1800s produced noticeable changes. Agricultural activities affecting water quality included streamside vegetation clearing, grazing, and irrigation. Water quality impacts increased and sedimentation/turbidity increased, summer flows were reduced, summer temperatures were increased, and dissolved oxygen decreased. This effect is still occurring and will likely continue into the future.

Logging activity in the late nineteenth and twentieth centuries was limited and water quality problems from logging were not widespread. With the increased logging and road building, increased sedimentation/turbidity, higher summer temperatures, and reduced large woody structure in streams occurred. Improved methods in road construction and logging have greatly reduced erosion from earlier levels. The present trend toward watershed restoration and decommissioning or upgrading roads will further reduce sediment sources. Water quality impacts should further be reduced by the adoption of the Aquatic Conservation Strategy and other components of the Northwest Forest Plan. Management of riparian and aquatic areas on non-federal lands will improve under the revised Oregon Forest Practices Act Water Protection Rules (Oregon Department of Forestry 1995).

Cumulative effects on water quality and quantity have peaked between 1960 and 1990 and are in a downward trend due to hydrologic recovery, riparian restoration, and increased stream protection.

## Hydrology

Thomas Creek base flows and peak flows were within the range of natural variation until the February 1996 flood. In the aftermath of the flood, base flows and peak flows should again fall within that range.

Stream flows during the summer are low due to the low summer rainfall. This condition existed in historic and (probably) prehistoric periods. USGS reports over 25 years have recorded low stream flows in the past because of the usual lower amounts of precipitation and below normal precipitation in drought years. If forest density is allowed to increase, transpiration will increase and amounts moving through the soil into the streams will decrease. Thinning of stands could temporarily reduce transpiration. This would allow more water to reach the stream during the summer though remaining trees would likely appropriate any excess water.

Base flows in the upper end of the watershed will continue to be on the upper end of the natural range due to high acreage of logging. Tree removal reduces the transpirational pumping from these areas that are now in varying stages of hydrologic recovery. Base flows on the lower end of the watershed will continue due to water rights use for agriculture, domestic, municipal, and industrial needs. These extractions from Thomas Creek will continue to rise and base flow rates necessary for adequate spawning area, refuge areas, adequate flows can be expected to be severely limited. Lower base flow rates combined with higher temperatures limit dissolved oxygen levels which limit fish habitats as well.

Peak flows have increased due to logging, especially in the transient snow zone. The precipitation enhancement index (adapted from the Washington DNR handbook) gives a hazard rating for peak flows using harvest levels in rain-dominated, transient snow, and snow dominated zones. The present hazard rating for Thomas Creek in the rain-dominated and the transient snow zone is 4.6 which is considered a moderate hazard. Rain-on-snow events occur in the spring in the TSZ zone and peak flows occur at this time. An increase in the magnitude and timing of peak flows can cause excessive scour which could result in loss of fish eggs which are in the gravel. This increase can also flush young fish downstream to less optimal rearing habitat and refuge habitat, which are especially limited downstream on municipal and agricultural lands. Using the private industrial owners assumptions for Thomas Creek Watershed over the next ten years both zones will approach the high end of the moderate hazard category. This is especially significant in the transient snow zone where higher peak flows would occur during rain-on-snow events that could result in greater erosion and sedimentation. In the snow-dominated zone a low hazard for increases in peak flows from major storm events exists. Increases in peak flows will likely continue in Thomas Creek. Restoration opportunities include allowing the watershed to heal and recover from the logging activity.

## Riparian Habitat

Compared with pre-1800 conditions, the streams lack structure, complexity, and species diversity. Pools are fewer and remaining pools are more shallow. Summer stream flows are low due to water rights out takes and lower precipitation. Peak flows are more flashy due to the high degree of acreage in the transient snow zone and the hydrologically unrecovered areas in this zone. Riparian habitats have less diversity in plant species and structure. The current supply of large woody debris may not be sufficient to meet the requirements of nutrient cycling, habitat diversity and fluvial geomorphology. Human related activities have augmented natural conditions to produce these conditions. (USDA & USDI 1994)

Nutrient cycling may have been impaired by changes in upland and riparian areas. Logging has greatly reduced the present and future recruitment of coarse woody debris. The number of road/stream crossings on in the watershed have prevented the movement of materials and nutrients from upslope to riparian areas. Road/culvert failures and larger debris flows have occurred with storm events resulting in movement from upland to riparian. Natural functions and processes have been altered and simplified in various reaches in the watershed.

Good riparian conditions provide adequate riparian habitats, high levels of potential large woody debris for the short and long-term, and structure for dissipation of stream energy. As Thomas Creek sub-basins are managed under the guidelines of the Aquatic Conservation Strategy and with the establishment of Riparian Reserves, riparian conditions should improve on federal land. Designated Riparian Reserves managed for natural stand characteristics would allow vegetation in the early and mid seral stages to mature resulting in a diverse stand structure, increased large woody recruitment potential and improved riparian habitat conditions.

Riparian conditions on private forest lands may slightly improve with the recent changes to the Forest Practices Act and implementation of the 1994 Protection Rules for private landowners in areas zoned as Forest Lands. Increases in residential development in the lower subbasins due to urban growth would increase riparian degradation from vegetation clearing, increased water rights use, and reduction in large woody debris potential.

Riparian surveys were begun in Thomas Creek in 1995 and many more miles remain to be inventoried to identify all opportunities for restoration. Some uninventoried reaches have already been identified as sites needing restoration.

## Fish Habitat Condition

Rearing habitat throughout the watershed is degraded and is expected to continue to be degraded for several decades. The primary reason for this trend is that instream habitat conditions are largely dependent upon riparian vegetation, particularly as a source of LWD. Across the Watershed, 66 percent of the riparian vegetation is less than 40 years old. It will be several decades before these stands have trees large enough to provide suitable (20 inch diameter) LWD to the channels. During the interim period, existing LWD in the channels is susceptible decay, erosion and transportation out of the watershed by high flows.

The amount of older forest habitats in Riparian Reserves is expected to increase on federal lands under the RMP. Riparian Reserves, which cover 41 percent of the federal lands in the watershed, have the potential to become older forest within 80 years. However, federal lands include only a small percentage of the entire stream network, and are highly scattered around the watershed. On a watershed basis, the effect of Riparian Reserves on federal lands will have little impact on LWD levels in fish-bearing streams. The development of corridors along FPA stream buffers on private/state lands will provide some degree of future LWD for most of the watershed. Recruitment of large, coniferous woody debris from agricultural lands is not expected to increase much in the future.

Neal Creek and Lower Thomas sub-watershed basins have the best potential, though limited, to provide LWD to streams in the future. In most of the watershed (Lower Mid Thomas, Upper Mid Thomas and Upper Thomas sub-watershed basins) little potential for LWD recruitment in the next 40-50 years exists. Forested lands are capable to producing adequately sized trees for future recruitment into channels and Riparian Reserves and buffers should provide for large trees near streams. Future management of federal lands within the watershed should include riparian restoration treatments. Areas rated as having a moderate potential for LWD recruitment are 40-80 year old stands, which may contain some trees of suitable size, but where mortality is low. Stands with moderate potential can, with active management, may become areas of high potential. Thinning can be used to increase the growth rate of young conifers in riparian areas. If these treatments are successful, the long-term trend for large wood recruitment should improve.

Pool habitat in tributary streams is maybe limited. Pool development in forested streams is highly influenced by LWD and present instream LWD levels are assumed to be much lower than reference levels throughout the watershed. Timber harvest has removed much of the instream LWD that existed before the 1950s. Debris torrents simplify stream channels by removing LWD and scouring channels resulting in channels with little pool habitat. With little LWD recruitment potential, pool habitat is expected to remain limited or decline.

Main channel pool habitat in Thomas Creek is abundant and off-channel habitat is common between Jordan and Criminal Creek. LWD and the potential for new recruitment are limited along the mainstem of Thomas Creek. LWD is important for maintaining off-channel and side-channel habitats along mainstem rivers and may provide additional complexity to main channel pools. Off-channel and side-channel habitats are likely to decline in the future as the existing LWD decays or is washed downstream.

The lower portions of Thomas Creek commonly have summer water temperatures that exceed 70E F. These high temperatures prevent anadromous fish from holding and rearing in these reaches (Wevers et al 1992). As water temperatures increase above 59E F, steelhead are increasingly subjected to thermal stress and increased susceptibility to disease. Factors that contribute to higher water temperatures include water withdrawals and removal of riparian vegetation. These factors occur both within and below the watershed. The harvest of older forests in the watershed during the past 40-50 years has opened the canopy along most of the perennial and intermittent streams. Clearcut areas have been replanted and stream shade is increasing, resulting in lower water temperatures in the watershed. Shade will continue to be a problem along some portions of Thomas Creek because of its width. Young alders, which can fully shade a tributary stream, often affect shade only along the streambanks of larger channels. Tall conifers are needed to block more of the incoming sunlight across wider channels. Federal Riparian Reserves and FPA buffers should protect streams in the future and result in temperatures that reflect the natural variability for climatic conditions within the watershed. While these changes in the upper watershed should help reduce downstream water temperatures, activities in the lower watershed that can affect water temperatures are still occurring. Providing cool water temperatures in stream reaches used by spring chinook as summer holding habitat will be critical to ODFW's efforts to reintroduce spring chinook to Thomas Creek

Sediment from the active earth movements on Silt Creek continues to degrade water quality in Thomas Creek. This earth movement is chronic and massive, affecting an entire mountain side. Another source of sediment is the channel itself; several new, large gravel/cobble bars were created by the February 1996 flood. As these bars erode, they will add fine sediment into the active channel. The impacts of this sediment and turbidity on Thomas Creek are not known, but there is concern about impacts to anadromous and resident fish spawning and rearing, especially following the impacts of the flood to spawning habitats. Chinook and steelhead spawn and rear below the falls (RM 31.5) approximately two miles downstream from Silt Creek. Resident fish spawn and rear above and below the falls. Fine sediment deposited in spawning gravels can reduce interstitial water flow, leading to depressed intragravel dissolved oxygen concentration, which can cause mortality of fish eggs. Fine sediment accumulations in spawning gravels can also physically trap emerging fry in the gravel and cause mortality. Fine sediment deposition may also reduce primary production and aquatic invertebrate abundance that may affect the availability of food for fish. Increases in suspended sediments can alter fish behavior, feeding efficiency and may cause abrasion damage to fish gills (Hicks et al 1991).

# Human Uses

## Forest Products

### Industrial Timber Lands and State of Oregon Administered Lands

It is expected that unless a desirable and cost-effective substitute becomes available, demand for wood products will remain high.  Some of this demand will be met through the importation of wood products, however, domestic wood products will also be an important component of supply.  This means that the predominant land use on private lands in the Thomas Creek Watershed will continue to be industrial forestry.  It is also expected that the general rotation age will continue to be 50 to 60 years.  However, harvesting levels and practices may vary depending on individual company policy, and economic and regulatory factors.  Similar trends are expected for small woodlot lands and lands managed by the state of Oregon.

### BLM-administered and Other Federally Managed Lands

Wood products will continue to be provided from BLM-administered lands consistent with the RMP/FEIS.  Most wood products will likely come from lands in the GFMA and CONN land use allocations.  No specific estimates of volume have been forecasted in this analysis.  Only limited wood products are expected from management activities on lands in the LSR and Riparian Reserve land use allocations.

### Special Forest Products

Special Forest Products has potential for growth as demand for existing products grow and if noncommercial products become more marketable.  Efforts such as the inventory and modeling system described in the current condition, may increase the marketability of special forest products on private and public forest lands.

## Residential and Agriculture

The population of Linn County is expected to increase 10 percent from 96,300 in 1994 to 106,688 in the year 2000.  Much of this growth will occur around the existing population and economic centers of the county such as Albany and Lebanon.  However, the Thomas Creek Watershed is close enough to the I-5 corridor that some growth in residential activity would be expected in the watershed.  Current zoning in the watershed would restrict the lot division to no less than 80 acres; however, variances can be obtained.

Sensitivity to timber management activities and public use on BLM lands adjacent to residential lands will continue to be a concern.  Sensitivity is expected to increase if the number of homes around BLM-administered lands increases.  Harvest of private industrial forest lands may also reduce buffers between residential dwellings and increase sensitivity of specific areas.

### Recreation

Increases in demand for semi-primitive and primitive settings for dispersed recreational activities will continue to grow. In the absence of such settings at the regional level, use of roaded natural and roaded modified areas would be expected to increase. Because of time and economic constraints, recreational opportunities close to communities will become more popular. Given the proximity of the Thomas Creek Watershed to the I-5 corridor, increases in dispersed use are expected. If the trend of gating off private lands also continues to increase in the watershed and surrounding areas, demands for dispersed recreation on public lands will intensify. The increases in use would most likely occur in the Neal Creek corridor where access is easy and there is contiguous public ownership.

Roaded Natural and Roaded Modified will continue to be the predominant setting on BLM-administered lands and on most of the private industrial forest lands. Lands classified as rural are not expected to increase or decrease significantly in the next ten years. There may be opportunities to provide additional opportunities for semi-primitive settings in the LSR's, where compatible with LSR values. The lands in an LSR in the Thomas Creek Watershed are in the Snow Peak area. While there are only 1,160 acres of LSR in the watershed, the LSR block continues into other watersheds.

### Visual Resources

It is expected that modifications associated with timber harvest on private and public lands would continue to be readily observable in most of the watershed. The sensitivity of future projects on BLM-administered lands with a VRM Class III rating would have to be evaluated on a site specific basis. More modifications would be evident on lands under in the GFMA land use allocation. Riparian Reserves within the GFMA may help buffer project areas from view. There would be fewer modifications evident in the LSR's and CONN land use allocations in the long term as older forest characteristics become more dominant in the landscape.

## Other Human Uses

### Water Rights

The existing water rights will be maintained and more applications are pending. There are concerns about water quantity and quality in Thomas Creek. These concerns will increase as the demands for water use increase.

## Lands and Minerals

Rock quarries for road building and maintenance will continue to be the primary mining activity on both public and private lands in the Thomas Creek Watershed.  No other commercial mining is expected.  There are also no planned leases or rights-of-way other than those associated with roads.

## Prohibited Uses

If no deterring actions are taken, prohibited uses would increase in the Thomas Creek Watershed, especially on public lands as private lands are closed.  It is hoped that the efforts of cooperative organizations such as the Linn County Forest Association and the Salem District's Law Enforcement Officer can help deter such activities.

## Cultural Resources

No changes in the cultural resources on public lands are expected unless more sites are discovered, or existing sites are found to have uninventoried artifacts.

# Chapter 7  Management Recommendations

The preceding chapters serve as the foundation and rationale leading to this chapter. These recommendations should be considered because of the data available for this watershed, which varies qualitatively and quantitatively. The recommendations presented here are set in the context of the Northwest Forest Plan and the Salem District Resource Management Plan. All recommendations fall within this existing direction. These recommendations can be used to help guide development of site-specific projects including timber sales, habitat restoration, access and travel management planning and biodiversity enhancement.

## Findings

**Finding #1:** A scarcity of older forest habitats exists in the watershed. Data shows approximately 10 percent of the watershed is older forest for all ownerships. Less than 5 percent is in old-growth more than 200 years of age. For federal lands, the amount is higher at 33 percent. About 14 percent of federal lands are in old-growth forests. Of this remaining older forest habitat in the watershed, less than 25 percent of it is functioning as interior older forest habitat. With Riparian Reserves and LSRs on federal lands and FPA buffers on private/state lands, the entire watershed (all ownerships) has the potential to support **10 to 12 percent** older forest habitat within 80 years under current management. In the future, older forest habitat will include the LSRs and will follow Riparian Reserves on federal lands. A shift in the *distribution* of older forest to federal lands would occur. However, the *total amount* of older forest would remain approximately the same. It is recognized that due to the small percentage of federal lands in this watershed (less than 20 percent) that there are limits to how much federal lands can contribute to older forest habitats over time. Older forest habitats are especially important next to water and near special habitats.

**Finding #2:** A scarcity of standing dead/down log habitat exists, especially larger material in the early stages of decay (large, hard material). Estimates show that the amounts of standing/down dead are below Salem District RMP standards. Over the long term, standing/down dead on federal lands is expected to approach 60 percent of potential cavity dwelling wildlife populations as older forest develops in LSRs and Riparian Reserves and green tree retention guidelines are implemented. A slight increase of standing/down dead on private/state lands would occur as new FPA requirements for standing dead continue to be implemented.

**Finding #3:** Some LSR boundaries delineated by the Salem District RMP follow legal boundaries (section lines) rather than ecological features. Of particular interest is Harry Mountain Ridge and Snow Peak. Managing along legal boundaries would be inconsistent with the management of these LSRs as ecosystems. In addition, three known spotted owl sites (KOSs) in the adjacent Quartzville and Crabtree watersheds that are viable would be better protected with ecological boundaries. Protecting these KOSs is particularly important since no viable known owl sites occur in Thomas Creek Watershed and these three sites represent the closest viable KOSs to the watershed. Adjustment of LSR boundaries along topographic features, type changes or even roads rather than legal boundaries would make the LSRs more ecologically sound.

**Finding #4:** Snow Peak Ecosystem and Park Creek Meadows are priority special habitats in the watershed. Older forest is especially important near these special habitats.

**Finding #5:** Certain special status/special attention and species of concern are associated with older forest habitats (including the northern spotted owl, *Oxyporus nobilissimus*, *Pseudocyphellaria rainierensis*, and *Corydalis aquae-gelidae*) and standing dead/down logs (see appendices A-1 and 2, B-1 and 2 ), which have been identified as habitats of concern. Of the eight active known spotted owl site centers in the watershed, none were found viable presently. Surveys indicate that four of the eight are stable presently, including two that are found in the Thomas Creek LSR. These two of the four are expected to remain stable in the long term, due to their location in the LSR.

Five active known owl site centers are found just outside the Thomas Creek Watershed. Based on past surveys of these sites and due to their location, surrounding topography, and past harvest patterns, none of four appear to contribute significantly to the functioning of the Thomas Creek Watershed. Three are found immediately to the south of the watershed in LSRs and represent the closest viable KOSs. All three are over the main Thomas Creek and Quartzville/Crabtree divide. The Thomas Creek Watershed was found not to be critical for the dispersal of spotted owls within the Cascade physiographic province.

**Finding #6:** A loss of soil productivity exists within the watershed. This is due to the high proportion of compactable soils that have had management activities. Also, contributing is nutrient loss due to removal of the surface horizon.

**Finding #7:** Currently, the average total road density across the Thomas Creek Watershed is estimated at 5+ miles per section, which is considered high. However, a high percentage of roads are at least seasonally closed which helps reduce disturbance to wildlife, particularly on private lands. The habitat effectiveness index derived from open road densities is already currently at or near 0.40, which is a threshold value between viable and limiting for elk. Open road densities on federal lands were found more limiting, with a habitat effectiveness index of 0.35. Road densities are expected to increase across the watershed as additional roads are constructed for harvest.

Roads have impacted riparian ecosystems and thus some water quality due to the large number of road stream intersections.

**Finding #8:** Water quality within this watershed needs improvement to ensure healthy riparian, aquatic and wetland ecosystems. Water quality was designated as limited due to erosional processes in the upper watershed and water withdrawal in the lower reaches. The low dissolved oxygen levels could be a result of increased water temperature due to the low summer flows and lack of riparian vegetation.

A scarcity of diverse older forest riparian areas exists. This has resulted in a lack of large woody debris necessary for stream structure.

**Finding #9**: Very little recent fish habitat inventory data is available for the Thomas Creek

Watershed. ODFW surveyed 12.5 miles of Thomas Creek, between Jordan Creek and Hortense Creek, in 1992. Less than three miles of inventory has been completed on tributary streams (Neal Creek and Ella Creek). Fish distribution within the watershed is poorly understood. BLM knows of no aquatic invertebrate data specific to the Thomas Creek Watershed.

**Finding #10**: Available data indicates a scarcity of LWD in the stream channels, especially large, key pieces of wood. LWD levels have been reduced by timber harvest activities, floods and debris torrents.

**Finding #11:** Recruitment potential for new LWD is very limited along most streams. It is estimated that only 8 percent of the riparian areas consist of 80+ year old conifer stands. Approximately 30 percent of riparian areas on federal lands consist of 80+ year old conifer stands. However, federal lands contain few miles of fish-bearing streams. Federal lands will have a limited impact on overall LWD levels in the watershed.

**Finding #12:** Stream habitat restoration opportunities are very limited on federal lands. Unconstrained and moderately constrained channels with gradients of 4 percent or less have the highest potential for salmonid habitat and are the most important reaches to consider for habitat restoration. Anadromous fish habitat on federal lands is limited to less than three miles of Thomas Creek and a portion of Ella Creek. While the federal portions of Thomas Creek have a suitable gradient for restoration work, the channel is confined by steep hillslopes and may be entrenched; both of which will limit access. Channel confinement maybe less restricting on some non-federal lands. Most tributary streams are too steep for instream projects.

**Finding #13:** Mass earth movement in the Silt Creek drainage is providing fine sediment and turbidity to Thomas Creek. The effects to anadromous and resident fish are unknown.

**Finding # 14:** Several areas with rural interface concerns occur in the Thomas Creek Watershed. Site-specific Rural Interface Areas on BLM-administered lands were identified in Table 18 page 70. Most of the Rural Interface Areas also have a VRM Class III rating. Most of the site-specific concerns from nearby residences about management practices on BLM-administered lands will be related to loss of mature forest, visual impacts, water quality and quantity impacts, and noise disturbance during logging and hauling activities. The two most sensitive areas are T. 9 S., R. 2 E., Section 31 and T. 10 S. R 1 E., Section 19. Concerns have been voiced by adjacent and nearby residence about past timber harvest activities on section 31. No specific concerns have been documented for section 19 however, given its proximity to several residences, the section was rated as having high potential sensitivity.

**Finding # 15:** With the patchwork ownership pattern of BLM administered and private industrial forest lands, the BLM has very little control over the viewshed as a whole in the Thomas Creek Watershed. It is assumed that timber harvesting activities will continue on private lands and will be evident throughout most of the watershed. On BLM-administered lands, the VRM Class I waterfalls would be adequately buffered by Riparian Reserves. No outstanding visual features were identified in the Thomas Creek Watershed that would warrant an upgrade from VRM Class III to VRM Class II. Special consideration should be given to those BLM lands that have high sensitivity for both Rural Interface and Visual Resource concerns.

**Finding # 16:** The recreational settings in the greatest demand for SCORP Region 8 are semi-primitive and primitive. The Snow Peak area is the only place in the Thomas Creek Watershed that has potential for helping to meet this need in the long term. However, most of the lands would be in adjacent watersheds. With the shortages in these settings, most of the growth in recreational use will occur in the widely distributed Roaded Natural and Roaded Modified settings. Dispersed recreational activities such as hunting, OHV use, motorcycle riding, fishing and target shooting will continue to be the dominating recreational use in the Thomas Creek Watershed. Most of this use will occur in the Neal Creek corridor and in the Snow Peak area due to the ease of access and contiguous public ownership. Areas designated for OHV use are scarce in the Willamette Valley. The Neal Creek area may provide some potential for such uses. The potential for OHV use and its compatibility with other resources and adjacent landowners should be further evaluated at the resource area or district level. No other outstanding recreational resources that warrant special protection or facility development were specifically identified on BLM-administered lands in the Thomas Creek Watershed.

**Finding # 17:** Prohibited uses such as illegal dumping, vehicle abandonment, long-term occupancy, equipment and sign vandalism, wildlife poaching, unauthorized removal of forest products and the growing or manufacturing of illegal drugs occur in varying degrees on private and public lands in the Thomas Creek Watershed. The trend of closing off public access to private lands may increase the incidence of these uses on public lands. Cooperative law enforcement efforts, such as the Linn County Protective Association, between public and private landowners, will help discourage prohibited uses.

## Recommendations

**Recommendation for Findings #1, 2, and 5:** Implement density management prescriptions in Riparian Reserves, LSRs, and CONN to develop and maintain older forest stand characteristics in younger age classes. Some desirable stand characteristics are larger green trees and recruitment of large standing/down dead and cull material for future stands, and multi-layered stands with well-developed understories and multiple species including hardwoods and other minor species, such as noble firs. Hardwood dominated forest types are relatively uncommon in Thomas Creek Watershed at 5 percent.

**Criteria:**

In the future, older forest would be found in the LSRs and Riparian Reserves on federal lands.

***Priorities for density management*** to accelerate the development of older forest conditions would be
1). In Riparian Reserves (See recommendation #8 also)
2). In LSR
3). CONN outside Riparian Reserves
4). *Oxyporus* reserve in section 5, T.11S., R.2E.

In all stands

a. Meet Aquatic Conservation Objectives
b. Maintain Habitat for the spotted owl
    1. Over 70 years, maintain as suitable habitat.
    2. 40-70 years, maintain as dispersal habitat

In young stands, additional criteria for identifying projects include:

a. Up to minimum commercial diameters, generally less than 20 years of age. Use a range of residual tree densities. Consider creating small isolated openings, less than ¼ acre in size, over less than 5 percent of the area, and leaving 10 percent unthinned.
b. Stocking control: Highest priorities are overstocked even-aged stands greater than 250 dominate/co-dominate trees per acre or 20 percent over target levels of 200-250 tpa.
c. Species composition control: favor minor species including hardwoods by increasing growing space around them.
d. Retain developing understories that do not interfere with the development of dominate and co-dominate trees in the stand, especially noble firs in the Pacific silver fir zone.
e. Standing dead/down log recruitment: retain enough green tree capital for recruitment in future stands.
f. Identify stands for treatment through stand exams, riparian surveys and/or stocking surveys.

In 20 to 70-year-old aged stands, where dominate trees in the stand are less than 18 inches d.b.h., criteria for identifying projects include:

a. Maintain 40 to 50 percent crown closures. Use a wide range of residual tree densities. Heavy thinning with as low as 25 to 50 trees per acre should occur over 5 to 15 percent of the area. Consider creating small isolated openings, less than 1 acre in size, over less than 5 to 15 percent of the area, and leaving 10 percent unthinned.
b. Stocking control: Highest priorities are overstocked even-aged stands greater than 200 dominate/co-dominate trees per acre.
c. Species composition control: favor minor species including hardwoods and noble firs.
d. Retain developing understories where present by reducing overstory stocking to allow for their growth.
e. Standing dead/down log recruitment: retain enough green tree capital for recruitment in future stands. Create enough large, hard standing/down dead with 20+ inches dbh trees to achieve 80 percent of potential cavity dwelling wildlife populations.
f. Identify stands for treatment through stand exams, riparian surveys and/or stocking surveys.
g. Use appropriate mitigation measures to insure the least impact.
h. Do not treat *Phellinus* pockets and do not plant nonnative species.

<u>In mature stands over 70 years of age</u> where dominate trees exceed 18 inches dbh, late successional characteristics are lacking and are unlikely to occur without treatment, criteria for identifying projects include:

a. Maintain 60 to 70 percent crown closures (suitable habitat). Use a wide range of residual tree densities. Heavy thinning with as low as 25 to 50 trees per acre should occur over 5 to 15 percent of the area. Consider creating small isolate openings, less than 1 acre in size over 5 to 15 percent of the area, and leaving 20 percent unthinned.
b. Stocking control: Highest priorities are overstocked even-aged stands greater than 150 dominate/co-dominate trees per acre in the overstory.
c. Species composition control: favor minor species including hardwoods and noble firs.
d. Retain developing understories where present by reducing overstory stocking to allow for their growth.
e. Standing dead/down log recruitment: Create enough large, hard standing/down dead with 20+ inches dbh trees to achieve 80 percent of potential cavity dwelling wildlife populations. Leave merchantable material on the site to meet snag and DWD criteria.
f. Use appropriate mitigation measures to insure the least impact.
g. Do not treat *Phellinus* pockets and do not plant nonnative species.
f. Identify stands for treatment through stand exams and/or riparian surveys.

**Recommendation for Findings #1, 2, and 5:** Implement RMP/ROD standards and guidelines for green tree retention for the creation, recruitment and development of standing/down dead habitat and to contribute to the development of older forest stand characteristics. Due to the scarcity of standing/down dead habitat, protect existing material. Leave additional green trees in future harvest units to make up for deficiencies in current conditions. Create large, hard standing/down dead in these deficient areas.

**Criteria:**

In GFMA, leave 10 to 12 green trees per acre for recruitment of standing dead, coarse woody debris and development of a large green tree component in future stands.

In CONN, leave 16 to 22 green trees per acre.

In RR and LSR, Create large, standing/down dead in areas with less than two large standing dead and less than 240 lineal feet per acre of down material.

Favor the development of large diameter noble firs in the Pacific silver fir zone.

Leave trees should be over 12 inches dbh and represent the current range of conifer species, size and diameters.

**Recommendation for Findings #3, 4 and 5:** Emphasize older forest in the vicinity of special habitats. Near special habitats, particularly Park Creek Meadows and the Snow Peak Ecosystem, protect and encourage the development of older forest habitats. Create, buffer and protect high contrast/natural edge habitats which along with the special habitats are among the most valuable wildlife habitats in the watershed.

**Criteria:**

Protect stands next to Park Creek Meadows. This includes T.10S., R.1E., section 1, OI units #010,020, 050, and 060. Allow these stands to develop into older forest habitats.

Protect the Snow Peak Ecosystem including nearby older forest stands, onw KOS, special habitats, and the *Oxyporus* and *Corydalis* populations in the *Oxyporus* Reserve by adjustment of the LSR boundaries as shown on Proposed LSR Boundary, Map 25.

**Recommendation for Findings #3, 4 and 5:** Adjust boundaries of LSRs to make them more ecologically sound and better protect special habitats and wildlife values in Thomas Creek and adjacent watersheds.

**Criteria:**

Use more ecologically meaningful features such as watershed boundaries, roads, and forest type breaks to define LSR boundaries.

Protect the Snow Peak Ecosystem including older forest stands in the vicinity, special habitats and *Oxyporus nobilissimus* by adjustment of the LSR boundaries as shown on Proposed LSR Boundary, Map 25.

Adjust the Quartzville/Crabtree LSR boundary to approximate the Harry Mountain ridge that separates Thomas Creek Watershed from Quartzville and Crabtree watersheds as shown on the FEIS federal land allocations proposed under Alternative 9. For simplicity and clarity, the new proposed boundary would be the Harry Mountain Road as shown on Proposed LSR Boundary, Map 25. Adjusting this LSR boundary along the topography would make this LSR more ecologically sound and better protect two adjacent KOSs. Protecting these KOSs is important because they represent the closest viable sites to the watershed and no viable KOSs are found within the Thomas Creek Watershed.

**Recommendation for Finding #5:** A temporary 600-acre reserve in section 5, T.11S., R.2E protects the only known sites of *Oxyporus nobilissimus* and *Corydalis aquae-gelidae* in the watershed. Both are critical to maintaining the viability of these species over their ranges as they are the southernmost known populations in their ranges. *Pseudocyphellaria rainierensis* is in the middle of its range in the Connectivity LUA in section 5, T.11S., R.3E. It is an important population to maintain to ensure the continued viability of the species throughout its range.

**Recommendation for Finding #6:** Maintain soil duff cover. On all proposed actions, keep soil compaction levels as low as operationally feasible. Mitigate compaction where possible using winged subsoilers, low psi backhoe pilers and other new technology. Mitigate existing compaction where feasible.

**Recommendation #7 for Findings #6 and 7:** Close approximately 13 miles of road to protect critical wildlife and botanical values and reduce open road densities on federal lands. High priority would be placed on road closures near special habitats, rare plant and fungus sites. In the future, maintain open road densities at or below current levels. The roads can be rehabilitated, obliterated, or blocked.

Identify and replace failing and under designed drainage structures that represent high risk adverse impacts to water quality and aquatic and riparian habitat conditions. Plan to convert all culverts to those able to withstand 100 year flood events.

Develop a comprehensive transportation management plan that meets the Aquatic Conservation Strategy Objectives. This will include establishing the purpose of each road by developing the road management objectives.

***Priorities for road closures***:

A. BLM roads not under current Reciprocal Right-of-Way Agreement.
B. Roads not accessing Matrix lands.
    Priorities:
    1. Riparian Reserves
    2. LSR
C. Roads with critical wildlife and botanical values.
D. Roads not used or maintained, i.e., overgrown.
E. Block roads when the above criteria are met.

        1. For law enforcement to prevent littering and dumping.
        2. When ATV or 4-wheel drives are causing undue resource damage.

F. Rehabilitate roads (includes a range of options from seeding, culvert removal, obliteration and subsoiling) when:

    1. Unstable areas are involved.
    2. The present condition is unsuitable.
    3. The potential for sediment contribution is significant.

**<u>When constructing new roads on federal lands</u>**, the following criteria may be used:

A. Strive for no net increase in road densities on federal lands

B. ***For roads crossing streams***

    1. Priority of areas to be avoided - Interior old growth or other special habitats, LSRs, Connectivity, older age classes.
    2. Consider constructing temporary crossings (low water crossings, temporary bridges, etc. ). Analyze all other opportunities.
    3. Provide for adequate fish passage.
    4. Do not cross any unstable soils.
    5. Balance with enhancement opportunities within the area.

C. ***For roads within Riparian Reserves*** (not crossing)

    1. On all streams, sustained parallel construction should be avoided and prevented within one site potential tree.
    2. Not on unstable ground.
    3. Consider temporary roads to be obliterated after the project is completed.

See Appendix G.1 for a specific list of recommended road closures - total 13 miles.

**Recommendation for Findings #2, 6 and 8:** Locate areas of severe erosion with particular emphasis on the area of unstable soil above and next to Silt Creek. Continue communication with the private landowner to search for alternatives to reduce sedimentation into Thomas Creek through cooperative means. Maintain an amount and distribution of woody debris approaching that of healthy stand conditions. Manage for recruitment and long-term maintenance of coarse woody debris.

**Recommendation for Finding # 8:** Use interim Riparian Reserve widths identified in the ROD standards and guidelines until a project level, site specific analysis is done by an interdisciplinary team. Changes in Riparian Reserves and management activities will be used to promote properly functioning riparian conditions and promote older forest characteristics. Maintain and enhance the species composition and structural diversity of plant communities in riparian area and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, normal rates of soil erosion, bank erosion, and channel migration. Plant and maintain native species in riparian areas and wetlands to provide adequate stream shading, especially the Neal Creek area. Maintain channel structure to provide energy dissipation. Provide adequate amounts and distribution of caorse woody debris in riparian areas to maintain physical stream compexity and stability. See

Recommendation for density management criteria. Riparian Reserve treatments designed by interdisciplinary team on specific sites would promote the following:

* An adequate source of coarse woody material.
* Adequate vegetative cover to protect banks and dissipate energy during high flow events.
* Minimum of 75 percent site potential shading for streams.
* Floodplain and channel characteristics adequate to dissipate stream energy.
* Lateral stream movement associated with natural sinuosity.
* Sinuosity, width/depth ratio and gradient balanced with landscape setting.
* Upland watershed not contributing to riparian degradation.
* Stream in balance with water and sediment supply.
* Stream vertically stable.
* Fall hazard trees across streams.

Coordinate with watershed councils, adjacent landowners, community members, and other agencies to improve water quality.

**Recommendation for Finding #9:** The BLM should cooperate with ODFW and other partners if the opportunity arises to complete additional fish habitat inventories in the watershed. BLM funding would be used to collect data on BLM lands. Opportunities should be explored for collecting information on aquatic invertebrates. Streams on federal lands in the Upper Thomas sub-watershed may provide opportunities to look for sensitive invertebrates known to occur at 4000-6000 foot elevations.

**Recommendation for Findings #8, 10 and 11:** Provide for adequate amounts and distribution of coarse woody debris in riparian areas to maintain physical stream complexity and stability. See Recommendation #1 for density management criteria. Other riparian reserve treatments designed by interdisciplinary team on specific sites would promote the following:

*An adequate source of coarse woody material.
*Adequate vegetative cover to protect banks and dissipate energy during high flow events.
*Minimum of 75 percent site potential shading for streams.
*Floodplain and channel characteristics adequate to dissipate energy.
*Vegetation with root masses capable of withstanding high flow events.
*Floodplain and instream structure adequate to dissipate stream energy.
*Lateral stream movement associated with natural sinuosity.
*Sinuosity, width/depth ratio and gradient balanced with landscape setting.
*Upland watershed not contributing to riparian degradation.
*Stream in balance with water and sediment supply.
*Stream vertically stable.
*Fall hazard trees across streams.

**Recommendation for Finding #12:** BLM lands need to be surveyed to decide if appropriate sites exist for fish habitat restoration. These surveys would decide if restoration needs exist, if suitable channel gradient and channel constrainment exists (generally 4 percent or less), and if access is available. Using helicopters to deliver LWD into Thomas Creek may be an option if suitable channel conditions exist but access is unavailable. Particular attention should be given to developing off-channel habitats along Thomas Creek. Some opportunities may exist for placing LWD into tributary streams for resident fish. Limited opportunities are found on federal lands for resident fish streams with most occurring in Neal Creek and Criminal Creek. The BLM should explore opportunities for cooperative restoration projects with adjacent landowners. Opportunities along Thomas Creek include:

1. T10S, R2E, Sec 17: good access from Thomas Creek Road, opportunity to open existing off-channel habitats and to place LWD

2. T10S, R2E, Sec 15: poor access, opportunity to place LWD

3. T10S, R3E, Sec 19: poor access, opportunity to create off-channel habitats and to place LWD

See density management recommendations for riparian areas in wildlife

**Recommendation for Finding #13:** Explore opportunities to catch and store sediment in Silt Creek before it reaches Thomas Creek. Opportunities may be found to stabilize the earth movement in the slide area. However, any measures to stable earth movement should be considered as temporary since the movement is natural and deep-seated.

**Recommendation for Findings #14 and 15:** Many management practices can be used to mitigate potential impacts associated with timber harvest activities in areas with Rural Interface and Visual Resource concerns. Below is a list of mitigating actions that could be taken depending on the proposed action and the site-specific characteristics.

*Early on in timber harvest or other project planning, reduce visual or other disturbance factors by designing the size, shape, and location of the timber harvest units or project.

*Get adjacent landowner participation early in planning process for areas with a potential for high sensitivity.

* Where possible, use green retention trees, and riparian reserves to buffer the visual impacts from view. Consider leaving additional trees for added buffering.

*Where possible, consider using alternative reforestation site preparation prescriptions to broadcast burning.

**Recommendation for Finding #16:** Further explore the potential of the Neal Creek Corridor for providing motorized and/or motorized trail use that is compatible with other resources.

At a minimum develop a GIS inventory of dispersed campsites and OHV activity in Neal Creek corridor and Snow Peak area. Add additional inventory on dispersed recreation in the watershed as time allows.

**Recommendation for Finding #17:** Continue to work with the Linn County Forest Protective Association and contribute toward funding the Linn County Forest Sheriff to the extent that budget constraints allow.

## Land Tenure

The highest priority lands in the Thomas Creek Watershed for retention in federal ownership include federal lands with high ecological values. These lands are considered Zone 1 according to definitions under Land Tenure on page 53 of the Salem District RMP. These lands include all LSRs, anadromous fish habitat, and Park Creek Meadows. The remaining lands in the watershed are in Zone 2 according to the RMP. The *Oxyporus* Reserve in section 5, T.11S., R.2E., in Zone 2, is also a high priority to retain in federal ownership. No federal lands are found in the watershed that meet the definition of Zone 3, high priority to exchange out of federal ownership.

The lands with potential for BLM acquisition include Indian Prairie (11S-2E- Sec. 4) and Erica Meadows (9S-1E - Sec. 26, 35, & 36). and fish habitat along Thomas Creek (10S-2E-Sec 24).

# Chapter 8  Data Gaps, Inventory, Monitoring

## Information Gaps

1. Lack of information on Special Status /Special Attention Species (including aquatic macroinvertebrates) occurrence in the Thomas Creek Watershed.

2. Lack of information on species associations with special habitats in the watershed.

3. TPCC type classification on private land.

4. Specific relationships between duff/woody material and beneficial soil organisms in the watershed.

6. Comprehensive data on coarse woody debris size and distribution throughout the watershed.

7. Soil carbon/nitrogen ratios.

8. Available trace elements in the soil and trace element requirements of tree species.

9. Water quality data throughout the watershed.

10. Streamflow data for Thomas Creek and tributary streams (such information ends in 1987).

11. Acres of compaction on private land.

12. Streamflow data for Upper Thomas Creek (present data is taken near Scio)

13. Groundwater levels for Thomas Creek (present data is taken from wells in Linn County).

14. Fish habitat inventory data for upper Thomas Creek and tributary streams; post-flood habitat data for Thomas Creek (Jordan to Hall Creek).

15. Fish distribution information.

16. Fish population information for anadromous and resident fishes.

17. Quantitative data on level and location of dispersed recreational use of private and public lands in the Thomas Creek Watershed.

## Inventory Needs

1. Survey for priority species in the watershed. Special emphasis should be placed on special status/special attention species (including aquatic macroinvertebrates) .

2. Survey special habitats. Highest priority would be placed on Park Creek Meadows and Snow Peak Ecosystem. Private lands to the north of Snow Peak should be inventoried and their potential for acquisition evaluated.

3. Continue spotted owl surveys of KOSs which have site centers or core areas on federal lands. Continue cooperative efforts with state/private land owners to survey other KOSs located on adjacent state/private.

4. Areas of landsliding after the 1996 flood.

5. Site-specific studies concerning natural erosion processes.

6. Ground truthing of all sediment sources.

7. Ground truthing of all stream categories and locations

8. Riparian inventories on all non-inventoried riparian areas.

9. Post flood inventories of all riparian areas inventoried in 1995.

10. Riparian restoration opportunities from inventories.

11. Information needed to craft acceptable method for adjusting riparian widths.

12. Fish habitat inventory data for upper Thomas Creek and tributaries and a post-flood inventory of Thomas Creek between Jordan and Hall Creek.

13. Fish distribution information.

14. Inventory dispersed campsites and other indications of concentrated visitor use (i.e. trails and target shooting areas) on BLM-administered lands. Develop GIS theme to store data. Also look for indications of prohibited uses.

## Monitoring

1. Monitor erosion resulting from road construction and use.

2. Monitor newly compacted areas via contract administrator.

3. Monitor movement of current landslide areas and other soil movement areas.

4. Monitor amounts and movement of coarse woody debris before and after timber operations.

5. Monitor spawning gravel quality in Thomas Creek.

6. Monitor spring chinook and steelhead spawning and juvenile population densities.

7. Monitor aquatic invertebrate populations in Thomas Creek.

8. Monitor inventoried visitation sites on an annual or biannual basis to help track level of use or identify potential conflicts with other resources.

### Water Quality and Quantity

1. Monitor changes in road density and condition.

2. Monitor stream temperatures and increase number of monitoring sites.

3. Measure streamflows in Thomas Creek and tributaries.

4. Monitor dissolved oxygen and turbidity levels.

5. Monitor other chemical parameters.

### Riparian

1. Monitor riparian habitat before and after implementing management prescriptions.

## Research

1. Determine data on duff, coarse woody debris, and relationships to beneficial soil organisms in the watershed.

2. Study natural erosional processes versus human generated erosional problems to determine extent of productivity loss.

3. Study data on duff, coarse woody debris and relationship to nutrient cycling.

4. Determine what coarse woody requirements of the watershed are to maintain site productivity.

5. Determine evapotranspiration rates for tree and shrub species.

6. Study damage to tree roots from using winged subsoiler to ameliorate compaction in density management areas.

### Water Quality and Quantity

1. Study effects of different densities of forest stands in different soil types to streamflow and water quality.

2. Study the change in streamflows resulting from density management treatments.

# Appendices

## A. Acronyms

The following list of Acronyms are used in this document.

| | |
|---|---|
| **AWHC** | Available Water Holding Capacity |
| **BLM** | Bureau of Land Management |
| **C/D** | Connectivity/Diversity |
| **CMAI** | Culmination of Mean Annual Increment |
| **CONN** | Connectivity |
| **CWD** | Coarse Woody Debris |
| **DA** | Designated Area |
| **DBH** | Diameter at Breast Height |
| **DEQ** | Department of Environmental Quality |
| **ECA** | Equivalent Clearcut Acres |
| **FEMAT** | Report ot the Forest Ecosystem Management Assessment Team |
| **FOI** | Forest Operations Inventory |
| **FPA** | Forest Practices Act (State of Oregon) |
| **GFMA** | General Forest Management Area |
| **GIS** | Geographic Information System |
| **HEc** | Habitat Effectiveness for cover quality |
| **HEf** | Habitat Effectiveness for forage quality |
| **HEr** | Habitat Effectiveness for open road densities |
| **Hes** | Habitat Effectiveness for size and spacing |
| **IDT** | Interdisciplinary team |
| **KOS** | Known Owl Site |
| **LSR** | Late-Successional Reserve |
| **LUA** | Land Use Allocation |
| **LWD** | Large Woody Debris |

| | |
|---|---|
| **OI** | BLM Operations Inventory: Forest Cover Stand Condition and Managment History |
| **O & C** | Oregon and California Railroad grant lands |
| **ODF&W** | Oregon Department of Fish and Wildlife |
| **PCT** | Precommercial Thinning |
| **PAW** | Plant Available Water |
| **PFC** | Potential Future Condition |
| **RMP/FEIS** | Salem District Resource Management Plan/Final Environmental Impact Statement |
| **PSQ** | Probable Sale Quantity |
| **RIA** | Rural Interface Area |
| **RN** | Roaded Natural |
| **ROD** | Record of Decision |
| **ROS** | Recreation Opportunity Spectrum |
| **SEIS/ROD** | Supplemental Environmental Impact Statement/Record of Decision for Amendments to Forest Service and Bureau of Land Managment Planning Documents Within the Range of the Northern Spotted Owl |
| **SFP** | Special Forest Products |
| **SSS** | Special Status Species |
| **SWB** | Sub-Watershed Basin |
| **TPCC** | Timber Production Capability Classification |
| **TSZ** | Transient Snow Zone |
| **VRM** | Visual Resource Managemnet |
| **WAA** | Watershed Analysis Area |
| **WODDB** | Western Oregon Digital Database |

## B.  Public Scoping

During the winter of 1994, letters were sent to a random selection of landowners within the Thomas Creek watershed.   A copy of the letter follows.   The addition of Neal Creek in Spring 1995 and the thought that visitors/users of the watershed might have some concerns to share, prompted the posting of signs to solicit other inquiries.

The following is a short summary of the comments that were received.  They are not listed in any order, the number in () indicates the number of comments about that issue.

1.  Timber - timber productivity should be maintained (4)

2.  Federal Land Management - the federal land makes up a very small portion of the watershed, so why is the BLM doing watershed analysis.  The Northwest Forest Plan states that watershed analysis is a tool to be used by federal agencies to generate information to guide ecosystem management.

3.  Water Quality - maintain and enhance water quality for fisheries, irrigation and other uses.(5) Stream restoration projects needed - public education.

Other individual concerns that were brought up include: gating and closing all roads, building no more new roads, banning 3 wheelers, 200 year rotation, surveying for sensitive species.  Some concerns dealt with areas outside the realm of influence of this watershed analysis and are not addressed.  These included: preserving white oak meadows, rewarding those who plant and penalizing those who don’t, catching litterers,  no herbicide spraying, and no cattle grazing in riparian areas.

Since this is a dynamic analysis, public comments will be taken at any time and can be added to the file along with any new data that is forth coming.

## Thomas Creek Watershed

Citizen Interview

1. Name ______________________________ Date______________

   Address________________________________________________

   ________________________________________________

   Telephone______________________________

   Organization __________________________________________

2. What do you see as the most important issues in this watershed? What do you think needs to be done to resolve these issues?

3. Are there any specific locations within this watershed of particular concern to you? What are those areas and what are your concerns?

4. What kind of watershed restoration work would you like to see planned in the Thomas Creek Watershed and specifically where would that work be?

## C.1. Wildlife

The following list of vertebrate species is known or suspected to occur in the Thomas Creek WA. Occurrence codes for Herpetofauna species are based on records in the Salem District Wildlife Observation Database (WOBS), Oregon Natural Heritage Program (ONHP), and on extrapolation from literature specific to the Pacific Northwest region as a whole. This list is intended to be modified as new information is acquired.

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### HABITAT & OCCURRENCE KEY:

V=Willamette Valley & Cascades Foothills Only

H=High Elevation Habitats Only

I=Introduced, L=local, B=Breeding, Spring, Summer & Fall

NB=Non-breeding, Fall, Winter & Spring

OU=Occurrence Uncertain, UB=Unknown Breeding Status,

E=Extirpated

### FEDERAL LISTINGS: ODFW LISTINGS:

LE=Listing Endangered, SE=State Endangered

LT=Listing Threatened, ST=State Threatened

C1=Candidate, SOC=Species of Concern, SC=State Critical

BS=Bureau Sensitive, SV=State Vulnerable

AS=Assessment Species, SP=State Peripheral or Naturally Rare

TS=Tracking Species, SU=State Undertermined Status

### SURVEY AND MANAGE SPECIES (SU & MA)

Y=Listed in table C-3 of Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the N.Spotted Owl.

B=Protection buffer Species

### THOMAS CREEK WA - WILDLIFE LIST - HERPTILES

| SPECIES | SPCODE | FEDERAL | STATE | BUREAU | SU & MU | OCC |
|---|---|---|---|---|---|---|
| Northwestern salamander | AMGR | | | | | |
| Long-toed salamander | AMMA | | | | | OU |
| Pacific giant salamander | DIEN | | | | | |
| Cascade torrent salamander | RHCA | | SV | | | L |
| Clouded salamander | ANFE | | SU | TS | | L |
| Oregon slender salamander | BAWR | | SV | BS | | |
| Ensantina | ENES | | | | | |
| Dunn's salamander | PLDU | | | | | |
| Roughskin newt | TAGR | | | | | |
| Pacific tree frog | HYRE | | | | | |
| Tailed frog | ASTR | SOC | SV | BS | | L |
| Red-legged frog | RAAU | SOC | SU | BS | | |
| Foothill yellow-legged frog | RABO | SOC | SV | BS | | OU |
| Bullfrog | RACAT | | | | | I,V |
| Northwestern pond turtle | CLMA | SOC | SC | BS | | OU |
| Northern alligator lizard | ELCO | | | | | |
| Southern alligator lizard | ELMU | | | | | V,L |
| Western fence lizard | SCOC | | | | | V,L |
| Western skink | EUSK | | | | | A,L |
| Rubber boa | CHBO | | | | | A |
| Racer | COLCO | | | | | V |
| Ringneck snake | DIPU | | | | | V,L |
| Gopher snake | PIME | | | | | V |
| Northwestern garter snake | THOR | | | | | A |
| Common garter snake | THSI | | | | | A |
| Western rattlesnake | CRVI | | | | | OU[1] |

`

## CASCADES RESOURCE AREAS - WILDLIFE LIST - BIRDS

| SPECIES | SPCODE | FEDERAL | STATE | BUREAU | SU & MA | OCC |
|---|---|---|---|---|---|---|
| Pied-billed grebe | POPO | | | | | B |
| Eared grebe | PODNI | | | | | NB |
| Western grebe | AEOC | | | | | NB |
| Great blue heron | ARHE | | | | | B |
| Green-backed heron | BUST | | | | | V,B |
| Canada goose | BRCA | | | | | B |
| Wood duck | AISP | | | | | B |
| Green-winged teal | ANCR | | | | | NB |
| Mallard | ANPL | | | | | B |
| Northern pintail | ANAC | | | | | NB |
| Cinnamon teal | ANCY | | | | | V,B |
| Blue-wingedTeal | ANDI | | | | | V,UB |
| Northern shoveler | ANCL | | | | | NB |
| Gadwall | ANST | | | | | NB |
| American wigeon | ANAAM | | | | | NB |
| Ring-necked duck | AYCO | | | | | NB |
| Lesser scaup | AYAF | | | | | NB |
| Harlequin duck | HIHI | SOC | SP | BS | | UB |
| Common goldeneye | BUCL | | | | | NB |
| Barrow's goldeneye | BUIS | | SP | TS | | NB |
| Bufflehead | BUAL | | SP | AS | | NB |
| Hooded merganser | LOCUC | | | | | B |
| Common merganser | MERME | | | | | B |
| Ruddy duck | OXJA | | | | | NB |
| Turkey vulture | CAAU | | | | | B |
| Osprey | PAHA | | | | | B |
| Bald eagle | HALE | LT | ST | LT | | NB |
| Northern harrier | CICY | | | | | V,B |
| Sharp-shinned hawk | ACST | | | | | B |
| Cooper's hawk | ACCO | | | | | B |
| Northern goshawk | ACGE | SOC | SC | BS | | UB |
| Red-tailed hawk | BUJA | | | | | B |

| SPECIES | SPCODE | FEDERAL | STATE | BUREAU | SU & MA | OCC |
|---|---|---|---|---|---|---|
| Rough-legged hawk | BULA | | | | | V,NB |
| Golden eagle | AQCH | | | | | B |
| American kestrel | FASP | | | | | B |
| Merlin | FACO | | | AS | | NB |
| Peregrine falcon | FAPE | LE | SE | LE | | NB |
| Ring-necked pheasant | PHCO | | | | | V,I |
| Blue grouse | DEOB | | | | | H,B |
| Ruffed grouse | BOUM | | | | | B |
| Wild turkey - Merriam | MEGA | | | | | V,IL |
| California quail | CACAL | | | | | V,B |
| Mountain quail | ORPI | | | TS | | B |
| Virginia rail | RALI | | | | | B |
| American coot | FUAM | | | | | B |
| Sandhill Crane | GRCATA | | | TS | | NB |
| Killdeer | CHVO | | | | | V,B |
| Greater yellowlegs | TRME | | | AS | | V,NB |
| Solitary Sandpiper | TRSO | | | TS | | V,NB |
| Spotted sandpiper | ACMA | | | | | B |
| Western sandpiper | CAMAU | | | | | V,NB |
| Least sandpiper | CAMI | | | | | V,NB |
| Dunlin | CAALP | | | | | V,NB |
| Common snipe | GAGA | | | | | V,B |
| Ring-billed gull | LADE | | | | | NB |
| California gull | LACAL | | | | | NB |
| Herring gull | LAAR | | | | | NB |
| Rock dove | COLI | | | | | B |
| Band-tailed pigeon | COFA | | | | | B |
| Mourning dove | ZEMA | | | | | V,B |
| Common barn-owl | TYAL | | | | | V,B |
| Western screech-owl | OTKE | | | | | V,B |
| Great horned owl | BUVI | | | | | B |
| Northern pygmy-owl | GLGN | | | TS | | H,B |
| Northern spotted owl | STOC | LT | ST | LT | | B |

| SPECIES | SPCODE | FEDERAL | STATE | BUREAU | SU & MA | OCC |
|---|---|---|---|---|---|---|
| Barred owl | STVA | | | | | B |
| Short-eared owl | ASFL | | | | | V,B |
| Northern saw-whet owl | AEAC | | | | | B |
| Common nighthawk | CHMI | | | | | B |
| Common poorwill | PHNU | | | | | NB |
| Vaux's swift | CHVA | | | | | B |
| Rufous hummingbird | SERUF | | | | | B |
| Belted kingfisher | CEAL | | | | | B |
| Lewis’ woodpecker | MELE | | SC | BS | | NB |
| Acorn woodpecker | MEFO | | SU | TS | | V,B |
| Red-breasted sapsucker | SPRU | | | | | B |
| Downy woodpecker | PIPU | | | | | V,B |
| Hairy woodpecker | PIVI | | | | | B |
| Northern flicker | COAU | | | | | B |
| Pileated woodpecker | DRPI | | SV | BS | | B |
| Olive-sided flycatcher | COBO | | | | | B |
| Western wood-pewee | COSO | | | | | B |
| Willow flycatcher | EMTR | SOC | | BS | | B |
| Hammond's flycatcher | EMHA | | | | | H,B |
| Pacific-slope flycatcher | EMDI | | | | | B |
| Western kingbird | TYVE | | | | | UB |
| Horned lark | ERAL | | | TS | | V,UB |
| Purple martin | PRSU | | SC | BS | | V,UB |
| Tree swallow | TABI | | | | | B |
| Violet-green swallow | TATH | | | | | B |
| N.rough-winged swallow | STSE | | | | | V,B |
| Cliff swallow | HIPY | | | | | V,B |
| Barn swallow | HIRU | | | | | V,B |
| Gray jay | PECA | | | | | B |
| Steller's jay | CYST | | | | | B |
| Scrub jay | APCO | | | | | V,B |
| American crow | COBR | | | | | V,B |
| Common raven | CORCO | | | | | B |

| SPECIES | SPCODE | FEDERAL | STATE | BUREAU | SU & MA | OCC |
|---|---|---|---|---|---|---|
| Black-capped chickadee | PAAT | | | | | V,B |
| Chestnut-backed chickadee | PARU | | | | | B |
| Bushtit | PSMI | | | | | V,B |
| Red-breasted nuthatch | SITCA | | | | | B |
| White-breasted nuthatch | SICAR | | | | | V,B |
| Brown creeper | CEAM | | | | | B |
| Bewick's wren | THBE | | | | | V,B |
| House wren | TRAE | | | | | B |
| Marsh wren | CIPA | | | | | V,UB |
| Rock wren | SAOB | | | | | OU |
| Winter wren | TRTR | | | | | B |
| American dipper | CIME | | | | | B |
| Golden-crowned kinglet | RESA | | | | | B |
| Ruby-crowned kinglet | RECA | | | | | V,NB |
| Western bluebird | SIME | | SV | TS | | B |
| Mountain bluebird | SICU | | | | | H,NB |
| Townsend's solitaire | MYTO | | | | | H,B |
| Swainson's thrush | CAUS | | | | | B |
| Hermit thrush | CAGU | | | | | H,B<br>V,NB |
| American robin | TUMI | | | | | B |
| Varied thrush | IXNA | | | | | B<br>V,NB |
| Cedar waxwing | BOCE | | | | | B |
| Northern shrike | LAEX | | | | | V,NB |
| European starling | STVU | | | | | IB |
| Solitary vireo | VISO | | | | | V,B |
| Hutton's vireo | VIHU | | | | | V,B |
| Warbling vireo | VIGI | | | | | B |
| Red-eyed vireo | VIOL | | | | | OU |
| Orange-crowned warbler | VECE | | | | | B |
| Nashville warbler | VERU | | | | | NB |
| Yellow warbler | DEPE | | | | | V,B |
| Yellow-rumped warbler | DENCO | | | | | NB |

| SPECIES | SPCODE | FEDERAL | STATE | BUREAU | SU & MA | OCC |
|---|---|---|---|---|---|---|
| Black-throated gray warbler | DENI | | | | | B |
| Townsend's warbler | DETO | | | | | UB |
| Hermit warbler | DEOC | | | | | B |
| MacGillivray's warbler | OPTO | | | | | B |
| Common yellowthroat | GETR | | | | | B |
| Wilson's warbler | WIPU | | | | | B |
| Western tananger | PILU | | | | | B |
| Black-headed grosbeak | PHME | | | | | B |
| Lazuli bunting | PAAMO | | | | | V,B |
| Rufous-sided towhee | PIER | | | | | V,B |
| Chipping sparrow | SPPA | | | | | B |
| Vesper Sparrow | POGR | | SU | TS | | V,NB |
| Savannah sparrow | PASA | | | | | V,B |
| Fox sparrow | PAIL | | | | | V,NB |
| Song sparrow | MELME | | | | | B |
| Lincoln's sparrow | MELI | | | | | UB<br>V,NB |
| Golden-crowned sparrow | ZOAT | | | | | V,NB |
| White-crowned sparrow | ZOLE | | | | | B |
| Dark-eyed junco | JUHY | | | | | B |
| Red-winged blackbird | AGPH | | | | | B |
| Western meadowlark | STUNE | | | | | V,B |
| Brewer's blackbird | EUCY | | | | | V,B |
| Brown-headed cowbird | MOAT | | | | | V,B |
| Northern oriole | ICGA | | | | | V,B |
| Purple finch | CARPU | | | | | B |
| House finch | CARME | | | | | V,B |
| Red Crossbill | LOCU | | | | | B |
| Pine siskin | CAPI | | | | | H,B<br>V,NB |
| American goldfinch | CATR | | | | | V,B |
| Lesser goldfinch | CAPS | | | | | V,UB |
| Evening grosbeck | COVE | | | | | B |
| House sparrow | PADO | | | | | I,V,B |

## CASCADES RESOURCE AREA- WILDLIFE LIST - MAMMALS

| SPECIES | SPCODE | FEDERAL | STATE | BUREAU | SU & MA | OCC |
|---|---|---|---|---|---|---|
| Virginia opossum | DIVI | | | | | V,I |
| Pacific water shrew | SOBE | | | | | |
| Dusky shrew | SOMO | | | | | OU |
| Pacific shrew | SOPAC | | | | | |
| Trowbridge's shrew | SOTRO | | | | | |
| Vagrant shrew | SOVA | | | | | |
| Shrew-mole | NEGI | | | | | |
| Coast mole | SCOR | | | | | |
| Townsend's mole | SCTO | | | | | V |
| Big brown bat | EPFU | | | | | |
| Silver-haired bat | LANO | | | | B | |
| Hoary bat | LACI | | | | | |
| California myotis | MYOCA | | | | | |
| Long-eared myotis | MYEV | SOC | | BS | B | |
| Little brown myotis | MYLU | | | | | |
| Long-legged myotis | MYVO | SOC | | BS | B | |
| Yuma myotis | MYYU | SOC | | BS | | |
| Pacific western big-eared bat | PLTO | SOC | SC | BS | | L |
| Coyote | CALAT | | | | | |
| Gray Wolf | CALU | LE | SE | LE | | E |
| Gray fox | URCI | | | | | |
| Red fox | VUVU | | | | | V |
| Black bear | URAM | | | | | H |
| Raccoon | PRLO | | | | | |
| California Wolverine | GUGU | SOC | ST | BS | | H<br>OU$_1$ |
| River otter | LUCA | | | | | |
| Pine Marten | MAAM | | SC | BS | | H |
| Fisher | MAPE | SOC | SC | BS | | H<br>OU$_1$ |

| **SPECIES** | **SPCODE** | **FEDERAL** | **STATE** | **BUREAU** | **SU & MA** | **OCC** |
|---|---|---|---|---|---|---|
| Striped skunk | MEMEP | | | | | V |
| Ermine | MUER | | | | | |
| Long-tailed weasel | MUFR | | | | | |
| Mink | MUVI | | | | | |
| Spotted skunk | SPPU | | | | | |
| Mountain lion | FECO | | | | | |
| Bobcat | LYRU | | | | | |
| Elk | CEEL | | | | | |
| Black-tailed deer | ODHE | | | | | |
| Mountain beaver | APRU | | | | | |
| Northern flying squirrel | GLSA | | | | | |
| Western gray squirrel | SCIGR | | | | | V |
| California ground squirrel | SPBEE | | | | | |
| Golden-manteled ground squirrel | SPLA | | | | | H |
| Townsend's chipmunk | TATO | | | | | |
| Douglas squirrel | TADO | | | | | |
| Camas pocket gopher | THBU | | | | | V |
| Western pocket gopher | THMA | | | | | H |
| Beaver | CASCAN | | | | | |
| Bushy-tailed woodrat | NECI | | | | | |
| Dusky-footed woodrat | NEFU | | | | | V |
| Deer mouse | PEMA | | | | | |
| Red tree vole | ARLO | | | | Y | |
| Western red-backed vole | CLCA | | | | | |
| Gray-tailed vole | MICAN | | | | | |
| Long-tailed vole | MILO | | | | | |
| Creeping vole | MIOR | | | | | |
| Water vole | MIRI | | | | | H |
| Townsend's vole | MITO | | | | | V |
| Muskrat | ONZI | | | | | V |
| House mouse | MUMU | | | | | V,I |
| Norway rat | RANO | | | | | V,I |

| SPECIES | SPCODE | FEDERAL | STATE | BUREAU | SU & MA | OCC |
|---|---|---|---|---|---|---|
| Pacific jumping mouse | ZATR | | | | | |
| Porcupine | ERDO | | | | | |
| Nutria | MYCO | | | | | V,I |
| Pika | OCPR | | | | | H |
| Snowshoe hare | LEAM | | | | | H |
| European rabbit | ORCU | | | | | V |
| Brush rabbit | SYBA | | | | | V,OU |
| Eastern cottontail | SYFL | | | | | V,I |
| Black-tailed jackrabbit | LECA | | | | | V,OU |

# C.2. Special Status Wildlife Species

## Known & Suspected

|  | SPECIES & STATUS | HABITAT DESCRIPTION |
|---|---|---|
|  | **HERPETOFAUNA** |  |
| D | ANEIDES FERREUS **TS**<br>clouded salamander | Documented to occur in Thomas WA (2 sites). Prefers the spaces between loose bark on down logs in forests, forest edges, and clearings created by fire. |
| D | BATRACHOSEPS WRIGHTI **BS**<br>Oregon slender salamander | Documented to occur in Thomas WA (multiple sites). West slope of Cascades. Prefers down logs and woody material in more advanced stages of decay. Most common in mature and old-growth conifer forests. |
| D | ASCAPHUS TRUEI **SOC**<br>tailed frog | Documented to occur in Thomas WA (1 site). Cold, fast-flowing permanent springs and streams in forested areas. Has a very narrow temperature tolerance (40-60 degrees F). |
| D | RANA AURORA **SOC**<br>red-legged frog | Documented to occur in Thomas WA (multiple sites). Common in marshes, ponds, and streams with little or no flow, from the valley floor to about 2700 feet in mountain forests. Can occur in seasonal waters if wet until late May or June. |
| S | RANA BOYLEI **SOC**<br>foothill yellow-legged frog | No documented sites in Thomas WA, however, within geographic range. Recent declines in North portion of range. Habitat is permanent streams and vicinity, mainly in rocky, gravelly and sandy areas. |
| S | CLEMMYS MARMORATA MARMORATA **SOC**<br>Northwest pond turtle | No known sites in Thomas WA. There are historic sites in Santiam River drainages to north and west. Habitat is wetlands with emergent vegetation, rocky or muddy bottoms, sunny basking areas. Found in woodland, grassland and open forest. |
|  | **BIRDS** |  |
| S | HISTRIONICUS HISTRIONICUS **SOC**<br>harlequin duck | Highly likely to occur. Several reliable undocumented sighting in Thomas WA. Likely a rare summer resident. Found in whitewater mountain rivers and streams during nesting season. Winters on rocky coasts. |
| S | BUCEPHALA ISLANDICA **TS**<br>Barrow's goldeneye | Likely to occur in Thomas WA. Has been documented in North Santiam and Middle Santiam. Uncommon to rare Migrant and winter visitor. Open water. |
| D | BUCEPHALA ALBEOLA **AS**<br>bufflehead | Documented to occur. Common Migrant and winter visitor. Open water. |

| | | |
|---|---|---|
| S | HALIAEETUS LEUCOCEPHALUS **FT**<br>bald eagle | Suspected as a transient in Thomas WA. WA lacks larger bodies of water. Uncommon winter resident in Willamette Valley. Rare summer resident in Cascades. For nesting and perching, prefers large old-growth trees near major bodies of water and rivers. |
| D | ACCIPITER GENTILIS **SOC**<br>Northern goshawk | Documented to occur in Thomas WA (1 site). Breeding has not been confirmed. Rare Summer resident in Cascades, very rare in winter. Prefers mature or old-growth forests with dense canopy cover at higher elevations. |
| S | FALCO COLUMBARIUS **AS** | Highly likely to occur in Thomas WA. Uncommon Migrant and winter visitor. Fields, open areas and edges. |
| S | FALCO PEREGRINUS **FE**<br>peregrine falcon | Likely to occur as a transient/migrant in Thomas WA. Rare transient and winter visitor. Not likely to be a breeding species in Thomas WA. Found in a variety of open habitats near cliffs or mountains. Prefers areas near larger bodies of water, which is lacking in Thomas WA. |
| D | OREORTYX PICTA **TS**<br>mountain quail | Documented to occur in Thomas WA (multiple sites). Permanent resident. Prefers early successional stages with a mix of herbaceous and brushy vegetation. Associated with steep terrain. |
| S | GRUS CANADENSIS **TS**<br>sandhill crane | Suspected as a rare spring/fall overhead migrant in Thomas WA. |
| S | TRINGA MELANOLEUCA **AS**<br>greater yellowlegs | Suspected to occur in Thomas WA. Common transient and uncommon winter resident in Willamette Valley. Wetlands, flooded fields, and mud flats. |
| S | TRINGA SOLITARIA **TS**<br>solitary sandpiper | Suspected to occur in Thomas WA. Uncommon spring/fall migrant and transient in Willamette Valley. Wetlands, flooded fields, and small water bodies. |
| D | GLAUCIDIUM GNOMA **TS**<br>Northern pygmy owl | Common permanent resident in Thomas WA (multiple sites). Coniferous/mixed forests and edges. |
| D | STRIX OCCIDENTALIS CAURINA **FT**<br>Northern spotted owl | Permanent resident in Thomas WA (8 active known sites and 1 inactive site). Prefers mature and old-growth conifer forests with large down logs, standing snags in various stages of decay, high canopy closure and a high degree of vertical stand structure. |
| S | MELANERPES LEWIS **BS**<br>lewis' woodpecker | Likely to have occurred in the past. Formerly a common summer resident and uncommon winter visitor in Willamette Valley. Today it is a rare transient and migrant. Oak woodlands and hardwood forests. |
| S | MELANERPES FORMICIVORUS **TS**<br>acorn woodpecker | Suspected to occur in Oak woodlands in the Willamette Valley on the extreme western edge of Thomas WA. |
| D | DRYOCOPUS PILEATUS **BS**<br>pileated woodpecker | Common permanent resident in Thomas WA (multiple sites). Prefers to nest in old-growth and mature forests. Also forages in younger forests containing mature or old-growth remnants. Requires larger standing snags. |

|  |  |  |
|---|---|---|
| S | EMPIDONAX TRAILLII **SOC**<br>willow flycatcher | Highly likely common summer resident. Documented to south of WA. Associated with riparian areas. Prefers brushy habitat and early seral stages. |
| S | EREMOPHILA ALPESTRIS **TS**<br>horned lark | Suspected in extreme western edge of WA. Rare and local summer resident in Willamette Valley. Uncommon in winter. Open fields, grassy areas. |
| S | PROGNE SUBIS **BS**<br>purple martin | Suspected as a rare summer resident in Thomas WA. Typically occurs along rivers and other water bodies. Requires airspace free of obstructions to capture high-flying insects. Nests colonially in cavities in old buildings, abandoned woodpecker holes, and nest boxes. |
| D | SIALIA MEXICANA **TS**<br>western bluebird | Documented in Thomas WA (multiple sites). Uncommon permanent resident in Willamette Valley and adjacent foothills. Open areas with standing snags, or small farms with diversified agriculture. Nests in natural woodpecker cavities or artificial nest boxes. |
| S | POOECETES GRAMINEUS **TS**<br>vesper sparrow | Suspected to occur in extreme western portion of WA. Rare and local summer resident in Willamette Valley. Very rare in winter. Dry, grassy areas. |
|  | **MAMMALS** |  |
| S | MYOTIS EVOTIS **SOC**<br>long-eared myotis | Highly likely to occur in Thomas WA. Associated with snags and cave habitat. Prefers older forests. Forages over water and riparian areas. |
| S | MYOTIS VOLANS **SOC**<br>long-legged myotis | Highly likely to occur in Thomas WA. Associated with cliff/cave and snag habitat. Prefers older forests. Forages over water and riparian areas. |
| S | MYOTIS YUMANENSIS **SOC**<br>yuma myotis | Highly likely to occur in Thomas WA. Associated with cliff/cave and snag habitat. More closely associated with riparian areas than the other myotis. Prefers older forests. Forages over water and riparian areas. |
| S | PLECOTUS TOWNSENDII TOWNSENDII **SOC**<br>pacific western big-eared bat | Likely to occur in Thomas WA. Feeds on flying insects in a variety of habitats in forested areas. Primary habitat is caves, rock outcrops, and abandoned mines. |
| E | CANIS LUPUS **FE**<br>gray wolf | Likely occurred in the WA in the past. Remote mountains, wilderness, forests, tundra. Extirpated |
| E? | GULO GULO LUTEUS **SOC**<br>California wolverine | Occurrence uncertain in WA. Likely extirpated. Found in higher elevation mountainous and isolated coniferous forests. |
| D | MARTES AMERICANA **BS**<br>pine marten | One sighting in the WA. Mature and old-growth forests containing large quantities of standing snags and downed logs, in the more isolated, eastern portions of the WA. Prefers wetter forests, often near streams. |
| E? | MARTES PENNANTI **SOC**<br>fisher | Occurrence uncertain. Likely extirpated. Prefers mature and old-growth forests and riparian areas containing large quantities of dead and down wood. |

# KEY

**Occurrence:**

S = Suspected
D = Documented
E = Extirpated

**Status:**

FE = Federal endangered
FT = Federal Threatened
SOC = Species of Concern & Bureau Sensitive
BS = Bureau Sensitve
BA = Bureau Assessment
TS = Bureau Tracking

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## D.1. Special Status Plants

| **SPECIES & STATUS** | **HABITAT** | **ELEVATION (FT)** | **BEST I.D. SEASON** |
|---|---|---|---|
| **FEDERAL ENDANGERED (FE)** | | | |
| **LOMATIUM BRADSHAWII* (Rose) Math. & Const.<br>Bradshaw's lomatium | WV Linn, Mari<br>WET MEADOWS<br>GRAVELLY STREAMBEDS | <750 | APRIL-MAY |
| **FEDERAL THREATENED (FT)** | | | |
| *HOWELLIA AQUATILLIS* A. Gray<br>howellia | WV Clac, Mari, Mult<br>SHALLOW PONDS & MARSHES | <200 | MAY |
| **SIDALCEA NELSONIANA* Piper<br>Nelson's sidalcea | WV Linn, Mari | <2000 | JUNE-JULY |
| **FEDERAL PROPOSED THREATENED (PT)** | | | |
| *CASTILLEJA LEVISECTA* Greenm.<br>golden paintbrush | WV Linn, Mari, Mult<br>WET OR VERNALLY WET MEADOWS | <1000 | APRIL-AUGUST |
| **FEDERAL CATEGORY 1 CANDIDATES (FC1)** | | | |
| *DELPHINIUM PAVONACEUM* Ewan<br>peacock larkspur | WV clac, Mari, mult | <1500 | MAY-JUNE |
| **ERIGERON DECUMBENS* Nutt. VAR. *DECUMBENS*<br>Willamette daisy | WV Clac, Linn, Mari<br>GRASSLANDS | <1000 | JUNE-EARLY JULY |
| **SPECIES OF CONCERN (SoC)** | | | |
| **ASTER CURTUS* Cronq.<br>white-topped aster | WV Clac. Linn, Mari, Mult. | | |

| **SPECIES & STATUS** | **HABITAT** | **ELEVATION (FT)** | **BEST I.D. SEASON** |
|---|---|---|---|
| *ASTER GORMANII* (Piper) Blake<br>Gorman's Aster | WC Clac, Linn, Mari<br>OPEN OR SPARSLEY TIMBERED, ROCKY RIDGETOPS & MEADOWS | >3500 | LATE JULY-AUGUST |
| **CIMICIFUGA ELATA* Nutt.<br>tall bugbane | WV, WC, Clac, Linn, Mari, Mult<br>MOIST WOODS | <2000 | JUNE-MID JULY |
| **CORYDALIS AQUAE-GELIDAE* Peck & Wilson<br>cold-water corydalis | WC Clac, Linn, Mari, Mult<br>COLD SPRINGS & STREAMS | >1000 | MID JUNE-JULY |
| *DELPHINIUM LEUCAPHAEUM* Greene<br>white rock larkspur | WV Clac, Mari, Mult | <1000 | MAY-EARLY JUNE |
| **HORKELIA CONGESTA* Douglas ssp. *CONGESTA*<br>shaggy horkelia | WV Linn<br>OPEN SANDY OR ROCKY FLATS TO OPEN WOODS | LOW | APRIL-JUNE |
| *LUPINUS SULPHUREUS* Douglas ssp. *KINKAIDII* (Smith) Phillips<br>Kincaid's lupine | WV Linn, Mari<br>WILLAMETTE VALLEY | <1500 | MAY-JULY |
| *MONTIA HOWELLII* S. Watson<br>Howell's montia | WV, WC Clac, Linn, Mult<br>ROCKY RIVER BANKS ESP. IN DISTURBED SITES | <2500 | APRIL-EARLY MAY |

| **SPECIES & STATUS** | **HABITAT** | **ELEVATION (FT)** | **BEST I.D. SEASON** |
|---|---|---|---|
| **BUREAU SENSITIVE (BS)** | | | |
| *DELPHINIUM OREGANUM How.*<br>Willamette Valley larkspur | WV Linn, Mari | LOW | |
| **OXYPORUS NOBILISSIMUS* W.B. Cooke<br>giant polypore fungus, fuzzy sandozi | WC Clac, Linn<br>OLD GROWTH NOBLE FIR | | |
| *ROMANZOFFIA THOMPSONII* Marrala ined.<br>Thompson's mistmaiden | WC Linn, Mari<br>SEEPY ROCK WALLS WITH FULL SUNLIGHT | >2600 | APRIL-EARLY MAY |
| **ASSESSMENT SPECIES (AS)** | | | |
| *BOTRYCHIUM MINGANENSE* Vict.<br>gray moonwort | WC Linn | | |
| *BOTRYCHIUM MONTANUM* W.H. Wagner<br>mountain grape-fern | WC Linn, Mari | | |
| *CALAMAGROSTIS BREWERI* Thurb.<br>Brewer's reedgrass | WC Clac, Mari<br>STREAMBANKS, LAKE MARGINS, & MOIST MEADOWS | >4000 | |
| *CICENDIA QUADRANGULARIS* (Lim.) Griseb<br>(*Microcala quadrangularis*)<br>timwort | WV Linn<br>MARSHY MEADOWS | 300-1700 | MAY-JUNE |

| **SPECIES & STATUS** | **HABITAT** | **ELEVATION (FT)** | **BEST I.D. SEASON** |
|---|---|---|---|
| **HUPERZIA*<br>*OCCIDENTALIS* (Clute) Beitel<br>(*Lycopodium selago*)<br>fir club-moss | WC Clac, Linn, Mari<br>DENSE MOIST WOODS<br>HUMID AREAS<br>EXPOSED CLIFFS & TALUS | >1000 | JULY-AUGUST |
| *HYPOGYMNIA OCEANICA* Goward<br>lichen | WC Mari | | |
| *LOPHOZIA LAXA* (Lindb.) Grolle<br>liverwort | WC Linn | | |
| *LYCOPODIELLA INUNDATA* (L.) Holub<br>(Lycopodium inundatum)<br>bog club-moss | WC Clac, Linn<br>SPHAGNUM BOGS<br>MUDDY ELK WALLOWS | >3000 | |
| *LYCOPODIUM COMPLANATUM* L.<br>ground cedar | WC Clac, Mari, Mult<br>MOIST FORESTS | >3000 | |
| *MIMULUS TRICOLOR* Hartw. Ex Lindl.<br>three-colored monkeyflower | WV Linn, Mari<br>VERNAL POOLS<br>FLOODPLAINS | <1000 | MAY - JUNE |
| *NEPHROMA OCCULTUM* Wetm.<br>Lichen | WC Clac, Linn | | |
| *OPHIOGLOSSUM PUSSILUM* Raf.<br>(O. vulgatum) L. misapplied<br>adder's tongue | WC Clac, Linn<br>WET MEADOWS<br>BOGS | 2000 | |

| **SPECIES & STATUS** | **HABITAT** | **ELEVATION (FT)** | **BEST I.D. SEASON** |
|---|---|---|---|
| *POLYSTICHUM CALIFORNICUM* (D.C. Eat.) Diels<br>California sword-fern | WC Linn<br>BASE OF CLIFFS & OUTCROPS IN SHADE | MID | |
| *SCHEUZERIA PALUSTRIS* L. Var. AMERICANA Fern.<br>scheuchzeria | WC Clac, Linn, Mari<br>BOGS<br>LAKE MARGINS | 3400-4000 | JUNE-JULY |
| *STEREOCAULON SPATHULIFERUM* Vainio<br>lichen | WC Linn | | |
| *TAYLORIA SERRATA* (Hedw.) Bruch & Schimp. In B.S.G.<br>moss | WV, WC Clac, Mari<br>WETLANDS | | |
| *WOLFFIA COLUMBIANA* Carst.<br>Columbia water-meal | WV, WC Clac, Linn, Mult | | |
| **TRACKING SPECIES (TS)** | | | |
| *ALLIUM CAMPANULATUM* S. Watson<br>Sierra onion | WC Linn<br>DRY SOILS | HIGH | JUNE-JULY |
| *ARABIS FURCATA* S. Watson<br>cascade rockcress | WC Clac, Mari<br>CLIFFS, TALUS<br>ALPINE & SUBALPINE MEADOWS | MID-HIGH | MAY-JULY |
| *CASTILLEJA RUPICOLA* Piper<br>cliff paintbrush | WC Linn, Mari, Mult<br>CREVICES IN ROCKS | >500 | JUNE-AUGUST |

| **SPECIES & STATUS** | **HABITAT** | **ELEVATION (FT)** | **BEST I.D. SEASON** |
|---|---|---|---|
| *CYPERUS ACUMINATUS* Torr. & Hook<br>short-pointed cyperus | WV Linn | | |
| *CYPRIPEDIUM MONTANUM* Douglas<br>mountain lady's-slipper | DRY TO FAIRLY MOIST, OPEN TO SHRUB- OR FOREST-COVERED VALLEYS OR MOUNTAIN SIDES. | LOW-MID | MAY-AUGUST |
| *DOUGLASIA LAEVIGATA* A.Gray<br>smooth-leaved douglasia | WC Clac, Mari, Mult, Linn<br>ROCK CREVICES ON WET CLIFFS | MID-HIGH | JUNE-JULY |
| *ELMERA RACEMOSA* (S. Watson) Rydb. VAR. *PUBERULENTA* C.L. Hitchc.<br>hairy elmera | WC Linn<br>ROCKY PLACES | >5000 | AUGUST |
| *EPILOBIUM LATIFOLIUM* L.<br>broad-leaved willow-herb | WC Linn | | |
| *EPILOBIUM LUTEUM* Pursh<br>yellow willow-herb | WC Clac, Linn | | |
| *ERIGERON CASCADENSIS* Heller<br>cascade daisy | WC Linn, Mari | MID-HIGH | JUNE-JULY |
| *ISOPYRUM STIPITATUM* A. Gray<br>dwarf isopyrum | WV Mari<br>CASCADES<br>SHADY PLACES | LOW-MID | FEBRUARY-MAY |

| **SPECIES & STATUS** | **HABITAT** | **ELEVATION (FT)** | **BEST I.D. SEASON** |
|---|---|---|---|
| *JUNCUS KELLOGGII* Engelm.<br>Kellogg's dwarf rush | WV Mari<br>DAMP OR WET PLACES FROM OPEN FIELDS TO MONTANE MEADOWS AT MID ELEVATIONS | LOW-MID | APRIL-JULY |
| *LATHYRUS HOLOCHLORUS* (Piper) C.L. Hitchc.<br>thin-leaved peavine | WV Clac, Linn, Mari<br>WILLAMETTE VALLEY FENCEROWS<br>LOAMY,MOIST SOIL | <1500 | JUNE |
| *LECIDEA DOLODES* Nyl.<br>lichen | WC Linn | | |
| *LYCOPODIUM ANNOTINUM* L.<br>stiff club-moss | WC Clac, Mari, Mult<br>SPHAGNUM HUMMOCKS IN MOIST SHADY BOGS | MID | JULY-AUGUST |
| *MERTENSIA BELLA* Piper<br>Oregon bluebells | WC Linn, Mari | | |
| *MIMULUS PULSIFERAE* A. Gray<br>candelabrum monkeyflower | WV Linn<br>BARS ALONG STREAMS | | APRIL-JUNE |
| *MONTIA DIFFUSA* (Nutt.) Greene<br>branching montia | WV, WC Clac, Linn, Mari, Mult<br>MOIST WOODS<br>RECENTLY BURNED AREAS | <3500 | APRIL-JULY |
| *PILOPHORUS NIGRICAULIS* Sato<br>lichen | WC Linn, Mari, Mult | | |
| *SCIRPUS CYPERINUS* (L.) Kunth.<br>woolgrass | WV Linn, Mult. | | |

| **SPECIES & STATUS** | **HABITAT** | **ELEVATION (FT)** | **BEST I.D. SEASON** |
|---|---|---|---|
| *SCIRPUS PENDULUS* Muhl.<br>(S.lineatus)<br>drooping bulrush | Linn | | |
| *SIDALCEA CAMPESTRIS* Greene<br>meadow sidalcea | WV Clac, Linn, Mari, Mult<br>FENCEROWS & ROADSIDES | <1000 | LATE JUNE-JULY |
| *SIDALCEA CUSICKII* Piper<br>Cusick's checker-mallow | WV Linn | <4000 | MAY-JULY |
| *SILENE SUKSDORFII* Robins.<br>Suksdorf's silene | WC Mari<br>ALPINE & SUBALPINE SCREE SLOPES | >4000 | JULY-SEPT |
| *VACCINIUM OXYCOCCUS* L. Var. INTERMEDIUM<br>wild bog cranberry | WC Clac, Linn, Mari, Mult.<br>SPHAGNUM BOGS | LOW-MID | MAY-JULY |

## D.2. Survey and Manage Species known to occur in the Cascade Resource Area

This list is adapted from Appendix B-1 Managment of SEIS Special Attention Species in the Salem District ROD and Management Plan. Only species known to occur in the Cascade Resource Area are listed.

| **SPECIES** | **SURVEY STRATEGIES** | | | |
|---|---|---|---|---|
| | **1** | **2** | **3** | **4** |
| **FUNGI**<br>**CHANTERELLES** | | | | |
| *CANTHARELLUS CIBARIUS* | | | X | X |
| *CANTHARELLUS SUBALBIDUS* | | | X | X |
| *CANTHARELLUS TUBAEFORMIS* | | | X | X |
| **CHANTERELLES - GOMPHUS** | | | | |
| *GOMPHUS CLAVATUS* | | | X | |
| **GOMPHUS FLOCCOSUS* | | | X | |
| *GOMPHUS KAUFFMANII* | | | X | |
| **PHAEOCOLLYBIA** | | | | |
| *PHAEOCOLLYBIA CALIFORNICA* | X | | X | |

| | | | | |
|---|---|---|---|---|
| *PHAEOCOLLYBIA KAUFMANII* | X | | X | |
| **NOBLE POLYPORE (RARE AND ENDANGERED)** | | | | |
| *OXYPORUS NOBILISSIMUS* | X | X | X | |
| **RARE RESUPINATES AND POLYPORES** | | | | |
| **GYROMITRA INFULA* | | | X | X |
| **CAULIFLOWER MUSHROOM** | | | | |
| *SPARASSIS CRISPA* | | | X | |
| **LICHENS**<br>**RARE NITROGEN-FIXING LICHENS** | | | | |
| *PANNARIA RUBIGINOSA* | X | | X | |
| **PSEUDOCYPHELLARIA RAINIERENSIS* | X | X | X | |
| **NITROGEN FIXING LICHENS** | | | | |
| **LOBARIA OREGANA* | | | | X |
| **LOBARIA PULMONARIA* | | | | X |
| *LOBARIA SCOBICULATA* | | | | X |
| *NEPHROMA BELLUM* | | | | X |
| *NEPHROMA HELVETICUM* | | | | X |
| *NEPHROMA LAEVIGATUM* | | | | X |
| *NEPHROMA RESUPINATUM* | | | | X |
| *PANNARIA SAUBINETII* | | | | X |
| *PELTIGERA COLLINA* | | | | X |
| *PELTIGERA PACIFICA* | | | | X |
| *PSEUDOCYPHELLARIA ANOMAL.A* | | | | X |
| *PSEUDOCYPHELLARIA ANTHRASPIS* | | | | X |
| *PSEUDOCYPHELARIA CROCATA* | | | | X |
| *STICTA FULIGINOSA* | | | | X |
| *STICTA LIMBATA* | | | | X |
| **PIN LICHENS** | | | | |
| *CALICIUM VIRIDE* | | | | X |
| *CHAENOTHECA FURFUACEA* | | | | X |
| *CYPHELIUM INQUINANS* | | | | X |
| **RIPARIAN LICHENS** | | | | |
| *CETRELIA CETRARIOIDES* | | | | X |
| *RAMALINA THRAUSTA* | | | | X |

| | | | | |
|---|---|---|---|---|
| **USNEA LONGISSIMA** | | | | X |
| **BRYOPHYTES** | | | | |
| **ANTITRICHIA CURTIPENDULA* | | | | X |
| *PTILIDIUM CALIFORNICUM* | X | X | | X |
| **VASCULAR PLANTS** | | | | |
| *ALLOTROPA VIRGATA* | X | X | | |
| **CORYDALIS AQUAE-GELIDAE* | X | X | | |

## D.3. Noxious Weeds to Search for in the Thomas Creek Watershed Analysis Area

H = Hitchcock & Cronquist. Flora of the Pacific Northwest.

| **PRIORITY I SPECIES - POTENTIAL NEW INVADERS**<br>*known populations in the Cascade Resource Area | | | |
|---|---|---|---|
| **SCIENTIFIC NAME** | **COMMON NAME** | **BEST ID. SEASON** | **COMMENTS** |
| ***CARDUUS PYCNOCEPHALUS*** | Italian thistle | May - June | H. Pg.188 |
| ***CARTHAMUS LANATUS*** | distaff thistle | | W. Pg. 80. |
| ***CARTHAMUS LEUCOCAULOS*** | whitestem distaff thistle | | |
| ***CENTAUREA SOLSTITIALIS*** | yellow starthistle | | W. Pg. 94 |
| ***CENTAUREA VIRGATA*** | squarrose knapweed | | W. Pg. 97 |
| ***CHONDRILLA JUNCEA*** | rush skeletonweed | mid July - Frost | H. Pg. 500 |
| ***CENTAUREA CALCITRAPA*** | purple starthistle | | W. Pg. 87 |
| ***CENTAUREA IBERICA*** | Iberian starthistle | | W. Pg. 86 |
| ***CARDUUS TENUIFLORUS*** | slenderflower thistle | | W. Pg. 79 |
| ***LYTHRUM SALICARIA*** | purple loosetrife | Aug. - Sept. | H. Pg. 303 |
| ***SILYBUM MARIANUM*** | milk thistle | Late April - Early June | H. Pg. 549 |
| **PRIORITY II SPECIES - ERADICATION OF NEW INVADERS** | | | |
| ****CENTAUREA DIFFUSA*** | diffuse knapweed | July - Sept. | H. Pg. 498<br>T12S R3E SEC. 14 |
| ****CENTAUREA MACULOSA*** | spotted knapweed | July - Oct. | H. Pg. 499<br>T7S R4E Sec. 2<br>T12S, R3E Sec. 9, 30 |
| ****CENTAUREA PRATENSIS*** | meadow knapweed | July - Oct. | H. Pg. 499<br>T1-S R2E Sec. 23<br>T9S R3E Sec. 25<br>T10S R1E Sec. 8 & 14<br>T12S R1E Sec. 15 |

| | | | |
|---|---|---|---|
| ***ULEX EUROPARUS** | gorse | April - Sept. | H. Pg. 278<br>T2S R6E<br>Highland Butte |
| **PRIORITY III SPECIES - ESTABLISHED INFESTATIONS** | | | |
| ***CIRSIUM ARVENSIS** | Canada thistle | July - Aug | H. Pg. 503 |
| ***CIRSIUM VULGARE** | bull thistle | July - Sept | H. Pg. 503 |
| ***CYTISUS SCOPARIUS** | Scotch broom | May - June | H. Pg. 260 |
| ***HYPERICUM PERFORATUM** | St. Johnswort | June - July | H. Pg. 295 |
| ***SENECIO JACOBAEA** | tansy ragwort | July - Sept | H. Pg. 545 |

# D.4. Plant Species List for the Thomas Creek Wateshed Analysis Area.

Compiled January 1996 from Botanical Clearance Surveys & from botanical monitoring. and other existing resource area species lists.

Vascular plant nomenclature based on Hitchcock & Cronquist 8th printing 1991.
Names in parenthesis are from National Plant Codes, National Plants Database March 1994

| **Scientific Name** | **Common Name** | **PLANTS** |
|---|---|---|
| **Conifer Trees** | | |
| Abies amabilis | Pacific silver fir | ABAM |
| Abies grandis | Grand fir | ABGR |
| Abies procera | Noble fir | ABPR |
| Pseudotsuga menziesii | Douglas-fir | PSME |
| Taxus brevifolia | Pacific yew | TABR2 |
| Thuja plicata | Western redcedar | THPL |
| Tsuga heterophylla | Western hemlock | TSHE |
| Tsuga mertensiana | Mountain hemlock | TSME |
| **Deciduous Trees(>8m tall)** | | |
| Acer macrophyllum | Bigleaf maple | ACMA3 |
| Alnus rubra | Red alder | ALRU2 |
| Alnus sinuata<br>(A. viridis ssp. sinuata) | Sitka alder | ALSI3 |
| Castanopsis chrysophylla | Golden chinkapin | CACH6 |
| Fraxinus latifolia | Oregon ash | FRLA |
| Populus trichocarpa<br>(P. balsamifera spp. trichocarpa) | Black cottonwood | POTR15 |
| Prunus emarginata | Bitter cherry | PREM |
| Prunus virginiana | Choke-cherry | PRVI |
| Prunus spp. | Cherry | PRUNU |
| Quercus garryana | Oregon white oak | QUGA4 |
| **Shrubs** | | |
| Acer circinatum | Vine Maple | ACCI |
| Amelanchier alnifolia | Pacific serviceberry | AMAL2 |
| Arctostaphylos uva-ursi | Kinnikinnick | ARUV |
| Berberis aquifolium (Mahonia aquifolium) | Tall Oregon grape | BEAQ |
| Berberis nervosa | Dwarf Oregon grape | BENE2 |

| | | |
|---|---|---|
| (Mahonia nervosa var. nervosa) | | |
| Cornus sericea spp. occidentalis (C. stolonifera) | Creek dogwood | COSEO |
| Corylus cornuta | California hazle | COCO6 |
| Cytisus scoparius | Scot's broom | CYSC4 |
| Gaultheria shallon | Salal | GASH |
| Gaultheria ovatifolia | Slender wintergreen | GAOV2 |
| Holodiscus discolor | Oceanspray | HODI |
| Juniperis communis | Common juniper | JUCO6 |
| Menziesia ferruginea | Fool's huckleberry | MEFE |
| Oemleria cerasiformis | Indian plum | OECE |
| Paxistima myrsinites (Pachystima myrsinites) | Oregon boxwood | PAMY |
| Rhamnus purshiana | Cascara buckthorn | RHPU |
| Ribes bracteosum | Stink current | RIBR |
| Ribes lacustre | Prickly current | RILA |
| Ribes sanguineum | Winter current | RISA |
| Rosa gymnocarpa | Baldhip rose | ROGY |
| Rubus laciniatus I | Evergreen blackberry | RULA |
| Rubus lasiococcus | | RULA2 |
| Rubus leucodermis | Black raspberry | RULE |
| Rubus parviflorus | Thimbleberry | RUPA |
| Rubus spectabilis | Salmonberry | RUSP |
| Rubus ursinus | California dewberry | RUUR |
| Salix sitchensis | Sitka willow | SASI2 |
| Salix sp. | Willow | SALIX |
| Sambucus cerulea | Blue elderberry | SACE3 |
| Sambucus racemosa | Red elderberry | SARA2 |
| Sorbus sitchensis | Sitka mountain-ash | SOSI2 |
| Spirea densiflora var. splendens | Subalpine spirea | SPDES2 |
| (S.splendens var. splendens) | | |
| Symphoricarpos albus | Snowberry | SYAL |
| Symphoricarpos mollis | Trailing snowberry | SYMO |
| Vaccinium membranaceum | Big huckleberry | VAME |
| Vaccinium ovalifolium | Oval-leaf huckleberry | VAOV |
| (V. alaskense) | (Alaska huckleberry) | |
| Vaccinium parvifolium | Red huckleberry | VAPA |

**Ferns & Allies**

| | | |
|---|---|---|
| Adiantum pedatum | Maidenhair fern | ADPE |
| Athyrium filix-femina | Lady fern | ATFI |
| Blechnum spicant | Deer fern | BLSP |
| Botrychium multifidum | Leathery grape-fern | BOMU |
| Cheilanthes gracillima | lace lip-fern | CHGR |

| | | |
|---|---|---|
| Cryptogramma crispa (C. acrostichoides) | Parsley-fern | CRCR10 |
| Dryopteris austriaca | Spreading wood-fern | DRAU5 |
| Equisetum sp. Horsetail | EQUIS | |
| Polypodium glycyrrhiza | Licorice fern | POGL8 |
| Polystichum munitum | Sword fern | POMU |
| Pteridium aquilinum | Bracken fern | PTAQ |
| Selaginella sp. | Selaginella | SELAG |

**<u>Herbs</u>**

| | | |
|---|---|---|
| Achillea millefolium | Yarrow | ACMI2 |
| Achlys triphylla | Vanilla leaf | ACTR |
| Actaea rubra | Baneberry | ACRU2 |
| Adenocaulon bicolor | Pathfinder | ADBI |
| Anaphalis margaritacea | Pearly-everlasting | ANMA |
| Anemone deltoidea | Windflower | ANDE3 |
| Anemone lyallii | Lyall's anemone | ANLY |
| Anemone oregana var. oregana | Oregon anemone | ANORO |
| Antennaria racemosa | Raceme pussytoes | ANRA |
| Aralia nudicaulis | Wild Sarsaparilla | ARNU2 |
| Arenaria macrophylla | Bigleaf sandwort | ARMA18 |
| (Moehringia macrophylla) | | |
| Asarum caudatum | Wild ginger | ASCA2 |
| Aquilegia formosa | Columbine | AQFO |
| Boykinia elata | Slender boykinia | BOEL |
| (Boykinia occidentalis) | | |
| Boykninia major | Mountain boykinia | BOMA3 |
| Calochortus subalpinus | Mariposa | CASU2 |
| Caltha biflora (C. leptosepala spp. howellii) | Twin-flowered marshmarigold | CABI2 |
| Campanula scouleri | Scouler's harebell | CASC7 |
| Cardamine | | |
| Cardamine breweri | Brewer's bittercress | CABR6 |
| Castilleja | | |
| Chimaphila menziesii | Little prince's pine | CHME |
| Circaea alpina | Enchanter's nightshade | CIAL |
| Cirsium arvense I | Canadian thistle | CIAR4 |
| Cirsium arvense var. horridum | Canadian thistle | CIARH |
| Cirsium vulgare I | Common thistle | CIVU |
| Clintonia uniflora | Queen-cup bead lily | CLUN2 |
| Collinsia parviflora | Small flowered blue-eyed Mary | COPA3 |
| Collomia tenella | Diffuse collomia | COTE |
| Comandra umbellata | Bastard toad-flax | COUM |

| | | |
|---|---|---|
| Coptis laciniata | Goldthread | COLA3 |
| Corallorhiza maculata | Spotted coral-root | COMA4 |
| Corallorhiza mertensiana | Merten's coral-root | COME4 |
| Cornus canadensis  (C. unalaskchense) | Bunchberry dogwood | COCA13 |
| Corydalis aquae-gelidae | Cold-water coydalis | COAQ |
| Corydalis scouleri | Scouler's corydalis | COSC4 |
| Daucus carota  I | Queen Anne's Lace | DACA6 |
| Dicentra formosa | Bleeding heart | DIFO |
| Digitalis purpurea  I | Foxglove | DIPU |
| Disporum spp. | DISPO | |
| Disporum smithii | Fairy-lanterns | DISM2 |
| Dodecatheon poeticum | Narcissus shooting-star | DOPO |
| Eburophyton austiniae<br>(Cephalanthera austiniae) | Phantom orchid | EBAU |
| Epilobium sp. | Willow-herb | EPILO |
| Epilobium angustifolium I | Fireweed | EPAN2 |
| Epilobium minutum | Small-flowered willow-herb | EPMI |
| Eriophyllum lanatum | Oregon sunshine | ERLA6 |
| Erythronium | | |
| Fragaria spp. | Wild strawberry | FRAGA |
| Galium spp. | Bedstraw | GALIU |
| Galium oreganum | Oregon bedstraw | GAOR |
| Geum macrophyllum | Large-leaved avens | GEMA4 |
| Goodyera oblongifolia | Rattlesnake orchid | GOOB2 |
| Habenaria saccata<br>(Platanthera stricta) | Slender bog-orchid | HASA |
| Hieracium albiflorum | Hawkweed | HIAL2 |
| Hieracium scouleri | Scouler's hawkweed | HASC2 |
| Hydrophyllum tenuipes | Waterleaf | HYTE |
| Hypopitys monotropa<br>(Monotropa hypopitys) | Pinesap | HYMO3 |
| Iris tenax | Oregon iris | IRTE |
| Isopyrum hallii | Hall’s isopyrum | ISHA |
| Lactuca muralis  (Mycelis muralis) | Wall lettuce | LAMU |
| Lathyrus | | |
| Leucanthemum vulgare I<br>(Chrysanthemum leucanthemum) | Ox-eye daisy | LEVU |
| Lilium columbianum | Tiger lily | LICO |
| Linnaea borealis | Twinflower | LIBO3 |
| Listeria caurina | Northwest listeria | LICA10 |
| Lomatium martindalei | Martindale's lomatium | LOMA5 |
| Lupinus rivularis | Stream lupine | LURI |
| Lysichiton americanus | Skunk cabbage | LYAM3 |

| | | |
|---|---|---|
| (Lysichitum americanum) | | |
| Mitella ovalis | Oval-leaved mitrewort | MIOV |
| Mitella pentandra | Fivestamen mitrewort | MIPE |
| Monotropa uniflora | Indian pipe | MOUN3 |
| M ontia cordifolia | Broadleaved miner's lettuce | MOCO4 |
| Montia parvifolia | Littleleaf montia | MOPA2 |
| Montia sibirica var. sibirica (Claytonia sibirica) | Candyflower | CLSIS |
| Nemophila parviflora | Small-flowered nemophila | NEPA |
| Nothochelone nemorosus | Turtleheads | NONE3 |
| (Penstemon nemorosus) | | |
| Oenantha sarmentosa | Water-parsley | OESA |
| Osmorhiza chilensis | Sweet-cicely | OSCH |
| Oxalis oregana | Oregon oxalis | OXOR |
| Parnassia fimbriata var. hoodiana | Fringed grass-of-parnassus | PAFIH |
| Pedicularis racemosa | Leafy lousewort | PERA |
| Penstemon davidsonii | Davidson penstemon | PEDA2 |
| Penstemon procerus | Small-flowered penstemon | PEPR |
| Penstemon rupicola | Cliff penstemon | PERU |
| Petasites frigidus | Coltsfoot | PEFR5 |
| Phlox adsurgens | Periwinkle phlox | PHAD2 |
| Phlox diffusa var. longistylis | Spreading phlox | PHDIL5 |
| Phyllodoce empetriformis | Red mountain-heather | PHEM |
| Pityopus californica | Pinefoot | PICA9 |
| Plantago major var. major I | Common plantain | PLMAM |
| Prunella vulgaris | Heal-all | PRVU |
| Ranunculus | | |
| Rumex acetosella I | Sheep sorrel | RUAC3 |
| Saxifraga | | |
| Saxifraga ferruginea | Rusty saxifrage | SAFE |
| Saxifraga occidentalis | | SAOC4 |
| (S. occidentalis var. allenii) | | |
| Sedum oregonense | Creamy stonecrop | SEOR2 |
| Sedum spathulifolium | Spatula-leaf stonecrop | SESP |
| Senecio jacobaea I | Tansy ragwort | SEJA |
| Senecio triangularis | Triangle-leaf groundsel | SETR |
| Silene douglasii | Douglas silene | SIDO |
| Smilacina racemosum spp. amplexicaule | False solomonseal | SMRAA? |
| (Maianthemum racemosa) | | |
| Smilacina stellatum (Maianthemum stellata) | Starry false solomonseal | SMST? |
| Stachys spp. | Hedge-nettle/Betony | STACH |
| Stellaria crispa | Crisped starwort | STCR2 |
| Streptopus amplexifolius | Twisted-stalk | STAM2 |
| Streptopus roseus | Rosy twisted-stalk | STRO4 |

| | | |
|---|---|---|
| Synthyris reniformis | Snow-queen | SYRE |
| Taraxacum spp. | Dandelion | TARAX |
| Tellima grandiflora | Fringe-cup | TEGR2 |
| Tiarella trifoliata | | |
| Tolmiea menziesii | Pig-a-Back plant | TOME |
| Trautvetteria caroliniensis | False bugbane | TRCA |
| Trientalis latifolia | Starflower | TRLA6 |
| (T. borealis ssp. latifolia) | | |
| Trifollium spp. | Clover | TRIFO |
| Trillium ovatum | Pacific trillium | TROV2 |
| Valeriana scouleri | Scouler's valerian | VASC2 |
| Vancouveria hexandra | Inside-out-flower | VAHE |
| Veratrum viride | False hellebore | VEVI |
| Viola glabella Stream violet | VIGL | |
| Viola palustris Marsh violet | VIPA4 | |
| Viola sempervirens | Redwoods violet | VISE3 |
| Xerophyllum tenax | Beargrass | XETE |

### Grasses, Sedges & Rushes

| | | |
|---|---|---|
| Agrostis diegoensis | Thin bentgrass | AGDI |
| Carex spp. | Sedge | CAREX |
| Carex leptopoda | Dewey's sedge | CALE24 |
| (C. deweyana var. leptopoda) | | |
| Carex luzulina | Woodrush sedge | CALU7 |
| Carex obnupta | Slough sedge | CAOB3 |
| Carex obscura | | |
| Deschampsia cespitosa | Tufted hairgrass | DECE |
| Festuca microstachys | Eastwood fescue | FEMI2 |
| Juncus effusus | Common rush | JUEF |
| Juncus effusus var. gracilis | Lamp rush | JUEFG |
| Juncus ensifolius | Swordleaf rush | JUEN |
| Luzula parviflora | Small-flowered woodrush | LUPA4 |
| Pleuropogon oregonus | | PLOR3 |
| (Lophochlaena oregona) | | |

### Mosses

| | | |
|---|---|---|
| Antitrichia curtipendula | Antitrichia moss | ANCU3 |
| Kindbergia praelonga | | |

### Liverworts

| | | |
|---|---|---|
| Conocephalum conicum | Coneheads | CONOC3 |

**Lichens**

| | | |
|---|---|---|
| Alectoria sarmentosa | Witch’s hair lichen | ALSA9 |
| Cladonia spp.   Cup lichen | CLADO3 | |
| *Lobaria oregana | Oregon lung lichen | LOOR60 |
| *Lobaria pulmonaria | Lung lichen | LOPU60 |
| *Pseudocyphellaria rainierensis | Rainier psedocyphellaria lichen | PSRA3 |
| Ramilina farinacea | Farinose cartilage lichen | RAFA60 |
| Sphearophorus globosus | Globe ball lichen | SPGL60 |
| Umbilicaria polyrrhiza | Manyroot navel lichen | UMPO2 |
| *Usnea longissima | Beard lichen | USLO50 |
| Usnea plicata | ? | |

**FUNGI**

Gomphus flocossus
Gyromitra infula
Naematoloma fasciculare
Russula brevipes
Suillus lakei

## E.1. Geology of Thomas Creek Watershed.

The Thomas Creek Watershed is in the Western Cascade Range. It is in the Santiam River Section in the Middle to South Santiam Valleys. These valleys were carved in the Oligocene to Miocene era volcanic flows and tuffs that have become mineralized. (Baldwin 1984)

### GEOLOGIC HISTORY - OVERVIEW

Construction of the cascade mountain began some 40 million years ago during the Eocene era. The curved oceanic Farallan plane began under thrusting the North American continental plate. Early volcanism followed from this and flowed from a volcanic chain found immediately east of the Pacific continental margin. These small, low volcanoes spaced along a northeast/southeast belt deposited thick accumulations of andesitic tuffs and lava flows that form the base of the Western Cascade Mountains. This broad belt indicates that the subducting Farallan plane was undercutting the continental plate at a shallow angle and at a rapid rate ( 3 inches/year). During the Eocene (53.5 to 37.5 million years ago) and the Oligeocene ( 37.5 to 22.5 million years ago) eras, the coastline angled in this northwest/southeast direction through the Willamette Valley to just west of the volcanic vents of the Western Cascades. Volcanic ash was flushed out of the vents into marine basins along the coast. Upper continental shelve sands were the final marine sediments to be deposited along the retreating shoreline. During the Oligeocene era, numerous eruptions of andesitic lavas and siliceous tuffs are interspersed with oceanic sediments in the eastern margins of the valley. (Orr et al, 1992) (Heilman and Anderson 1981)

During the mid-Miocene periods (22.5 to 5 million years ago), more tilting and folding from subduction were followed by volcanic lava flows along with the development of the Western Cascades volcanic arc. The growth of the range was modest as the volcanic accumulations sank almost as fast as they piled up. Concurrently with other areas of Oregon, violent eruptions from volcanic cones 13 to 9 million years ago left accumulations unmatched today. However, by 7 million years ago, the belt had narrowed to a band as wide as the present day High Cascades Range. Cascade volcanism is the result of tectonic forces deep in the crust. On the North American plate, the Western Cascades were rotated clockwise into their present position. As the rotation began and the angle of the Farallan descending slab became flatter, volcanic activity moved from west to east. This is illustrated by the fact that the oldest rocks in the Cascades are 42 million years old and the youngest are ten million years old on the west edge of the High Cascade Range. Over time, more than six times as much material has erupted in the West Cascades as in the East. Convergences are slowing from three to one-half inch per year with more slanting angles and less subducting. This slowing down began in the Miocene era and continues to this day. Additional uplift, mild folding, and faulting began 4.5 million years ago during the Pliocene epoch. (Orr et al 1992) (Heilman and Anderson 1981)

## GEOLOGIC MATERIAL - PRESENT CONDITION

The basic rocks that make up most geologic material and the soils derived from this material of the Thomas Creek Watershed are igneous rocks. Sedimentary rock and marine deposits occur in minor amounts. The igneous rocks that occur in Thomas Creek occur in two main groups. These are (1) extrusive volcanic such as basalt and andesite (2) extrusive igneous pyroclastic rocks. A third group **is** the intrusive rocks that have cooled from molten masses beneath the earths surface/ This intrusive material is most often found in the Coast Range where intrusions in to sedimentary rocks result in erosion of the sedimentary rock and leave the harder igneous rock exposed.

The western portions of the Cascades (and Thomas Creek) are underlain by layer of hard extrusive igneous rocks, mainly basalt and andesite, which became crystallized at or near the earths surface. Andesite has an intermediate composition while basalt has a mafic, darker, more dense composition (COPE 1992). These are exposed along the northern portion and in the higher elevations in the south. Pyroclastic rock is a type of extrusive rock composed of rock fragments erupted from volcanic vents and transported through the air, as if shot through a cannon. (COPE 1992) The material is partially molten when ejected and individual pieces may fuse to form a weak, porous rock. More often, the pieces are deposited with volcanic ash and form volcanic breccia that are coarse, angular fragments 1/4 to 2 inches in diameter within a matrix of volcanic ash of tuff the pieces are less than 1/4 inch in diameter when imbedded in the ash. The hardness of pyroclastic rocks is dependent on the fusion and compaction of individual pieces at the time of deposition. Usually pyroclastic rocks are soft and the ash weathers to form clay. Volcanic ash, tuff, and breccia are present throughout the Thomas Creek Watershed.

Extrusive igneous rocks such as basalt and andesite are often intermixed with pyroclastic rock and considering the two together is often preferable.  (Burroughs et al 1976)

There are few places in Thomas Creek where the ground water is high and sag ponds and hummocky ground occurs.  Tipped and jackstrawed trees and hydrophytic plants are the vegetative indicators for high ground water.  Erosion of the base between benches and the stream results in steepening of the slopes and increases the possibility of failure.  Tension cracks are occasionally seen at the edge of these benches.  (Burroughs et al 1976)

Alternating layers of extrusive and pyroclastic rocks can have stability problems.  If andesite and/or basalt overlies pyroclastic rock, the softer pyroclastic material, especially when wet, would move and slump, removing the base of support for the basalt and andesite material above and cause the collapse of large portions of land.  Pyroclastic material overlying basalt/andesite may also cause unstable conditions as ground water infiltrates through the pyroclastic material and moves along the contact zone exposed and pyroclastics may slide out onto the road.  The height of this zone may make convention road support structures impractical.    (Burroughs et al 1976)

“Progressive slope failure” has been identified in Hamilton Creek and can occur in deep soils on steep slopes (such as Kinney gravelly loam) in extrusive igneous material.  The first failure may be a bank slump on a road.  The loss of support could cause failure of the next block of soil immediately upslope and so on until eventually a series of slumps will occur all the way to the ridgetop.    (Burroughs et al 1976)

As stated previously, pyroclastic material includes tuffs derived from volcanic ash and breccias  of coarse texture and contains angular fragments of hard material.  These materials weather rapidly to clay and occur in isolated pockets, extensive deposits, or in layers between other layers of extrusive rock.  Because of their rapid weathering, their location is important to the stability of the area.    (Burroughs et al 1976)

## RELATIONSHIP TO SOIL STABILITY

These materials come in many colors from dark reddish purple though light yellow to green. While these materials have poor stability, some have observed the green tuffs and breccias to be extremely unstable although there is not universal agreement on this. Soil color can provide a key to the color of the pyroclastic materials underlying it. Clays with a 2.5 Y and 10 YR Munsell color hues generally come from greenish rock. Soils with a 7.5 YR generally are derived from yellowish and reddish rock and are relatively more stable. (Paeth et al 1971) The relationship between pyroclastic rock and slope stability in a Forest Service study on the H.J. Andrews Experimental Forest by Dyrness. In this study, 94% of mass soil movement events occurred on the 37% of the area made up of pyroclastic material and 64% of mass soil movement events were on the 8% of the area made up of green tuff and breccias. (Dyrness 1967) One field test for identifying pyroclastic material is immersion in water after which a clod will completely disintegrate when testing positive for pyroclastic presence. In addition, many soil types have been identified as derived from breccias and tuffaceous rock. (Burroughs et al 1976)

Comparative rates of soil movement from various land uses have been inventoried over a twenty-five-year period in the experimental forest in the Cascade Range. Mass erosion rates were calculated to be 0.87 cubic meters per hectare per year for undisturbed forests (based on 32 landslides), 2.45 cubic meters per hectare per year for clearcuts (based on 36 landslides, and 26.19 cubic meters per hectare per year associated with roads (based on 71 landslides). In a summary of several studies, McNutt and McGreer (1985) calculated natural slumping rates of 0.0224 per square mile per year or one slump in 45 years per square mile in areas of undulating topography with slope gradients of less than 60%. Natural failure rates of areas of steep to extremely steep slopes (70 to 100%) slopes in old growth Douglas-fir stands. Based on observations in the H. J. Andrews, slide erosion decreases to undisturbed forest rates ten to fifteen years after logging and associated activities have ceased. Slide erosion rates decrease for roads as well but at a much slower rate. The slide erosion rate continues to be many times greater than the undisturbed forest rate for more than 20 years after construction although the decrease does occur after the first few large storms that follow construction and/or reconstruction activities.

## GEOMORPHOLOGY

The Thomas Creek Watershed comprises two general geomorphic surfaces, Eola surface and the Looney unit.  The Eola surface is in the eastern areas of Thomas Creek in the crests and saddles of low foothills. This surface occurs on the remnants of the oldest stable geomorphic surfaces in this area.  Remnants remain because of extensive erosion during the Pleistocene and Holocene ages after the surface was though to have originated during the early to middle Pleistocene age.  Jory, Bellpine, and Nekia occur at the elevations of 600 to 1,200 feet and Honeygrove and Peavine occur at elevations of 1200 to 2800 feet. These soils are Ultisols (low base forest soils that have undergone extensive weathering and leaching of bases) which nonetheless are some of the most productive forest soils in the Thomas Creek Watershed. (SCS 1982)

The Looney unit is in the western half of Thomas Creek and is not a geomorphic surface because of the variability in age but is used for geomorphic mapping of mountainous terrain.  This unit usually adjoins the Eola surface in western Oregon.  The terrain is completely dissected and steeply sloping and geomorphic surfaces are not always recognizable.  Erosion is active on most of the unit and mass soil movement is also evident.  The soils were formed in glacial till and colluvium and derived from andesite and basalt mixed with volcanic ash.  The soils in Thomas Creek include Keel, Hummington, and Highcamp in the areas above 3000 feet and Kinney, Klickatat, Quartzville, Blachly, Honeygrove, and Peavine that occur at 1200 to 2800 feet.  Three significant breaks are present in the Looney unit: stable, metastable, and active slopes.  On stable surfaces with annual precipitation of 60 to 90 inches per year, Honeygrove and Peavine series have developed where Quartzville and Blachly have developed on stable slopes with annual precipitations of 85 to 120 inches.  Soils such as Kinney, Harrington, and Klickatat are on the more steeply sloping, metastable and active slopes.  (SCS 1987)

## E.2. Beneficial Uses.

| Stream Name | Location | Beneficial Use | Number of permits |
|---|---|---|---|
| **Thomas** | **T.10 S., R.3E., Sec. 27-36** | **Forest Management** | **2** |
| **Thomas / S. Santiam** | **T.10 S., R.1E., Sec. 2** | **Irrigation** | **5** |
| **Thomas / S. Santiam** | **T.10 S., R.1E., Sec. 12** | **Irrigation** | |
| **Thomas / S. Santiam** | **T.10 S., R.1E., Sec. 12** | **Domestic** | |
| **Thomas** | **T.10 S., R.1E., Sec. 7** | **Livestock** | **2** |
| **Thomas** | **T.10 S., R.1E., Sec. 7** | **Irrigation** | |
| **Jordan** | **T.9 S., R.1E., Sec. 27** | **Recreation** | **4** |
| **Jordan** | **T.9 S., R.1E., Sec. 27** | **Livestock** | **2** |
| **Jordan** | **T.9 S., R.1E., Sec. 27** | **Irrigation** | |
| **Jordan / Thomas** | **T.10 S., R.1E., Sec. 4** | **Irrigation** | |
| **Jordan / Thomas** | **T.9 S., R.1E., Sec. 25** | **Recreation** | |
| **Jordan / Thomas** | **T.9 S., R.1E., Sec. 36** | **Irrigation** | |
| **Jordan / Thomas** | **T.9 S., R.1E., Sec. 31** | **Irrigation** | |
| **Jordan** | **T.9 S., R.1E., Sec. 31** | **Domestic** | |
| | | | |

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## E.4.  Thomas Creek Flow Records Near Scio, OR

Statistical Summaries for the year 1963 - 1987

Monthly and annual statistics based on mean daily discharge, in cubic feet per second.

| **Month** | **Minimum** | **Year** | **Maximum** | **Year** | **Mean** | **% of Annual Runoff** |
|---|---|---|---|---|---|---|
| OCT | 25 | 1975 | 633 | 1969 | 177 | 3.0 |
| NOV | 128 | 1977 | 1900 | 1974 | 726 | 12.0 |
| DEC | 104 | 1977 | 2310 | 1965 | 1090 | 18.7 |
| JAN | 144 | 1977 | 1840 | 1972 | 1960 | 18.1 |
| FEB | 176 | 1977 | 1670 | 1986 | 866 | 13.5 |
| MAR | 245 | 1965 | 1500 | 1972 | 711 | 12.2 |
| APR | 298 | 1968 | 888 | 1963 | 560 | 9.3 |
| MAY | 168 | 1973 | 745 | 1963 | 379 | 6.5 |
| JUNE | 74 | 1966 | 682 | 1984 | 205 | 3.4 |
| JULY | 29 | 1967 | 407 | 1983 | 79 | 1.4 |
| AUG | 13 | 1967 | 203 | 1968 | 42 | 0.7 |
| SEPT | 18 | 1965 | 251 | 1968 | 67 | 1.1 |
| Annual | 229 | 1977 | 760 | 1974 | 496 | 100.0 |

## Nine year ground water levels for Linn County (USGS) measured in feet below land surface datum.

| Date | Water Level | Date | Water Level | Date | Water Level | Date | Water Level |
|---|---:|---|---:|---|---:|---|---:|
| Oct 17, 1974 | 12.49 | Dec 17, 1974 | 9.25 | Mar 20, 1975 | 3.51 | July 23, 1975 | 8.97 |
| Oct 22, 1974 | 5.39 | Dec 26, 1974 | 5.39 | Apr 29, 1975 | 4.09 | Aug 22, 1975 | 11.57 |
| Nov 22, 1974 | 12.40 | Jan 30, 1975 | 4.13 | May 16, 1975 | 4.42 | Sept 15, 1975 | 11.25 |
| Nov 22, 1974 | 11.93 | Mar 5, 1975 | 3.43 | June 25, 1975 | 7.29 | | |
| 1976 | | | | | | | |
| Nov 24, 1975 | 8.71 | Jan 23, 1976 | 3.40 | Apr 14, 1976 | 3.16 | Jul 27, 1976 | 10.38 |
| Dec 15, 1975 | 5.22 | Feb 20, 1976 | 3.51 | May 13, 1976 | 4.51 | Aug 24, 1976 | 9.62 |
| | | Mar 16, 1976 | 3.29 | Jun 25, 1976 | 8.18 | Sept 30, 1976 | 11.21 |
| 1977 | | | | | | | |
| Oct 22, 1976 | 11.76 | Nov 24,1976 | 12.43 | Dec 28, 1976 | 12.03 | Jan 20, 1977 | 12.11 |
| Feb 17, 1977 | 12.50 | Mar 22, 1977 | 6.69 | Apr 21, 1977 | 6.58 | May 20, 1977 | 7.75 |
| June 21, 1977 | 8.81 | July 20, 1977 | 10.08 | Aug 22, 1977 | 11.36 | Sep 26, 1977 | 11.88 |
| 1978 | | | | | | | |
| Oct 18,1977 | 12.03 | Dec 3, 1977 | 7.80 | Dec 20, 1977 | 5.53 | Jan 16, 1978 | 4.09 |
| Feb 22, 1978 | 3.83 | Mar 21, 1978 | 3.41 | Apr 18, 1978 | 3.40 | May 24, 1978 | 3.80 |
| June 20, 1978 | 5.77 | July 19, 1978 | 7.07 | Aug 29, 1978 | 8.61 | Sep 26, 1978 | 8.52 |
| 1979 | | | | | | | |
| Oct 22, 1978 | 8.33 | Nov 23, 1978 | 7.30 | Dec 31, 1978 | 9.35 | Jan 23, 1979 | 6.66 |
| Apr 5, 1979 | 7.20 | Apr 23, 1979 | 6.17 | May 23, 1979 | 7.55 | June 24, 1979 | 7.46 |
| July 23, 1979 | 8.01 | Aug 23, 1979 | 8.52 | Sept 21, 1979 | 8.59 | | |
| 1980 | | | | | | | |
| Oct 24, 1979 | 9.27 | Nov 20, 1979 | 5.10 | Dec 20, 1979 | 2.47 | Jan 23, 1980 | 2.45 |
| Feb 22, 1980 | 2.48 | Mar 21, 1980 | 2.20 | Apr 24, 1980 | 2.47 | May 16, 1980 | 4.05 |

|  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|
| June 26, 1980 | 5.98 | July 21, 1980 | 6.98 | Aug 20, 1980 | 9.04 | Sept 22, 1980 | 9.57 |
| 1981 |  |  |  |  |  |  |  |
| Oct 20, 1980 | 10.59 | Nov 20, 1980 | 9.45 | Dec 23, 1980 | 3.86 | Jan 26, 1981 | 2.67 |
| Feb 20, 1981 | 2.66 | Mar 26, 1981 | 2.30 | Apr 23, 1981 | 2.63 | May 22, 1981 | 3.91 |
| June 11, 1981 | 3.64 | Aug 25, 1981 | 7.24 | Sept 23, 1981 | 8.18 |  |  |
| 1982 |  |  |  |  |  |  |  |
| Oct 20, 1981 | 8.93 | Nov 29, 1981 | 5.96 | Dec 22, 1981 | 5.85 | Jan 20, 1982 | 5.98 |
| Feb 22, 1982 | 5.12 | Mar 23, 1982 | 6.42 | Apr 22, 1982 | 6.24 | June 23, 1982 | 8.30 |
| July 20, 1982 | 8.76 | Aug 22, 1982 | 9.26 | Sept 20, 1982 | 9.62 |  |  |
| 1983 |  |  |  |  |  |  |  |
| Oct 20, 1982 | 11.38 | Nov 23, 1982 | 10.68 | Dec 21, 1982 | 4.02 | Jan 24, 1983 | 3.02 |
| Feb 23, 1983 | 2.18 | Mar 23, 1983 | 2.40 | Apr 20, 1983 | 2.71 | May 24, 1983 | 4.24 |
| June 20, 1983 | 5.86 | July 19, 1983 | 6.61 | Aug 22, 1983 | 7.85 | Sept 16, 1983 | 8.41 |

## F.1. Fish species found in the Thomas Creek Watershed.

| Common name | Scientific name |
|---|---|
| Steelhead trout, resident rainbow trout | *Oncorhynchus mykiss* |
| Cutthroat trout | *Oncorhynchus clarki* |
| Chinook salmon | *Oncorhynchus tshawytscha* |
| Whitefish | *Prosopium williamsoni* |
| Sand roller* | *Percopsis transmontana* |
| Pacific lamprey | *Lampetra tridentata* |
| Brook lamprey | *Lampetra richardsoni* |
| Coarse-scale sucker | *Catostomus* spp. |
| Squawfish | *Ptychocheilus oregonensis* |
| Largemouth bass* | *Micropterus salmoides* |
| Smallmouth bass* | *Micropterus dolomieui* |
| Bluegill* | *Lepomis macrochirus* |
| Sculpins | *Cottus* spp. |
| Bullhead* | *Ictalurus* spp. |
| Dace | *Rhinichthys* spp. |

* Known to occur in Thomas Creek, but may not occur in the WAA.

## F.2. Special status aquatic invertebrates that may occur in the Thomas Creek Watershed.

| Common name | Scientific name | Comments[1] | Status[2] |
|---|---|---|---|
| Beer's false water penny beetle | *Acneus beeri* | Location: WSC (Linn Co.) - only known site is 5-15 miles east of Cascadia, OR | BS |
| Vertrees's ceraclean caddisfly | *Ceraclea* (=*Athr ipsodes*) *vertreesi* | Location: CR (Benton Co.), WIV (Marion Co.) Found in rivers and streams, low to mid elevation larger streams and rivers | BS |
| Cascades apatanian caddisfly | *Apatania*(=*Radema*) *tavala* | Location: WSC - several locations in Cascades between 4000 and 6000 ft. elevation | BS |
| Siskiyou caddisfly | *Tinodes siskiyou* | Location: WSC (Linn Co.) Several widespread Oregon sites. Aquatic habitat is in streams, no other information given. | BS |
| Tombstone Prairie farulan caddisfly | *Farula reapiri* | Location: WSC (Linn Co.) - only location in Salem Dist. is Tombstone Prairie (4000 ft.). Likely to occur in Cascades above 4000 ft. elevation | BS |
| Tombstone Prairie oligophlebodes caddisfly | *Oligophlebodes mostbento* | Location: WSC (Linn Co.) - known only from Tombstone Prairie (4000 ft). | BS |
| One-spot rhyacophilan caddisfly | *Rhyacophila unipunctata* | Location: WSC (Hood River, Lane Co.) - only known sites (2) are at higher elevations of the Cascades, above 3500 ft. elevation | BS |
| Johnson's waterfall carabid beetle | *Pterostichus johnsoni* | Location: WSC (Marion, Mult. Co.) - historically near Mehema, currently only known from Columbia Gorge waterfalls | TS |
| Alsea ochrotrichian micro-caddisfly | *Ochrotrichia alsea* | Location: CR, WIV, WSC (Benton, Clackamas Co.). Specific aquatic habitat unknown, found in streams and medium rivers, mid to low elevations | TS |
| Fender's rhyacophilan caddisfly | *Rhyacophila fenderi* | Location: CR, WSC (Yamhill, Benton, Lane Co.) - has been found near McMinnville. Has been found in small to medium streams, some in first order streams | TS |

[1] CR = Coast Range, WIV= Willamette Valley, WSC= Westside Cascades

[2] BS=Bureau Sensitive, TS = Bureau tracking species

## F.3. Pool habitat and gravel quality ratings for surveyed stream reaches in the Thomas Creek Watershed.

### Pool Habitat

Channel width per pool: This metric is used to express the frequency of pool occurrence. The ODFW benchmark for "desirable" is "less than 8 channel widths per pool"; and undesirable is "more than 20 channel widths per pool."

All three surveyed reaches on the mainstem Thomas Cr. are within the desirable range for pool frequency. The values for channel widths per pool range from 4.1 to 5.7.

The frequency of pools in lower Neal Cr. is 5.8 channel widths per pool, which is desirable. Upper Neal Cr., at 13.5 channel widths per pool, and Ella Cr., at 9.1 channel widths per pool, have intermediate pool frequencies.

Percent pool area: The ODFW benchmark for "desirable" is "more than 35 percent pool area"; and undesirable is "less than 10 percent pool area."

Reaches 1 and 2 of Thomas Cr. have 34 percent and 42 percent, respectively, of the stream area in pool habitat, which is desirable. Pool area in reach 3 is 29 percent; slightly less than desirable.

Lower Neal Cr. has 26 percent of its area in pools; slightly less than desirable. The upper Neal Cr. reach rates as desirable with 50 percent pool area. Pool area in Ella Cr. is only 14 percent, which approaches an undesirable level.

Percent deep pools: There is no ODFW benchmark for this metric. Good is 20 percent of the pools (calculated from pool length) should be over 3 ft. deep.

All three reaches on Thomas Cr. exceed the 20 percent level (range is 27 to 43 percent), which would rate as good.

Lower Neal Cr. (13 percent) and Ella Cr. (10 percent) have a fair amount of deep pool habitat. Upper Neal Cr., with 27 percent deep pool habitat, is good, however, the lower half of this reach has no deep pools.

Complex pools (deep pools with LWD): There is no standard for this metric. LWD is an important cover element for salmonids.

Information on LWD is available for only Thomas Cr. mainstem and Ella Cr. There were no pools in Thomas Cr. with LWD.

Ella Cr. has one deep pool with LWD, or 9 percent of the deep pools.

Spawning gravel quantity and quality

Gravel quantity: The ODFW benchmark for “desirable” is “more than 34 percent of riffle area is gravel”; and undesirable is “less than 15 percent of riffle area is gravel.”

Reach 1 of Thomas Cr. has approximately 1.5 miles of riffle habitat and gravels make up 40 percent. Reach 2 has 0.6 miles of riffles, of which 46 percent is gravel. These reaches, with a gradient of 1-2 percent, provide the best spawning habitat, particularly for chinook salmon. Reach 3, a slightly steeper section (3 percent), has only 0.3 miles of riffle habitat, of which 26 percent is gravel.

The surveyed portion of lower Neal Cr. has about 0.5 miles of riffle habitat, or about 44 percent of the reach. These riffle areas are 44 percent gravel, which provide spawning habitat for resident fish. Spawning gravels are limited in the upper portion of Neal Cr. Only 0.2 miles of riffle exist, and only 10 percent is in gravel. Ella Cr. is typical of the upper tributaries to Thomas Cr. because it is a relatively high gradient stream (4 to 20 percent gradient). Low gradient riffle habitat is limited (11 percent) and only 17 percent is gravel.

Gravel quality: Gravel quality refers to the amount of fines (silt, sand, and organics) that are present in the gravels in spawning riffles. This metric refers to the percent of fines identified in the surface substrates. The ODFW benchmark for desirable is “less than 10 percent”, with “greater than 25 percent” as undesirable.

Reaches 1 and 2 of Thomas Cr. had good gravel quality with 4 percent and 8 percent fines, respectively. The percent fines increased to 12 percent in reach 3.

Gravel quality was good in lower Neal Cr. (4 percent fines), but approached undesirable levels (20 percent fines) in upper Neal Cr. This data is not available for Ella Cr.

| **Thomas Creek WA** | **Large woody debris recruitment potential from adjacent riparian area, by subwatershed.** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Conifer of hardwood riparian area (acres), by age classes. Recruitment potential is LOW, MODerate , and HIGH | | | | | | | | | |
| Subwatershed (SW) | Owner | CON<40 | CON 40-80 | CON>80 | HRD<40 | HRD 40-80 | HRD>80 | Non-forest | | Calc. Total |
| | | LOW | MOD | HIGH | LOW | MOD | MOD | LOW | | |
| Lower Thomas | BLM | 85 | 47 | 41 | 0 | 0 | 7 | 9 | | 189 |
| | PVT | 338 | 715 | 10 | 186 | 266 | 1 | 1109 | | 2625 |
| | SUM | 423 | 762 | 51 | 186 | 266 | 8 | 1118 | | 2814 |
| | %SW | 15% | 27% | 2% | 7% | 9% | 0% | 40% | | |
| | %SWBLM | 45% | 25% | 22% | 0% | 0% | 4% | 5% | | |
| Neal Creek | BLM | 429 | 246 | 199 | 3 | 13 | 14 | 46 | | 950 |
| | PVT | 563 | 1161 | 79 | 52 | 180 | 3 | 359 | 2397 | |
| | SUM | 992 | 1407 | 278 | 55 | 193 | 17 | 405 | | 3347 |
| | %SW | 30% | 42% | 8% | 2% | 6% | 1% | 12% | | |
| | %SWBLM | 45% | 26% | 21% | 0% | 1% | 1% | 5% | | |
| Lower Mid Thomas | BLM | 289 | 141 | 326 | 31 | 22 | 4 | 27 | | 840 |
| | PVT | 2321 | 998 | 327 | 119 | 59 | 0 | 37 | | 3861 |
| | SUM | 2610 | 1139 | 653 | 150 | 81 | 4 | 64 | | 4701 |
| | %SW | 56% | 24% | 14% | 3% | 2% | 0% | 1% | | |
| | %SWBLM | 34% | 17% | 39% | 4% | 3% | 0% | 3% | | |
| Upper Mid Thomas | BLM | 256 | 0 | 138 | 0 | 9 | 0 | 43 | | 446 |
| | PVT | 2126 | 0 | 87 | 207 | 5 | 0 | 6 | | 2431 |
| | SUM | 2382 | 0 | 225 | 207 | 14 | 0 | 49 | | 2877 |
| | %SW | 83% | 0% | 8% | 7% | 0% | 0% | 2% | | |
| | %SWBLM | 57% | 0% | 31% | 0% | 2% | 0% | 10% | | |
| Upper Thomas | BLM | 135 | 0 | 85 | 0 | 0 | 0 | 23 | | 243 |
| | PVT | 1223 | 18 | 0 | 63 | 0 | 0 | 7 | | 1311 |
| | SUM | 1358 | 18 | 85 | 63 | 0 | 0 | 30 | | 1554 |
| | %SW | 87% | 1% | 5% | 4% | 0% | 0% | 2% | | |
| | %SWBLM | 56% | 0% | 35% | 0% | 0% | 0% | 9% | | |
| Percent within Subwatershed | | LOW | MOD | HIGH | | | | BLM Total | | 2668 |
| Lower Thomas | | 61% | 37% | 2% | | | | PVT Total | | 12625 |
| Neal Creek | | 43% | 48% | 8% | | | | TOTAL | | 15293 |
| Lower Mid Thomas | | 60% | 26% | 14% | | | | | | |
| Upper Mid Thomas | | 92% | 0% | 8% | | | | | | |
| Upper Thomas | | 93% | 1% | 5% | | | | | | |
| Percent within Subwatershed on Federal Lands only | | | | | | TOTAL FOR THOMAS WAA | | | | |
| | | LOW | MOD | HIGH | | | LOW | MOD | HIGH | TOTAL |
| Lower Thomas | | 50% | 29% | 22% | | ACRES | 10092 | 3909 | 1292 | 15293 |
| Neal Creek | | 50% | 29% | 21% | | Percent | 66% | 26% | 8% | |
| Lower Mid Thomas | | 41% | 20% | 39% | | | | | | |
| Upper Mid Thomas | | 67% | 2% | 31% | | BLM 0ACRES | 1376 | 503 | 789 | 2668 |
| Upper Thomas | | 65% | 0% | 35% | | Percent | 52% | 19% | 30% | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

## F.5. Citations for Fisheries

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## G.1. Thomas Creek Proposed Road Closures.

| Road Number | ~ miles | Comments |
|---|---|---|
| T10S -R 01E - 5.1 | 0.06 | Fuzzy Sandozi Reserve / CONN |
| T10S -R 01E - 5 | 1.17 | Fuzzy Sandozi Reserve / CONN |
| T10S -R 01E - 5.3 | 0.12 | Fuzzy Sandozi Reserve / CONN |
| T10S -R 01E - 29 | 0.25 | Spotted Owl core area / LSR |
| T10S -R 01E - 21.C | 0.98 | Spotted Owl core area / LSR |
| T10S -R 02E - 9.2 | 0.34 | Spotted Owl core area / LSR |
| T10S -R 02E - 9.3 | 0.27 | Spotted Owl core area / LSR |
| T09S -R 01E - 36 (Sec. 9) | 0.80 | Spotted Owl core area / LSR |
| T10S -R 02E - 11 | 0.67 | Spotted Owl core area / LSR / Shooting / Garbage |
| T10S -R 02E - 11.1 | 0.50 | Spotted Owl core area / LSR / Shooting / Garbage |
| T10S -R 02E - 19 | 0.48 | Spotted Owl core area / LSR / Shooting / Garbage |
| T10S -R 02E - 19.1 | 0.18 | Spotted Owl core area / LSR / Shooting / Garbage |
| T10S -R 02E - 19.5 | 0.35 | Spotted Owl core area / LSR / Shooting / Garbage |
| T10S -R 02E - 19.7 | 0.24 | Spotted Owl core area / LSR / Shooting / Garbage |
| T10S -R 02E - 21 | 0.31 | Spotted Owl core area / CONN |
| T10S -R 02E - 21.1 | 0.11 | Spotted Owl core area / CONN |
| T10S -R 02E - 14 | 0.30 | Spotted Owl core area / LSR |
| T10S -R 02E - 13.3 | 0.22 | CONN / Spotted Owl core area |
| T10S -R 02E - 13.2 | 0.09 | CONN / Riparian Reserve |
| T11S -R 03E - 2.6 | 0.09 | Riparian Reserve |
| T11S -R 03E - 4 | 0.74 | Pseudocyphallaria / CONN / Riparian Reserves |
| T11S -R 03E - 4.5 | 0.09 | Pseudocyphallaria / CONN / Riparian Reserves |
| T11S -R 03E - 6.1 | 0.17 | Riparian Reserves |
| T10S -R 01E - 19 (no #) | 0.32 | Riparian Reserves / Not used |
| T10S -R 01E - 33.3 | 0.28 | Riparian Reserves / Not used |

| Road Number | ~ miles | Comments |
|---|---|---|
| T10S -R 01E - 33.4 | 0.27 | |
| T10S -R 01E - 33.6 | 0.60 | Not used |
| T10S -R 01E - 23.1 | 0.76 | Through Riparian Reserve / Not used |
| T10S -R 01E - 23.? | 0.05 | Not used |
| T10S -R 01E - 35.3 | 0.16 | CONN / Not used |
| T10S -R 01E - 36 | 0.22 | CONN / Riparian Reserve / Dumping |
| T10S -R 02E - 9 | 0.21 | Not used |
| T10S -R 02E - 9.1 | 0.30 | Riparian Reserve / Not used |
| T10S -R 02E - 13.4 | 0.42 | CONN / Not used |
| T11S -R 04E - 5.4 | 0.33 | Not used |
| T11S -R 04E - 5.3 | 0.05 | Not used |
| T11S -R 04E - 5.5 | 0.51 | Not used |
| T11S -R 04E - 5.? (no #) | 0.06 | Not used |
| T11S -R 04E - 6 (no #) | 0.06 | Not used |
| | 13.13 | |

## H.1. Recreation Opportunity Spectrum (ROS)

The Recreation Opportunity Spectrum (ROS) is the planning framework that was used to inventory both private and public lands in the Thomas Creek Watershed. Three major components that affect visitor use and preference are setting, activity, and desired experience. Visitors participating in the same activity may be seeking different settings and experiences. For example, one camper may desire a wilderness setting to experience solitude and challenge. Another camper may want highly developed facilities that offer more comfort and social opportunities. To meet these different needs, ROS is a system that is divided into seven major classes that provide a spectrum of opportunities, ranging from more primitive to more developed.

Primitive: Characterized by an unmodified natural environment of fairly large size where evidence of humans and human-induced restrictions and controls is essentially absent and motorized access is not permitted. Very low social interaction.

Semi-Primitive / Non-Motorized: Characterized by a predominantly natural environment of moderate to large size where evidence of humans and human controls is present but low. Motorized use is not permitted. Social interaction is low.

Semi-Primitive / Motorized: This class is similar to the previous one, however, motorized use is allowed.

Roaded Natural: Characterized with a predominantly natural environment with moderate evidence of human modification and control, that are in harmony with a natural setting. Moderate social interaction

Roaded Modified: Forest or other natural environment, with obvious modifications such as logging or mining, etc., road access and limited facility development, within an open space context. Moderate social interaction.

Rural: Characterized by an environment that is culturally modified to the point that it is dominant feature. Cultural modifications are usually associated with agricultural activities, residental activities, and utility corridors. Moderate social interaction.

Urban: This class is similar to rural however facility development is intensified and the environment though natural appearing is often landscaped. Modifications are designed to enhance specific recreational activities.

## H.2. Thomas Creek Watershed Cultural Resource Site List

**T. 9. S., R. 2 E.**

OR-08-29 (35LI75) Mt. McCully Lithic site. Flakes and cores of red jasper. Possibly a tool manufacture/maintenance site for local red jasper. Approx. 1 acre in size. Partially disturbed by logging.

**T. 10 S., R. 2 E.**

OR-08-IA-8 Isolated find, Obsidian blade mid-section. Probable knife. Collected.

SHS 805 Trail to the Thomas Donation Land claim (DLC) of Nov. 1852. Trail disappeared from maps after 1938.

SHS 807 thomas Creek Trail. Began at Thomas'KLC (1852). The trail was shown as a settler trail on GLO survey maps dating to 1879. The Linn County Fire Protection Association (LCFPA) used the trail from about 1911 to 1947.

SHS 808 Old Mill City to Snow Peak Trail. LCFPA built the trail and a phone line along the trail in 1911 to access the Snow Peak Lookout (build 1912). From 1912 to 1950's, the LCFPA annually mainteained the trail and phone line with a four man crew. In the 1950's, the trail and phone went out of use due to improved acess and communications provided by roads and radios.

SHS 875 GLO mapped trail, 1917.

**T. 11 S., R. 2 E.**

OR-08-96 (35LI216) Lithic scatter of obsidian, jasper and chert flakes. Two acres in size. Good condition.

OR-08-97 (35LI217) Lithic scatter of obsidian and jasper flakes. Less than 1/4 of an acre. Poor condition.

OR-08-98 (35LI218) Lithic scatter of obsidian and jasper flakes. Less than 1/4 of an acre. Poor condition.

OR-08-99(35LI219) Lithic scatter of obsidian and cher flakes. Two acres in size. Good condition.

SHS 809 New Mill City Snow Peak trail. LCFPA trail

SHS 813 Trail to Snow Peak. GLO mapped in 1897. The trail is apparently an Indian trail predating historic entry into the area. The LCFPA improved and extended the trail in the 1920's. Additional improvement was done by the Civilian Conservation Corp (CCC) in the 1930's. The trail was out of use by 1941 having been replaced by roads.

**T. 10 S., R. 3 E.**

OR-08-IA-20 Isolated find.  Large obsidian knife mid-section.  Collected.

SHS 817 Monument Peak-Snow Peak Trail.  Major access route of the LCFPA to reach ore control stations, lookouts on Monument Peak (1914) and Snow Peak (1912), and Cougar Camp.

**T. 11S., R. 3 E.**

OR-08-26 (35LI72) Campsite.  Obsidian and cryptocrystalline flakes.  Point fragment, shaft straighteners.  Two acres in size.  Good condition.

OR-08-111(35LI246) Lithic scatter of obsidian flakes.  Very small site essentially destroyed by road construction.

OR-08-116(35LI245) Lithic scatter of obsidian and chert flakes.  Less than 1/10 of and acre in size. Essentially destroyed by road construction.

OR-08-129 Lithic scatter of jasper and chert flakes.  Approximately 3/4 of an acre in size.  Largely destroyed by road construction.

OR-08-71 (SHS 637) Historic Cougar Camp.  The camp may have originally been used by miners traveling to and from the Quartzville mining District, but recorded use dates from 1911 into the 1950's when the LCFPA developed the camp for fire protection purposes.  In the 1930's, the CCC crews improved the camp and built three cabins.  Currently, remains of two structures, cut logs, nails, and several refuse dumps are visible at the site.

**T. 11 S., R. 4 E.**

OR-08-54(35LI126) Thomas Ridge Saddle Campsite.  Obsidian, jasper and basalt flakes.  Two basalt biface fragments.  About 1 acre in size.  Partially disturbed.

OR-08-55(35LI127) Thomas Ridge West Campsite.  Obsidian and jasper flakes, two scrapers, one knife and one biface were found.  Approximately 1/4 of an acre in size.  Has been disturbed.

## I. Recommended Treatments by Stand.

No treatment stands are not listed if they have no other treatment list in any sub-unit. Interpretation was made from aerial photos and field recon by the Area Silviculturist. Stands have divisions within the old FOI designated units based on stand conditions. This is meant to be used as a guide to prioritize managment activities. Site specific analysis is expected.

| | | | |
|---|---|---|---|
| NT | No Treatment | NW | Nonforest Water |
| NR | Nonforest Rock | NB | Nonforest Brush |
| PCT | Precommercial Thinning | NH | Nonforest Road or Rockpit |
| CT | Commercial Thinning | | |

| Township - Sec. | Key # | Div. | Birth date | Recommended Treatment |
|---|---|---|---|---|
| 9S 2E Sec. 31 | 950312 | .10 | 1976 | CT |
| | | .11 | | NT |
| | | .12 | 1976 | Regeneration Harvest |
| | | .13 | 1976 | NT |
| | 950308 | .10 | 1700 | Sold but not cut |
| | | .11 | 1920 | Commercial thinning (< 15 ac.) |
| | | .12 ,.14 | 1700 | Sold but not cut |
| | | .13 | 1910 | Sold but not cut |
| | 950317 | .11,.12 | 1900 | Regeneration Harvest |
| | 950316 | .11, .12 | 1920 | Regeneration Harvest |
| | | .13,.14 | 1980 | NT |
| | 930319 | .11 | 1900 | Regeneration Harvest |
| | | .12 | 1970 | Pruning |
| | | .13 | | Commercial Thinning (<15 ac) |
| | | .14,.15 | 1980 | Sold but not cut |
| | 950322 | | 1910 | Regeneration Harvest |
| | 954021 | | 1980 | Post &Pole |
| 10S 1E Sec.1 | 950625 | .10 ,.11 ,.13 | 1880 | Regeneration Harvest |
| | | .12 | 1880 | NT |
| | 950627 | .10 | | NT |
| | 950628 | .10 | 1975 | CT / Pruning |
| | | .11 | 1975 | Pruning |
| | | .12-.15 | | NT |

| Township - Sec. | Key # | Div. | Birth date | Recommended Treatment |
|---|---|---|---|---|
|  | 950629 |  | 1930 | CT |
|  | 959630 |  | 1800/1930 | Post & Pole |
|  | 950631 |  | 1800/1950 | CT |
|  | 953713 |  | 1800 | Regeneration Harvest |
| 10S 1E Sec. 19 | 950634 | .10 | 1950 | CT |
|  |  | .11 | 1950 | Regeneration Harvest - high priority |
|  | 950635 |  | 1900 | Regeneration Harvest - high priority |
|  | 950636 | .10-.12 | 1950/1930 | Regeneration Harvest - high priority |
|  | 950638 | .10-.11 | 1930 | Regeneration Harvest |
|  |  | .12-.15 |  | NT |
|  | 950641 | .10 | 1930 | CT |
|  |  | .11-.12 | 1700/1930 | Regeneration Harvest |
|  | 950643 | .10 | 1950 | CT |
|  |  | .11 | 1950 | CT (<15 acres) |
|  |  | .12 | 1950 | NT |
|  |  | .13 | 1950 | Regeneration Harvest |
|  | 952885 | .10 | 1978 | Post & Pole / Pruning |
|  | 953254 | .10 | 1940 | CT |
|  |  | .11 | 1940 | CT (< 15 acres) |
| 10S 2E Sec. 5 | 950748 | .10 -.21 | 1945 | CT |
|  |  | .18 |  | Pruning |
|  |  | .20 |  | Regeneration Harvest - high priority |
|  | 950749 | .10,.13 | 1970/1940 | Regeneration Harvest |
|  |  | .11 | 1970 | CT/Pruning |
|  |  | .12 | 1945 | NT |
|  |  | .14 | 1980 | PCT |
|  | 950752 |  | 1910 | Regeneration Harvest |
|  | 950753 | .10-.11 | 1940 | CT (<15 ac) |

| Township - Sec. | Key # | Div. | Birth date | Recommended Treatment |
|---|---|---|---|---|
|  | 950756 |  | 1972 | Regeneration Harvest |
| 10S 2E Sec. 7 | 950759 | .10-.12 | 1800/1900 | Regeneration Harvest |
|  | 950759 | .15 | 1800/1900 | Regeneration Harvest |
|  |  | .16 | 1975 | Pruning |
|  |  | .17-.20 |  | Regeneration Harvest |
|  | 950761 | .10 |  | Pruning |
|  |  | .11-.13 |  | NT |
| 11S 2E Sec. 4 | 951203 | .10 -.20 |  | NT |
|  |  | .14 |  | Regeneration Harvest |
|  | 951205 | .10,.12 | 1900 | Preparatory Cut |
|  |  | .11 | 1900 | Regeneration Harvest |
|  | 951202 |  | 1890 | Regeneration Harvest |
|  | 951202 |  | 1890 | Regeneration Harvest |
|  | 953322 |  | 1960 | CT |
|  | 953324 |  | 1960 | CT |
|  | 951179 | .10,.11 | 1975 | NT |
|  |  | .12 | 1975 | PCT |
| 11 S 2E Sec 2 | 951165 | .10 | 1968 | CT |
|  |  | .11-.16 | 1968 | NT |
|  |  | .14 | 1968 | Post & Pole |
|  |  | .17 | NH |  |
|  | 951178 | .10,.14 | 1978 | PCT |
|  |  | .11-.13 | 1978 | NT |
|  | 953323 | .10 | 1960 | CT |
|  |  | .11-.12 | 1960 | NT |
|  | 951167 |  | 1800 | Regeneration Harvest |
|  | 951163 | .10 | 1963 | Post & Pole |
|  |  | .11 | 1963 | NT |
|  | 951162 | .10 | 1800 | Regeneration Harvest |
|  |  | .11-.13 | 1800 | NT |

| Township - Sec. | Key # | Div. | Birth date | Recommended Treatment |
|---|---|---|---|---|
| 11S 2E Sec. 23 | 950870 | .10-.11 | 1975 | Post & Pole |
|  | 950851 | .10-.22 | 1840 | Regeneration Harvest |
|  | 950869 |  | 1973 | Post & Pole |
|  | 950865 |  | 1974 | Post & Pole |
|  | 950871 | .10 | 1980 | PCT |
|  |  | .11 | 1970 |  |
|  | 950864 | .10 | 1974 | Post & Pole |
|  |  | .11 | NH | NT |
|  | 950862 | .10,.13 | 1973 | Post & Pole |
|  |  | .11-.12 | 1973 | NT |
| 10S 2E Sec. 25 | 950875 | .10-.13 | 1800 | Regeneration Harvest |
|  | 950878 |  | 1950 | Regeneration Harvest |
|  | 953276 | .10-.12 | 1980 | PCT |
|  | 953278 |  | 1981 | Post & Pole |
|  | 953140 | .10 | 1980 | PCT |
|  |  | .11-.12 | 1980 | NT |
| 11S 2E Sec. 6 | 953163 | .10,.12 | 1960 | CT |
|  |  | .11 | NW |  |
|  | 951437 |  | 1800 | Regeneration Harvest |
|  | 951448 | .10,.11 | 1973 | Post & Pole |
|  | 953164 | .10 | 1960 | CT |
|  |  | .11 | 1960 | NT |
|  | 951439 | .10..14 | 1974 | Post & Pole |
|  |  | .11-.12 | NR |  |
|  |  | .13,.15 | 1974 | NT |
|  | 951440 | .10-.11 | 1800 | Regeneration Harvest |
|  |  | .12 | 1960 | CT |
|  | 952967 |  | 1984 | PCT |
|  | 951445 |  | 1870 | Regeneration Harvest |
|  | 953863 |  | 1958 | CT |

| Township - Sec. | Key # | Div. | Birth date | Recommended Treatment |
|---|---|---|---|---|
|  | 951444 |  | 1800 | Regeneration Harvest |
|  | 951438 | .10 | 1974 | Post & Pole |
|  |  | .11 | 1974 | NT |
|  | 951447 | .10-.11 | 1979 | PCT |
|  |  | .12 | 1965 | Post & Pole |
|  | 953165 | .10 | 1965 | CT |
|  |  | .11-.12 | 1965 | NT |
|  | 95.1452 | .10 | 1983 | PCT |
|  |  | .11 | 1983 | NT |
|  | 951449 | .10 | 1981 | NT |
|  |  | .11 | 1981 | PCT |
| 10S 3E Sec. 19 | 950971 | .10 | 1983 | Post & Pole |
|  |  | .11-.13 | 1983 | NT |
|  | 950966 |  | 1920 | CT |
|  | 953984 | .10 | 1992 | NT |
|  |  | .11 | 1980 | PCT |
|  | 950972 | .10-.11 | 1980 | Post & Pole |
|  | 953297 | .10 | 1840 | Regeneration Harvest |
|  |  | .11,.13 | 1980 | Post & Pole |
|  |  | .12 | 1990 | NT |
|  |  | .14-.16 | 1840 | NT |
|  |  | .17 | 1980 | Post & Pole |
|  |  | .18-.21 | 1840 | NT |
|  | 953983 |  | 1970 | Post & Pole |
|  | 953297 |  | 1980 | Post & Pole |
| 11S 3E Sec.4 | 951429 | .10 | 1983 | PCT |
|  |  | .11 | 1983 | NT |
|  | 953419 |  | 1987 | PCT |
|  | 951425 | .10 | 1978 | PCT |
|  |  | .11 | 1978 | NT |

| Township - Sec. | Key # | Div. | Birth date | Recommended Treatment |
|---|---|---|---|---|
|  |  | .12-.13 | 1978 | PCT |
|  |  | .14 | NR |  |
|  | 951420 | .10 | 1969 | Post & Pole |
|  |  | .11-.13 | 1969 | NT |
|  |  | .14 | 1978 | PCT |
|  |  | .15 | 1978 | Post & Pole |
|  | 951430 | .10-.12 | 1984 | PCT |
|  |  | .13 | 1970 | Post & Pole |
|  | 951410 | .10 | 1968 | Post & Pole |
|  |  | .11-.20 | 1968 | NT |
|  | 951428 | .10-.11 | 1979 | PCT |
|  |  | .12-.13 | 1979 | NT |
|  | 951416 | .10-.11 | 1920 | NT |
|  |  | .12 | 1920 | Regeneration Harvest |
|  |  | .13 | NG |  |
|  | 951411 | .10 | 1800 | Regeneration Harvest |
|  |  | .11-.12 | 1970 | NT |
|  |  | .13 | 1920 | NT |
|  |  | .14,.18, .24 | 1800 | NT |
|  |  | .15,.17,.27 | NR |  |
|  |  | .16 | 1968 | NT |
|  |  | .19 | NB |  |
|  |  | .20-.21 | 1980 | NT |
|  |  | .22-.23, .25-.26., .28 | 1800 | Regeneration Harvest |
|  | 951417 | .10..11,.14 | NR |  |
|  |  | .12,.13,.15-.21 | NB |  |
|  | 951422 | .10 | 1800 | Regeneration Harvest |
|  |  | .11-.12 | 1970 | NT |
|  |  | .13 | 1800 | NT |
|  | 951411 | .29 | 1800 | Regeneration Harvest |

| Township - Sec. | Key # | Div. | Birth date | Recommended Treatment |
|---|---|---|---|---|
| | | .30 | 1800 | NT |
| | 953161 | .10 | 1961 | CT |
| | | .11 | 1970 | PCT |
| | | .12 | 1961 | Post & Pole |
| | 951433 | .10 | 1979 | PCT |
| | | .11 | 1979 | Post & Pole |
| | | .12 | 1979 | NT |
| | 952964 | | 1984 | PCT |
| | 953162 | .10 | 1963 | Post & Pole |
| | | .11-.14 | 1970 | NT |
| | | .15 | 1963 | CT |
| 11S 3E Sec. 2 | 951400 | .10 | 1983 | PCT |
| | | .11 | 1973 | Post & Pole |
| | 951407 | .10 | 1973 | Post & Pole |
| | | .11 | 1973 | NT |
| | 951401 | .10 | 1983 | PCT |
| | | .11 | 1983 | NT |
| | 951404 | .10-.11 | 1973 | Post & Pole |
| | | .12 | 1973 | NT |
| | 951385 | .10-.12, .15, .17-20 .24-.26, .28-.31,.33 | 1800 | Regeneration Harvest |
| | | .13-.14,.16,.21,.32 | 1966 | NT |
| | | .27 | 1970 | PCT |
| | 951399 | .10 | 1979 | PCT |
| | | .11 | 1970 | Post & Pole |
| | 951408 | .10 | 1979 | Post & Pole |
| | | .11-.12 | 1979 | NT |
| | 951396 | .10 | 1977 | NT |
| | | .11 | 1977 | Post & Pole |
| | 951392 | .10-.12 | 1800 | Regeneration Harvest |

| Township - Sec. | Key # | Div. | Birth date | Recommended Treatment |
|---|---|---|---|---|
|  | 951394 | .10 | 1966 | Post & Pole, Prune |
|  |  | .11-.13 | 1966 | NT |
|  | 951390 | .10 | 1975 | Post & Pole |
|  |  | .11 | 1975 | NT |
| 11S 4E Sec. 6 | 952152 | .10 | 1980 | PCT |
|  |  | .11 | 1980 | NT |
|  |  | .12-.13 | 1970 | Post & Pole |
|  | 952150 | .10, .12-.13 | 1980 | PCT |
|  |  | .11 | 1980 | Post & Pole |
|  | 953054 | .10 | 1973 | PCT |
|  |  | .11-.13, .17-.18 | 1973 | NT |
|  |  | .14-.15 | NB |  |
|  |  | .16 | 1973 | Post & Pole |
|  | 952140 | .10,.12,.16,.19,.20 .22-.24,.26-.29 | 1800 | Regeneration Harvest |
|  |  | .11 | 1980 | PCT |
|  |  | .13-.15,.21,.25 | 1800 | NT |
|  |  | .17-.18 | NB |  |
|  | 952148 |  | 1800 | Regeneration Harvest |
|  | 952145 |  | 1940 | CT |
|  | 953763 |  | 1976 | PCT |
|  | 952151 | .10 | 1973 | PCT |
|  |  | .11-.12 | 1973 | NT |
| 11S 4E Sec. 5 | 952107 | .10 | 1800 | Regeneration Harvest |
|  |  | .11 | NR |  |
|  |  | .12 | 1970 | Post & Pole |
|  |  | .13-.14,.17 | 1800 | NT |
|  |  | .15-.16,.18,.22-.25 | 1800 | Regeneration Harvest |
|  |  | .19-.21 | NG |  |
|  | 952111 | .10 | 1962 | Post & Pole |

| Township - Sec. | Key # | Div. | Birth date | Recommended Treatment |
|---|---|---|---|---|
| | | .11 | 1962 | PCT |
| | | .12-.13 | 1962 | NT |
| | 952119 | | 1968 | Post & Pole |
| | 952128 | .10-.14 | 1800 | Regeneration Harvest |
| | 952134 | .10 | 1973 | PCT |
| | | .11 | 1973 | NT |
| | 952136 | .10 | 1982 | PCT |
| | | .11 | 1970 | NT |
| | 952137 | .10,.12-.18 | NB | |
| | | .11 | NW | |
| | 953051 | | 1980 | PCT |
| | 953053 | .10-.11 | 1988 | NT |
| | | .12 | 1970 | Post & Pole |
| | 953762 | .10 | 1968 | Post & Pole |
| 11S 4E Sec. 4 | 952090 | .11 | 1973 | PCT |
| | | .12-.14 | 1980 | NT |
| | 952103 | | 1966 | Post & Pole |
| | 952105 | .10 | 1973 | Post & Pole |
| | | .11-.13 | 1973 | NT |
| | 952087 | .10-.16 | 1800 | Regeneration Harvest |
| | | .17.20 | NH | |
| 10S 1E Sec. 29 | 950692 | .10 | 1930 | CT |
| | | .11 | 1980 | PCT |
| | | .12 | 1930 | Regeneration Harvest |
| | 950693 | .10-.11 | 1860/1940 | Regeneration Harvest |
| | | .12 | 1980 | PCT |
| | 950694 | .10 | 1976 | CT |
| | | .11 | 1976 | NT |
| | | .12 | 1860 | Regeneration Harvest |
| | 950695 | .10-.11 | 1973/1860 | CT |

| Township - Sec. | Key # | Div. | Birth date | Recommended Treatment |
|---|---|---|---|---|
| | | .12 | 1860 | Regeneration Harvest |
| | 950696 | .10-.14 | 1860 | Regeneration Harvest |
| | 950697 | .10-.11 | 1950 | CT |
| | | .12 | 1950 | NT |
| | | .13-.14 | 1860 | Regeneration Harvest |
| | 950698 | .10,.14 | 1960 | CT |
| | | .11 | 1960 | NT |
| | | .12-.13 | 1960 | Post & Pole |
| | | .15 | 1860 | Regeneration Harvest |
| 10S 1E Sec. 21 | 950646 | .10,.12 | 1940 | Regeneration Harvest |
| | | .11 | 1940 | CT |
| | 950649 | | 1930 | CT |
| | 950650 | | 1950 | Regeneration Harvest |
| | 950653 | .10,.11,.13 | 1930 | Regeneration Harvest |
| | | .12 | NG | |
| | 950654 | .10-.14 | 1880 | Regeneration Harvest |
| | 953256 | .10 | 1950 | CT |
| | | .11 | 1950 | NT |
| | 953771 | .10-.13 | 1930 | Regeneration Harvest |
| | 950650 | | 1950 | Regeneration Harvest |
| 10S 1E Sec. 23 | 950656 | | 1890 | Regeneration Harvest |
| | 950657 | .10 | 1800 | Regeneration Harvest |
| | 950658 | .10 | 1963 | CT |
| | | .11 | 1963 | Regeneration Harvest |
| | 950659 | .10 | 1964 | CT |
| | | .11 | 1964 | Regeneration Harvest |
| | | .12 | NG | |
| | 950660 | .10 | 1967 | CT |
| | | .11-.12,.14,.16-.17 | 1967 | NT |
| | | .13 | 1800/1967 | Overstory Removal |

| Township - Sec. | Key # | Div. | Birth date | Recommended Treatment |
|---|---|---|---|---|
| | | .15 | 1967 | Post & Pole Removal |
| | 950661 | .10-.12,.15 | 1974/1900 | NT |
| | | .13 | 1974 | Prune |
| | | .14 | 1974 | Post & Pole |
| | 952886 | | 1984 | PCT |
| | 952888 | .10 | 1984 | PCT |
| | | .11 | 1992 | NT |
| | 953157 | .10 | 1978 | Post & Pole |
| | | .11 | 1978 | NT |
| | 953258 | .10-.11 | 1960 | CT |
| 10S 1E Sec. 25 | 950675 | .10,.12 | 1960 | CT |
| | | .11,.13-.14 | 1960 | NT |
| | 950676 | .10-.11 | 1900 | Regeneration Harvest |
| | 953260 | .10,.15 | 1968/1940 | Regeneration Harvest |
| | | .11 | 1968 | Post & Pole |
| | | .12,.13-.14 | 1968 | NT |
| | 953261 | .10 | 1940 | CT |
| | | .11-.12 | 1940 | Regeneration Harvest |
| | 953411 | .10-.13,.15-.18 | 1840 | Regeneration Harvest |
| | | .14 | 1960 | Post & Pole |
| | | .19 | 1930 | CT |
| | 953779 | .10-.13 | 1940 | Regeneration Harvest |
| 10S 1E Sec.27 | 950679 | .10,.12-.13 | 1976 | Post & Pole |
| | | .11 | 1985 | NT |
| | | .14 | 1985 | PCT |
| | | .15 | 1940 | Regeneration Harvest |
| | 950680 | | 1920 | CT |
| | 950681 | .10,.17 | 1960 | CT |
| | | .11,.13-.16,.18-.19, .21 | 1970 | NT |

| Township - Sec. | Key # | Div. | Birth date | Recommended Treatment |
|---|---|---|---|---|
| | | .12,.20 | 1960 | Regeneration Harvest |
| | 950687 | .10-.13 | 1950/1800 | Regeneration Harvest |
| | 950690 | | 1975 | CT |
| | 952890 | .10-.11,.13-.14 | 1950 | Regeneration Harvest |
| | | .12 | 1950 | CT |
| | 953266 | .10,.12,.15-.16,.19 | 1940 | CT |
| | | .11,.13,.18 | 1920 | Regeneration Harvest |
| | | .14 | 1985 | PCT |
| | | .17 | 1985 | |
| | | | NT | |
| | 953267 | .10-.14 | 1950 | CT |
| 10S 1E Sec. 33 | 950711 | .10,.16,.22 | 1960 | CT |
| | | .11,.15..17 | 1960 | Regeneration Harvest |
| | | .12-.14,.18,.20-.21, .23-.26,.28 | 1960/1800 | NT |
| | | .27 | 1980 | PCT |
| | 950717 | .10 | 1975 | Post & Pole |
| | | .11 | 1975 | NT |
| | 950719 | .10 | 1975 | Post & Pole |
| | | .11-.14 | 1990 | NT |
| | 952894 | .10 | 1986 | pct |
| | | .11-.12 | 1960 | NT |
| | 952895 | .10 | 1986 | PCT |
| | | .11-.12 | 1980 | NT |
| | 953780 | .10,.12,.18 | 1960 | Regeneration Harvest |
| | | .11 | 1960 | CT |
| | | .13-.17,.19 | 1960/1990 | NT |
| | 950720 | .10-.11,.13 | 1978 | NT |
| | | .12 | 1978 | Post & Pole |
| 10S 1E sec. 35 | 950722 | .10-.12 | 1940 | CT |

| Township - Sec. | Key # | Div. | Birth date | Recommended Treatment |
|---|---|---|---|---|
|  | 950724 | .10,.12,.14-.19 | 1840 | Regeneration Harvest |
|  |  | .11,.20-.21 | 1840 | NT |
|  |  | .13 | 1970 | Post & Pole |
|  | 950726 |  | 1964 | Post & Pole |
|  | 950727 | .10 | 1973 | Post & Pole |
|  |  | .11-.12 | 1973 | NT |
|  | 950729 | .10-.13,.16 | 1950 | CT |
|  |  | .14-.15,.17-.18 | 1967 | NT |
|  | 952898 |  | 1984 | PCT |
|  | 952899 |  | 1986 | PCT |
|  | 952731 | .10 | NB |  |
|  |  | .11 | 1950 | NT |
| 10S 1E Sec. 36 | 950738 | .10-.15 | 1840 | Regeneration Harvest |
|  |  | .16-.19 | 1970 | NT |
|  | 953171 | .10-.11 | 1964 | Post & Pole |
|  |  | .12 | 1964 | CT |
|  |  | .13 | 1964 | NT |
|  | 953413 | .10,.12,.16 | 1840 | Regeneration Harvest |
|  |  | .11,.13-.15 | 1985 | NT |
| 11S 1E Sec. 1 | 951018 | .10-.11 | 1950 | CT |
|  | 951031 | .10,.12 | 1981 | PCT |
|  |  | .11 | 1981 | NT |
| 10S 2E Sec. 31 | 950881 | .10,.14 | 1967 | Post & Pole |
|  |  | .11-.13 | 1967 | NT |
|  | 950883 |  | 1973 | Post & Pole |
|  | 950889 | .10-.12 | 1880 | Regeneration Harvest |
|  | 950893 | .10,.14-.15 | 1850 | Regeneration Harvest |
|  |  | .11-.13,.16-.17 | 1985 | NT |
|  | 950897 |  | 1800 | Regeneration Harvest |
|  | 950899 | .10-.11 | 1970 | NT |

| Township - Sec. | Key # | Div. | Birth date | Recommended Treatment |
|---|---|---|---|---|
|  |  | .12-.13 | 1970 | CT |
|  | 952913 |  | 1982 | Post & Pole |
|  | 953280 | .10-.11,.15 | 1962 | CT |
|  |  | .12-.14 | 1962 | Regeneration Harvest |
|  | 953283 | .10,.15 | 1950 | CT |
|  |  | .11-.14,.16-.18 | 1950 | NT |
|  | 953286 | .10-.13 | 1950 | CT |
|  |  | .14-.18 | 1950 | NT |
|  | 953414 | .10-.11 | 1900 | Regeneration Harvest |
| 10S 2E Sec. 19 | 950828 | .10-.12,.14 | 1950 | NT |
|  |  | .13,.15 | 1950 | Regeneration Harvest |
|  | 950833 | .10-.12 | 1860 | Regeneration Harvest |
|  | 950834 | .10-.19 | 1860 | Regeneration Harvest |
|  | 950836 | .10 | 1950 | CT |
|  |  | .11-.12 | 1950 | Regeneration Harvest |
|  | 950838 |  | 1950 | Regeneration Harvest |
|  | 950839 |  | 1950 | Regeneration Harvest |
|  | 950840 |  | 1965 | CT |
|  | 952908 | .10 | 1983 | PCT |
|  |  | .11-.12 | 1980 | NT |
|  | 952909 |  | 1986 | PCT |
|  | 953272 |  | 1987 | PCT |
| 11S 2E Sec. 5 | 951210 | .10,.18 | 1960 | CT |
|  |  | .11-.17,.19-.21 | 1960 | NT |
|  | 951212 | .10-.11 | 1981 | PCT |
|  |  | .12 | 1981 | NT |
|  | 951213 | .10-.11 | 1900 | Regeneration Harvest |
|  |  | .12-.13 | 1800 | NT |
|  | 951214 | .10-.13,.17-.22 | 1956 | NT |
|  |  | .16 | 1956 | CT |

| Township - Sec. | Key # | Div. | Birth date | Recommended Treatment |
|---|---|---|---|---|
| | 951216 | .10,.12 | 1960 | CT |
| | | .11 | 1970 | NT |
| | 951219 | .10-.11 | 1966 | Post & Pole |
| | | .12,.14-.16 | 1966 | NT |
| | | .13 | 1966 | CT |
| | 951224 | .10-.11,.13-.15 | 1800 | Regeneration Harvest |
| | | .12,.16 | 1800 | NT |
| | 951225 | .10-.11,.15 | 1967 | Post & Pole |
| | | .12-.14,.16 | 1967 | NT |
| | 951226 | .10 | 1962 | CT |
| | | .11-.13 | 1962 | NT |
| | 951227 | .10-.11,.13-.14 | 1900 | Regeneration Harvest |
| | | .12 | NH | |
| | 951235 | .10 | 1978 | PCT |
| | | .11 | 1978 | NT |
| | 951236 | | 1973 | Post & Pole |
| | 951238 | .10-.12,.14-.15 | 1975 | NT |
| | | .13 | 1975 | PCT |
| | 953326 | .10,.15,.18 | 1965 | Post & Pole |
| | | .11-.12,.14,.17 | 1980 | NT |
| | | .13,.16 | 1980 | PCT |
| | 953327 | .10 | 1960 | Regeneration Harvest |
| | | .11-.15,.17,.21-.23 | 1960 | NT |
| | | .16,.18-.19 | 1960 | Post & Pole |
| | 953328 | .10 | 1960 | CT |
| | | .11 | 1960 | NT |
| | 953638 | .10,.14 | 1960 | Regeneration Harvest |
| | | .11-.12 | 1960 | NT |
| | | .13 | NH | |
| | 953725 | | 1910 | Regeneration Harvest |

| Township - Sec. | Key # | Div. | Birth date | Recommended Treatment |
|---|---|---|---|---|
| | | | | |
| * | 951433 | .10 | 1979 | PCT |

## J.1. LSR Boundary Change Map

## J.2. Other Maps

**Maps**

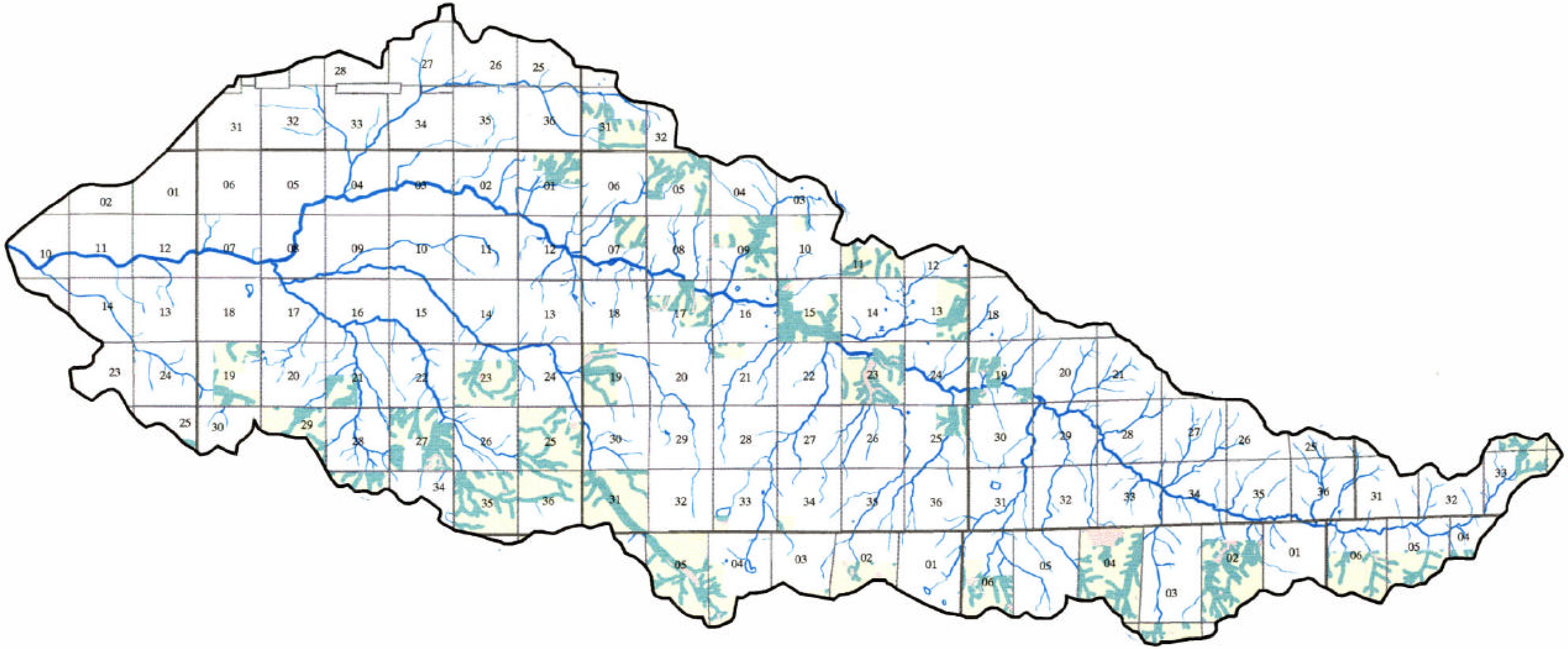
Watershed Location Map

The following are GIS Maps

1. Federal Riparian Reserve/Forest Practices Act Stream Buffers
2. Federal Land Use Allocations
3. Federal Land Use Allocations/Riparian Reserves
4. Ownership
5. Vegetation Age Class
6. Seral Stage
7. Vegetation Type
8. BLM Land Fragile Soils
9. Generalized Road Surface Type
10. Transportation
11. Spotted Own Habitat
12. Resident/Anadromous Fish
13. Stream Order
14. Stream Flow
15. Hydrologic Recovery
16. Vegetation Type (w/in 30m. Stream Buffer)
17. Rural Interface Area
18. County Zoning
19. Road Closure Status
20. Visual Resource Management Classification
21. Generalized Road Control
22. Snow Zone/Slope Hazard
23. Hill Shade
24. Digital Elevation Model
25. Proposed LSR Boundary Adjustment

# Thomas Creek Watershed

## FEDERAL RIPARIAN RESERVE/FOREST PRACTICES ACT STREAM BUFFERS



### LEGEND

🟦 Federal –Riparian Reserves

▨ Federal –Riparian Adjacent Fragile Soils

🟦 Private –Forest Practices Act Stream Buffers

🟨 Federal Land

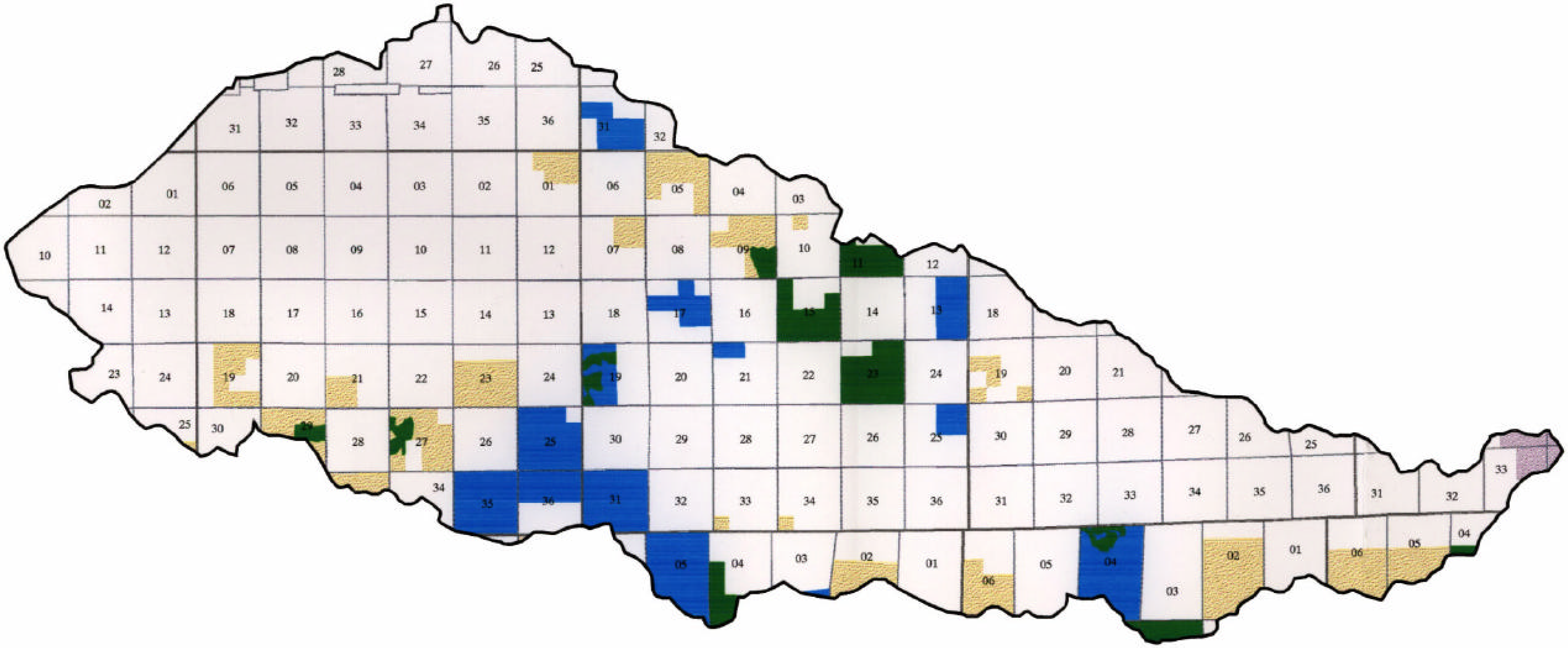
No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by BLM.

Map Created:
12/03/96 10:22 AM

Map #: 1

# Thomas Creek Watershed

## FEDERAL LAND USE ALLOCATION



### LEGEND

| | |
|---|---|
| 🟦 | Matrix (BLM) – Connectivity/ Diversity Block |
| 🟨 | Matrix (BLM) – General Forest Management Area |
| 🟩 | Late Successional Reserve |
| 🟪 | Matrix (USFS) |

N

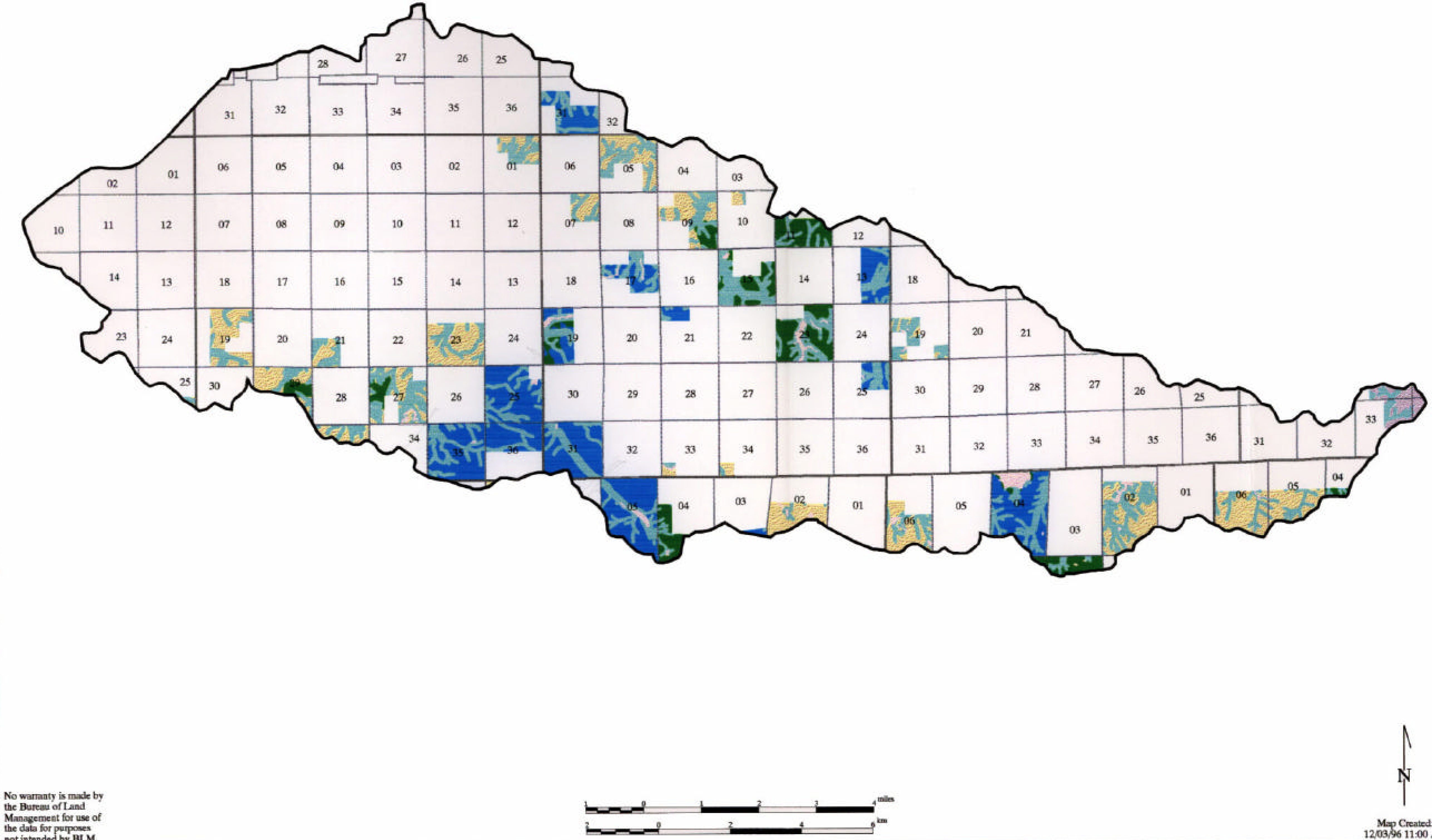
1 0 1 2 3 4 miles

2 0 2 4 6 km

Map Created:
12/03/96 10:36 AM

Map #: 2

# Thomas Creek Watershed



## FEDERAL LAND USE ALLOCATION/ RIPARIAN RESERVES

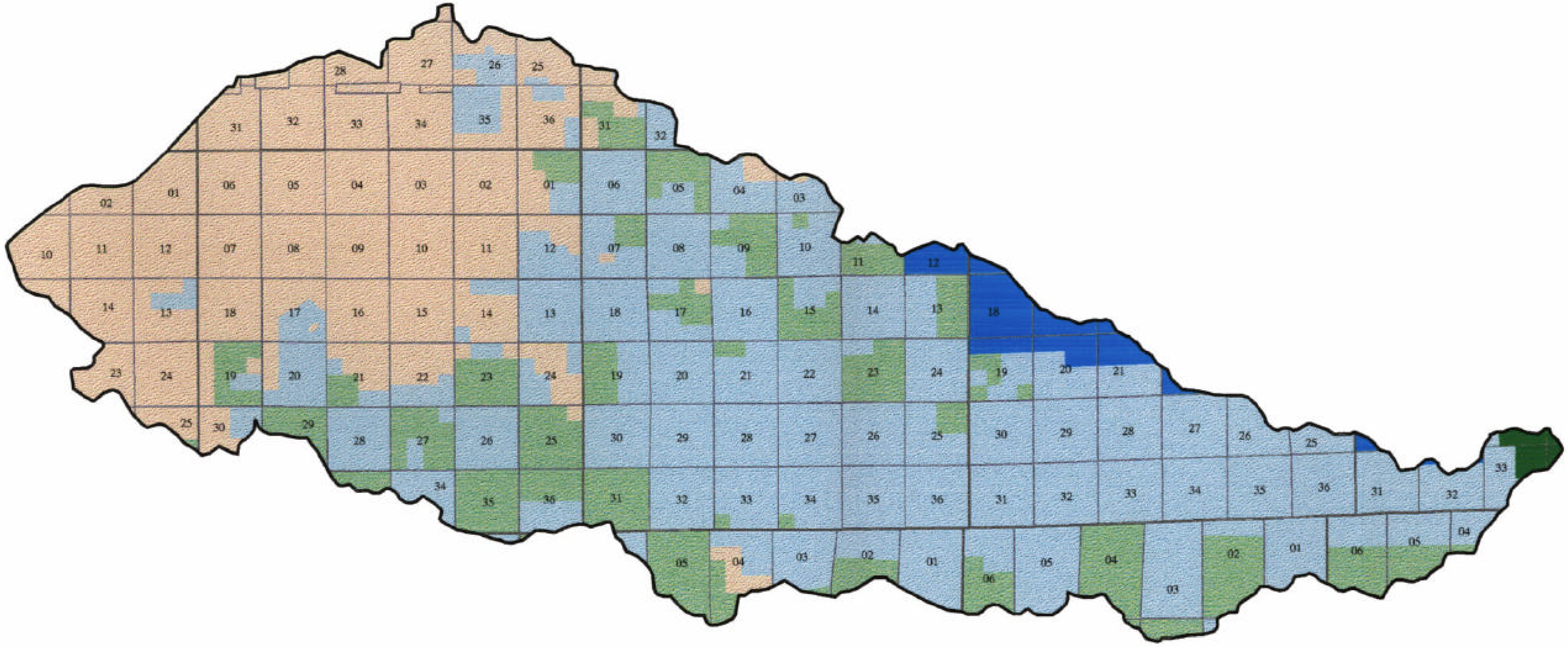
### LEGEND

- 🟦 Matrix (BLM) – Connectivity/ Diversity Block
- 🟨 Matrix (BLM) – General Forest Management Area
- 🟩 Late Successional Reserve
- 🟪 Matrix (USFS)
- ▨ Federal –Riparian Reserves
- ▢ Federal –Riparian Adjacent Fragile Soils

Map Created:
12/03/96 11:00 AM

Map #: 3

# Thomas Creek Watershed



## OWNERSHIP

### LEGEND

🟩 BLM Lands

🟩 USFS Lands

🟦 Private Industrial

🟧 Private Non-Industrial

🟦 State Forest

Map Created:
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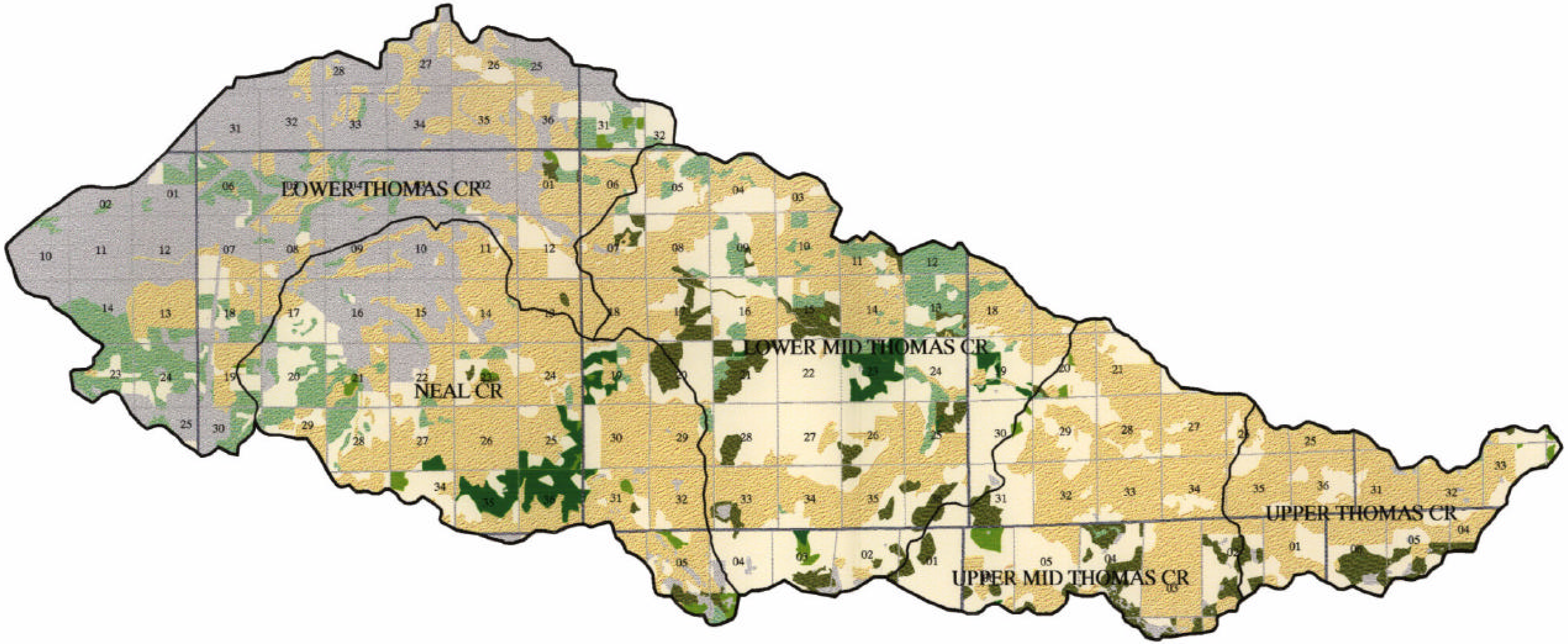
Map #: 4

# Thomas Creek Watershed

# VEGETATION AGE CLASS



## LEGEND
(Ten Year Age Class)

- ▭ 0 -20
- ▨ 30 -50
- 🟩 60 -80
- 🟩 90 -110
- 🟩 120 -190
- 🟩 200 +
- ▨ Non-Forest

miles

km

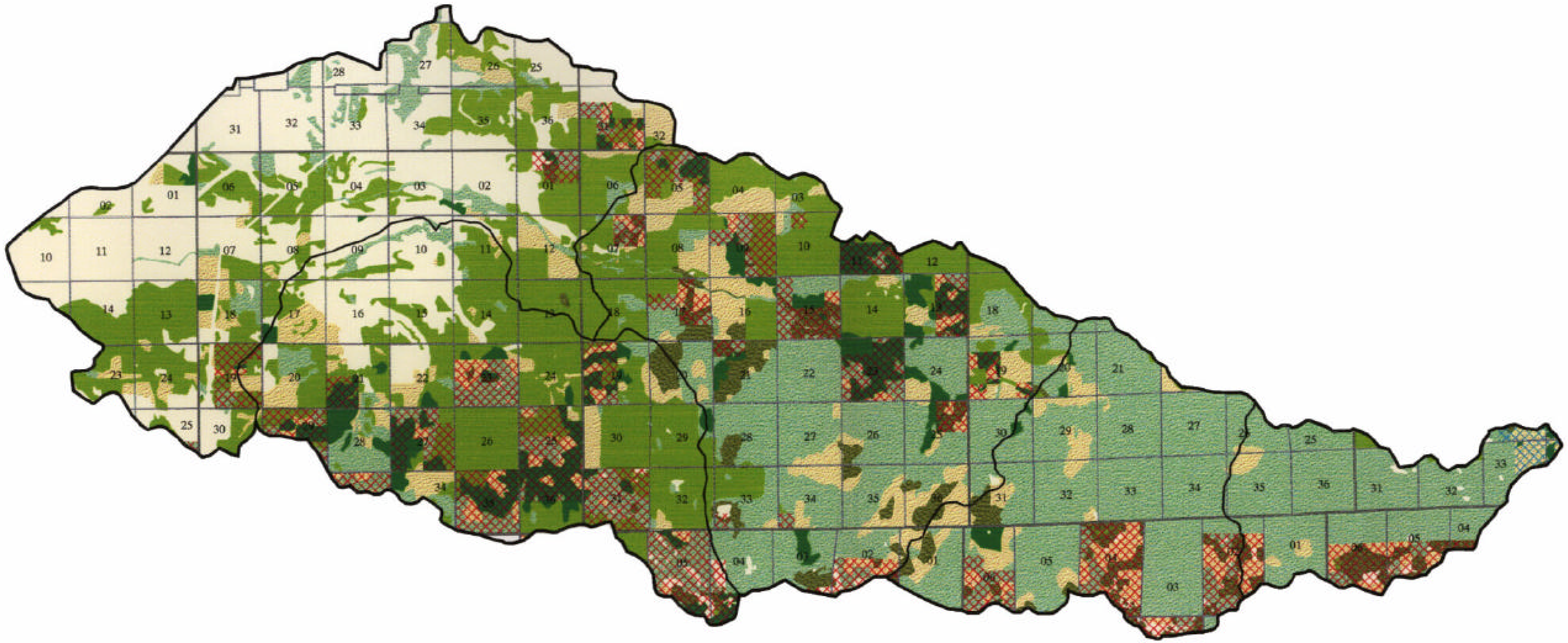
N

Map Created:
12/03/96 11:35 AM

Map #: 5

# Thomas Creek Watershed

## SERAL STAGE



### LEGEND

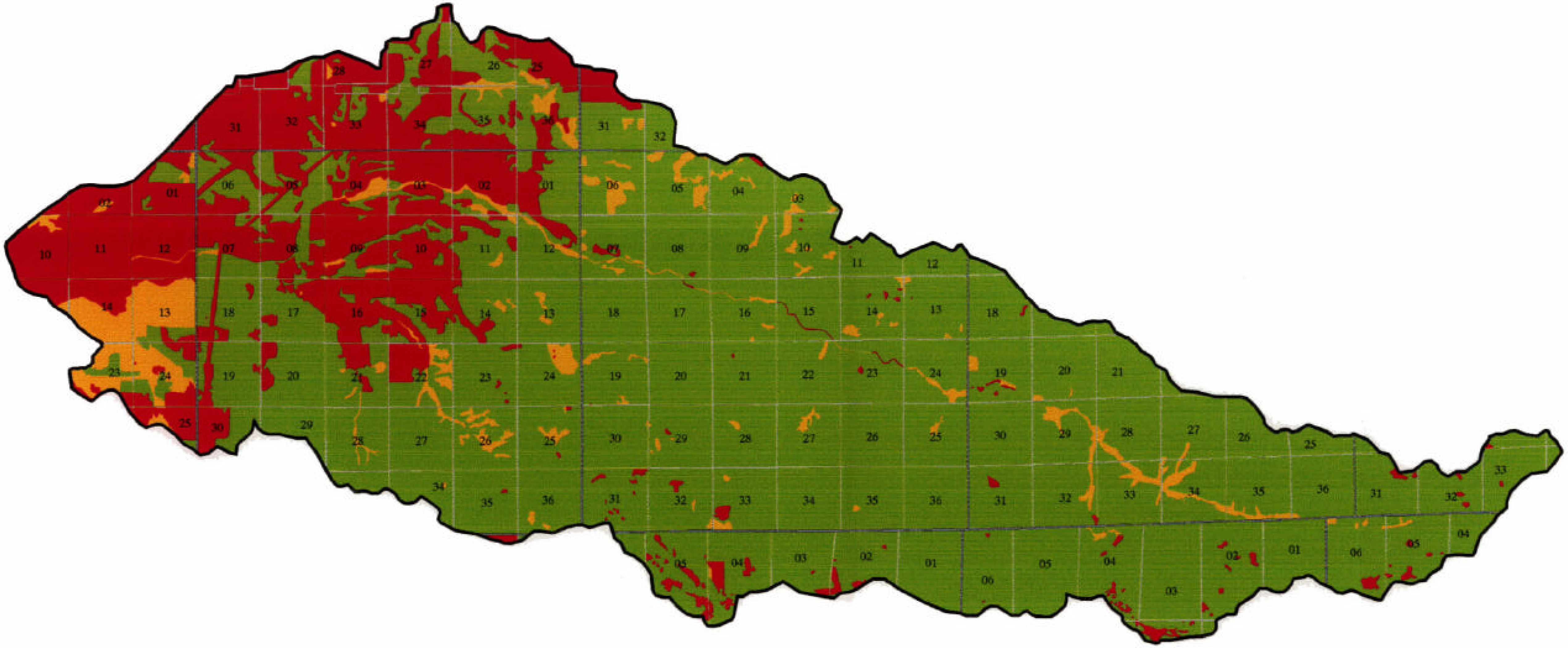
- Non-Forest
- Early/Grass/Forb
- Open Sapling
- Closed Sapling
- Mature
- Old Growth
- BLM Lands
- USFS Lands

Map Created:
12/03/96 11:46 AM

Map #: 6

# Thomas Creek Watershed

## VEGETATION TYPE



LEGEND

🟩 Conifer Forest

🟧 Hardwood Forest

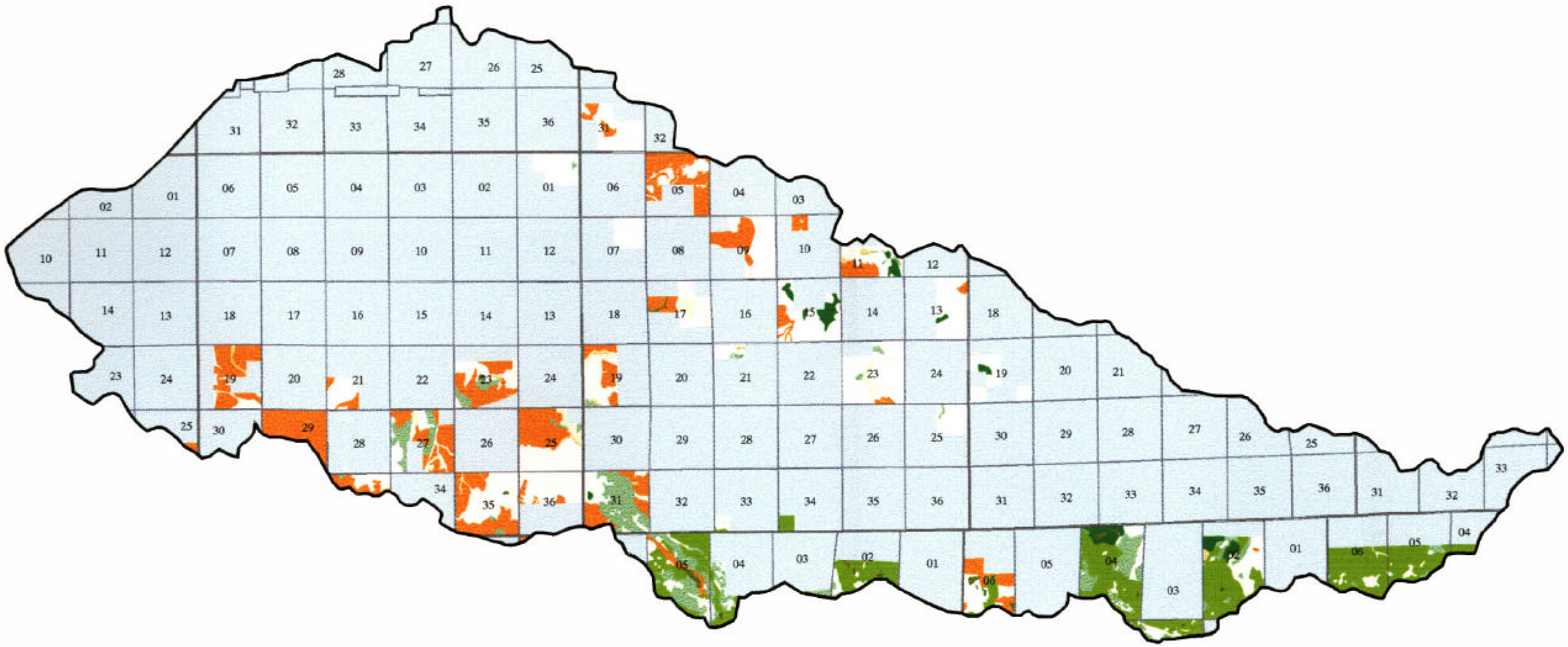
🟥 Non-Forest

Map Created:
12/03/96 11:55 AM

Map #: 7

# Thomas Creek Watershed

## BLM LAND FRAGILE SOILS



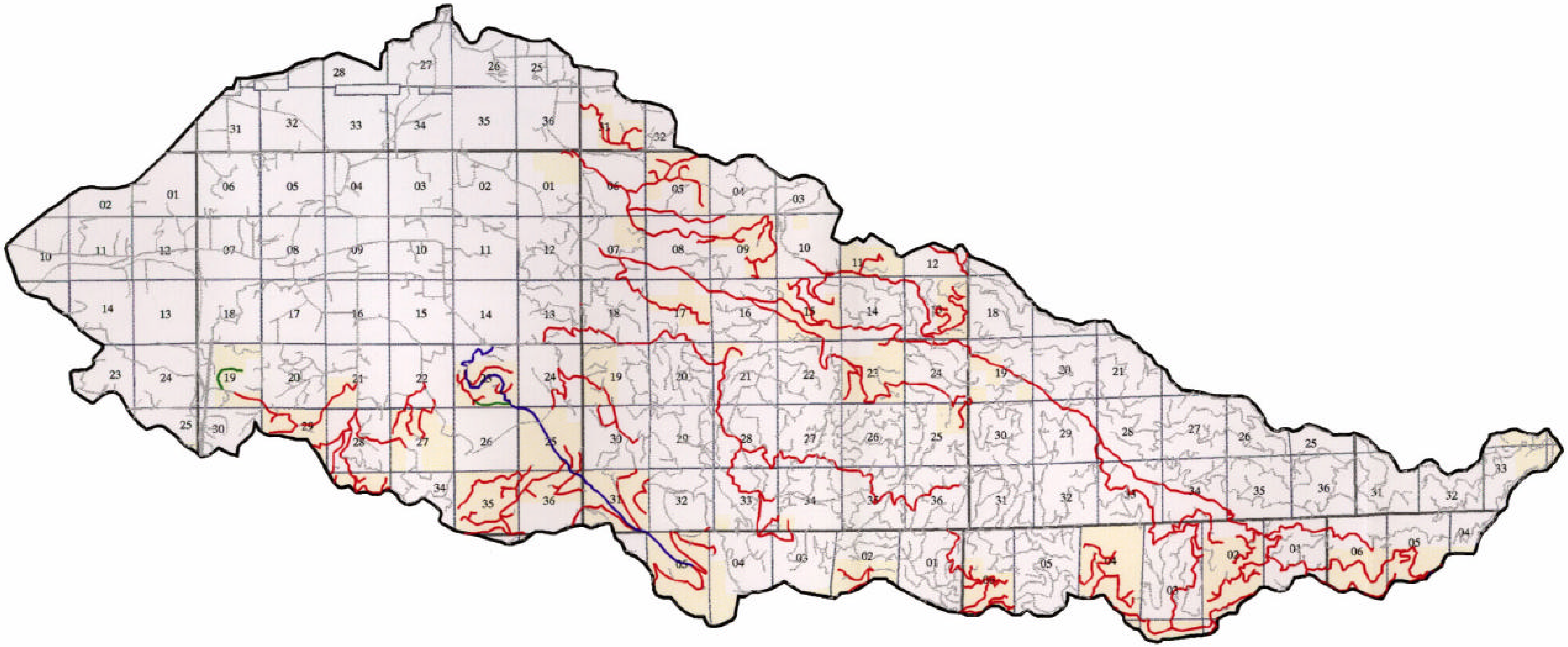
### LEGEND

- ☐ Steep, Stream Adjacent
- 🟨 Steep, Non-Stream Adjacent
- 🟩 Soil Moisture Limitations
- 🟩 Soil Nutrient Limitations
- 🟩 Unstable Soils
- ▨ High Water Table/ Hydric Soil Cond.
- 🟧 Compacted Soil
- ☐ Normal Productivity
- ☐ Pvt -Unassessed

Map Created:
12/03/96 12:09 PM

Map #: 8

# Thomas Creek Watershed



## GENERALIZED ROAD SURFACE TYPE

LEGEND

Rocked

Asphalt

Natural

Not Coded

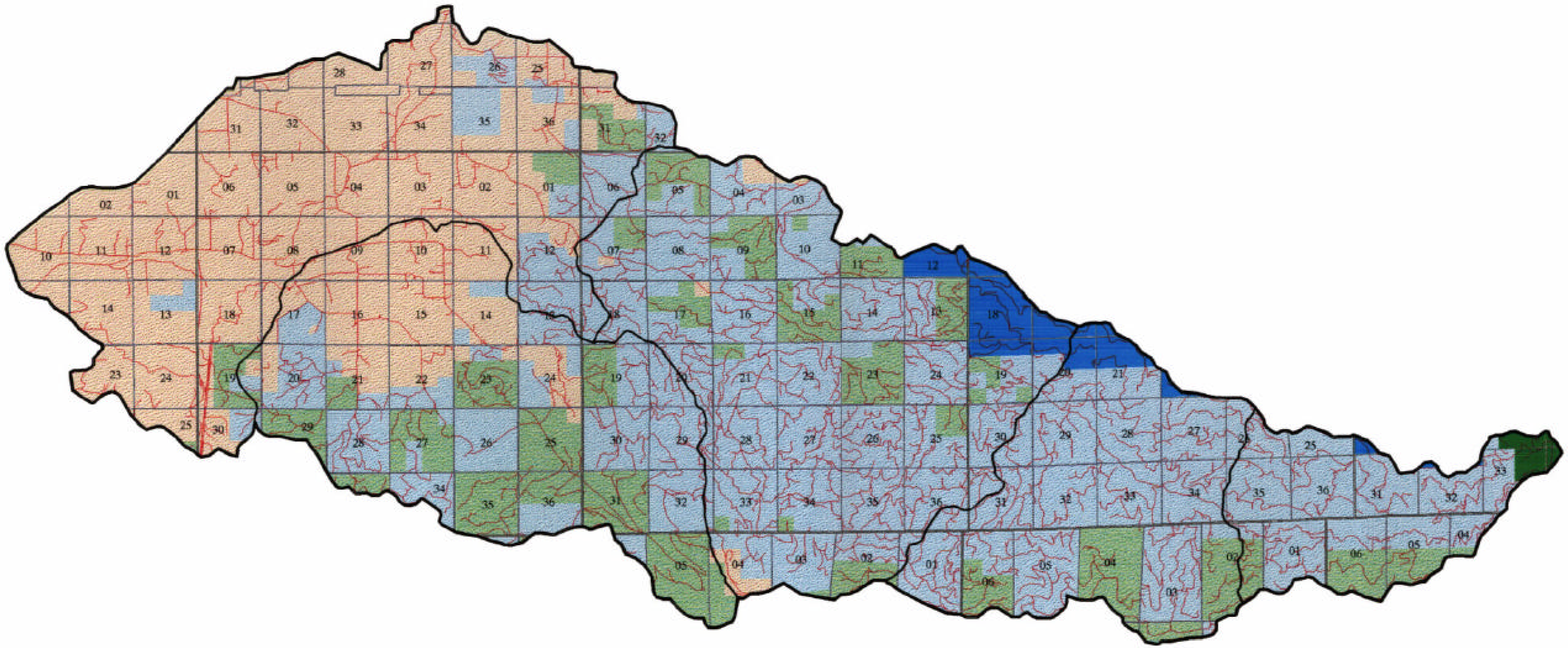
Federal Lands

No warranty is made by the Bureau of Land Management for use of the data for purposes not intended by BLM.

Map Created:
12/03/96 12:16 PM

Map #: 9

# Thomas Creek Watershed



## TRANSPORTATION

### LEGEND

🟩 BLM Lands

🟩 USFS Lands

🟦 Private Industrial

🟧 Private Non-Industrial

🟦 State Forest

— Roads

1 0 1 2 3 4 miles

2 0 2 4 6 km

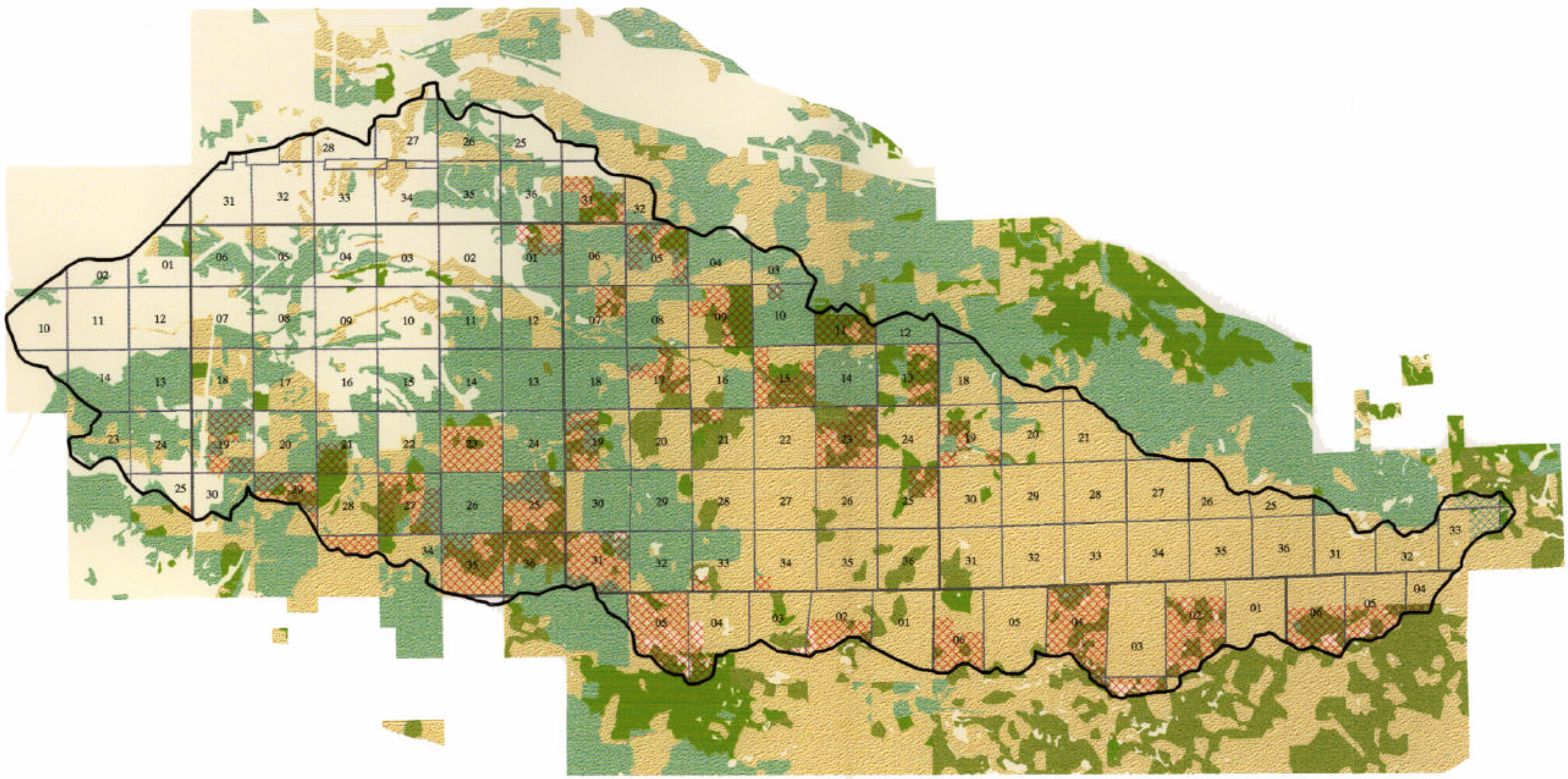
N

Map Created:
12/03/96 12:19 PM

Map #: 10

# Thomas Creek Watershed

## SPOTTED OWL HABITAT



Map Created:
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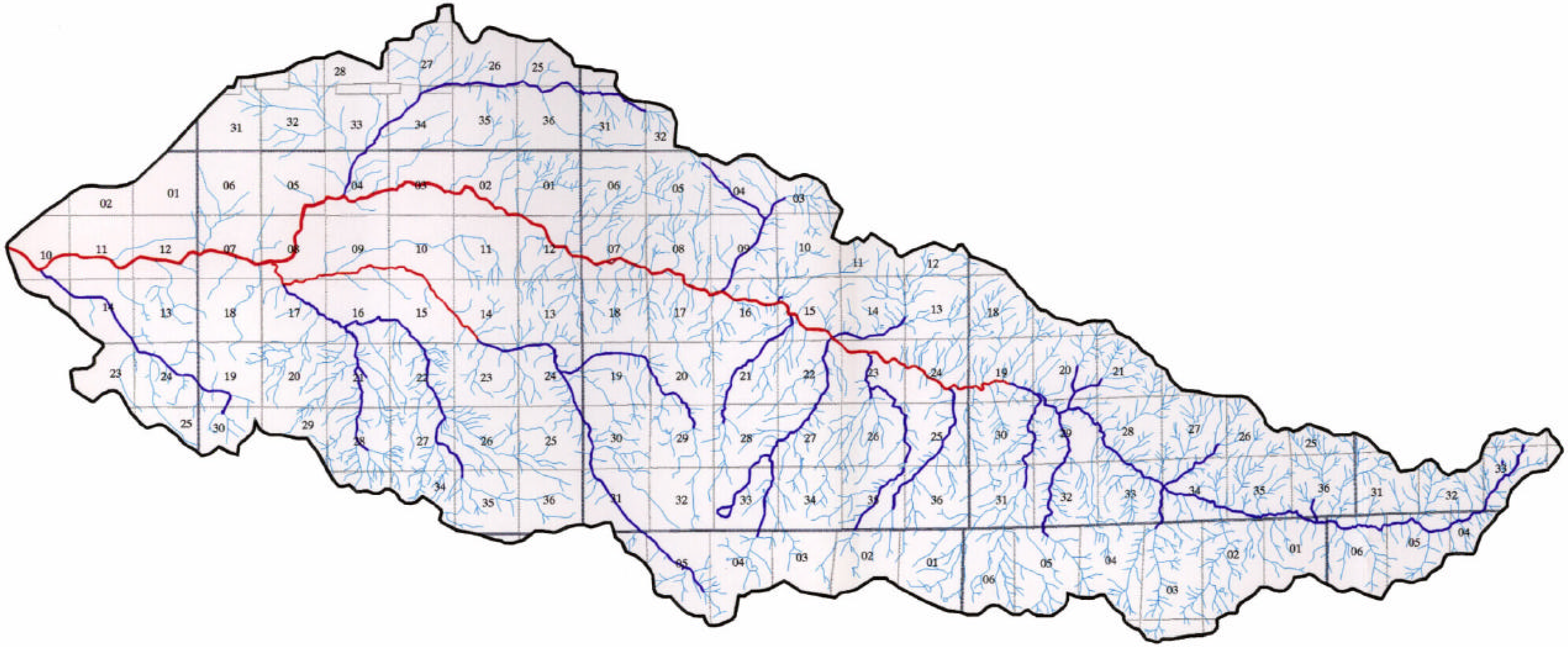
Map #: 11

# Thomas Creek Watershed

# RESIDENT/ ANADROMOUS FISH



**LEGEND**

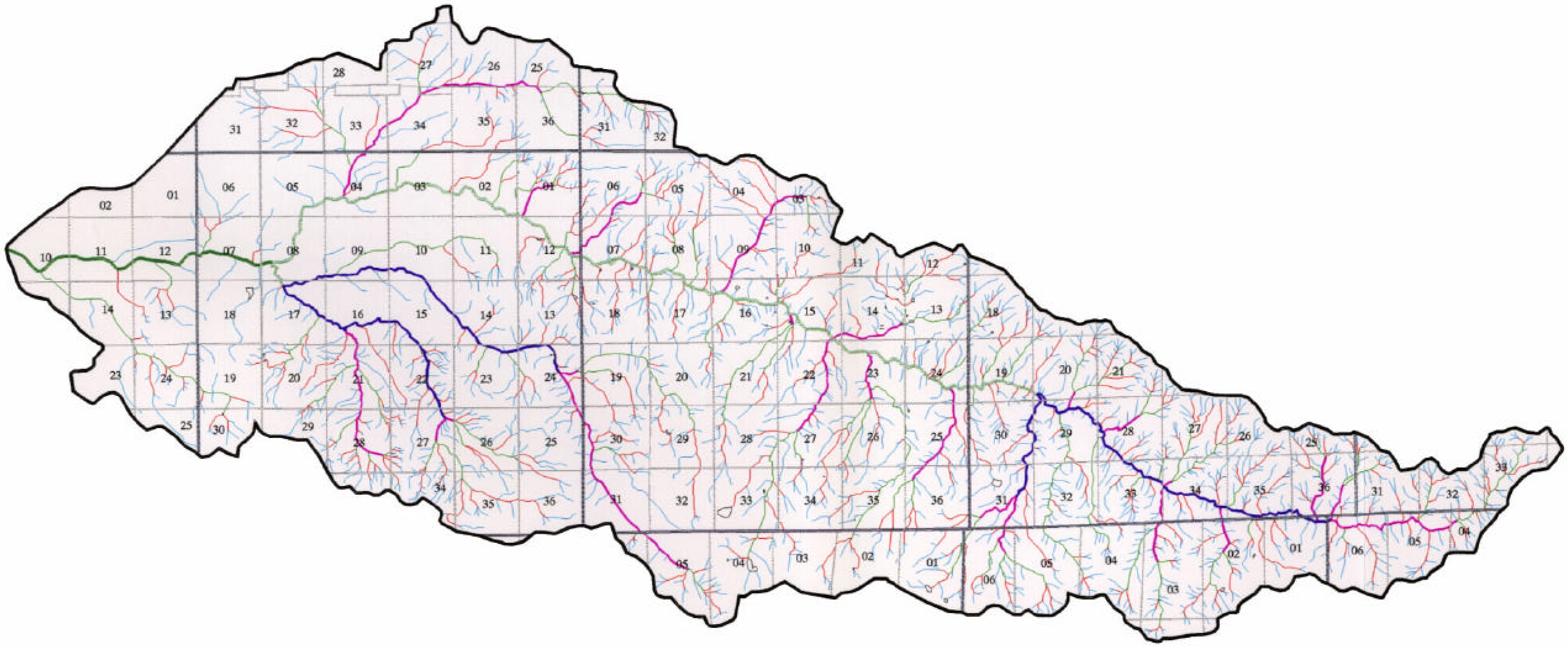
Resident

Resident and Anadromous

Map Created:
12/03/96 2:24 PM

Map #: 12

# Thomas Creek Watershed



## STREAM ORDER

## LEGEND

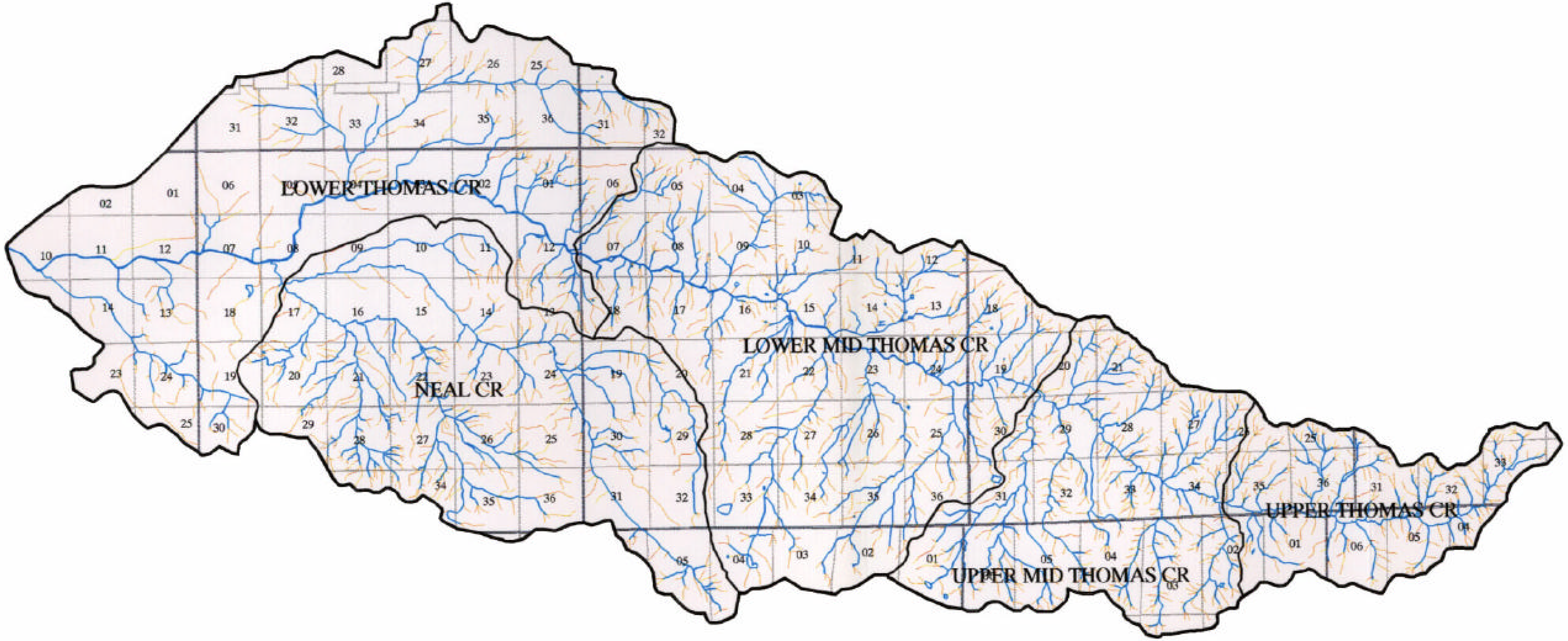
- 1st Order
- 2nd Order
- 3rd Order
- 4th Order
- 5th Order
- 6th Order
- 7th Order
- Lake or Pond

Map Created:
12/03/96 12:29 PM

Map #: 13

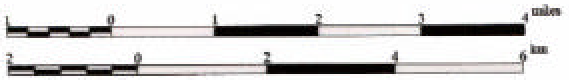
# Thomas Creek Watershed

## STREAM FLOW



**LEGEND**

| | |
|---|---|
| ╱╲╱ | Perennial |
| ╱╲╱ | Intermittant |



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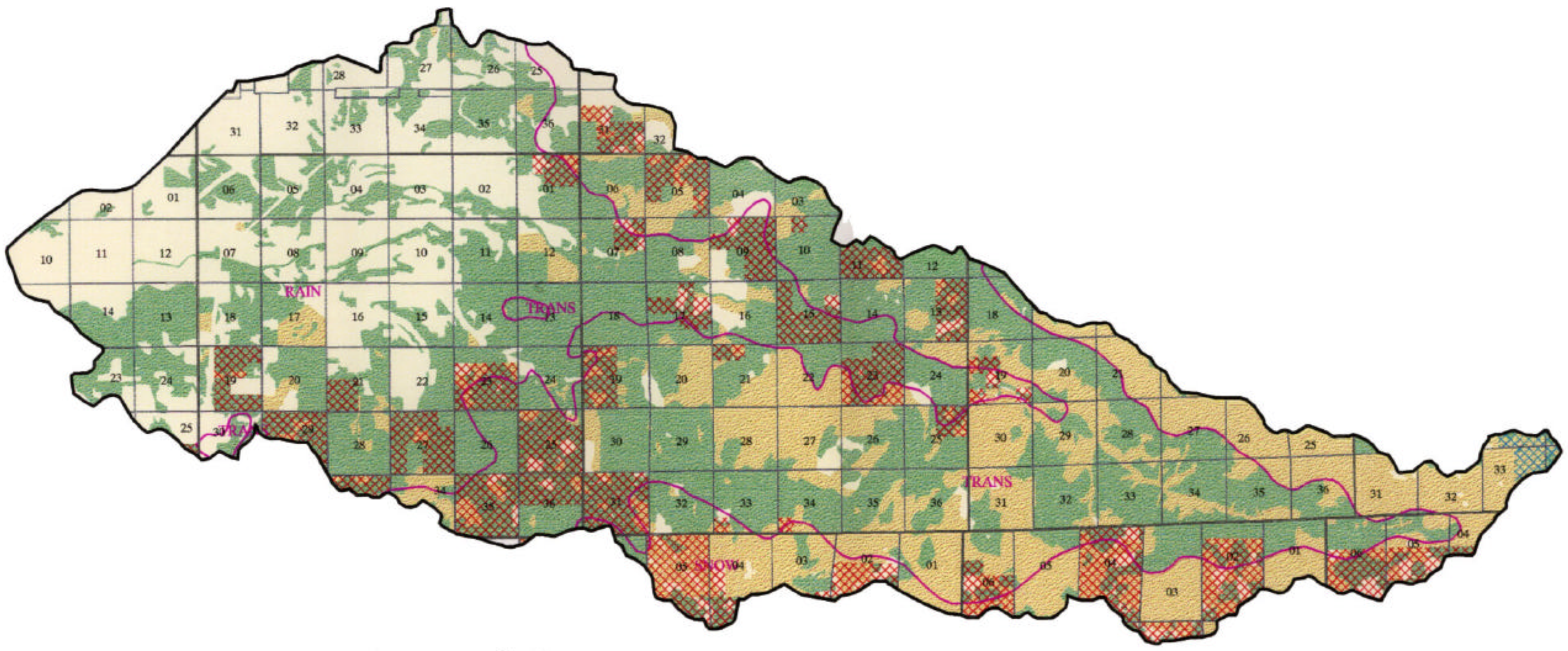
Map #: 14

# Thomas Creek Watershed

## HYDROLOGIC RECOVERY



Slush

### LEGEND

- ▭ Maximum Erosion
- 🟨 Transition
- 🟩 Recovered
- ▨ BLM Lands
- ▨ USFS Lands
- — Snow Zone Boundary

N

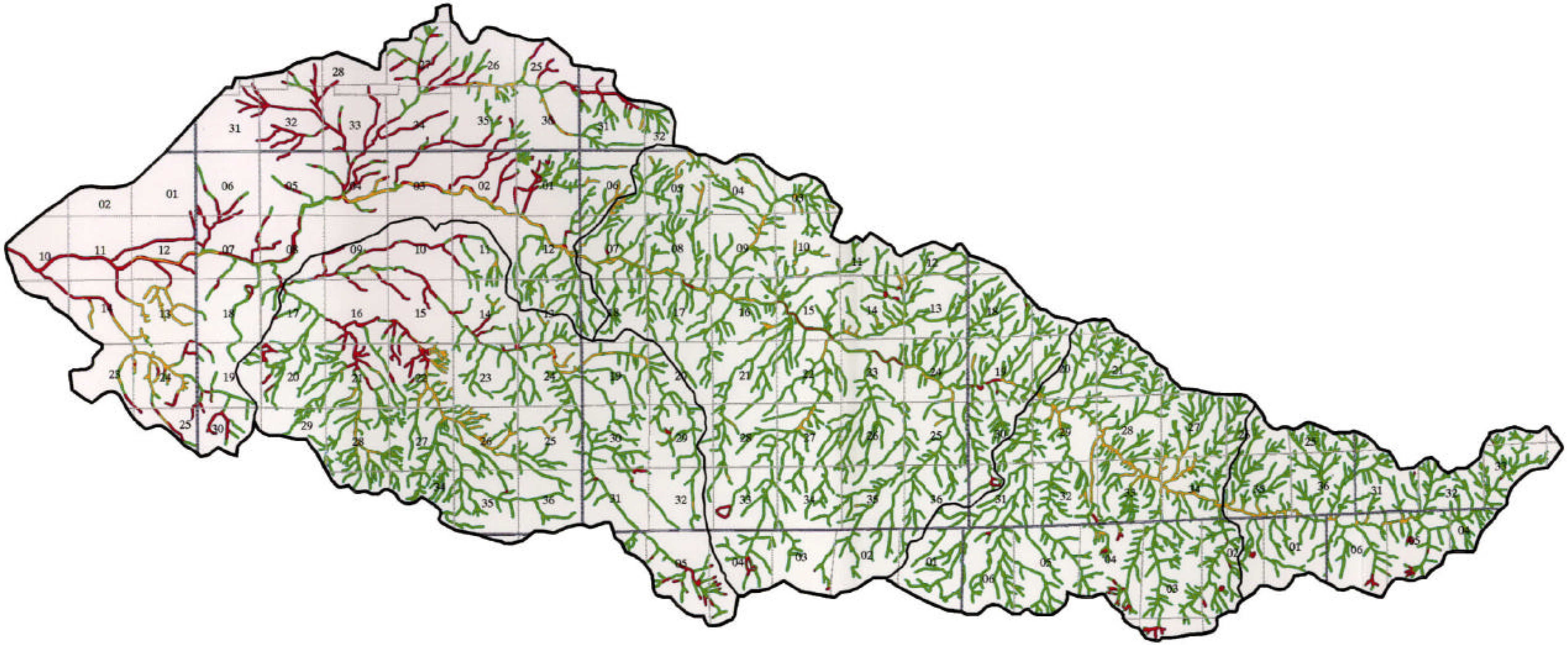
Map Created:
12/03/96 1:26 PM

Map #: 15

# Thomas Creek Watershed

## VEGETATION TYPE

(w/in 30m. Stream Buffer)



### LEGEND

🟩 Conifer Forest

🟧 Hardwood Forest

🟥 Non-Forest

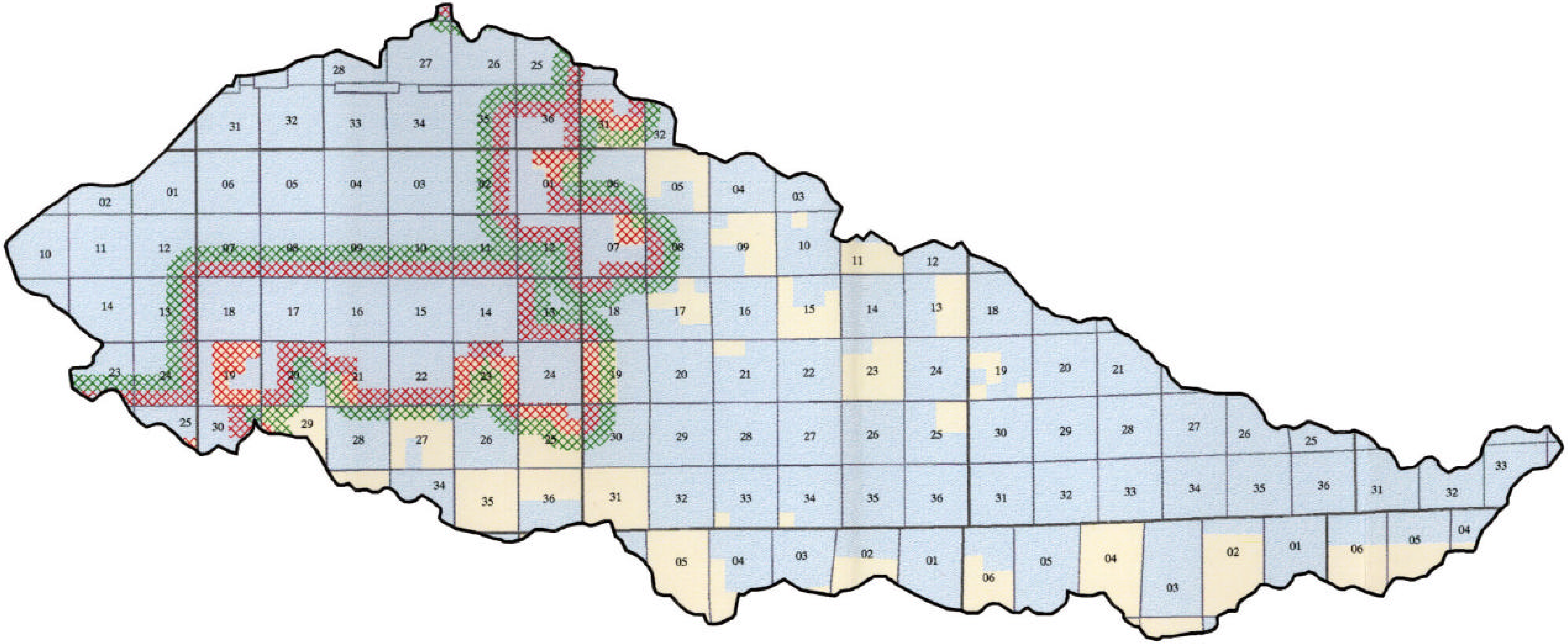
— Stream Buffer (30 meters.)

Map Created:
12/05/96 7:54 AM

Map #: 16

# Thomas Creek Watershed

## RURAL INTERFACE AREA



### LEGEND

- 🟥 Rural Interface Area (1/4 Mile Zone)
- 🟩 Rural Interface Area (1/2 Mile Zone)
- 🟨 BLM Lands

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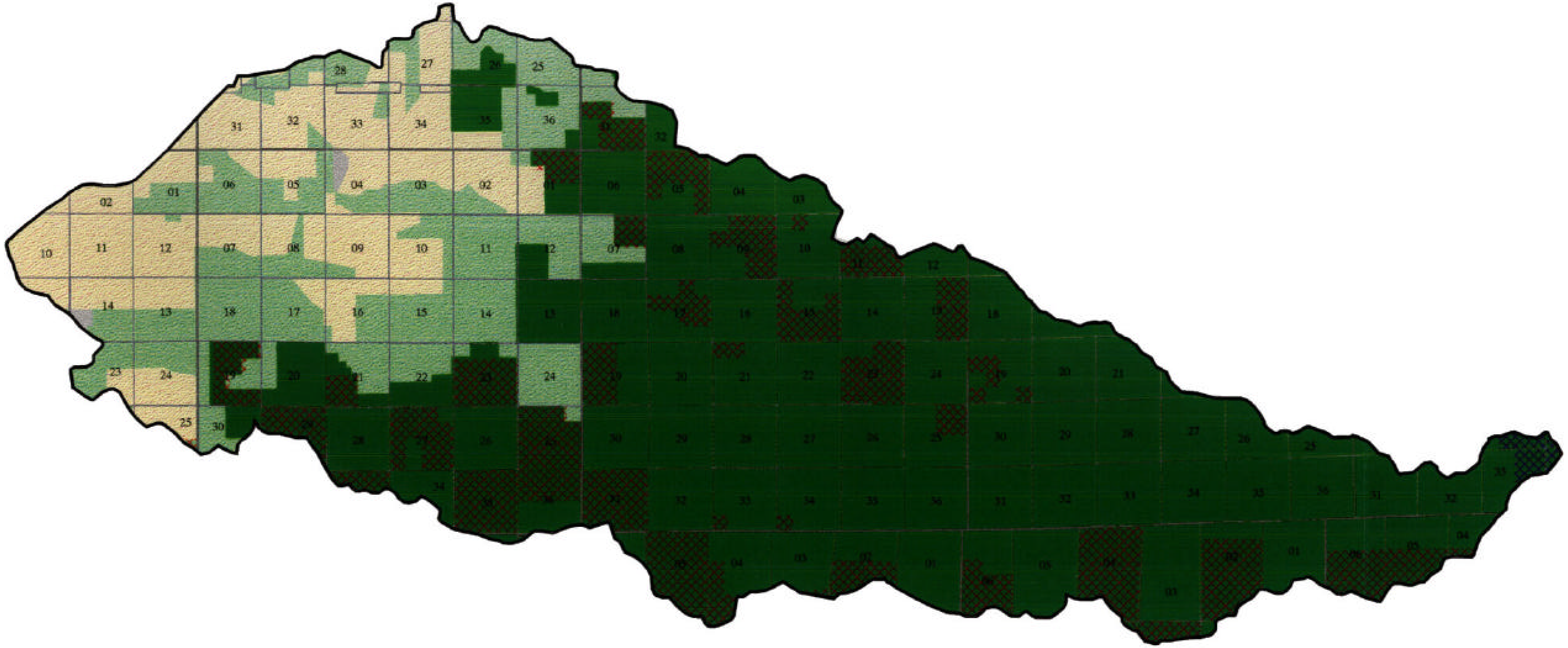
12/03/96 1:48 PM

Map #: 17

# Thomas Creek Watershed

## COUNTY ZONING



### LEGEND

- 🟨 Agriculture
- 🟩 Agriculture and Forest
- ■ Forest Conservation
- ▨ Rural Residential
- ▨ BLM Land
- ▨ USFS Land

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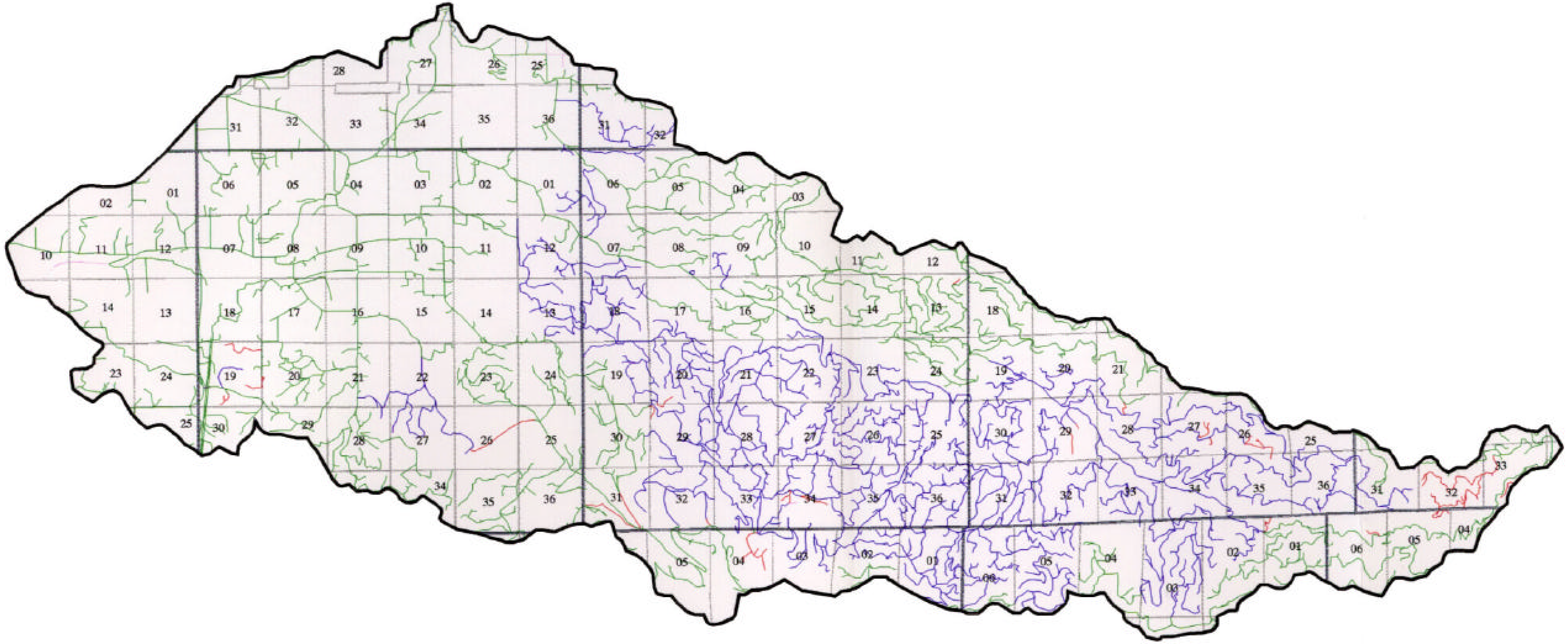
12/03/96 2:27 PM

Map #: 18

# Thomas Creek Watershed

## ROAD CLOSURE STATUS



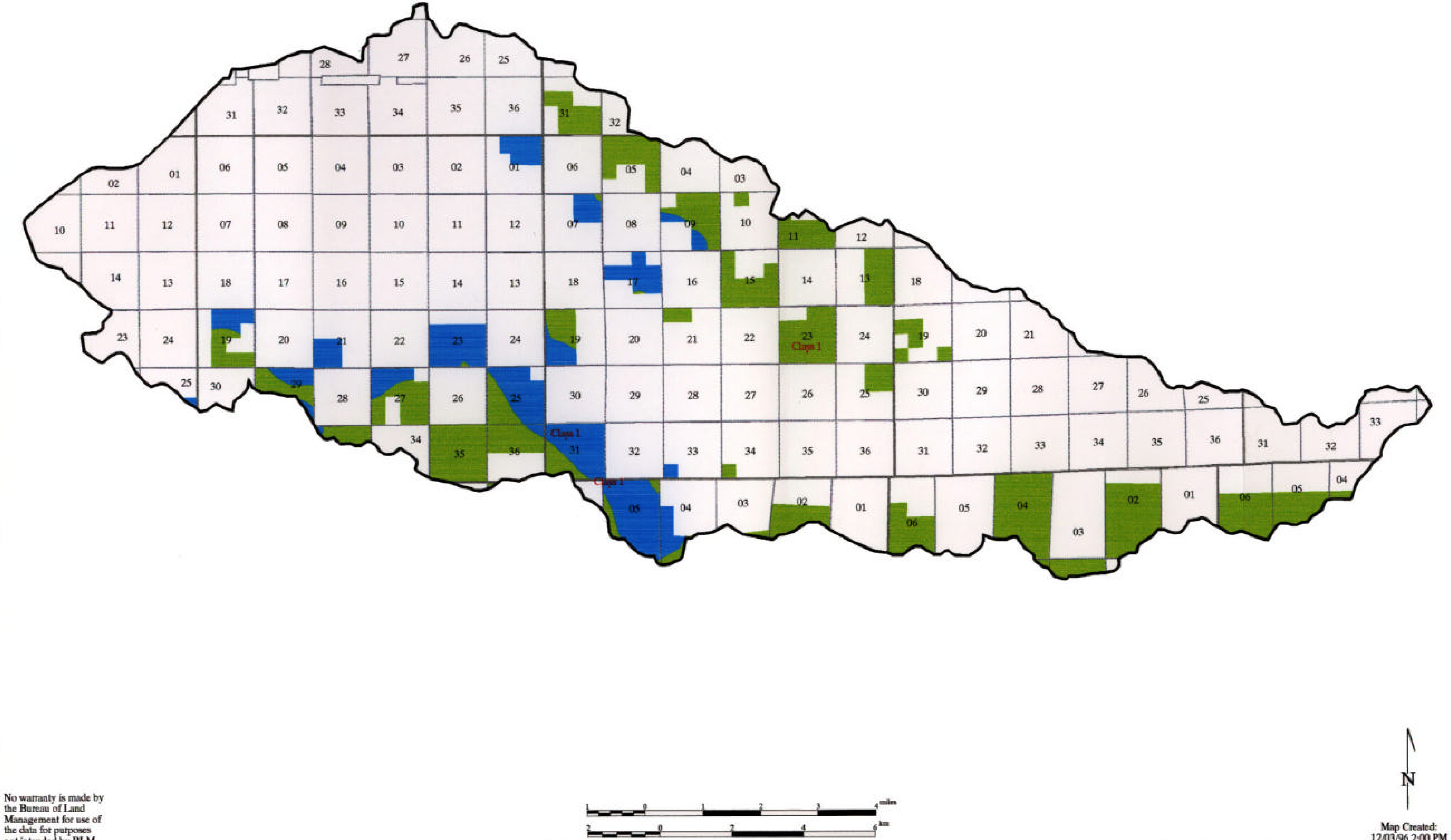
### LEGEND

- Closed Road
- Open Road
- Seasonal Road
- Not Coded

Map Created:
12/03/96 1:54 PM

Map #: 19

# Thomas Creek Watershed



## VISUAL RESOURCE MANAGEMENT CLASSIFICATION

LEGEND

🟥 Class 1

🟦 Class 3

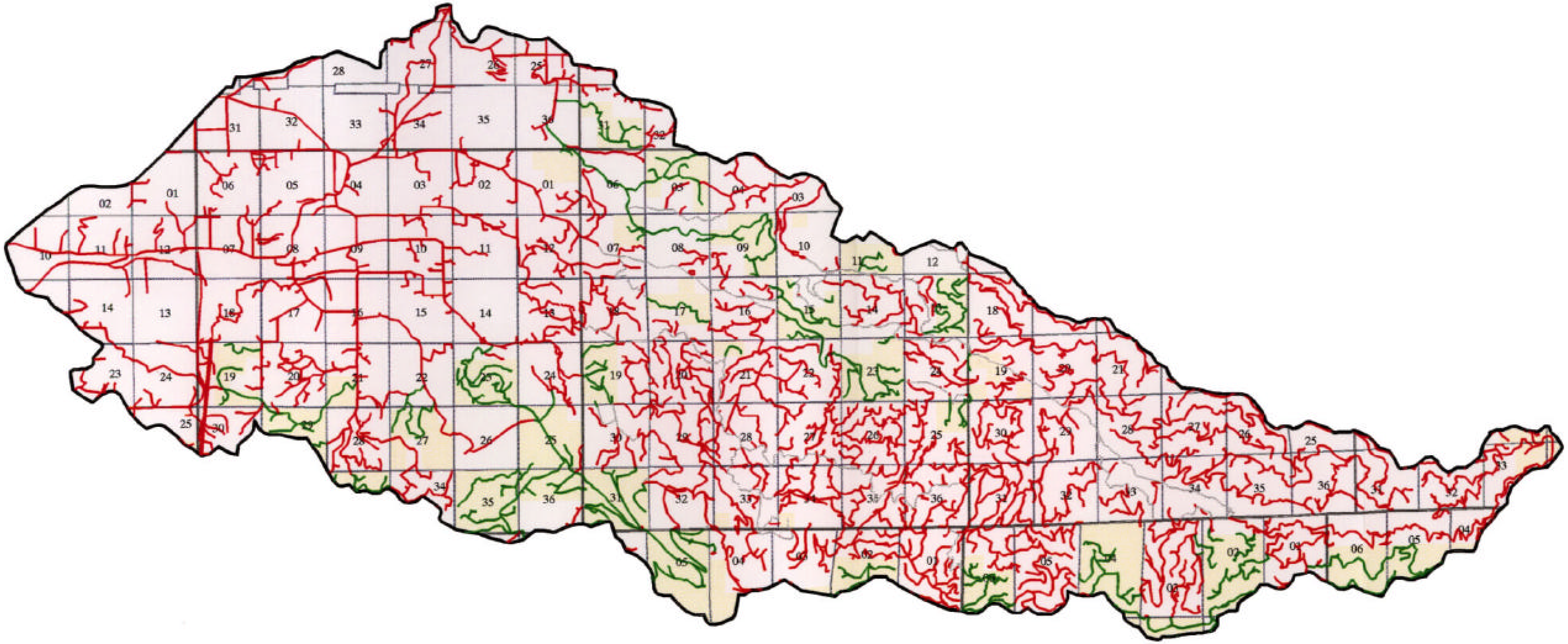
🟩 Class 4

Map Created:
12/03/96 2:00 PM

Map #: 20

# Thomas Creek Watershed

## GENERALIZED ROAD CONTROL



### LEGEND

🟩 BLM Controlled

🟦 USFS Controlled

🟥 Private

◻ Not Coded

▨ Federal Lands

1 0 1 2 3 4 miles

2 0 2 4 6 km

N

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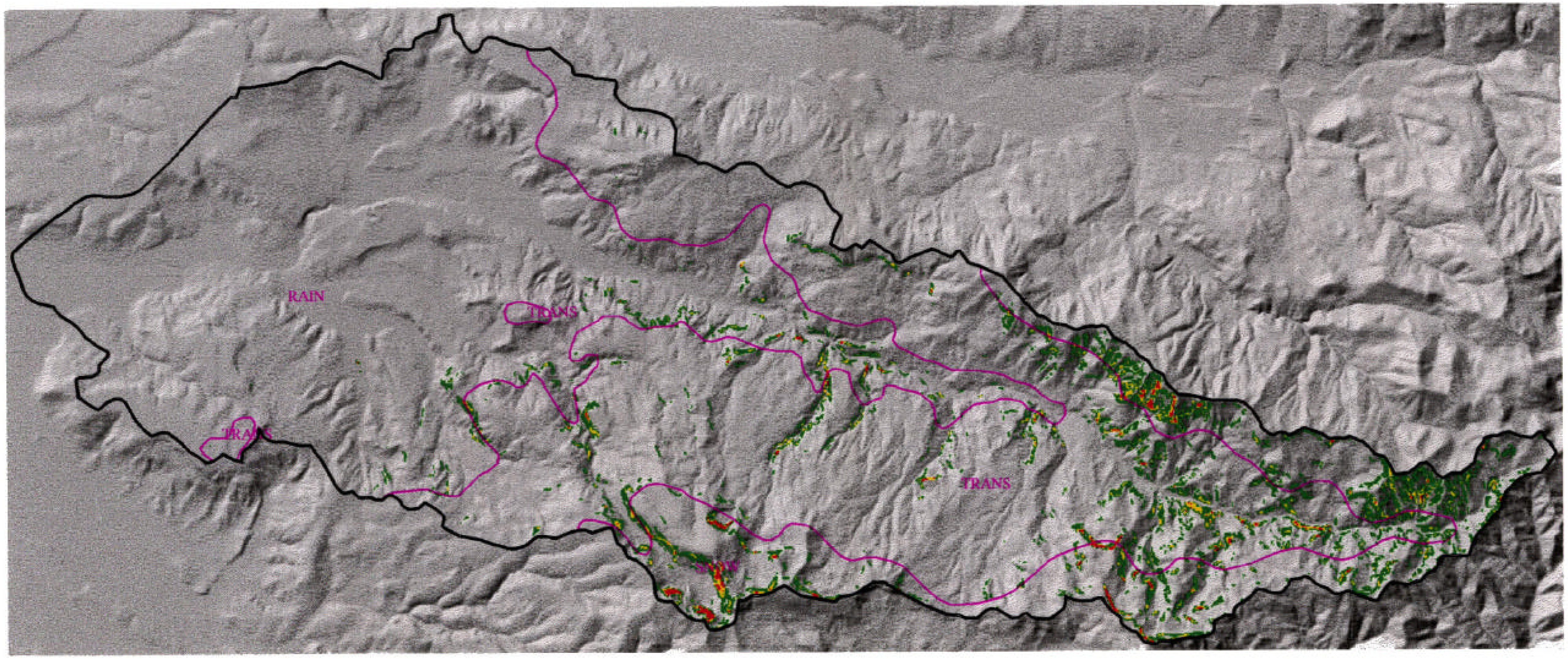
12/03/96 2:32 PM

Map #: 21

# Thomas Creek Watershed

## SNOW ZONE/ SLOPE HAZARD



### LEGEND

(Hazard Rating –Slope %)

🟥 Severe (> 90%)

🟨 High (76% –90%)

🟩 Moderate (60% –75%)

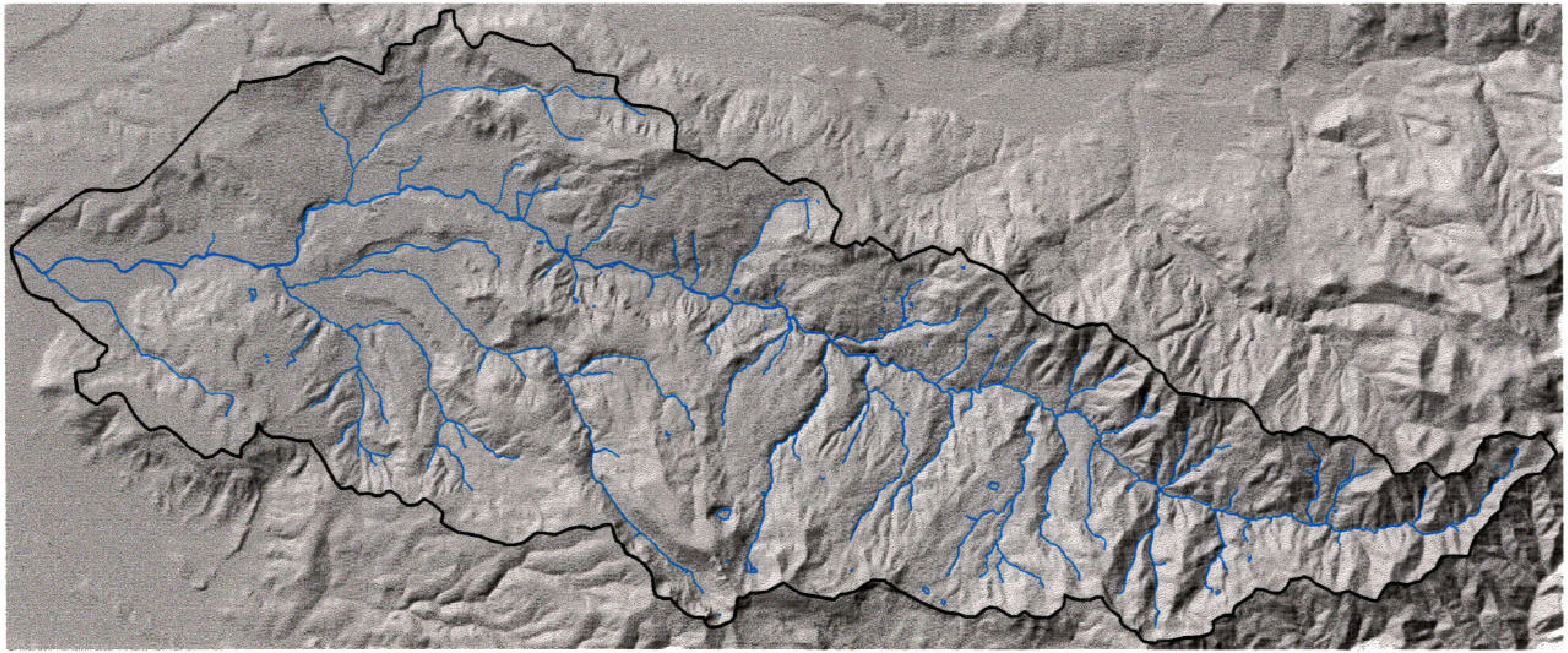
— Snow Zone Boundary

Map Created:
12/09/96 11:57 AM

Map #: 22

# Thomas Creek Watershed

## HILL SHADE



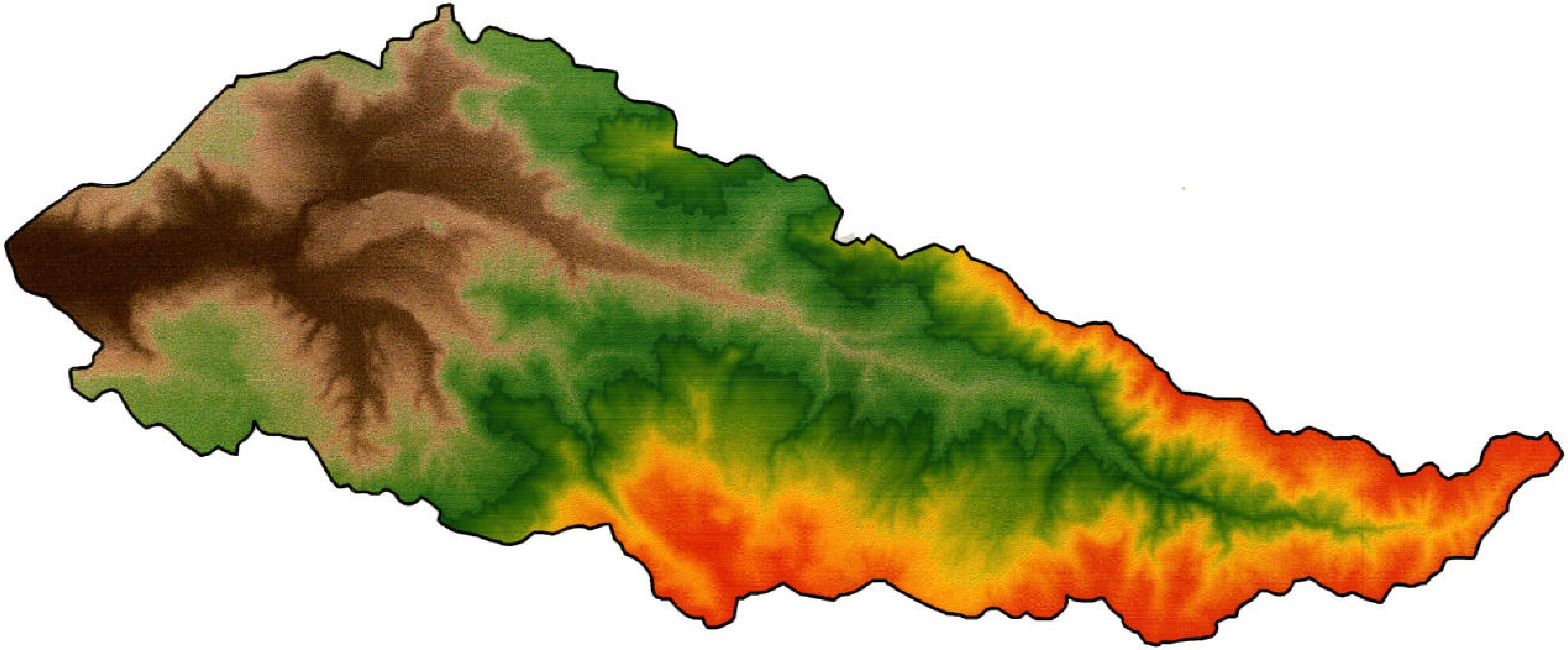
LEGEND

Streams
(3rd order and larger)

Map Created:
12/09/96 11:55 AM

Map #: 23

# Thomas Creek Watershed



## DIGITAL ELEVATION MODEL

(Equal Area Stretch)

ELEVATION RANGE

4390 ft.

351 ft.

☐ NO DATA AVAILABLE

DEM STATISTICS

| | |
|---|---|
| Min Elev (ft): | 351 |
| Max Elev (ft): | 4390 |
| Mean Elev (ft): | 1764 |
| Standard Dev. (ft): | 966 |

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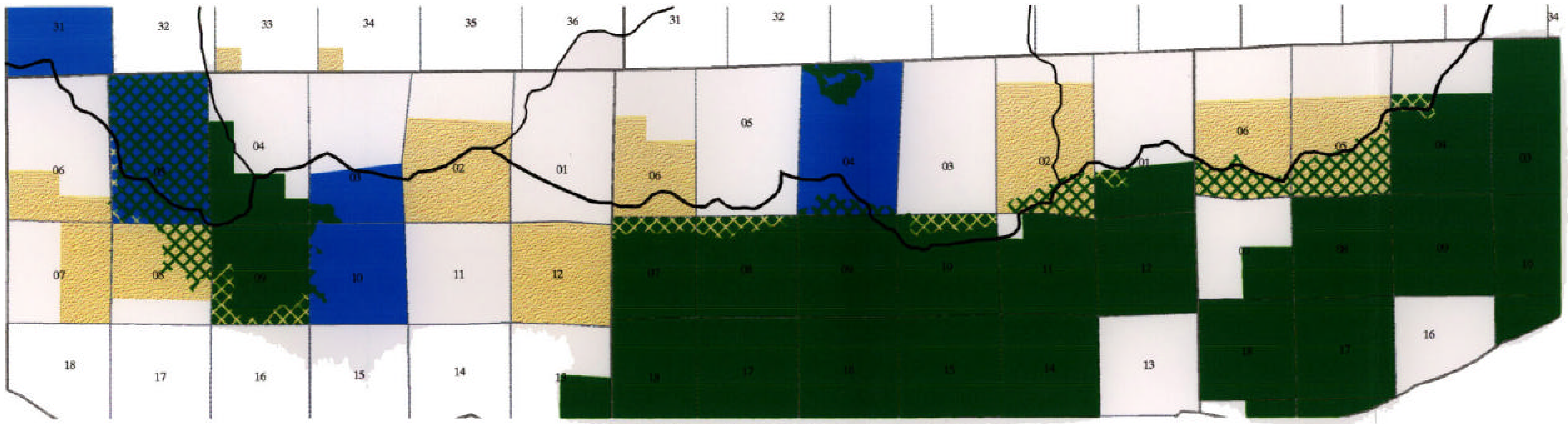
12/09/96 11:51 AM

Map #: 24

# Thomas Creek Watershed

## FEDERAL LAND USE ALLOCATION PROPOSED MODIFICATIONS



### LEGEND

🟦 Matrix (BLM) – Connectivity/ Diversity Block

🟨 Matrix (BLM) – General Forest Management Area

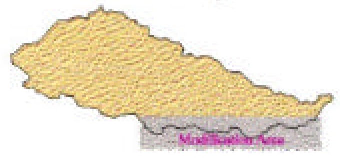
🟩 Late Successional Reserve

🟪 Matrix (USFS)

▨ Proposed GFMA

▨ Proposed LSR

Locator Map



Map Created: 12/18/96 1:53 PM

Map #: 25