HILLS CAMP THINNINGS PROJECT
UPPER WILLAMETTE RESOURCE AREA
BLM EUGENE DISTRICT
ENVIRONMENTAL ASSESSMENT
DOI-BLM-OR-E060-2010-0003-EA

1.0 INTRODUCTION
The Upper Willamette Resource Area, Eugene District BLM proposes to implement commercial thinning and density management projects on approximately 1040 acres in the Lower McKenzie and Little Fall Creek 5th field watersheds. The sale names and locations are as follows:

- Solomon Creek (T. 16S., R. 01W., sec 33, T. 17S., R. 01W. section 7)
- Boulder Creek (T. 17S., R. 01W. sec. 35, T. 18S., R. 01W., sect. 5)
- Wild Jack (T. 18S., R. 01E., sec. 19, T. 18S., R. 01W., secs. 7 and 9)

The Land Use Allocations for these acres are Matrix and Riparian Reserve. Project actions may include timber harvest, instream habitat restoration, road construction, road improvements and decommissioning.

2.0 PURPOSE AND NEED
The need for action in Matrix and Riparian Reserves has been established through the results of field reviews and stand examinations, which indicate that stands (ages 30-70 years) would benefit from thinning or density management release. Currently, the stands are dense, overstocked and uniform in structure. This results in reduced tree growth and stand vigor. Treatment would increase stand vigor, growth rates, crown differentiation and stand complexity.

The purposes of the actions in Matrix are to (1) Produce a sustainable supply of timber (1995 ROD/RMP p. 34); (2) Provide habitat for a variety of organisms associated with both late-successional and younger forests and maintain valuable structural components, such as down logs and snags (1995 ROD/RMP, p. 34). Additional direction for road management directs us to provide and manage the road system to serve resource management needs (1995 ROD/RMP, p. 98).

The purposes of the actions in Riparian Reserves are to provide for the conservation of and habitat for Special Status Species as well as other terrestrial species, and to meet Aquatic Conservation Strategy Objectives (1995 ROD/RMP, p. 23).

2.1 CONFORMANCE
This project is in conformance the 1995 *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents within the Range of the Northern Spotted Owl* (Northwest Forest Plan {NSO-ROD} USDA Forest Service and USDI Bureau of Land Management, April 1994), and the 1995 *Eugene District Resource Management Plan* (1995 RMP). This project is consistent with court orders relating to the Survey and Manage mitigation measure of the Northwest Forest Plan, as incorporated into the Eugene District Resource Management Plan.

On December 17, 2009, the U.S. District Court for the Western District of Washington issued an order in *Conservation Northwest, et al. v. Rey, et al.*, No. 08-1067 (W.D. Wash.) (Coughenour, J.), granting Plaintiffs' motion for partial summary judgment and finding a variety of NEPA violations in the BLM and USFS 2007

Record of Decision eliminating the Survey and Manage mitigation measure. Previously, in 2006, the District Court (Judge Pechman) had invalidated the agencies' 2004 RODs eliminating Survey and Manage due to NEPA violations. Following the District Court's 2006 ruling, parties to the litigation had entered into a stipulation exempting certain categories of activities from the Survey and Manage standard (hereinafter "Pechman exemptions").

Judge Pechman's Order from October 11, 2006 directs: "Defendants shall not authorize, allow, or permit to continue any logging or other ground-disturbing activities on projects to which the 2004 ROD applied unless such activities are in compliance with the 2001 ROD (as the 2001 ROD was amended or modified as of March 21, 2004), except that this order would not apply to:

A. Thinning projects in stands younger than 80 years old;
B. Replacing culverts on roads that are in use and part of the road system, and removing culverts if the road is temporary or to be decommissioned;
C. Riparian and stream improvement projects where the riparian work is riparian planting, obtaining material for placing in-stream, and road or trail decommissioning; and where the stream improvement work is the placement large wood, channel and floodplain reconstruction, or removal of channel diversions; and
D. The portions of project involving hazardous fuel treatments where prescribed fire is applied. Any portion of a hazardous fuel treatment project involving commercial logging would remain subject to the survey and management requirements except for thinning of stands younger than 80 years old under subparagraph a. of this paragraph."

Following the Court's December 17, 2009 ruling, the Pechman exemptions are still in place.

The implementation of this project will not have significant environmental effects beyond those already identified in the 1995 Final EIS/Proposed RMP. Information compiled by the Interdisciplinary Team (ID Team) to analyze effects and is available for review at the Eugene District Office.

2.2 SCOPING

Scoping information about the Hills Camp Thinning Project was first provided in the October 2010 *Eye to the Future.* No scoping comments were received.

2.3 ISSUES

The ID Team brought forward additional concerns related to resources that had potential of being affected by the proposed actions. The resource concerns related to the issues are analyzed in Section 3.0: Affected Environment and Environmental Consequences.

Issues identified:

1. What are the effects of the proposed commercial thinning on greenhouse gas emissions?
2. What are the effects of the proposed commercial thinning and proposed road actions on water quality and aquatic resources?
3. What are the effects of the proposed commercial thinning and road actions on attaining and maintaining ACS objectives?
4. What are the effects of the proposed commercial thinning and road actions on soil compaction and displacement?

5. What are the effects of the proposed commercial thinning and road actions on the spread of invasive species?
6. What are the effects of the proposed commercial thinning and road actions on T&E and special status species?
7. What are the effects of Logging Systems on the cost of yarding, road construction, maintenance and renovation?

3.0 ALTERNATIVES

This section describes alternatives identified by the interdisciplinary team. Please refer to Appendix A for maps of the project proposal by alternative. At the end of this section, Table 1 displays the differences between alternatives by acres treated and miles of road constructed and decommissioned.

3.1 ALTERNATIVE 1: NO ACTION

Under this alternative no project actions would take place. Commercial thinning, road management, and aquatic habitat restoration actions would not occur within the proposed project area.

3.2 ALTERNATIVE 2: MAXIMUM ACRES TREATED

This alternative is designed to treat as greatest number of acres within the project area. It consists of seven commercial thinning areas encompassing approximately 730 upland acres. They are delineated as follows:

- Boulder Creek 5 215 acres.
- Boulder Creek 35 110 acres.
- Wild Jack 7 100 acres.
- Wild Jack 9 65acres.
- Wild Jack 19 130 acres.
- Solomon 7 85 acres.
- Solomon 33 25 acres.

Matrix Management

Stands would be thinned from below resulting in a residual basal area ranging from approximately 120 square feet to 160 square feet. Trees selected for harvest would be the suppressed, intermediate, and co-dominant conifer trees, leaving the larger trees. This prescription would result in a stand with a variable spacing of 15 and 35 feet between remaining conifers and hardwoods. All hardwoods and Pacific yew would be retained, except where necessary to accommodate logging systems and for safety.

Riparian Reserve Management

Silvicultural treatments would occur in the outer edges of the Riparian Reserve and would be treated the same as the uplands. Areas of no harvest, in close proximity to streams and wetlands, would vary between 25 feet and 400 feet. Approximately 315 Riparian Reserve acres would be treated and are delineated as follows:

- Boulder Creek 5 95 acres.
- Boulder Creek 35 35 acres.
- Wild Jack 7 15 acres.
- Wild Jack 9 30 acres.
- Wild Jack 19 60 acres.
- Solomon 7 55 acres.

- Solomon 33 25 acres.

Except in Solomon 33 and portions of Wild Jack 19, an average of 120 linear feet per acre of coarse wood debris (2 trees/acre) and 3 snags/acre would be created within portions of treated Riparian Reserves.

Logging Systems
Thinning would be accomplished with a combination of cable and ground-based yarding systems. Skyline yarding would be proposed for approximately 280 acres and ground based yarding would be proposed for approximately 760 acres (see maps in Appendix B).

Roads
See Appendix C for road tables (Tables 7-14), which detail much of the following information.

Construction, Maintenance, and Improvements:
Approximately 18 miles of existing BLM controlled roads would be utilized as part of the project. Of that, roughly 15 miles of road would need maintenance including adding crushed rock and culvert replacements. There would be approximately 5 miles of proposed temporary road construction and approximately 4 miles of proposed permanent road construction. Approximately 8 miles of private controlled road would be used for timber and rock haul.

Culvert Replacements and New Installations:
Between 12 and 16 stream crossing (non fish) culverts and 3 to 6 cross drain culverts have been identified for replacement. Approximately 6 stream crossing (2 non-listed fish) culverts, 13 cross drain culverts and one temporary bridge would be installed on newly constructed roads.

Road Decommissioning:
Approximately 0.86 miles of roads, which are not expected to be needed for future management actions within the next 5 years, would be decommissioned. Actions may include entrances barricaded, slopes water – barred, stream and cross drains removed, stream channels restored, and drain dips constructed. Around 5 miles of road, which would not be needed for future management actions beyond 5 years, would be fully decommissioned. Actions on roads to be fully decommissioned may include tilling of road bed and/or slash or brush placement, and mulching and planting of native species in disturbed areas.

3.3 ALTERNATIVE 3: MINIMIZE PERMANENT ROAD DENSITY

This alternative is designed to minimize stream crossings in Riparian Reserves, reduce the amount of permanent road construction and minimize the acres of ground based treatment in Riparian Reserves. Silviculture prescriptions for Matrix and Riparian Reserves would not differ from Alternative 2.

Logging Systems
Thinning would be accomplished with a combination of cable and ground-based yarding systems. Skyline yarding would be proposed for approximately 305 acres and ground based yarding would be proposed for approximately 665 acres (see maps in Appendix B).

Roads
Construction, Maintenance, and Improvements:
Approximately 17 miles of existing BLM controlled roads would be utilized as part of the project. Of that, approximately 15 miles of road would need maintenance including adding crushed rock and culvert replacements. There would be approximately 6 miles of proposed temporary road construction and

approximately 2 miles of proposed permanent road construction. Approximately 9 miles of private controlled road would be used for timber and rock haul.

Culvert Replacements and New Installations:
Between 12 and 16 stream crossing (non-listed fish) culverts and 3 to 6 cross drain culverts have been identified for replacement. Approximately 5 stream crossing (non-listed fish) culverts and 12 cross drain culverts would be installed on newly constructed roads.

Road Decommissioning:
Approximately one mile of road would be decommissioned. Actions may include entrances barricaded, slopes water-barred, stream and cross drains removed, stream channels restored, and drain dips constructed. Approximately 5 miles of road would be fully decommissioned. Actions in addition to decommissioned may include tilling of road bed and/or slash or brush placement, and mulching and planting of native species in disturbed areas.

3.4 ALTERNATIVE 4: NO NEW ROAD CONSTRUCTION OR GROUND BASED LOGGING SYSTEMS IN RIPARIAN RESERVES

This alternative differs from Alternatives 2 and 3 in that there are no new permanent roads constructed within the project area; there are no new stream crossings; there are no new roads in Riparian Reserves and ground based yarding systems are not used to treat Riparian Reserves.

Silviculture prescriptions for Matrix and Riparian Reserves would not differ from Alternative 2.

Logging Systems
Thinning would be accomplished with a combination of cable and ground-based yarding systems. Skyline yarding would be proposed for approximately 205 acres and ground based yarding would be proposed for approximately 387 acres (see maps in Appendix A).

Construction, Maintenance, and Improvements:
Approximately 16.5 miles of existing BLM controlled roads would be utilized as part of the project. Of that, approximately 15 miles of road would need maintenance including adding crushed rock and culvert replacements. There would be approximately 3 miles of proposed temporary road construction and no permanent road construction. Approximately 7.5 miles of private controlled road would be used for timber and rock haul.

Culvert Replacements and New Installations:
Between 5 and 7 stream crossing (non fish) culverts and 3 to 6 cross drain culverts have been identified for replacement.

Road Decommissioning:
Approximately 3 miles of road would be fully decommissioned. Actions may include entrances barricaded, slopes water –barred, stream and cross drains removed, stream channels restored, and drain dips constructed. Additional actions may include tilling of road bed and/or slash or brush placement, and mulching and planting of native species in disturbed areas.

3.5 ALTERNATIVES CONSIDERED BUT NOT ANALYZED IN FURTHER DETAIL

3.5.1 ALTERNATIVE HAUL ROUTE FOR WILD JACK 9

An alternative was considered for an additional route for timber haul from the Wild Jack 9 unit. This route would have exited BLM land west onto road 18-1-8, which is located on T18S, R01W section 9. This haul route was dropped from further consideration because this road is located on private lands and the BLM does not have legal access to this road.

TABLE 1: COMPARISON OF ALTERNATIVES 2, 3 AND 4

	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4
TREATED ACRES Matrix and RR (approximate)	**1040**	**990**	**610**
PERMANENT ROAD CONSTRUCTION	**4 miles**	**2 miles**	**0**
TEMPORARY ROAD CONSTRUCTION	**5 miles**	**6 miles**	**3 miles**
ROADS TO BE DECOMMISSIONED (less than 5 YEARS)	**1 miles**	**1 miles**	**0**
ROADS TO BE DECOMMISSIONED (greater than 5 YEARS)	**4 miles**	**4 miles**	**3 miles**

4.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL EFFECTS

4.1 Issue 1: What are the effects of the proposed commercial thinning on greenhouse gas emissions?

4.1.1 AFFECTED ENVIRONMENT

Forest carbon levels depend on local climate, natural disturbances, human management, age and forest type. Forest management may change atmospheric greenhouse gas levels because carbon is removed, released and/or rearranged in the organic matter throughout the forest ecosystem. Carbon calculations used for this analysis are based on broad assumptions and estimates based on regional averages. Carbon calculations for affected environment and environmental effects in this analysis are meant to serve as relative indices of the net effect of timber harvest, rather than precise estimates of actual tons of carbon. Assumptions are available on file at the Eugene District Office. The carbon affected environment consists of carbon stored in trees growing on site. Currently, there is an estimated 69,500 metric tonnes of carbon stored across the 1,040 approximate acres in the project area.

4.1.2 ENVIRONMENTAL EFFECTS

Alternative 1: No Action

Under the No Action alternative, continued forest growth over the next 30 years would result in an increase in live tree stand volume of approximately 171 cubic feet per acre, or 176,195 cubic feet across the project area. This equates to an increase in storage of approximately 1,402 metric tonnes of carbon per year. Therefore, forest growth under the No Action alternative would result in the storage of an additional 42,047 metric tonnes of carbon over the project area in the long term compared to current conditions.

Alternative 2: Maximum Acres Treated

The proposed commercial thinning would result in carbon dioxide emissions as a result of timber harvest and fuels treatments, after which forest growth would result in storage of carbon.

Alternative 2 would harvest an estimated of 11.5 million board feet of timber, which across the approximately 1,040 acre project area, contains a total an estimated 15,249 metric tonnes of carbon. The carbon within harvested wood is calculated based on factors presented in the Revision of the Resource Management Plans of the Western Oregon BLM (USDI 2008; Appendix C, p. 28), which is incorporated here by reference. Of this carbon in harvested wood, 2,130 metric tonnes would be emitted in the short-term and over the long-term (30 years), 4,364 metric tonnes would be cumulatively emitted.

Because the proposed commercial thinning would maintain the forest stand, the carbon storage in forest pools other than live trees (e.g., understory vegetation, forest floor, soil carbon) is assumed for the purpose of this analysis not to change as a result of thinning harvest, except for the pile burning to dispose of slash described below. BLM (USDI 2008, p.540; Appendix C, p. 29) analyzed the changes to carbon storage in forest other than live trees and concluded that the amount of carbon stored in forests (other than live trees) generally reflects the structural stage, and that analysis is incorporated here by reference.

Pile burning to dispose of slash after timber harvest would result in the consumption of 420 tons for the entire project area, which would emit 191 metric tonnes of carbon in the short-term.

Fuel consumption associated with the proposed action would also result in carbon dioxide emissions. This analysis assumes an average 20 miles haul distance, 2.65 gallons of diesel fuel per thousand board feet to yard and haul logs to the mill, and 6 pounds of carbon per gallon of diesel fuel. The overall emissions associated with yarding equipment and hauling is then estimated at a total of 1,882 metric tonnes.

In total, the action would result in the emission of 4,203 metric tonnes in the short-term and an additional 2,233 metric tonnes over the long-term, for a cumulative total of 6,437 metric tonnes. This would equate to the emission of approximately 23,603 metric tonnes of carbon dioxide.

Over the next 30 years, continued forest growth following harvest would result in an increase in live tree stand volume of an average 86 cubic feet per acre, or 88,990 cubic feet across the project area. This equates to an increase in storage of approximately 708 metric tonnes of carbon per year. Forest growth would equate to the sequestration of approximately 21,236 metric tonnes of carbon dioxide over the long term. In conclusion, forest growth 30 years following harvest would result in carbon storage which would exceed the carbon directly and indirectly emitted from harvest, resulting in a net storage of carbon compared to current conditions.

Alternative 3: Minimize Permanent Road Construction

Alternatives 3 would have less treated acres and would therefore have carbon storage and emissions between the no action alternative and Alternative 2. Values are shown below in Table 2.

Alternative 4: No Permanent Road Construction

Alternative 4 has the least acres treated; therefore it has the least carbon stored in harvested wood, the least emissions, and the most live tree carbon storage compared to Alternatives 2 and 3.

TABLE 2: SUMMARY OF EFFECTS ON CARBON FOR ALL ALTERNATIVES

	No Action		Alternative2		Alternative 3		Alternative 4	
	Short-term	Long-term (30 yrs)	Short-term	Long-term (30 yrs)	Short-term	Long-term (30 yrs)	Short-term	Long-term (30 yrs)
Total Live Tree Carbon Storage	1402 tonnes per year	42,047	708 tonnes per year	21,236	726	21,783	1,063	31,894
Harvested Wood Carbon Storage	0	0	15,249		14,719		8,884	
Emissions from Harvested Wood	0	0	-2,130	-4,364	-2,056	-4,212	-1,241	-2,542
Emissions from Fuels Treatments	0	0	-191		-105		-73	
Emissions from Operations	0	0	-1,882		-1816		-1,096	
Total Emissions	0	0	-4,203	-6,436	-3,977	-6,133	-2,410	-3,711

*This analysis did not model carbon stored through competition-related mortality

4.2 Issue 2: What are the effects of the proposed commercial thinning and proposed road actions on water quality and aquatic resources?

4.2.1 AFFECTED ENVIRONMENT

Water Quality

This project is located northeast and southeast of Springfield, Oregon and is within 3 separate 5th field watersheds. These watersheds are the McKenzie, Pudding Creek-Middle Fork Willamette, and Little Fall Creek watersheds. Table 16 in Appendix C further illustrates hydrologic unit code (HUC) divisions (10th field watersheds and 12th field sub-watersheds), unit locations within those areas, and named streams near the units.

Approximately two hundred seventy-five stream segments exist within or adjacent to the project areas. Most of these are perennial first or second order streams. A few streams are not connected by surface flow, but rather connect hydrologically by subsurface flow. Disconnected streams are common in rotational landslide topography. Forty-three wetlands and three springs/seeps were also identified within or adjacent to the project areas.

The Oregon Department of Environmental Quality (DEQ) developed Total Maximum Daily Loads (TMDLs) for temperature, bacteria, dissolved oxygen, and turbidity for the Upper Willamette sub-basin in September 2006. Stream temperature has been addressed in the Salem and Eugene District BLM Willamette Basin Water Quality Restoration Plan approved by Oregon DEQ in July 2008. That plan outlines a comprehensive strategy for

implementing, monitoring, and evaluating management to address water quality impairment on BLM lands in the Willamette basin.

Camp Creek (located downstream from Solomon 7 and 33 units) and Little Fall Creek (downstream from Wild Jack 19 unit) are included on the 303(d) Water Quality Limited list for year around elevated temperatures, as determined by Oregon DEQ.

Annual precipitation in the project area ranges from 51 to 73 inches (1295 to 1855 millimeters). The project area elevation ranges from 660 to 1980 feet. This elevation range places all units in the rain dominated zone with no acres in the transient snow zone.

The project area was previously harvested 40-80 years ago. Logging roads and skid trails from past timber harvests have impacted the stream network throughout the project area. Impacts from historic logging activities range from old log culvert stream crossings to skid trails constructed over stream channels. Erosion and sedimentation from these old skid roads have delivered fine sediment to the channels, undercut stream banks, or buried channels with road or skid road related debris. A few of these old roads now carry water during winter storm events, extending the natural stream system and occasionally diverting flow from their natural stream channels.

All three watersheds have high densities of roads within them. Road densities over 3.5 miles of road per square mile are considered "Not Properly Functioning" (FEMAT, 1993). The McKenzie Watershed has 4.4 miles of road per square mile, the Pudding Creek –Middle Willamette Watershed has 5.3 miles of road per square mile and the Little Fall Creek Watershed has 5.3 miles per square mile.

Some stream crossings and ditch relief culverts in this project area are not functioning properly due to rust, mechanical damage, being undersized, or other factors that increase the risk of culvert failure. A few road segments lack ditch relief culverts, increasing flow and sediment delivery to stream crossings and increasing the risk of road or culvert failure. A few roads have degraded surface aggregate resulting in fine sediment being eroded from the road surface. Some roads run parallel to streams, so fine sediment is delivered to streams by way of runoff in wet winter months and dust in dry weather.

Aquatic Resources - Fisheries:

As mentioned earlier, past logging practices have left the aquatic environment with elevated levels of sediment, interrupted ground water and stream flows and have depleted large coarse wood debris from riparian areas and streams.

Numerous tributaries within the timber harvest area do not have fish within them due to limited flow, steep cascades or natural (waterfall) and manmade (culvert) barriers. There are several anadromous and resident fish species that occur within these watersheds. Cutthroat trout have the widest distribution, followed by steelhead, and then Chinook salmon. Table 15 in Appendix C displays the fish species present in project area streams.

The Upper Willamette River Chinook ESU was listed as threatened under the Endangered Species Act on June 28, 2005 (70FR37160). Chinook salmon occupy the Lower McKenzie, Middle Fork Willamette, and Little Fall Creek watersheds and are part of the Upper Willamette River Chinook Evolutionary Significant Unit (ESU). The Final Environmental Impact Statement for the Revision of the Western Oregon Resource Management Plans describes the status of the species, including life history, populations, status and distribution, and key limiting factors for the Upper Willamette River Chinook salmon ESU. (USDI BLM, 2008; Appendix J-Fish, pp. 338-342)

Approximately 77 stream miles within the McKenzie watershed are occupied by the Upper Willamette River Chinook salmon. Approximately 0.61 miles of streams on BLM are occupied by Upper Willamette Chinook salmon in this 5th field watershed. Approximately 22 stream miles within the Pudding Creek-Middle Fork Willamette watershed are occupied by the Upper Willamette River Chinook salmon. No streams on BLM are occupied by Upper Willamette Chinook salmon within the Pudding Creek-Middle Fork Willamette watershed. Approximately 19 stream miles within the Little Fall Creek watershed are occupied by the Upper Willamette River Chinook salmon. Approximately 1.03 miles of streams on BLM are occupied by Upper Willamette Chinook salmon in this 5th field watershed.

Optimum temperatures for coho salmon, steelhead, and cutthroat trout are 13 to 16 degrees Celsius and temperatures over 29 degrees Celsius are considered lethal (Meehan 1991).

Fine sediments (sand, silt, and clay at less than 2 millimeters) enter and leave river channels naturally, but increased suspended sediment, turbidity, and sedimentation can adversely affect fish behavior, physiology and growth (Anderson et al. 1996). The effects of fine sediment on fish habitat are generally expressed as the percent of embeddedness at reach scales. Embeddedness is defined as the degree to which larger particles (such as boulders, cobble, and gravel) are surrounded and/or covered by smaller particles (silt, sand). Increases in sedimentation or embeddedness can reduce fish-spawning and rearing habitat, fish egg and fry survival, and food availability (Chamberlin et al. 1991, Hicks et al. 1991).

Increased concentrations of suspended sediment and turbidity can also have direct effects on fish behavior, physiology, and growth (Anderson et al. 1996). The Oregon Department of Fish and Wildlife (ODFW) considers properly functioning substrates to have <20% fines, sands or sediment. In general, all watersheds have elevated levels of sediment. The average level of sediment in streams surveyed within the McKenzie Watershed is 18.6 % with 11 out of 26 streams having sediment levels above 20%. The average level of sediment in streams surveyed within the Pudding Creek-Middle Willamette Watershed is 31.5 % with 3 out of 4 streams having sediment levels above 20%. The Little Fall Creek watershed had no surveys on file.

Connectivity is important for fish production and restoring fish passage is an effective way to increase the availability of habitat (Roni et al. 2002). It is common for fish to move within streams and between stream systems throughout the year (Kahler et al. 2001). A road inventory was conducted in the planning area that included an assessment of road and culvert conditions. Numerous cross drain and stream culverts were assessed and found to be at risk of failure and preventing fish passage.

Aquatic Resources - In stream Woody Debris

The lack of large wood in streams has been identified as a limiting factor for the survival and productivity of anadromous salmonids in western Oregon (FEMAT, 1993) and has been identified as a limiting factor in the recovery planning for ESA-listed anadromous salmonids on the Oregon coast, the Lower Columbia River and the Upper Willamette River (Nicholas et al. 2005, ODFW 2010a, ODFW 2010b). In Western Oregon, ODFW considers the amount of large wood in stream channels to be high if there are more than 48 pieces per mile and low if there are less than 16 pieces per mile (Foster et al, 2001). The average number of pieces of large wood per mile in streams surveyed within the McKenzie Watershed is 19.68 pieces per mile, with only 3 streams out of 26 streams having high levels of large woody debris. The average number of pieces of large wood per mile in streams surveyed within the Pudding Creek-Willamette Watershed is 12.39 pieces per mile, with no streams out of 4 streams having high levels of large woody debris. The Little Fall Creek watershed had no surveys on file.

4.2.2 ENVIRONMENTAL EFFECTS

ALTERNATIVE 1: NO ACTION

Water Quality

Under this alternative, no harvest related actions, road improvement, road decommissioning, culvert replacement, or aquatic habitat restoration would occur. Stream temperatures would remain unchanged for both the long and short term. Fine sediment input into streams would continue due to road related problems at failing, deteriorating, and/or non-functional stream crossing culverts. Road-stream crossings on roads 16-1-31.1, 17-1-7, 17-1-7.1, 18-1E-19.2, 18-1E-19.1, 18-1-15.1, 18-1-7.3, 18-1-15.1, and 17-1-34 would not be replaced and would continue to be a moderate to high risk of failure. No impacts to peak flows are anticipated since no timber would be removed under this alternative. Cumulative effects under this alternative are expected to maintain current watershed conditions. The opportunity to improve aquatic habitat conditions and water quality would be lost or postponed.

No changes to stream temperature would be expected, since existing shade in the riparian areas would remain unaltered from current conditions. In the long term, riparian vegetation would continue to grow, providing increased shade to protect stream temperatures.

Aquatic Resources - Fisheries

Turbidity in streams adjacent to the project area would continue to have the potential for chronic sediment problems due to failing culverts and road drainage issues. Water quality and impacts to fish bearing habitat would continue to be impacted by road related sedimentation under this alternative. Deteriorating undersized stream crossing culverts could plug, blocking stream flow and the resulting road failure(s) could cause channel scouring downslope from the road. Road related sedimentation could escalate for three reasons: 1) no stream crossing culverts (log or corrugated metal) would be replaced, 2) lead-off ditches or relief culverts would not be properly maintained (or new ones installed), and 3) no additional aggregate would be placed on the local access roads or haul routes and no blading would occur. As a result, direct sediment delivery to streams via the ditch line from those roads would continue.

Under this alternative road-stream crossings would continue to be partial to total passage barriers to all life stages of fish and other aquatic-dependent species. Due to the culverts being undersized, high and moderate flows would continue to erode downstream channels, thus worsening passage conditions at these sites. Ditch lines that currently drain into area streams would continue to produce chronic erosion at these areas.

Cumulative effects from a variety of sources (ditch lines without culverts, etc.) could increase fine sediment into the stream channels and negatively affect downstream fish habitat. Road decommissioning, and road maintenance would either not take place, or be postponed until a later date. Water quality degradation and impacts to fish bearing habitat may increase as several road crossings further deteriorate due to the lack of maintenance. Without additional aggregate surfacing and relief drainage, future road conditions would continue to accelerate sediment delivery and surface runoff to streams.

The effective shade would be maintained along streams on BLM land, but timber harvesting on private lands would follow Oregon State Forest Practices and would reduce the effective shade zone in those area and increase solar radiation to streams flowing onto BLM lands. This alternative is expected to maintain the current conditions within the project area. The potential to improve aquatic habitat conditions through road decommissioning, undesignated OHV trail closure, replacement of high risk road-stream crossings, road drainage improvements, and increased riparian function from thinning would not occur.

Current fish production within the project areas would continue to be hindered by the following processes: poor road drainage causing increased sedimentation of area streams, decreased movement of fish would continue to limit production within basins due to fish passage barriers which would be replaced under other alternatives, riparian areas would continue to be overstocked and would slowly provide inputs of large wood (smaller suppressed trees would die providing smaller pieces) but riparian stands would not grow faster or gain complexity due to no thinning

Aquatic Resources - In stream Woody Debris
This alternative would have no immediate effect on the level or recruitment of in stream large woody debris. The recruitment of large wood to the stream channel would continue by natural processes. Currently overstocked stands have smaller suppressed trees dying and providing wood to riparian areas and streams. However, due to the uniform nature of the riparian stand, the development of large trees and subsequent large woody recruitment to the stream channel would be delayed and these stands would not develop until significant mortality occurred within the stand, allowing the remaining trees to grow faster.

Current levels of in-stream large wood within the project area would remain at low to moderate levels until modified by natural processes. The lack of habitat complexity, rearing habitat and spawning grounds would continue to be limiting factors for salmonid production.

ALTERNATIVE 2: MAXIMUM ACRES TREATED

Water Quality
Under this alternative, thinning in the Riparian Reserve is not expected to impact water temperatures since no-harvest stream buffers (ranging from 75 to 400 feet) would be implemented. The primary shade zone along all streams would be maintained by these no-harvest buffers. Thinning within the secondary shade zone would maintain at least fifty percent canopy closure. Although thinning in the secondary shade zone may slightly increase direct solar radiation penetrating into the primary shade zone, the primary shade zone would provide sufficient shading to maintain stream temperatures.

There would likely be a pulse of sediment during the construction work of culvert installation, but this is expected to be a short term impact. Typically, fine sediments disturbed by the equipment are flushed out by seasonal fall rains and some erosion occurs until disturbed soils on the inlets/outlets are stabilized by natural vegetation, mulch, or rip-rap. During the short term, there would also be a likely pulse of sediment during the harvest time period due to increased road use. This project allows for year-round timber haul where impacts vary by season of use, whereas dry season use typically results in less sediment production. Log haul would occur over native, gravel and paved road surfaces controlled by BLM and private industry.

A road-related inventory identified that some roads within the project area do not have adequate relief drainage or road surfacing aggregate. Road segments with the potential for delivery would receive additional relief culverts and/or replacements and all new stream crossings on the haul route would receive road surfacing aggregate that would further reduce any road-related sediment delivery to streams. Implementation of project design features would further minimize sedimentation impacts to project area streams.

New permanent road crossings in Boulder 5 would improve the current condition at two of the three proposed permanent road-stream crossings. Currently, the historic crossing where Spur BC5F would cross stream #4 was decommissioned without removing the old log culvert. This has resulted in a confined channel with a sediment dam behind the logs. By removing this log culvert and placing a bank-full width culvert, the stream would be able to naturally transport sediment and bed load materials. Natural stream meander would also be

better achieved above and below the crossing. The second crossing of stream #4 (upstream) in Boulder 5 would also be an improvement of the existing condition. Currently, there is a historic road crossing with either no culvert or a completely buried log culvert at this location. Currently, the stream is flowing over the historic road fill. There is a 4 to 5 foot tall headwall cut where the stream is currently cutting back the road fill. This is currently a chronic source of sediment delivery to stream #4. Under this alternative, the crossing would be much improved by placing a culvert at the natural gradient of the stream and would stop the chronic source of sediment input from the currently eroding road bed.

In general, long-term decreases in sediment delivery would result from upgrading permanent roads by replacing culverts, adding cross drains, adding aggregate, grading and decommissioning constructed roads.

Best Management Practices and Project Design Features would be used to disconnect the road system from the stream network as much as possible. Culverts placed at all stream crossings would be sized for 100 year flood events. Placement of crushed rock aggregate within the Riparian Reserve on roads BC5F, BC5E, BC5L, BC35D, and SC07A would help to prevent sediment delivery from roads to the stream network.

Under alternative 2, commercial thinning is not expected to impact current peak flows. As much of the existing young stands of timber mature in the watershed, an improved condition with regard to channel impacts from peak flows should occur. Harvesting of mature timber on public and private lands may reverse that trend. Renovation of existing roads used for harvesting and hauling would reduce surface runoff from entering nearby streams over the long term. Decommissioning roads no longer needed would also contribute to a reduction in road related runoff being delivered to the stream system and promote infiltration of surface flow in the project area, resulting in reduced sediment delivery.

Aquatic Resources - Fisheries

As mentioned above, treatment in the Riparian Reserve is not expected to impact water temperature, thereby protecting habitat conditions for aquatic and riparian-dependent species. Stream crossing culvert replacements may result in the loss of some over story vegetation, but not to the level of affecting stream temperature.

Treated riparian reserves would have no-harvest buffers widths of a minimum of 75 feet. These buffers would provide protection to over-steepened and/or unstable streambanks and headwalls, and filter out potential sediment transported from skyline and ground-based yarding processes; thus, minimizing sediment-related impacts to nearby streams and fish bearing habitat. Skyline yarding landings are generally located on ridge top topography and outside of the stream influence zone. To minimize adverse effects to stream habitat, relief culvert installation would be installed to reduce direct sediment onto hillsides and not directly into streams. The implementation of project design features would minimize most potential sediment related effects on water quality and aquatic habitat from harvest activities.

The replacement of fish passage barrier culverts would restore the migration corridors of suitable spawning and rearing habitat for various salmonid fish and other aquatic-associated species. Culverts would be sized to meet the 100 year flow event and would be designed as stream simulated which would meet the passage criteria for all life stages of fish. Over the long-term, this type and size culvert would greatly reduce upstream and downstream channel erosion, stabilize existing sites, and would eventually mimic the natural stream channel characteristics. These replacements would also reduce the risk of road failure that would increase sediment levels at each failure site.

Effects to listed Fish Species: Upper Willamette River Spring Chinook salmon have critical habitat adjacent to one thinning unit (Wild Jack 19). However, this unit has a different age class that would not benefit from

thinning and was given no cut buffers of 300 feet or more. The only other project elements that are in close proximity to listed fish habitat are haul routes. All haul routes over listed fish are on paved roads or far above listed fish on gravel roads. Therefore these haul routes have no causal mechanism to increase road related sediment where listed fish may reside.

In September 2005, the United States Fish and Wildlife Service (USFW) published a final rule designating critical habitat for Bull Trout, listed as Threatened under the Endangered Species Act (70 FR 56212). The only area in the planning area that contains Bull Trout is the main stem McKenzie River and the Middle Fork Willamette River that is considered migration habitat for Bull Trout in these stream systems. Much like the Upper Willamette River Spring Chinook salmon, Bull Trout would not be affected by this project due to the distance downstream to any of their critical habitat.

Aquatic Resources - In stream Woody Debris

This alternative would treat most of the outer portions of the Riparian Reserves. Thinning is expected to speed the development of large-diameter trees thus resulting in a long-term increase in large woody debris (LWD) levels in streams and riparian areas within the project area. The thinned areas would have a small amount of timber blow down or natural mortality from thinning, and the no cut buffer would continue to supply approximately 90-95 % of all LWD to area streams. The increase in LWD potential would have long term benefits to refugia habitat (cover), influence the size and location of pools, the formation of deeper pools, creation of backwater and off-channel habitat, and the deposition and sorting of gravels thereby providing suitable spawning habitat. All of these factors would improve fish habitat and production.

Cumulative Effects: Implementation of Alternative 2 is expected to create short term increases of turbidity in all watersheds at specific stream crossings where culverts would be installed or replaced and new road construction in Riparian Reserves would take place. This alternative combined with on-going and planned road renovation on BLM and privately owned lands, would result in a long-term reduction of road-related sediment and surface water runoff delivery to streams and fish bearing habitat due to improved road drainage.

Protective streamside buffers on BLM land and the utilization of standard best management practices (BMP's) would maintain existing sediment rates to streams. The addition of potential large wood to the system would help regulate the sediment regime and add to hydraulic complexity. A higher diversity of riffle and pool habitat is expected to develop over time, thus influencing the physical and biological characteristics of the stream system and creating productive habitats for salmonid fish. Large woody debris entering the stream system from BLM lands (either naturally or stream channel enhancement) would be distributed downstream over time by natural processes, thereby providing benefits beyond the project area.

Replacement of fish passage barrier culverts would result in an increase in the amount of suitable spawning and rearing habitat available for salmonids within the watershed. In addition, replacement of deteriorated and/or undersized stream crossing culverts would greatly reduce the risk of mass wasting and the chronic erosion and sedimentation thus providing benefits to the overall health of the aquatic ecosystem within the watershed.

Maintaining primary shade zones along streams would protect water temperatures on BLM land. Such standards are not used on private lands; therefore, sediment and temperature increases elsewhere in the watershed are expected to occur at the current rate.

ALTERNATIVE 3: MINIMIZE PERMANENT ROAD CONSTRUCTION

Water Quality

Under alternative 3, effects to water temperature would be unchanged. Potential sediment delivery would decrease due to the decrease of the number of road-stream crossings. The main haul routes would still be renovated, reducing surface runoff from entering nearby streams over the long term. Portions of the main haul route that are not used under this alternative would not be improved. No difference in peak flows would be expected between the alternatives.

Aquatic Resources – Fisheries

Alternative 3 would be similar to the effects of Alternative 2. However, as mentioned above potential sediment deliver would decrease due to the overall reduction in road-stream crossings. Although some units have the same number of stream crossings in each Alternative 2 and 3, the stream crossings may be on smaller intermittent streams, compared to a temporary bridge over a large stream (Boulder 5), which would have less of an effect on water quality and aquatic organisms. Therefore, with fewer roads and stream crossings, some small, short term increases in turbidity to area streams would not occur (due to road crossings) as they would in alternative 2.

Aquatic Resources – Instream Woody Debris

Effects under this alternative would be similar to those under alternative 2. However approximately 50 acres would not be thinned. Those unthinned acres would not see an improved stand trajectory, and would not achieve an improvement in large woody debris potential. The stand would continue to mature at its current rate and would not see the benefits of thinning.

ALTERNATIVE 4: NO PERMANENT ROAD CONSTRUCTION

Water Quality

Under alternative 4, no new permanent roads would be constructed within the project area and no new stream crossings (permanent or temporary) would be constructed. This would eliminate the short term increase of sediment input created by culvert installation and road use during the harvest period. In the long term, this would also eliminate the removal or replacement of most of the proposed moderate to high risk of failure culverts. Several chronic sediment producing historic crossings (such as Boulder 5, Spur BC5E and BC5F) would remain unchanged. Over the long term, excessive erosion will occur at these historic crossings through normal processes until the stream gradients are restored.

Aquatic Resources – Fisheries

Alternative 4 would be similar to the effects of Alternative 3, with the exception of fewer roads being built, fewer stream crossings (short term increases in turbidity). In general the only differences in Alternative 2, 3, and 4 are the amount of road construction and stream crossings. Alternative 4 has no new stream crossings and therefore would have little effect on stream turbidity. Road work would still improve drainage on roads and would decrease the amount of run off to area streams. Less acres would be treated, but effects to fish and the aquatic environment would be from different numbers of stream crossings (small short term increases in turbidity) and roads constructed. The riparian acres treated would not increase stream turbidity because no cut buffers would filter out any disturbed soil and would keep material from moving very far offsite within the Riparian Reserves.

Aquatic Resources – Instream Woody Debris

Effects under this alternative would be similar to those under alternative 2 and 3. However since all permanent road construction and all treatment in Riparian Areas would be foregone under this alternative, approximately 400 acres would not be thinned. Those unthinned acres would not see an improved stand trajectory and would not achieve an improvement in large woody debris potential. The stand would continue to mature at its current rate and would delay the large woody debris potential in these unthinned areas.

4.3 Issue 3: What are the effects of the proposed commercial thinning and road actions on attaining and maintaining ACS objectives?

4.3.1 Affected Environment

See Section 4.2.1 for a description of affected watersheds.

The Riparian Reserve width (potential site tree height) for the 2012 Thinning sale is 200 feet on either side for intermittent and perennial streams without fish and 400 feet on either side for fish-bearing streams. Riparian Reserves consist of the stream and the area on each side of the stream extending from the edges of the active stream channel to 200 or 400 feet slope distance. Riparian Reserves would be thinned with a minimum no cut buffer of 75 feet or greater.

4.3.2 Environmental Effects

Alternative 1-No action

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

At the site and project scale in the short and long term, landscape features would be maintained across the landscape because no project activities would take place and the Riparian Reserves would not be affected. Therefore, all landscape features would not be affected and would be maintained. In the long term, riparian areas would not benefit from thinning and would slowly recover from previous disturbance. Under this alternative, current stream and riparian conditions would be maintained. Small and large wood recruitment to the stream and riparian areas would continue at the current rate. Density induced mortality recruitment of smaller diameter down wood is beginning to slow yet should continue for the next few decades and then generally subside for many decades until tree growth increases and large down logs begin to enter riparian areas due to natural processes such as disease and competition among dominant and co-dominant trees. Therefore, these landscape features would be maintained. Riparian Reserve conditions would be maintained and the distribution, diversity, and complexity of watershed features to ensure protection of aquatic species would be maintained.

At the watershed scale in the short and long term, current conditions and the forest development trajectory would be unchanged. Thinning and culvert work would not occur to restore the distribution, diversity, and complexity of watershed scale features.

2. *Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater*

tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and -dependant species.

At the site and project scale in the short term, spatial and temporal connectivity would be maintained. However, many culverts that need upgrading would not be upgraded through this project putting them at risk for failure and sediment pulse and would continue to impede connectivity. The opportunity to improve passage of aquatic species at culvert sites would be deferred.

At the watershed scale in the short and long term, spatial and temporal connectivity would be maintained through the Riparian Reserve network. However, as stated above, some culverts would not be upgraded through this project but would have little discernable effect at the watershed scale.

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

At the site and project scale in the short term, the physical integrity of stream banks and bottoms would be unchanged, including the chronic sediment sources, scouring culvert sites, and log culverts. In the long term, the risk of failure at these sites would continue and increase as conditions deteriorate.

At the watershed scale in the short and long term, the physical integrity of stream banks and bottoms would be maintained.

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

In the short term at the site and project scale, current water quality conditions would be maintained and would not be improved because road maintenance activities would not disconnect road drainage from streams or other activities that would prevent sediment transport to streams. In the long term, water quality would be at risk due to lack of road improvement and maintenance and fill failure that could occur. At the watershed scale in the short and long term, water quality would be maintained as Riparian Reserves continued to grow large conifers but would not be improved. These improvements would have little effect at the watershed scale due to the amount of road miles in the watershed and general poor drainage of area roads.

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

At the site and project scale in the short term, the current sediment regime would be maintained and road improvements would not occur, so chronic fine sediment sources would continue to contribute sediment to area streams. In the long term, the likelihood that some high risk road fill sites would contribute pulses of sediment to streams would continue to increase.
At the watershed scale in the short and long term, the current sediment regime would be maintained because no actions would occur to restore the sediment regime.

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

At the site and project scale in the short term, in-stream flows would be maintained in their current condition. At the site scale, the opportunity to restore the spatial distribution of flows through road drainage improvements would be deferred. In the long term, in-stream flows would be maintained as Riparian Reserves continued to grow large conifers on BLM-administered lands.

At the watershed scale in the short term, maintaining in-stream flows at the site level would support maintaining in-stream flows at the watershed scale, though this effect would not be measureable. In the long term, in-stream flows would be maintained as conifers continued to mature in Riparian Reserves on BLM-administered lands.

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

At the site or project scale, there would be no disturbance of floodplains or wetlands in the project area. The opportunity for road drainage improvements to improve the timing, variability, and duration of floodplain inundation at some sites would be deferred. In the long term, Riparian Reserves would continue to mature and allow passive restoration of floodplain and wetland function. Previously compacted areas would continue to recover, allowing for more infiltration during flooding.

At the watershed scale in the short term, the timing, variability, and duration of floodplain inundation would be maintained in the current condition. Deferred road drainage improvements would have had no influence on floodplains or wetlands at the watershed scale. In the long term, maturing Riparian Reserves throughout the watershed would allow passive restoration of floodplain and wetland function.

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

At the site and project scale in the short term, species composition and structural diversity of riparian areas would be maintained because the current condition would be unaffected. In the long term, the opportunity to increase the rate of dominant/codominant tree growth would be deferred.

At the watershed scale in the short term, the species composition and structural diversity would be maintained. Riparian Reserves would maintain this composition and diversity on BLM-administered lands at a watershed scale. In the long term, riparian areas would continue to mature with regard to species composition and structural diversity on the current trajectory. However, due to the small numbers of acres in the project area, this would not affect species composition and structural diversity at the watershed scale.

Snags and down/in stream logs: Over the next few decades, untreated Riparian Reserves would continue to recruit smaller diameter snags and down/in-stream logs mostly through density-induced (suppression) mortality. This recruitment would mostly cease when stands enter the mature-seral stage. The amount of recruitment during this time would be greater than in treated areas, but the overall diameters would be less. Riparian Reserves would not realize the potential benefits of accelerated rates of recruitment of larger down/in-stream logs and snags from larger trees (as compared to the Action Alternatives).

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

Aquatic habitat: At the site and project scale, water quality would be maintained in its current condition; including aforementioned negative effects to water quality from known or potentially failing culverts, fill, and unmaintained roads in Riparian Reserves. Species such as aquatic invertebrates, aquatic salamanders, and red legged frog that are associated with aquatic stream habitats would generally continue to experience known and potential negative impacts to water quality as described under ACS Objs. 1-7.

Terrestrial riparian habitat (within Riparian Reserves):
Species associated with riparian terrestrial habitats would not experience any negative short term effects due to soil compaction, changes in down log habitat function, and changes in canopy closure and stand microhabitats (as compared to the Action Alternatives). No negative long term effects to the terrestrial portion of the Riparian Reserves are expected. However, the terrestrial portions of Riparian Reserves would continue to grow and differentiate at a slower rate compared to the thinned outer portions of the Riparian Reserves in the Action Alternatives. See ACS Objective 8 regarding snag and down/in-stream wood recruitment.

Known or potential positive or negative effects to other aquatic dependent species such as aquatic invertebrates and aquatic salamanders would correspond to known or potential positive or negative effects mentioned above (ACS Objectives 1-7) to water temperature, turbidity, and substrate composition.

At the watershed scale in the short term, Riparian Reserves on all BLM-administered lands would continue to provide varying qualities and amounts of habitat for some riparian-dependant species throughout the watershed.

In the long term, passive restoration would allow Riparian Reserves to mature, supporting restoration of habitat for riparian-dependent species within the watershed.

Alternative 2- Maximum Acres Treated

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

Site or Project Scale -

Short-Term: Variable no-harvest buffers (75 to 400 feet) would be implemented on all riparian thinning units to protect stream bank stability, maintain stream shade, and minimize sedimentation. There would be approximately 315 acres of Riparian Reserve thinning to promote the growth of large conifers and increase species diversity. Approximately 279 acres would be harvested using cable yarding while the remaining 758 acres would be harvested using ground based equipment (total acres, upland and Riparian Reserves). These acres would be well distributed throughout the project area (3 different 5th field watersheds) and represent a small amount of the Riparian Reserve acreage within these watersheds. Use of ground-based equipment within Riparian Reserves would be minimized and confined to approved skid trails, roads, and landings. Within the Riparian Reserves there would be a small amount of short-term soil disturbance from log yarding that potentially could move off site. Sediment reaching stream channels would be highly unlikely due to the no-harvest buffer and the vegetation and duff that remained after the thinning occurred.

Long-Term: Thinned portions of Riparian Reserves would experience accelerated tree growth and crown development, and therefore the subsequent rate these stands would become late-seral habitat due to tree *size*. It is uncertain if increased tree growth would also accelerate development of late-seral *structure* such as large side limbs, cavities, other deformities (when compared to the No Action Alternative).

Watershed Scale –

Short-Term: At the watershed scale, thinning the relatively small amount of acres within the riparian zone would have very little effect on the distribution, diversity, and complexity of watershed and landscape-scale feature to ensure protection of aquatic species in the short-term. Riparian thinning would not alter or influence the sediment regime at the fifth-field watershed scale because of no-harvest buffers.

Long-Term: At the watershed scale, the riparian conditions and the distribution, diversity, and complexity of watershed features that ensure protection of aquatic species would be improved in thinned areas, but would not affect conditions at the watershed scale.

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

Site or Project Scale –

Short-Term: Approximately 315 acres of Riparian Reserves would be thinned throughout the project area. Spatial and temporal connectivity would be maintained where Riparian Reserves are excluded from thinning and restored where Riparian Reserves are thinned. Some improvements to spatial connectivity would be made by upgrading culverts. However, many culverts that need upgrading would not be upgraded through this project but may be upgraded at a later date.

Long-Term: Spatial and temporal connectivity would be maintained in its current condition where Riparian Reserves are excluded from thinning, 75 feet or more on either side of streams. Connectivity would be restored where Riparian Reserves are thinned because the upper slopes of the Riparian Reserves would accelerate the development of large trees, eventually providing large wood and other elements increasing complexity and increasing connectivity with floodplains and wetlands in the project area and immediately downstream. These benefits would occur at faster rate compared to the No Action Alternative

Watershed Scale –

Short-Term: Spatial and temporal connectivity would be maintained through the Riparian Reserve network, and improved at culvert replacement sited. However, as stated above, some culverts impeding spatial or temporal connectivity would not be replaced with this project.

Long-Term: Spatial and temporal connectivity would be maintained or improved through the Riparian Reserve network. Thinning in Riparian Reserves would maintain or improve forest conditions for species using riparian areas, and culvert replacement would improve connectivity above and below the road stream crossing.

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

Site or Project Scale -

Short-Term: Replacing rusted or damaged stream crossing culverts would reduce the risk of fill failures. Permanent culverts would be sized to accommodate 100 year storm events, reducing the risk of failure in major flood events, reducing or eliminating downstream scour or upstream sediment accumulation. Removing or replacing stream crossing culverts, and adding a temporary stream crossing are unlikely to negatively affect the physical integrity of the stream channels and would directly improve conditions at sites where active erosion continues. The physical integrity of the bottom configuration and banks would be restored where

existing culverts or road fills would be removed via road decommissioning or restoration work (install culverts). Untreated stream buffers ranging between 75 to 400 feet on either side of stream channels would protect the integrity of stream banks and channels.

Long-Term: The physical integrity of the aquatic system would be maintained or improved in the long term through culvert replacement or removal, and cross-drain placement through this project. There would be a long-term reduction in the risk of negative impacts to the physical integrity of the aquatic system at the sites or downstream. Additional cross drains would also reduce the artificially extended stream channel network, and reduce the risk of chronic and catastrophic crossing failures, road related landslides, and direct sediment delivery to streams by directing water off the road to stable side slopes.

Watershed Scale –

Short-Term: Although culvert upgrades would disturb some stream banks, at the watershed scale these small disturbances would not influence the overall aquatic system from culverts spread out throughout the project area. Furthermore, these culvert upgrades would restore bank and bottom configurations within the aquatic environment.

Long-Term: The physical integrity of the aquatic system would be maintained or improved by culvert replacement or removal, or cross-drain placement, directly improving conditions in both the short-term and long-term. A small number of culvert treatments are spread out throughout the watersheds and would not improve the aquatic system at the watershed scale.

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

Site or Project Scale -

Short-Term: Temperature and sediment production, water quality parameters most readily impacted by the proposed project, would be maintained through the use of no-harvest buffers on riparian thinning units. Water quality would be improved in the short-term as a result of road renovation and improvement, although small amounts of sediment could be mobilized and transported to streams when the work begins. There are some unauthorized OHV trails within the project area. These trails will be decommissioned and blocked within the thinning areas when they are use as skid trails.

Long-Term: Water quality would be maintained in the long term. There would be a slight improvement in water quality at this scale as a result of road drainage improvements.

Watershed Scale –

Short-Term: Water quality would be maintained at the watershed scale because Riparian Reserves would continue to function and protect water quality. Culvert replacement would introduce small amounts of sediment during project implementation while road improvements would reduce sediment delivery to local stream channels but both would have little effect at the watershed scale.

Long-Term: Water quality would be maintained as Riparian Reserves continue to grow large conifers. Road work would help maintain water quality but this would have little effect at the watershed scale due to the limited extent of this work in the watersheds.

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

Site or Project Scale -

Short-Term: The current sediment regime would be maintained because vegetation in Riparian Reserves would continue to protect aquatic systems from additional sediment delivery as a result of management actions. Road renovations and improvements would maintain or improve the sediment regime. The exception is in-stream culvert replacements, which would improve the sediment regime after a short, localized introduction of fine sediment.

Long-Term: The current sediment regime would be improved as a result of proposed road renovation and improvement. The volume of sediment introduced from road-related sources would be reduced as a result of improved road drainage and some unauthorized OHV trail obliteration within these watersheds.

Watershed Scale –

Short-Term: The current sediment regime would be maintained as a result of this project because timber harvest would be excluded from variable no-harvest stream buffers within Riparian Reserves. The sediment regime would be maintained through road renovations and improvements, but would not be discernable at the watershed scale.

Long-Term: The sediment regime would be maintained at the watershed scale though not improved as it is at the site scale. The restoration of the sediment regime due to road work at the watershed scale would not be discernable at the watershed scale when compared to the volume of sediment generated from roads and other sources throughout the watershed.

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

Site or Project Scale -

Short-Term: All of the area is within the rain dominated hydroregion and is not susceptible to increased peak flows (USDI, 2008). Riparian thinning would not have an impact on stream flows due to the remaining canopy after harvest, a variable no-harvest stream buffer, and the fact that the riparian thinning lies within the rain dominated area. Improved road drainage, in both the short and long term, would restore in-stream flows by preventing the accumulation of water draining directly into streams and having better infiltration.

Long-Term: In the long-term, in-stream flows would be maintained as Riparian Reserves continued to grow large conifers. The rate of growth of conifers would increase within the 315 acres of riparian thinning units.

Watershed Scale –

Short-Term and Long-Term: Maintaining and improving in-stream flows at the site level supports maintaining in-stream flows at the watershed scale, though these efforts would not be detectable at the watershed scale.

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

Site or Project Scale -

Short-Term: There would be no disturbance of floodplains or wetlands because no-harvest buffers would provide protection to these areas. Road drainage improvements would improve the timing, variability, and duration of floodplain inundation in the short term at the site scale.

Long-Term: Forests in Riparian Reserves would continue to mature and allow passive restoration of floodplain and wetland function. Previously compacted areas would continue to slowly recover, increasing infiltration during hydrologic events.

Watershed Scale –

Short-Term: The timing, variability, and duration of floodplain inundation would be maintained by minimizing disturbance within floodplains and wetlands. Road drainage improvements would improve the timing, variability, and duration of floodplain inundation at the site scale, but would have no detectable influence at the watershed scale.

Long-Term: Maturing forests in Riparian Reserves throughout the watershed supports passive restoration of floodplain and wetland function, but would have no detectable influence at the watershed scale.

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

Site or Project Scale -

Short-Term: Thinning would occur in roughly 20-40% of Riparian Reserves, depending on the Action Alternative. Untreated terrestrial habitat, including plant species diversity, in Riparian Reserves would be mostly unaffected by nearby thinning. In treated terrestrial portions of Riparian Reserves, thinning actions would reduce vertical and horizontal cover due to understory and overstory tree removal. Harvest would also damage some existing herbs and shrubs, some minor and shade tolerant trees, and may physically damage snags and down logs, and would compact some soils. Some treated areas may experience excessive shrub growth or introduction/spreading of non-native plants due to thinning. Many removed trees would likely die under the No Action Alternative (due to suppression mortality). Therefore, dominant and codominant tree species diversity would not be adversely affected. Because roughly 60-80 % of Riparian Reserves would not be treated, overall herb, shrub and tree species diversity would probably not be adversely affected in the Riparian Reserves as a whole.

Long Term: Thinned portions of Riparian Reserves would experience accelerated tree growth and crown development, and therefore the subsequent rate these stands would become late-seral habitat due to tree *size*. It is uncertain if increased tree growth would also accelerate development of late seral *structure* such as large side limbs, cavities, other deformities (when compared to the No Action Alternative). Canopy closure and microclimate conditions would generally recover 10-15 years after thinning.

Snags and down/in-stream logs: Over the next few decades, unthinned portions of Riparian Reserves would continue to recruit mostly smaller diameter snags and down/in-stream logs through density-induced mortality (as described for the No Action Alternative). In the thinned portions of Riparian Reserves , the amount of density-induced mortality recruitment of snags and down/in-stream logs over the next few decades would be greatly reduced compared to the No Action Alternative (because these trees would be removed by this project for wood products). However, thinning would accelerate growth rates of dominant trees and thereby accelerate the potential time when these areas could begin to provide large snag and down/in-stream log

recruitment by natural processes such as wind throw, breakage, and disease-induced mortality, etc. (as compared to the No Action Alternative).

Watershed Scale –
Due to the relatively small amount of watershed acres being treated by this project, all short and long-term effects (beneficial or detrimental) would be negligible at the entire watershed scale.

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

Site or Project Scale -
Short-Term:-Thinning would occur in roughly 20-40% of Riparian Reserves, depending on the Action Alternative. Untreated terrestrial habitat in Riparian Reserves would be mostly unaffected by nearby thinning. Associated plant and wildlife species would be generally be maintained in their current conditions. Within treated portions of Riparian Reserves, thinning would reduce vertical and horizontal cover due to understory and over story tree removal. Harvest would also damage existing herbs and shrubs, some minor and shade tolerant trees, may physically damage snags and down logs, and would compact some soils. Some treated areas may experience excessive shrub growth or introduction/spreading of non-native plants due to thinning. Many removed trees would likely die under the No Action Alternative (due to suppression mortality). Therefore, dominant and co-dominant tree species diversity would not be adversely affected. Approximately 60-80 % of Riparian Reserves would not be treated; therefore, overall herb, shrub and tree species diversity would probably not be adversely affected in the Riparian Reserves as a whole.

Long Term: In untreated portions of Riparian Reserves, herb and shrub layers would be unaffected. Dominant and co-dominant trees would continue to grow and differentiate at a rate slower than in treated Riparian Reserve areas. Thinned portions of Riparian Reserves would experience accelerated tree growth and crown development, and therefore the subsequent rate these stands would become late-seral habitat due to tree *size*. It is not possible to predict if increased tree growth would also accelerate development of late-seral *structure* such as large side limbs, cavities, other deformities (when compared to the No Action Alternative). Canopy closure and microclimate conditions would generally recover 10-15 years after thinning.

Wildlife Species in Terrestrial Riparian Habitat (within Riparian Reserves): Both species and habitat in untreated portions of Riparian Reserves would generally be unaffected. Dominant and co-dominant trees would continue to grow and differentiate at a rate slower than in treated Riparian Reserve areas.

Within treated portions of Riparian Reserves, species associated with riparian terrestrial habitats would experience some detrimental short term effects due to soil compaction; changes in, or destruction of, down log habitats; changes in herb and shrub layers; and changes in canopy closure and microhabitats. Some species may be injured or displaced by thinning (e.g. salamanders). However, no negative long term effects to species are expected due to nearby untreated areas in 60-80% of Riparian Reserves. Species habitats are expected to recover in 5-15 years as canopy closure and moist microclimates increase.

Wildlife Species in Aquatic Habitat: Species such as aquatic invertebrates, aquatic salamanders, red legged frogs, and harlequin ducks that are obligated to stream habitats would experience both beneficial and detrimental affected in various degrees by thinning. However, these species would benefit from all of the known/potential benefits described under ACS Objs. 1-8 above.

Watershed Scale –
Due to the relatively small amount of watershed acres being treated by this project, all short and long-term effects (beneficial or detrimental) would generally be insignificant at the entire watershed scale.

Alternative 3 – Minimize Permanent Road Density
This alternative would be similar to the ACS objectives described under Alternative 2 with the exception of fewer roads and stream crossings constructed and fewer acres thinned in upland and riparian areas. Therefore, all components of the ACS objectives would be maintained and some short disturbances would not occur as they would in Alternative 2.

Alternative 4 – No New Road Construction
This alternative would be similar to Alternative 3 with the exception of fewer roads and no stream crossings constructed and fewer acres thinned in upland and riparian areas. Therefore, all components of the ACS objectives would be maintained and some short disturbances would not occur as they would in Alternative 3.

4.4 Issue 4: What are the effects of the proposed commercial thinning and road actions on soil compaction and displacement?

4.4.1 Affected Environment
Field inspection during sale provided verification of the Lane County Soil Survey. Maps are provided in the Analysis file. All sections exhibit some level of impact to soil quality from past harvest, but the current extent of detrimental soil conditions (severe compaction, severe displacement, and/or active erosion) varies in response to different treatment history and soil sensitivity.

Solomon Ck. 33:
Overall, the Solomon units occupy low foothills along the margins of the Willamette Valley. The soils contained are moderately deep and well drained, silty clay loam and cobbly silty clay loam. Slopes are usually less than 50%, except for short steep pitches as much as 60 percent. The three small polygons in section 33 represent variable topography and soil types. Klickitat soils occupy the moderately steep side slope in the northeast portion of the section. The soils are moderately deep, 20 to 40 inches, and well drained, with a stony loam surface layer and cobbly clay loam subsoil.

Ritner soils occupy more gradual terrain, generally less than 30 percent slope, in the northeast portion. The topsoil is cobbly silty clay loam, the subsoil very cobbly silty clay loam over igneous bedrock at 20 to 40 inches.

Hazelair silty clay loam occupies the eastside of units 33D & west side of 33C. Hazelair soils are moderately deep and somewhat poorly drained. Permeability is very slow because subsoil clay content is as high as 70%. Hazelair soils exhibit high chroma mottles and generally reduced soil colors in the top fifteen inches of the soil surface which reflects the seasonal high water table. Because of this, this soil types is classified as “Fragile” under the Timber Productivity Capability Classification System (TPCC). These sites are perennially too moist to allow ground based logging systems.
Skid trails on Hazelair soils have disrupted surface flow and water storage characteristics in localized areas. Pieces slated for ground based systems in this section are probably at or above the 2% growth-loss standard as directed in the 1995 RMP (pg. 37).

Klickitat stony loam and Ritner cobbly silty clay loam are both classified as intermediate productivity and intermediate resiliency. These soils are both prone to compaction despite the high skeletal content. Units 33

A and B exhibit persistent deep compaction from past harvest activities on both Ritner and Klickitat sites with minimal vegetative recovery. A steep, deeply excavated skid road extends over 2,000 feet between Rd. 17-1-4.3 to Rd. 16-1-34. Unit 33D exhibits moderate to light compaction throughout on Nekia soils.

Solomon Ck. 7:
Nekia soils make up over 75% of this harvest area. This soil is classified as high productivity and high resiliency. Nekia soils are usually moist, and seasonal moisture draw down may not occur until late July. Ritner soils are a minor component, located in the northwest corner of the proposed unit. An existing excavated skid road provides access across slope in excess of 35% to the ridgetop site with Ritner soils.

Skid trail and cable corridors from past entries are evident, but field surveys indicate that current compaction is only light or moderate within skid trails and elsewhere. Excavation is minimal since slopes are consistently gentle.

Boulder Ck. 35**:**
Peavine soils occupy the greatest acreage in both Boulder Ck. units. These soils are moderately deep, 30 to 40 inches, and well drained, with silty clay loam topsoil over silty clay and clay subsoils. Peavine silty clay loam is classified as high productivity and high resiliency.

Though difficult to estimate, residual compaction of varied severity is probably about five percent of the total acres proposed for treatment in this unit (14 acres where soils exhibit platey structure greater than four inches deep, which is considered severe compaction and 2.5 acres with moderate compaction and 3 acres with light compaction).

Boulder Ck. 5:
The history of mass movement has produced broken topography with variable slopes. Short steep slopes in excess of 40% are intermingled with depressional pockets that contain deeper soils, with high water holding capacity. Peavine sites are available for ground based logging systems where slopes are less than 35 percent, provided the full suite of Design Features are applied to reduce the severity and spatial extent of compaction and displacement.

At present, at least 5% or 25 acres of the total acreage proposed for harvest show some level of soil quality reductions from past activities, primarily machine effects to soil properties and function. Aerial photos taken in 1969 show a dense network of travel ways that impact up to one-third of the soil surface. In 2002 the Mckenzie Resource Area decommissioned about 2.5 miles of the heavily used native surface roads.

Wild Jack 19:
Peavine silty clay loam is the dominant upland soil, occurring in the northwest portion of the section. The silty clay loam is the most widespread soil series in Lane County and is classified as a high productivity and a high resiliency soil. The deep (60 inches or more), moderately well drained soil usually occurs in depressional topography adjacent to streams and wetlands, or on old landslide topography that has benches and short steep slopes. These soils have a seasonal high water table at 2 to 3 feet as evidenced by mottles. Root growth tends to be horizontal due to the saturated subsoil which makes trees highly susceptible to windthrow.

Cumley soils are contained in the large piece in the northeast corner of the section. These sites are perennially too moist to permit ground based systems without compaction occurring and like Hazelair soils they are classified as “Fragile” under the TPCC system. These soils are only dry between 4 to 12 inches for less than 40 days during the summer months. These soils are also prone to slumping when road cuts are made in the steeper areas.

Historic use of ground based equipment on variable slopes, sometimes in excess of 45%, especially above Rd. 18-1E-19.1, produced deeply entrenched trails with no drainage outflows. These trails can act as intermittent streams during winter storm events, routing water than may lead to accelerated erosion and sediment transport. Existing compaction within sub-units proposed for ground base logging systems is estimated between 5 and 10 percent.

TPCC is a soil based classification system designed to identify sites that are incapable of sustained intensive timber production without loss of long term productivity potential. About five acres in the northwest corner of Wild Jack, sec. 19 are being proposed for withdrawal from the commercial timber base due to a high risk of instability. The topography is hummocky with short steep pitches, pockets of saturated soils, and common pistol butted trees of varied size. Vegetation consists of mature western red cedar, hemlock, true fir with ferns and herbaceous species that prefer moist sites.

Wild Jack 7**:**
Soils are varied, with Cumley series on the east side of the narrow ridge which contains stony Klickitat soils. Skid trails on Cumley soils have altered drainage patterns and water budget due to deep persistent compaction**.** Moderate compaction is common and evident east of the central ridge where sensitive Cumley soils occur. Some small wetlands have been enlarged, some reduced in size due to alteration of infiltration and water storage characteristics. Areal extent of residual compaction, including old compacted skid road/trails and within unit compaction, is estimated between two and five percent of total acres proposed.

Wild Jack 9:
This proposed unit is a complex of rotational slides. Klickitat soils occur on the upper third of the landform with slopes in excess of 45%. Bellpine soils occur on a gradual mid-slope bench with numerous wetlands (sag ponds). This moderately deep, well drained soil is on foothills and uplands adjacent to the Willamette valley. The surface texture is silty clay loam over a silty clay subsoil. Weathered tuffaceous sandstone is at a depth of 34 inches. Permeability is slow and the risk of erosion is high. Bellpine silty clay loam is classified as high productivity and high resiliency. Peavine soils occupy the north facing lower slopes along the south section line. Cumley soils occupy the depressional topography adjacent to streams in the northeast portion.

4.4.2 ENVIRONMENTAL EFFECTS

Alternative 1: No Action
No additional compaction or displacement would occur as a result of new activities. Residual compaction and excavation in certain areas would continue to impair water storage, natural rates of erosion and soil productivity.

Alternative 2: Maximum Acres Treated
The majority of the thinning proposed would occur on sites with high resiliency and intermediate resiliency soils. High resiliency soils can sustain substantial vegetative manipulation and still maintain nutrient capital, natural rates of erosion, and inherent physical and chemical properties. Intermediate resiliency soils may require mitigations and/or design features to reduce the potential for chronic erosion and possible loss of soil productivity.

Cable Yarding:
About 279 acres, or 27% of the total acres planned for harvest would be yarded with skyline systems. Direct effects of the cable yarding would be the displacement of surface soils and organic matter, and discontinuous

localized compaction, and erosion within yarding corridors. These effects are typically confined to a strip less than 12 feet wide. When topography permits, independent corridors spaced approximately 150 feet apart would be required. Under this design, the bare soil subject to compaction and erosion, would occupy approximately 3 to 5 % of the unit area. Compaction would be deeper and more continuous for areas harvested in the winter when soils are wet.

Cumley soils in Wild Jack 7 are recommended for dry season skyline because winter yarding on the high water table soil would produce deep persistent compaction and gouging within corridors leading to disruption of drainage patterns and water storage characteristics.

After operations, bare soil exposure, soil displacement, and compaction in corridors and associated landings would occupy about 5% of the skyline portions or approximately 14 acres within the project area. The severity and duration of these soil conditions depends on soil characteristics, topography, harvest methods, and implementation of effective mitigations. Full vegetative recovery in skyline corridors, with ground cover at 65% or more, is expected within five years for the high resiliency soils (Nekia, Peavine, Bellpine). Vegetative recovery on the coarse textured intermediate resiliency soils is expected in 10 to 20 years (Klickitat, Ritner).

Ground based Yarding:

In general, ground based yarding systems are planned on suitable soils where slopes are less than 35 percent; about 758 acres or approximately 73% of the 1040 acre project area. These systems have the potential for more extensive, deeper displacement of surface soils and more severe compaction than skyline systems because trails are wider and compaction extends deeper. Where organic matter and topsoils are displaced, long term site productivity is reduced. Areal extent and severity of compaction would vary considerably depending on the amount and distribution of surface litter and slash, soil texture and structure, percent of soil moisture, and the weight and function of the machinery employed by the operator. Utilizing existing skid trails would reduce new adverse effects and provides the opportunity to treat residual effects in some areas. However, studies have concluded that after six trips most soil textures will become compacted to the point that bulk density is increased and soil function is impaired (Steinfeld, D., 1997).

After harvest, about 12% of the ground based acres, or 91 acres would be occupied by skid trails and landings. To achieve the RMP standard of 2% residual compaction, skid trails would be decompacted with an excavator to restore infiltration and hasten vegetative recovery.

Anticipated compaction and associated growth loss effects in Boulder 5 may exceed those on typical Peavine sites elsewhere in the project area. The highly variable topography and soil drainage characteristics of the resident Peavine soils cause a narrow window for dry soils in many of the sub-units slated for ground based systems.

Mechanized Felling:

The mechanized cutter must travel off designated trails to every tree slated for removal. Depending on the soil type, this could result in soil compaction dispersed throughout the site rather than confined to designated skid trails. Project design features to mitigate these impacts would be implemented if this type of equipment were to be used, such as requiring that these machines travel over a layer of slash.

Road Construction:

Long term soil productivity would be irreversibly lost on about 16 acres of productive forest land throughout the project area, due to the proposed construction of approximately 4 miles of new rocked roads.

Proposed construction of native surface roads and associated landings for short term use would result in the loss of topsoil, on about 18 acres of productive forest land. Decompaction with an excavator modified for

tillage (full decommissioning) would improve infiltration and mitigate the potential for long term erosion. Root growth in the loosened soil would be better distributed and more vigorous, resulting in an accelerated improvement of soil structure and recovery back to a forested condition as compared to leaving untreated compacted surfaces. However, dependent on the depth of excavation, soil function and long term soil productivity may still be impaired for 50 to 100 years.

Also, compaction of skid trails and temporary roads on Klickitat and Ritner soils may not be effectively decompacted with standard tillage techniques due to the high coarse content, especially where fragments are cobles and stones.

Alternative 3: Minimize Permanent Road Construction

As compared to Alternative 2, fewer acres (665) would be harvested with ground based systems and skyline acreage would increase to 305 acres. Length of temporary road constructed would increase, with 5.0 miles slated for full decommissioning including decompaction with an excavator. Permanent rocked road mileage would be somewhat reduced as compared to Alternative 2, with a corresponding reduction in the number of acres where soil productivity would be lost for the long term.
Of this about 15 acres of ground base harvest in Boulder, sec. 5 would not be implemented (sub-unit 05i &05A), eliminating the need for one mile of native surface road. Minimizing new skid trails, road and landing locations within Riparian Reserves would reduce the extent of new compaction and loss of organic matter. Natural rates of water storage and erosion would remain intact.

Alternative 4: No Permanent Road Construction

Under this alternative approximately 114 prescribed for ground base harvest within Riparian Reserves would be eliminated. This alternative would eliminate direct impacts to soils, in the form of machine caused compaction and displacement.

Proposed spur SC07A in Solomon 7 would not be built under this alternative. The loss of topsoil over approximately 1.5 acres and subsequent localized productivity losses on those acres would not occur. However, a 2,000 foot long skid trail under this alternative would become necessary resulting in a compacted surface, which would require decompaction. Drainage design would still be necessary to curtail accelerated erosion that may result if water is routed down the tread.

Approximately 1 mile (est. 6 acres) of permanent rocked road would not be constructed in Boulder 5. Long term loss of site productivity on about 8 acres of forest soils would not occur.

4.5 Issue 5: What are the effects of the proposed commercial thinning and road actions on the spread of invasive species?

4.5.1 Affected Environment

Weeds are present in all the units in varying amounts, probably due to past disturbance history, proximity of human habitation and current road use. Open roads are located throughout the project are and vehicles are the most common vector for the spread of weeds. Residual impacts from past management practices, such as bare ground or areas of open canopy, may further facilitate the spread of weeds from roadsides into the forest.

Specific weeds present within the project area are Scotch broom (Cytisus scoparius), false brome (Brachypodium sylvaticum), herb Robert (Geranium robertianum), shining geranium (Geranium lucidum), Blackberries (Rubus armeniacus, R. laciniatus, R. vestitus), and English ivy (Hedera helix). These weeds spread

quickly and can dominant forest understories. Also present are holly (Ilex aquifolium), St. Johnswort (Hypericum perforatum), thistles (Cirsium arvense, C. vulgare) foxglove (Digitalis purpurea), sweetpea (Lathyrus latifolis), tqansy Senecio sylvaticus) and ox-eyed daisy (Leucanthemum vulgare) are present along the roads. These species tend to grow along the roads and in forest openings and rarely dominant the forest understory.

4.5.2 ENVIRONMENTAL CONSEQUENCES

Alternative 1: No Action

Currently open roads would continue to act as a vector with weed populations already present within the project area. New weed populations may also be introduced along these vectors. Because no harvest activities would occur, it would remain difficult for non-shade tolerant species to spread into areas devoid of new disturbance. However, some species such as Shining geranium and herb Robert spread quickly even without disturbance to move them around.

Alternative 2: Maximum Acres Treated

Noxious and invasive non-native species populations would be expected to increase with disturbance due to new areas of open ground and increased roading activity during project implementation. Once introduced, false brome, herb Robert, shining geranium are known to spread quickly throughout a stand. They spread is not limited by shade and will spread into closed canopy stands. These species quickly occupy large areas of forest, crowding out native forbs and grasses.

Holly can also survive in the forest, but rarely sets seed in the understory with most new plants coming from seed spread by birds.

The spread of Scotch broom, St. Johnswort, tansy and Canada thistle is limited by light, typically, these species spread along roads and skid trails, so the less road construction and ground based logging, the less the spread of these species.

Boulder Creek section 5 has an infestation of shining geranium, herb Robert, English ivy and holly. These infestations are small at this time and could be controlled manually. Removing them could limit the spread of these weeds in this road system and watershed. Roads are a major vector for the spread of weeds.

Use of project designs features vehicle washing, pretreatment especially along roads, use of “Early Detection, Rapid Response” techniques to treat small infestations before they become widespread, use of weed free gravel, working from least to most infested areas, and sowing native seed on disturbed ground, can reduce the spread of weeds

This alternative disturbs the most ground and is the highest risk for the introductions and spread of weeds along roads and in to the forest

Alternative 3: Minimize Permanent Road Construction

Overall, effects would be similar to those in Alternative 2. However, reducing road density helps to reduce risk of weeds spread because vehicles (and roads) are widely recognized as major vectors for the spread of noxious weeds.

Alternative 4: No Permanent Road Construction

Overall, effects would be similar to those in Alternatives 2 and 3. Limiting ground disturbance in riparian

reserves would have the side benefit of reducing the risk of the spread of weeds into riparian reserves. Logging machinery can spread weeds from existing infestations in the stands and roadsides in to new areas of the stand. The moist conditions of riparian reserves are conducive to the spread of weeds. Weed seeds can germinate and establish at any time of year. Blackberries, shining geranium and herb Robert can quickly take over riparian areas, outcompeting native plants and reducing the amount and diversity of native plants.

4.6 Issue 6: What are the effects of the proposed commercial thinning and road actions on T&E, Special Status Species, and their habitats?

4.6.1 Affected Environment

Special Habitats - Coarse Woody Debris and Snags:
Coarse woody debris (CWD) is a general term for down logs and braches, stumps, rootwads, and bark piles that are an important habitat feature for many wildlife species, including Special Status species analyzed in this EA. CWD provides forage and breeding sites, travel corridors for species with low mobility and small home ranges (*e.g.* invertebrates, small mammals, and amphibians) and refugia. Additionally, CWD provides important basic ecological function like moisture retention, nutrient cycling, and microclimate buffering.

In the project area, down logs are the most prominent and important CWD habitat. Data were collected on their type and amount during stand exams. These data show down logs, distributed across a variety of diameters and decay classes, being generally more abundant and well distributed in Riparian Reserves and irregularly distributed in lower concentrations in Matrix upland areas (Table 17 Appendix C). The total amount of down logs across all decay classes of at least 8 inches in diameter, range from 728 – 1495 linear feet per acre for an average of 1057 linear feet. Most down logs in the project area are small diameter (8”-15”) and low decay class from either recent suppression mortality or large diameter (>20”) and high decay class from recruitment and/or residue from the previous stand or harvest. Most recent stand recruitment of down logs since the last major disturbance (logging) has been of smaller 8-19 inch diameter pieces.

Large, moderately decayed down logs (diameter $\geq$ 20 inches in decay class 3-4) are generally the most important to associated wildlife species and represent habitat that is currently available. Proposed harvest units contain an average of 345 linear feet per acre of down logs of this size and decay class, with values ranging from 131 in Solomon Creek section 7 to 488 in Wild Jack section 9. These logs are mostly present as remnants from the last major disturbance event which was logging.

Large down logs with little decay (decay class 1-2) are currently less useful to wildlife species but do represent future habitat once they have sufficiently decayed. Proposed harvest units contain an average of only 18 linear feet per acre of down logs of this size and decay class. This habitat is absent in all units except Boulder Creek section 5 and Wild Jack section which have 19 and 104 linear feet/acre of these logs respectively. The low amounts of these types of down logs are due to the current stand age and that they were mostly removed during previous harvest. Unmanaged stands of similar age and forest type in western Oregon have, on average, 383 lf/ac of decay class 1-2 CWD with 20”+ DBH (USDI 2002), far more than the proposed units.

The average amount of snags in all decay classes at least 8 inches in diameter are extremely low in the project area (0.6/acre). Stand exam data show 1.3 and 1.9 snags per acre of 8-11 inches in diameter in decay class 1 in Boulder Creek 5 and Solomon 33 respectively; no snags of any type were detected in the other proposed harvest areas. Snags of this diameter of do not provide most of life history needs for snag associated species due to their small size and relatively short life until they decay and fall.

Large well decayed snags (diameter ≥ 20 inches in decay class 3-4) that are the most important as *current* habitat for wildlife species, are entirely absent from proposed harvest areas because they were removed by previous logging. Potential future snag habitats in large or medium sized snags with little decay (diameter > 16 or 20 inches in decay class 1-2) are also entirely absent from proposed harvest areas.

Special Habitats - Ponds:
Several small ponds, some greater than one acre in size, exist within the project area. Depending on seasonal water depths, local microclimate, and solar exposure, some of these are suitable breeding and rearing areas for red legged frogs and/or northwestern salamanders. None are suitable for western pond turtles. Through normal design features, all wetlands would receive no harvest buffers (25-200 feet) commensurate with their size and avoiding adverse affects to water quality. These habitats and any species associate with them are not expected to be negatively impacted by project actions and are not discussed further in this EA.

Special Status Species:
Special Status wildlife species, migratory birds, and habitat features that may be impacted by the proposed Alternatives are discussed below. Species eliminated from consideration due to no potential impacts or no discernable differences in impacts between alternatives are listed in Tables 19 -20 in Appendix C.

Special Status Species - Northern Spotted Owl (Threatened):
Suitable habitat (aka nesting habitat) for spotted owls provides for all of the species' life history requirements, and is also called Nesting/Roosting/Foraging (NRF) habitat. In the project area it is generally described as conifer forest greater than 80 years old with at least 60-70% canopy cover and mature or late-seral characteristics such large-diameter trees with nesting structure (broken tops, cavities, or platforms), large side limbs, multiple canopy layers, large down logs and snags, and a somewhat open understory. Stands that show some of these characteristics, except nesting structure, and provide roosting and hunting opportunities, are called foraging habitat. Forage habitat is usually seen in conifer dominated stands at least 40-60 years old. Stands without nesting, roosting, and foraging components (i.e, not nesting or foraging habitat) but with sufficient canopy cover and sub-canopy space for spotted owl movement and short-term roosting are referred to as dispersal habitat. These stands are used to facilitate owl movement at both the site and landscape scale, including juvenile dispersal, and may also provide minimal foraging opportunities if the habitat supports prey species. Dispersal (only) habitat is generally found in stands 40 to 80 years old.

Proposed harvest units are not in or near critical habitat designated in 1992 or 2008.

Habitat in Proposed Harvest Areas: Generally, the proposed units show relatively small tree size, simple structure, high tree density, mostly uniform age distribution, restricted sub-canopy flying room, and no snags. As a result, proposed harvest areas are characterized as dispersal habitat. Roughly half of these areas (especially in Riparian Reserves) are also functioning as moderate to low quality forage habitat due to slightly lower tree densities, slightly larger tree size, and some adequate sub-canopy flying space and down wood.

Overall, proposed harvest areas lack nesting structure due to their size, density, and lack of mature-late-seral characteristics (e.g., large side-limbs, cavities and other deformities). Occasional single large trees, or patches less than one acre ,with potential nesting size and structure are present in harvest areas but they are not expected to provide nesting habitat because their crowns are above, and discontinuous with, the main stand canopy and any potential nesting structure is unfavorably exposed. These trees would be reserved from harvest.

Adjacent or Nearby Habitat): Little to no suitable nesting habitat exists on nearby non-federal lands. Most non-federal land habitat is under 50 years old and predominantly functions as dispersal and/or lower quality forage habitat. This habitat is likely to be harvested soon due to harvest rotation intervals on these lands.

Adjacent BLM lands near Boulder Creek 35 and Wild Jack 7 and 19 proposed harvest areas have suitable habitat. These habitats are associated with nearby known sites and are considered in their analysis.

Surveys and Site Histories for Nearby Known Sites: Known sites have been identified through surveys beginning on the district in the 1970s (see Table 18 in Appendix C). Three known sites, Osborn Knob, Hills Camp, and Cedar Wallace Creek, exist within 0.05 – 1.1 mile of proposed harvest areas and will be analyzed in this EA. All sites are considered active based on survey data and/or sufficient habitat to support a resident pair. All spotted owl sites in the project are thought to have been identified, but surveys have been sporadic in amount and area surveyed from year to year and new sites or site center locations may exist due to changes in habitat, particular owl behavior, or influence from barred owls. Within the last decade, spotted owls have been detected in or within 0.25 mile of all harvest units except Solomon Creek and Boulder Creek 5. These detections were all attributed to the nearby known sites analyzed in this EA.

Spotted Owl Site-Specific Habitat within the Provincial Home Range, Core Area and Nest Patch: The USFWS has established three generalized areas surrounding site centers to be used as consistent metrics to analyze habitat quality and amount at a site and any corresponding effects to pair occupation and reproductive capability. These areas are:

1) Nest Patch (NP) - 300m/0.19 mile radius circle, 70 acres),
2) Core Area (CA) - 0.5 mile radius circle, 503 ac.), and
3) Provincial Home Range (PHR) - 1.2 miles radius circle, 2895 ac. in the Western Cascades physiographic province in the Willamette planning province.

Consistent with spotted owl biology and established consultation standards, the quality, amount, and orientation of habitat in the three areas above, in combination with survey data, are all analyzed to determine the existing and post-harvest habitat conditions at nearby owl sites and any resulting effects to site occupation or reproductive capability. All known sites within 1.2 miles of proposed harvest areas are analyzed in this EA.

Table 18 in Appendix C depicts the current and post-harvest conditions, including acres modified by harvest for Alternative 2, in the Core Area and Provincial Home Range areas around the three nearby spotted owl sites. Harvest actions would not occur within site Nest Patch areas. . Slight differences in habitat modified by each Action Alternative are discussed in the Environmental Effects section.

Generally, spotted owl sites are considered "at risk" for pair occupation and reproduction when the amount of suitable habitat falls below 40% (1158 ac.) in the PHR and below 50% (252 ac.) in the Core Area. To some extent, forage habitat can sometimes fulfill *some* of the life history needs normally provided by suitable habitat (i.e., forage habitat requisite for successful reproduction). However, all sites affected by project actions are in "at risk" condition (i.e, reduced chance) for occupation and reproduction, even when forage habitat is analyzed as "the functional equivalent" of suitable habitat at sites.

Special Status Species - Bald Eagle (BLM Sensitive):

Nesting and Winter Roosting Habitat: Suitable nesting habitat for bald eagles in the area is usually located within roughly 1.5 miles of large aquatic forage resources found in a lake, river, or major tributary. Nest trees

are usually located in large trees with late seral characteristics such as well developed crowns and large side limbs. Stand conditions around a nest can vary but are typically mature to late seral stands with sufficient area to "buffer" nest trees from environmental conditions, human disturbance, and provide some nearby perching and roosting areas for adults and juveniles. Winter roost areas provide communal winter roosting for large groups of adults and subadults from late fall through spring. This habitat is usually found in larger area stands (i.e., 100 or more acres) with mature to late seral characteristics near a stable aquatic (e.g., river or reservoir) or terrestrial forage resource (e.g., sheep rearing areas). Younger mid-seral stands may also be used for winter roosting.

No known winter roost areas are located in or near the project area. One known nesting pair exists near the project area. This pair apparently uses two alternating nest location located roughly 1.2 and 1.7 miles from the Boulder Creek units. These nest locations would not be affected by harvest actions (habitat modification or disturbance to nesting).

Suitable nesting habitat in proposed harvest areas is limited to the infrequent large remnant tree, which would be reserved by project design features. These trees would likely not be used for nesting because there is already a pair nesting near the project area and nests of different pairs are usually not located this close to each other (i.e., within 2 miles). Generally, proposed harvest areas do not contain potential nesting habitat due to their small size, younger age, and general lack of mature-late-seral structure such as large side limbs. Winter roosting is possible in the Boulder Creek 35 harvest area. However, the quality of habitat is low and since winter roosting areas are generally conspicuous, it is reasonable to assume eagles are not currently using this habitat for winter roosting.

Bald Eagle Habitat Areas: Bald Eagle Habitat Areas (BEHAs) are a BLM Eugene District designated RMP reserve land allocation located primarily near larger rivers and reservoirs. They were designated to manage both current and future habitat for bald eagle nesting and winter roosting. Management considerations for BEHAs have been developed based on general bald eagle biology, Recovery Plan objectives and the McKenzie Resource Area Bald Eagle Habitat Management Plan citation) The fundamental management considerations for BEHAs are to maintain and develop mature to late seral habitats that are not subject to noise or line-of-sight disturbance from humans. Managing for human disturbance includes minimizing permanent road locations within 0.25 mile or more (depending on local topography) of BEHAs. Other types of actions that could disturb nesting are also discouraged (e.g. quarry blasting within one mile). Road management objectives include not creating new permanent roads, blocking or fully removing existing roads, and generally minimizing opportunities for human access and disturbance. Boulder Creek 35 is less than 0.1 mile from a BEHA.

Special Status Species - Migratory Birds:
Analysis in this EA includes only species found on the "Birds of Conservation Concern" and "Game Birds Below Desired Condition" lists developed by the USFWS in 2008 that could occur in the project area based on habitat and/or past survey data. For species that could be present in or near the project area, three of these species (bald eagle, harlequin duck, and northern goshawk,) are also BLM Sensitive Special Status Species and are addressed above. For six other species (black swift, mourning dove, rufous hummingbird, willow flycatcher, purple finch and wood duck), individuals or their habitat would not be affected by the proposed action because their habitats are not present or Riparian Reserve no-harvest buffers would fully maintain their habitat with little/no affects to the breeding behavior of individuals. The remaining four species (band-tailed pigeon, purple finch, northern goshawk and olive-sided flycatcher) that could be affected by the proposed modification of mid-seral habitat are discussed below.

Northern Goshawk (Raptor, Migratory Bird and Bird of Conservation Concern):
Northern goshawks prefer to nest in mature to late seral stands with late seral characteristics such as larger trees with large side limbs, multistory canopies, large down logs and snags, low amounts of brush and a relatively open understory (flying room). Nests are usually built on mistletoe, large brances, or on whorls near the boles of younger trees with smaller branches. Most nests located on the Eugene District have been in lower quality mid-seral stands as young as 50 years old that have only some of the preferred late seral characteristics. However, the local significance of such stands, especially their likelihood of facilitating repeated successful reproduction, is unknown. Goshawks forage in nesting stands as well as younger mid-seral stands with ample flying room and lower amounts of brush.

No known nests are present in or near the project area. Two historic detections in the 1990s occurred in older stands adjacent to harvest areas.

Although characterization of nesting habitat in younger stands in the watershed is difficult and uncertain, roughly half of proposed harvest areas are considered to be very low quality suitable nesting habitat (generally stands characterized as forage habitat for spotted owls) based solely on minimally sufficient flying room. The quality is considered low to small tree size, high stem densities, relatively simple tree architecture, and general lack of late seral characteristics (e.g., large limbs).

Band-tailed Pigeon (Migratory Bird and Bird of Conservation Concern):
The band-tailed pigeon is a fruit- and seed-eating bird that is widely distributed across North and South America. Nesting in Oregon is generally in mature, closed canopy conifer stands, while more open forest stands and agricultural lands are used for foraging. Band-tailed pigeons travel widely in search of food, giving the species a nomadic nature. Mineral springs and deposits are also thought to be key habitat features. Conifer habitat for the species is generally present throughout all proposed harvest areas.

Olive-sided Flycatcher (Migratory Bird and Bird of Conservation Concern):
The olive-sided flycatcher is an aerial insectivore associated with edge habitats between mature and early-seral stands, and large openings in late-seral habitat. It uses tall trees and snags for singing and foraging perches. Habitat is for the species is present at the edges of proposed harvest areas adjacent to early seral stands; predominantly where proposed harvest units are adjacent to private timber lands.

Purple Finch (Migratory Bird and Bird of Conservation Concern):
Purple finches are widely distributed, breeding in the Pacific states, the northeastern US, and Canada. The species typically uses early- to mid-seral coniferous habitat, but may also be found in agricultural and suburban settings. Purple finches' main diet is seeds, supplemented by fruit and insects. Competition with the house finch is thought to be reducing purple finch numbers.

4.6.2 ENVIRONMENTAL EFFECTS

ALTERNATIVE 1: NO ACTION

Special Habitats - Coarse Woody Debris and Snags:
Effects to CWD and snags are discussed for the time period of the next 30-50 years which coincides with the time when stands would enter early mature-seral stage and also could be regeneration harvested under the RMP.

Existing down logs and snags would not be physically degraded or removed, nor would their quality or function change due to alteration of surrounding microclimate. Untreated stands would continue to recruit small to medium-sized down logs and snags (≤ 16 inch diameters), primarily through suppression (density-induced) mortality. Although the recruited quantity would be higher than in treated stands, diameters would be smaller than in treated stands where tree growth was accelerated by thinning. Existing large-diameter down logs and snags would continue to decay and disappear from the stand. Recruitment of new large down logs and snags would not occur for many additional decades until natural processes create the necessary growing space for the development of large-diameter trees. The Action Alternatives' benefit of down log and snag creation from 14-19 inch diameter trees would not occur under this Alternative.

Special Status Species - Northern Spotted Owl (Threatened):
No direct or indirect effects to spotted owls or their habitat would occur under this Alternative. Stands would not be modified and no potential for noise disturbance would exist. The area would continue to provide for spotted owl use at current levels, and habitat development would continue along current trajectories. However, attainment of suitable nesting characteristic (i.e., larger trees) in thinned Matrix and Riparian Reserve lands would occur at a slower rate compared to the Action Alternatives.

Effects to Site-Specific Nest Patch, Core Area and Provincial Home Range Habitat and Effects to Nesting due to Disturbance (See Table 18 in Appendix C for existing and treated acres discussed below): For Cedar Wallace Creek and Hills Creek sites, there would be no meaningful difference in effects to site habitat and the potential for pair occupation or reproduction between the No Action and Action Alternatives.

For Osborn Knob, the site would not experience the adverse affects of degrading dispersal/forage habitat for 10-20 years after thinning. However, the site would not experience any eventual benefits to site habitat in Riparian Reserves.

Special Status Species - Bald Eagle (BLM Sensitive):
There would be no effects to BEHAs, bald eagles, or their habitat under this alternative.

Migratory Birds - Northern Goshawk, Band-tailed Pigeon, Olive-sided Flycatcher, Purple Finch:
There would be affect to species or their habitats. However, potential benefits of accelerated conifer growth in Riparian Reserves would not be realized under this alternative.

ALTERNATIVE 2: MAXIMUM ACRES TREATED

Special Habitats - Coarse Woody Debris and Snags:
Project Design Features would facilitate the effort to retain most existing CWD and snags in proposed units. However, harvest operations would damage some down logs (particularly those in decay class 4-5), and some snags could felled for safety reasons or be inadvertently knocked over. Conversely, reserved trees would be protected by project design features, but some snags could be created from these trees due to inadvertent felling and yarding damage. Changes in stand microclimate due to overstory removal could also adversely affect CWD and snag function and quality until stand canopy conditions recover in 5-15 years (e.g., down log moisture drops, surrounding stand microclimate becomes too dry for some amphibians).

Thinning in Matrix and Riparian Reserve lands would accelerate the growth rate of live trees. This could result in an acceleration of the rate large down wood or snags (from large live trees) could be available for recruitment as compared to the No Action Alternative. Such recruitment would not occur until stands are fully in the mature or even late-seral stages. Therefore, this recruitment benefit would only be realized in Riparian Reserves and not in Matrix uplands due to roughly 80 year regeneration harvest rotations on these lands. Existing large-diameter down logs and snags would continue to decay and disappear from the stand and result

in a shortage of these habitats for several decades. This shortage of snags and down logs would be due to both: 1) natural processes such as stem exclusion in mid-seral stands and the beginning of greater recruitment towards the end of mature-seral stage many decades layer; and 2) wood product extraction from harvest actions that would remove trees most likely to be recruited by the stand for down logs and snags.

Down log and snag creation would occur in treated portions of Riparian Reserves only (all harvest areas except for Wild Jack units19b and 19c). This would ameliorate some of the current and future shortage of these habitats. However, diameters of treated live trees would mostly be 14-19 inch and the total amount of these features created would fulfill only part of this shortage.

Special Status Species - Northern Spotted Owl:

Direct and Short Term Effects: No nesting habitat would be removed or adversely affected by project actions. Depending on which Action Alternative, roughly 440-740 acres of Matrix land (65-75% of treated areas) and 160-320 acres of Riparian Reserve land (25-35% of treated areas) would be thinned and result in effects to spotted owl dispersal-only and dispersal-forage habitats due to degrading the quality and/or function of these habitats. Post-harvest canopy coverage is expected to be roughly 40-50%.

Treatments would reduce vertical and horizontal cover due to understory and overstory tree removal, with varying levels of residual tree density and size. Harvest would also damage existing shrub and herb layers, and may also damage or destroy some coarse woody debris and snags. A moderate and diverse shrub layer is favorable to spotted owls for foraging. However, some areas may experience exaggerated or excessive shrub growth after treatment which can actually impede foraging. Spotted owls would theoretically continue to utilize all treated areas as dispersal-only habitat because canopy cover would remain greater than 40%. Roughly half of treated stands are currently dispersal-forage habitat. These treated stands would generally not function as forage habitat until stand canopy and understory tree growth recovers in 10-20 years.

All harvest area sections would retain some untreated Matrix and Riparian Reserve lands which would continue to provide dispersal/forage habitat while treated stands recover.

Adverse effects to nesting behavior due to noise from project actions would likely not occur because: where nesting could occur close enough to project actions to be disturbed (near Wild Jack 9 and Boulder Creek 35) there would be seasonal operating restrictions on habitat removal and noise-disturbing actions from March 1 to July 15.

Indirect and Long Term Effects: Overall, thinning would accelerate tree growth and crown development and therefore the subsequent rate treated stands would become nesting or higher quality forage habitat compared to the No Action Alternative. The roughly 160-300 acres of treated Riparian Reserves would experience this benefit and would be available to spotted owls as improved habitat. However, the roughly 440 – 720 acres of treated Matrix lands (65-75% of treated areas by Alternative) would likely not realize this improvement and or availability to spotted owls as improved habitat because these stands could be regeneration-harvested in as little as 30-50 years. Therefore, at the project level and within Matrix lands, it is likely that the proposed action would contribute little to the long-term conservation needs of the spotted owl.

Cumulative Effects: The amount, location, and timing of reasonably foreseeable actions that could occur on BLM lands in the watersheds are not known at this time. BLM actions would likely be thinning harvest of similar habitats and/or regeneration harvest of mature-late seral stands. Non-federal lands in the watershed mostly provide some short term dispersal or low quality forage habitat because most of these lands are young-mid seral age stands with low amounts of down logs, snags and late-seral characteristics. Habitats on non-

federal lands are generally not expected to improve within all temporal and spatial scales.

Effects determinations under ESA consultation are described in Section 5.0.

Effects to Site-Specific Nest Patch, Core Area and Provincial Home Range Habitat and Effects to Nesting due to Disturbance (See Table 18 in Appendix C for existing and treated acres): For all Action Alternatives, as described above, "degrading of habitat" due to thinning means that the quality of dispersal-only habitat and the function of dispersal-forage habitat would both be reduced to the lowest quality dispersal-only habitat (i.e., little/no forage qualities). This would persist until treated stands begin to recover in 10-20 years. Nest Patch habitat at any site would not be affected by the Action Alternatives.

For Cedar Wallace Creek, thinning would not degrade any acres in the Core Area, but would degrade roughly 22 acres (3% of existing habitat) in the outer edges of the PHR of this site.

For Hills Creek, thinning would not degrade any acres in the Core Area, but would degrade roughly 11 acres (1% of existing habitat) in the outer edges of the PHR of this site

Due to the low amount of habitat affected and its location, no adverse effects are expected to the site habitats or the ability of these sites to provide for pair occupation and reproduction.

For Osborn Knob, this site has two site centers 0.75 mile apart that represent different known pair activity centers for the site. These are depicted in Table 18 in Appendix C as IDNOs 1939O (original nest location) and 1939A (subsequent alternate nest location). Thinning would degrade no acres in the IDNO 19390 Core Area and 83 acres (19% of existing habitat) in the PHR. In IDNO 1939A, thinning would degrade 37 acres in the Core Area (25% of existing habitat) and 148 acres (23% of existing habitat) in the PHR.

Overall, the site would experience adverse effects to pair occupation or reproduction because:

1) Even before any harvest would occur, both IDNOs are "at risk" for successful pair occupation and reproduction due to low amounts of habitat in their Core Areas and PHRs; and
2) Because harvest areas in Boulder Creek 35 are very close to, and contiguous with, the 1939A location, they probably represent forage habitat that is important to successful reproduction at the site (i.e., foraging habitat for adults, rearing areas for young).

Additionally, on nearby private forest lands, several clear cut harvests have occurred recently and more are likely in the next few years. Overall, private lands are expected to provide little/no habitat for this site.

Special Status Species - Bald Eagle (BLM Sensitive):

Effects to Nests, Nesting Behavior, or Winter Roosting Areas: No known nests or winter roosting areas would be modified or disturbed by project actions. Nesting surveys would continue for the resident pair known nests near Boulder Creek 35. Should the pair in the area move their nest to a location that would be affected by project actions, project design and/or timing would be revised to avoid adverse effects to nesting habitat or behavior (habitat modification or noise and line-of-sight disturbance).

Effects to the Nearby Bald Eagle Habitat Area (BEHA) due to Roads: Under this alternative, Spur BC35D would be constructed through the entire length of unit 35A going from east to west for a length of roughly 1 mile. Most of this road and Spurs BC35B and BC35C would be located within 0.3 mile of the nearby BEHA. Except for permanently rocked portions near streams, this road, and Spurs BC35B and BC35C would be native surface and fully decommissioned by tilling after harvest. This would essentially return the area to pre-harvest conditions

relative to the potential for human noise or line-of-sight disturbance to the BEHA. Therefore this alternative would be compatible with management objectives for BEHAs and the *McKenzie Resource Area Bald Eagle Habitat Management Plan* (BLM 1998) specifically, and would likely not result in negative effects to eagle using the BEHA for nesting or winter roosting.

Migratory Birds - Northern Goshawk, Band-tailed Pigeon, Olive-sided Flycatcher, Purple Finch:
Proposed thinning harvest could have direct and indirect effects on these migratory birds and their habitats. Nests could be removed by project actions and adverse effects to nesting behavior could occur during felling and yarding actions. Spotted owl seasonal operating restrictions in Wild Jack 9 and Boulder Creek 35 would reduce many potential impacts to breeding behavior. Partial removal of overstory trees would reduce canopy cover and volume, and operations would remove or damage understory vegetation, snags and down logs, and some large remnant trees. This would reduce nesting and foraging opportunities for these species in the short term, particularly the olive-sided flycatcher and purple finch. Goshawk habitat is expected to recover quickly (in 5-15 years) and be improved due to increased sub-canopy flying room. Thinning would also stimulate growth in residual trees, understory trees, shrubs, and herbaceous vegetation over the course of several decades. These effects would benefit these and other migratory bird species that use or prefer mature and late-seral habitat. However, these effects would mostly only be realized in Riparian Reserves, due to roughly 80 year regeneration harvest rotation ages on Matrix uplands.

Cumulative Effects to Special Status Species and Migratory Birds: The amount, location, and timing of reasonably foreseeable actions that could occur on BLM lands in the watersheds are not known at this time. BLM actions would likely be thinning harvest of similar habitats and/or regeneration harvest of mature-late seral stands. For most species, cumulative landscape level effects are not known due to lack of specific information on individuals or local habitats (e.g., down logs and snags) as well as specific project locations. Non-federal lands in the watershed provide some short term low quality habitat for goshawks, olive-sided flycatcher, and purple finch, but little high quality or ongoing habitat for these or other non-T&E Special Status Species because most of these lands are young-mid seral age stands with very low amounts of down logs, snags and late-seral characteristics. These non-federal lands are often sinks, or barriers to landscape movements for slugs and salamanders. Habitats on non-federal lands are generally not expected to improve within all temporal and spatial scales.

ALTERNATIVE 3: MINIMIZE PERMANENT ROAD CONSTRUCTION

Special Habitats - Coarse Woody Debris and Snags:
Effects under this alternative would be similar to those effects discussed under Alternative 2.

Special Status Species - Northern Spotted Owl (Threatened):
Effects to general habitat characteristics would be similar to those effects discussed under Alternative 2.

Effects to Site-Specific Nest Patch, Core Area and Provincial Home Range Habitat and Effects to Nesting due to Disturbance (See Table 18 in Appendix C for existing and treated acres): For Cedar Wallace Creek and Hills Creek, the type and amount of habitat affected, and all effects to the sites, would the same as under Alternative 2.

For Osborn Knob, effects would be nearly the same as under Alternative 2, except that roughly 5 fewer acres would be treated in the outer edge of the Provincial Home Range. Harvest within the Core Area would be the same as Alternative 2.

Special Status Species - Bald Eagle (BLM Sensitive):
Under this alternative, Spurs BC35B and BC35C would be located within 0.3 mile of the nearby BEHA. Spur BC35D would enter unit 35A from the east and travel roughly 0.35 mile towards and into the unit. The entire length of this road is within 0.25 mile of the nearby BEHA. This road would be fully decommissioned by tilling after harvest. Roughly 0.4 mile of private road connecting to Spur BC35D from the east would be reopened. It is currently tank-trapped near its end. Most of this road is within 0.25 mile of the BEHA and all portions are close enough to the BEHA to be a concern as a vector for human noise or line-of-sight disturbance to future eagle behavior in the BEHA. At the least, this road would end at its current pre-harvest location (where spur BC35D begins) and continue to be blocked by a gate on the main road it connects to. Fully decommissioning the newly constructed spurs BC35B,C and D on BLM land and not increasing public access options on the connecting private road would return the area to existing pre-harvest conditions relative to the potential for human noise or line-of-sight disturbance to the BEHA. Therefore this alternative would be compatible with management objectives for BEHAs and the *McKenzie Resource Area Bald Eagle Habitat Management Plan* (BLM 1998) specifically, and would likely not result in negative effects to eagle using the BEHA for nesting or winter roosting.

Migratory Birds - Northern Goshawk, Band-tailed Pigeon, Olive-sided Flycatcher, Purple Finch:
Effects to migratory birds would be similar to those effects discussed under Alternative 2.

ALTERNATIVE 4: NO PERMANENT ROAD CONSTRUCTION

Special Habitats - Coarse Woody Debris and Snags:
Effects under this alternative would be similar to those effects discussed under Alternative 2.

Special Status Species - Northern Spotted Owl (Threatened):
Effects to general habitat characteristics would be similar to those effects discussed under Alternative 2.

*Effects to Site-Specific Nest Patch, Core Area and Provincial Home Range Habitat and Effects to Nesting due to Disturbance (See Table 18 in Appendix **C** for existing and treated acres):* For Cedar Wallace Creek, effects would be nearly the same as under to Alternative 2, except that roughly 12 fewer acres would be treated in the outer edge of the Provincial Home Range.

At the Hills Creek site the type and amount of habitat affected, and effects to the site, would the same as under Alternative 2.

For Osborn Knob, compared to Alternative 2, roughly 75 fewer acres would be treated: 60 acres in the PHR, and 15 acres in the Core Area. Overall, the site would still experience adverse effects, including a may affect, likely to adversely affect determination under ESA consultation. However, the negative impacts to site occupation and reproduction would be less than under the other Action Alternatives.

Special Status Species - Bald Eagle (BLM Sensitive):
In general, effects to known nests or winter roosting areas would be similar the same to those discussed under Alternative 2.

Spur BC35D would not be constructed under this Alternative because unit 35A would not be harvested. Spurs BC35B and BC35C are within 0.3 mile of the nearby BEHA. This would essentially return the area to pre-harvest conditions relative to the potential for human noise or line-of-sight disturbance to the BEHA. Therefore this

alternative would be compatible with management objectives for BEHAs and the *McKenzie Resource Area Bald Eagle Habitat Management Plan* (BLM 1998) specifically, and would likely not result in negative effects to eagle using the BEHA for nesting or winter roosting.

Migratory Birds - Northern Goshawk, Band-tailed Pigeon, Olive-sided Flycatcher, Purple Finch:
Effects to migratory birds would be similar to those effects discussed under Alternative 2.

4.7 Issue 7: What are the effects of Logging Systems on the cost of yarding, road construction, maintenance and renovation?

4.7.1 Affected Environment and Methodology

For this analysis, data includes estimated standing volume and proposed harvest volumes for each proposed timber sale. The harvest stand map was prepared with ArcMap to compute the stand area to evaluate Alternative Net Volume Harvest estimates by stand.

The following factors were used in the analysis:

- The Pond Values of Douglas fir logs of $400/MBF was used to complete calculations.
- Logging cost estimates from the appraisals of recent area timber sales was used to estimate Ground Based and Skyline stump to truck logging costs, ($120/MBF for Ground Based cost estimate, $182/MBF for Skyline cost estimate).
- A Haul Cost Appraisal to Eugene, Oregon was evaluated using Haul Cost Appraisal 6.1 for each Alternative and was included as $40/MBF for Alternative 2, 3 and 4.

4.7.2 Comparison of costs by Alternatives

Table 6 shows the difference in logging system cost and road construction by Action Alternative.

Table 6: Logging Volume and Cost by Action Alternative

	Alt2	Alt3	Alt4
Ground Based Acres	785	687	394
GB Volume	9100	7705	4228
GB Logging Cost	$1,092,000	$ 924,600	$ 507,360
Skyline Acres	279	305	205
Skyline Volume	2709	2927	1974
Skyline Logging Costs	$ 493,038	$ 532,714	$ 359,268
Total Volume	11,809	10,632	6,202
Other costs (includes haul, road maintenance, slash treatment and decommissioning)	$ 472,360	$425,280	$ 248,080
Road Const costs	$ 504,000	$ 420,000	$ 99,000
CMP's	$ 285,000	$ 205,000	$ 148,000
Road Imp Costs	$ 300,000	$ 300,000	$ 10,000
Total Rd Costs	$1,089,000	$ 925,000	$ 257,000
Total costs	$3,146,398	$2,807,594	$1,371,708
Total value	$4,723,600	$4,252,800	$2,480,800
Total net value	$1,577,202	$1,445,206	$1,109,092
Total Eng Cost per MBF	$ 92	$ 87	$ 41

5.0 CONSULTATION

NORTHERN SPOTTED OWL:
ESA consultation considers effects to general habitat due to habitat modification, and effects to site occupation and reproduction due to habitat modification and nesting behavior due to noise disturbance/disruption. Collectively these considerations result in an overall effects determination of project actions. Consultation was conducted under the two following batched Province BAs:
1)Biological Assessment of NLAA Projects with the Potential to Modify the Habitat and/or Disrupt Northern Spotted Owls Willamette Planning Province - FY 2011-2012, and;
2) Biological Assessment of LAA Projects with the Potential to Modify the Habitat and/or Disrupt Northern Spotted Owls Willamette Planning Province - FY 2011-2012

Consistent with the above documents, the No Action Alternative would result in a ***no effect*** determination to spotted owls or their habitat. The Action Alternatives overall would result in a ***may affect, but not likely to adversely affect*** determination for all harvest units except Boulder Creek 35 where actions would result in a ***may affect, likely to adverse affect*** determination due to affects to the Osborn Knob site.

6.0 LIST OF PREPARERS AND REFERENCES

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APPENDICES

APPENDIX A: Project Design Features

Harvest

1) Retain all incense-cedar, grand fir, yew, oaks and other hardwoods, except where necessary to accommodate safety and logging systems.
2) Apply seasonal restrictions or suspension of all harvest and road activities that would occur within 1/4 mile (or more) of known nesting great blue herons, peregrine falcons, bald eagles, spotted owls, great grey owls, accipiter hawks, and other owls, hawks, or raptors if they are located at any time during project activities.
3) Apply reasonable and prudent measures, in consultation with the United States Fish and Wildlife Service, to minimize disruption to Northern spotted owl pair nesting behavior and their progeny, including:
   - For harvest and related actions in harvest areas Boulder 35 (T17S, R1W, Sec 35) and Wild Jack 9 (T18S, R1W, Sec 9) - No harvest actions (including felling, yarding, decking) and road work (including construction and pre-harvest renovation) shall occur between March 1 and July 15 in all years the project is active.
   - Post-harvest road decommissioning and hauling are not subject to this restriction.
4) Snag, Down Log, and Large Tree Retention: All snags $\geq$ 12 inch diameter, all down logs in decay classes 3-4-5, and all large trees ($\geq$ 28 inch dbh) would be retained undamaged when possible, and would not be cut except those in road construction, landings, and yarding corridors, and those posing a safety hazard. When such trees are cut for the above reasons they would be left on site as down log habitat.
5) Falling and Yarding Techniques to protect snags, down logs, and large retention trees: Wherever feasible, place cable corridors and skid trails on the landscape to avoid felling or damaging large retention trees, snags and down logs. Utilize, when operationally feasible, falling and yarding techniques for the protection of large retention trees, existing down log and snags, and reserve areas.
6) Snag and Down Log Creation: Within treated portions of Riparian Reserves (depicted on Exhibit A-1) create an average of 120 linear feet/acre of down wood (2 trees per acre) and 3 snags/acre in all harvest areas except Riparian Reserves in Wild Jack units 19b and 19c.
   Treated trees:
   - Shall be $\geq$18 and $\leq$ 26" dbh
   - Shall be live and not contain visible bird-mammal nests, sloughing bark, cavities, broken leaders, or other notable deformities
   - Treatment would occur between August 1st to February 28th to minimize disturbance to nesting birds and mammals.
7) Retain conifers greater than 20 inch dbh in treated Riparian Reserves, except where necessary to accommodate safety and logging systems. Cut trees larger than 20 inch dbh would be left on site as coarse woody debris.
8) Down logs and root wads that present a hazard to logging operations or that are needed to close roads may be relocated within the project area.
9) Limit log lengths to 40' in length where necessary to minimize damage to residual trees, snags and coarse woody debris during yarding.
10) Apply the following requirements to skyline yarding areas:
    - Require one-end suspension of logs while skidding and cable yarding. Intermediate supports may be required to accomplish this objective.
    - To minimize impacts to residual trees and soils, spacing of cable corridors should be kept to 150 feet apart and limited to 12 feet in width.

- As determined by the Authorized Officer, if needed skyline yarding corridors with severe gouging would be left in an erosion resistant condition by the use of hand water barring or placement of wood debris.

11) Mechanized harvesting systems may be approved when:
- Movement of cutting equipment off designated skid trails shall be limited to a single pass.
- Mechanized harvester shall travel on the cushion of slash created by the harvesting process
- Where slopes are less than 45% in Matrix and 35% in Riparian Reserves
- When soil moistures are low (<25%) and provides resistance to compaction (typically July 1st – Oct 1st), unless waived by soil scientist.

12) Apply the following requirements to ground base yarding areas:
- Require felling of trees to lead of the skid trails and maximize winching distances.
- Placement of skid trails would be avoided within 150 feet of streams where feasible. All skidding equipment would remain on the designated skid trails.
- Skid trails should be 12 feet wide or less. Average distance between skid trails would be 150 feet or greater where feasible. Use existing skid trails or OHV trails, where possible. Avoid placing skid trails on rocky soils.
- Restrict yarding to seasonally dry period when soil moisture content provides the most resistance to compaction. This is usually July 1st and October 1st.
- Till, where feasible, compacted skid trails, with an excavator to a depth of 18 inches, when soil moisture is appropriate. Other equipment may be authorized if it can accomplish the required depth, lateral shatter of compacted layer, and place woody debris on the decompacted surfaces.
- Minimize damage to residual tree roots adjacent to trails.
- To reduce erosion and restore soil productivity, pull slash, logging debris and brush from forest floor onto severely compacted skid trails in consult with the Authorized Officer.
- If tillage cannot be accomplished the same operating season, all skid trails and temporary native surface roads would be left in an erosion resistant condition and blocked prior to the onset of wet weather. This would include construction of drainage dips, water bars, lead off ditches, and barriers (rootwads or brush piles) to prevent vehicle access until final blockage and/or tilling.

13) Keep a Spill Contamination Kit (SCK) on-site during any operation within the project area*; prior to starti*ng work each day, all machinery would be checked for leaks and necessary repairs would be made.

14) Removal, notification, transport and disposal of any diesel, hydraulic fluid, or other petroleum product released into soil and/or water would be accomplished in accordance with all applicable laws and regulations.

Road Construction and Use

15) Limit use of native surfaced roads to the dry season (generally between July 1 and October 1). Waterbars, drain dips, and/or lead-off ditches may be required to create an erosion resistant condition on roads during seasonal closures. Access to such roads shall be blocked during closures.

16) Apply Oregon Department of Fish and Wildlife (ODFW) in-water guidelines to all in stream activities. Work would be done between the dates of July 1st through October 15th.

17) Require the following along perennial streams:
- Stream flow would be routed around the construction activity as much as possible (e.g. temporary flow diversion structure).
- Sediment containment structure placed across the channel below the work section (i.e. straw bales) as needed.
- Work site would be pumped free of standing water
- Fish and other aquatic species would be removed from the project area and block nets placed above and below the worksite.

- After installation, the disturbed section would be planted with native seed and mulched with native straw or wood mulch before the first rains

18) Implement the following combination of methods during heavy and/or prolonged rainfall or freezing and thawing periods to minimize sedimentation from the gravel surfaced roads into stream channels:
    - keep ditch line, cross drains, and leadoff ditches clean and free to flow, while minimizing disturbance to existing ditch line vegetation.
    - Sediment traps may be installed in ditch lines lacking vegetation and having the potential to deliver sediment to streams.
    - Prior to and during haul operation, rock surfacing and road maintenance would be assessed throughout the project area and haul route.
    - If erosion and road degradation occur after freeze and thaw periods, log haul operations may be discontinued.

Decommissioning

19) Position fill or waste material from road decommissioning in a location that would avoid direct or indirect sediment discharges to streams or wetlands. Pull back stream banks at removed crossings to an angle of natural repose.
20) Till, where road sub grade conditions warrant, compacted road surfaces with an excavator when soil moisture is appropriate (generally July 1 to October 1). If tillage is not possible then waterbars and lead-off ditches would be constructed to reduce sedimentation to streams and wetlands. Logging debris and brush would be placed along the entire length of tilled roadbed to reduce erosion, maintain soil productivity and block access.
21) Block vehicle access where appropriate with earthen barricades with brush and/or slash additions.
22) Remove and dispose of pulled culverts appropriately.

Fuels

23) Cover and burn all landing piles along roads.
24) Pile, cover and burn slash, less than 6" in diameter and greater than 3' in length, within 25 feet of either side of designated (typically permanent) roads within harvest areas.
25) Scatter landing piles, along temporary roads, on top of the road surface to remove the fuel concentrations, deter OHV use and slow erosion. Resulting fuel bed would not be deep and continuous. Piles along temporary roads not scattered on the road surface would be covered and burned.
26) Cover all piles to be burned with plastic in compliance with the Oregon Smoke Management Plan.

Other

27) Prevent the spread of noxious weeds from other locations, by washing logging, road construction, and tilling equipment prior to entry on BLM lands.
28) Cultural resource surveys would be completed prior to harvest. If sites are found within the project area appropriate actions would be taken to mitigate effects to the sites.

APPENDIX B: Charts and Tables

Table 7: Hills Camp Thinnings Roads Alternative 2 – Proposed Road Construction, Maintenance, and Improvement (miles are approximate numbers)		
Temporary Road Construction	**Length**	**Comments**
Spur BC 35 A,C	0.11 miles	Native - Optional locations
Spur SC33B	0.1 miles	Native
Spur WJ 09F	0.08 miles	Native
Spur WJ 09D	0.30 miles	Native
Spur WJ 07A1	0.1 miles	Native – optional
Spur WJ09J	0.34 miles	Native
Spur WJ 07C	0.11 miles	Native
Spur WJ 07D	0.04 miles	Native
Spur WJ 09A	0.11 miles	Native
Spur WJ 09E	0.11miles	Native
Spur WJ 07E	0.10 miles	Native - optional use
Spur BC 5 A	0.15 miles	Native – ridgetop location
Spur BC 5 B	0.13 miles	Native –optional location
Spur BC 5 C	0.46 miles	Native
Spur BC 5 D	0.06 miles	Native
Spur BC 5 F3	0.05 miles.	Native
Spur BC 5 F2	0.14 miles	Native
Spur BC 35 D Segs. A and C	0.64 miles	Native
Spur BC 5 H	0.38 miles	Native
Spur BC 5 I	0.47 miles	Native – 2 stream crossings
Spur BC 5 J	0.25 miles	Native
Spur BC 5 L	0.06 miles	Native
Spur BC 5 M`	0.11 miles	Native
Spur BC 5 N	0.06 miles	Native
Spur BC 5 O	0.26miles	Native
Spur BC 5 P	0.11miles	Native
Spur BC 5 F1	0.15 miles	Native
Total	**4.98 miles**	
Permanent Road Construction	**Length**	**Comments**
Spur BC F1	0.21 miles	Rock surfacing across stream- major crossing
Spur BC 5 E	0.65 miles	Rock surfacing - major stream crossing
Spur BC 5 C	0.55miles	Rock surfacing - 1 stream crossing
Spur BC 5 G	0.13 miles	Rock surfacing
Spur WJ 19A	0.19 miles	Optional rock surfacing
Spur WJ 19C	0.04 miles	Optional rock surfacing
Spur WJ 09C	0.40 miles	Rock surfacing
Spur WJ 07A	0.38 miles	Rock surfacing
Spur SC07A	0.40 miles	Optional rock surfacing - 1 interm. stream crossing
Spur BC 35B	0.19 miles	Optional rock surfacing
Spur WJ 07B	0.13 miles	Optional rock surfacing
Spur SC33A	0.19 miles	Optional rock surfacing
Spur WJ 09B	0.25 miles	Optional rock surfacing
Spur BC 35D Seg. B	0.28 miles	Rock surfacing through riparian across stream
Total	**3.99 miles**	

Table 8: Proposed Road Decommissioning (miles are approximate numbers) ALT. 2		
Full Decommission (permanent)	**Length**	**Comments**
Spur BC 5F1	0.15 miles	Barricade at end of surfacing and till native segment
Spur BC 5F2	0.14 miles	Till
Spur BC 5F3	0.05 miles	Till
Spur BC 5C	0.46 miles	Barricade at end of surfacing and till native segment
Spur BC 5D	0.06 miles	Barricade and till
Spur BC 5H	0.38 miles	Till
Spur BC 5I	0.47 miles	Remove Culverts, Barricade and Till
Spur BC 5 J	0.25 miles	Till
Spur BC 5 K	0.08 miles	Till
Spur BC 5 L	0.06 miles	Till
Spur BC 5 M`	0.11 miles	Till
Spur BC 5 N	0.06 miles	Till
Spur BC 5 O	0.26 miles	Till
Spur BC 5 P	0.11 miles	Till
Spur BC 35A	0.06 miles	Barricade and till
Spur BC 35C	0.06 miles	Barricade and till
Spur BC 35D	0.56 miles	Remove stream crossing, barricade and till
Spur WJ 9A	0.11 miles	Barricade and till
Spur WJ 9J	0.34 miles	Till
Spur WJ 9E	0.11 miles	Barricade and till
Spur WJ 9F	0.08 miles	Till
Spur WJ 7C	0.11 miles	Barricade and till
Spur WJ 7D	0.04 miles	Till
Spur WJ 7E	0.10 miles	Barricade and till
Total	**4.23 miles**	
Decommissioning (short-term < 5 years)	**Length**	**Comments**
Spur BC 5A	0. 15 miles	Barricade – future use
Spur BC 5B	0. 13 miles	Barricade – future use
Spur WJ 9D	0.30 miles	Barricade – winterize
Spur BC 35D	0.36miles	Remove bridge - barricade - winterize
Total	**0.94 miles**	

Table 9: Proposed Haul Route Road Maintenance by Road Number for Alternative 2		
Road Number	**Length (approximate)**	**Comments**
17-1-3 / -3.6 (SC)	1.2 mile	Grade only
17-1-4.3 (SC)	1.1 mile	Brush, pull ditches, grade and spot rock
17-1-4.1 (SC) private control	0. 7 mile	Grade and maintain –add rock as needed.
18-1-7.3 (WJ)	1.16. mile	1 cross drain replacement. 0”-4” lift rock and dust abatement at house.
17-1-34 (BC)	0.94 mile	1 stream culvert replacement and 1 cross drain repl. 0 - 4” lift rock
17-1-32 (BC)	0.46 miles	0”- 4” lift rock , dust abatement at gate.
18-1-5.1 (BC)	0.38 miles	0”- 4” lift rock –grade and brush
17-1-7 (SC) Seg. A 0.1 private Seg.B- 1.05 BLM	1.15 mile	0”- 4” lift rock – 1 stream crossing replacement
17-1-7.1 (SC)	0.74 mile	0”- 4” lift rock - 1 stream crossing replacement
17-1-8 (SC) Seg. A 2.05 private control Seg.B 0.34 BLM	2. 39 mile	Maintenance - spot rock.
16-1-31.1 (SC)	2.49 mile	3 stream culvert replacements, 3-6 cross drain replacements. Spot rock.
16-2-35 (SC)	2.1 mile	Maintenance only
18-1-25A2 (WJ)	0.9 mile	Maintenance rock as needed
18-1E-19.1 (WJ)	0.71 mile	Brush, grade 0”- 4” lift rock for winter haul. 2 to 3 stream crossing replacements or removal.
18-1E-19.2 (WJ)	1.02 mile	Brush and grade spot rock; 2 - 4 stream crossing replacements (design).
18-1-15.1 (WJ) Seg.A-0.55 Seg. B-0.18 Private control Seg.C-0.64	1.37 mile	0”-4” lift rock - replace two cross drains.
18-1-9.3 (WJ)	0. 74 mile	Brush and grade
18-1-9.4 (WJ)	0. 19 mile	Brush and grade
WY 18-1-15A (WJ)	0.37 mile	Private control
WY 18-1-15.2A (WJ)	0. 62 mile	Private control
WY 18-1-25.1 (WJ)	0.02 mile	Private control
WY 18-1-25A1 (WJ)	0.8 mile	Private control
WY 18-1-9 Improvement (WJ)	0.25 mile	Private control –brush and widen – no ditch - Native
WY - 16-1-19 (SC)Workman Road	1 mile	Private Control
WY 1000 Mainline (SC)	1 mile	Private control
WY 1800C (SC)	0.27 miles	Private control - brush
Total BLM Roads	**17.27 miles**	
Private Controlled Roads	**7.75 miles**	

Table 10: Hills Camp Thinnings Alternative 3 - Proposed Road Construction, Maintenance, and Improvement (miles are approximate numbers)		
Temporary Road Construction	**Length**	**Comments**
Spur BC 35 A,C	0.11 miles	Native - Optional locations
Spur SC33B	0.1 miles	Native
Spur SC33A	0.19 miles	Native
Spur WJ 09F	0.08 miles	Native
Spur WJ 09D	0.30 miles	Native
Spur WJ 07A1	0.1 miles	Native – optional
Spur WJ 07B	0.13 miles	Native
Spur WJ 07C	0.11 miles	Native
Spur WJ 07D	0.04 miles	Native
Spur WJ 07E	0.10 miles	Native
Spur WJ09J	0.34 miles	Native
Spur WJ 09C	0.40 miles	Native
Spur WJ 09A	0.11 miles	Native
Spur SC07A	0.40 miles	Native
Spur WJ 09E	0.11miles	Native
Spur WJ 09B	0.25 miles	Native
Spur BC 5 A	0.15 miles	Native – ridgetop location
Spur BC 5 B	0.13 miles	Native –optional location
Spur BC 5 C	0.46 miles	Native
Spur BC 5 D	0.06 miles	Native - 1 intermittent stream crossing
Spur BC 5 F1	0.15 miles	Native
Spur BC 5 F3	0.05 miles.	Native
Spur BC 5 F2	0.14 miles	Native
Spur BC 35 D	0.34 miles	Native
Spur BC 35B	0.17 miles	Native
Spur BC 5 H	0.38 miles	Native
Spur BC 5 I	0.11 miles	Native
Spur BC 5 L	0.06 miles	Native
Spur BC 5 M`	0.11 miles	Native
Spur BC 5 N	0.06 miles	Native
Spur BC 5 O	0.21 miles	Native
Spur BC 5 P	0.11miles	Native
Spur WJ 19A	0.19 miles	Native
Spur WJ 19C	0.04 miles	Native
Total	**5.79**	
Permanent Road Construction	**Length**	**Comments**
Spur BC F1	0.21 miles	Rock surfacing across stream- major crossing
Spur BC 5 E	0.65 miles	Rock surfacing - major stream crossing
Spur BC 5 C	0.56 miles	Rock surfacing - 1 stream crossing
Spur BC 5 G	0.13 miles	Rock surfacing
Spur WJ 07A	0.38 miles	Rock surfacing
Total	1.93 miles	

Table 11: Proposed Road Decommissioning (miles are approximate numbers) ALT. 3		
Full Decommission (permanent)	**Length**	**Comments**
Spur BC 5F1	0.15 miles	Barricade at end of surfacing and till native segment
Spur BC 5F2	0.14 miles	Till
Spur BC 5F3	0.05 miles	Till
Spur BC 5C	0.22 miles	Barricade at end of surfacing and till native segment
Spur BC 5D	0.06 miles	Barricade and till
Spur BC 5H	0.38 miles	Barricade and Till
Spur BC 5I	0.06 miles	Till
Spur BC 35D	0.34 miles	Barricade and till
Spur SC 7A	0.40 miles	Barricade and till
Spur BC 5 L	0.06 miles	Till
Spur BC 5 M`	0.11 miles	Till
Spur BC 5 N	0.06 miles	Till
Spur BC 5 O	0.21 miles	Till
Spur BC 5 P	0.11 miles	Till
Spur BC 35B	0.19 miles	Barricade and till
Spur BC 35A	0.06 miles	Barricade and till
Spur BC 35C	0.06 miles	Barricade and till
Spur BC 35D	0.34 miles	Remove stream crossing, barricade and till
Spur WJ 9A	0.11 miles	Barricade and till
Spur WJ 9J	0.34 miles	Till
Spur WJ 9E	0.11 miles	Barricade and till
Spur WJ 9F	0.08 miles	Till
Spur WJ 7C	0.11 miles	Barricade and till
Spur WJ 7D	0.04 miles	Till
Spur WJ 7E	0.10 miles	Barricade and till
Spur WJ 7B	0.13 miles	Barricade and till
Total	**4.02 miles**	
Decommissioning (short-term < 5 years)	**Length**	**Comments**
Spur BC 5A	0. 15 miles	Barricade – future use
Spur BC 5B	0. 13 miles	Barricade – future use
Spur WJ 9D	0.30 miles	Barricade – winterize
Spur WJ 9C	0.40 miles	Barricade – future use
Total	**0.98 miles**	

Table 12: Proposed Haul Route Road Maintenance by Road Number for Alternative 3		
17-1-3 / -3.6 (SC)	1.2 mile	Grade
17-1-4.3 (SC)	1.1 mile	Brush, pull ditches, grade and spot rock
17-1-4.1 (SC) private control	0. 7 mile	Grade and maintain –add rock as needed.
18-1-7.3 (WJ)	1.16. mile	1 cross drain replacement. 0”-4” lift rock and dust abatement at house.
17-1-34 (BC)	0.94 mile	1 stream culvert replacement and 1 cross drain repl. 0 - 4” lift rock
17-1-26 (BC) private control WY Booth Kelly Mainline	1.0 mile	Asphalt and rock surfacing – maintenance
Spur WY200A (BC) T17S,R1W,Sec.36	0.38 miles	Open, brush , grade, install 1 intermittent stream culvert
17-1-32 (BC)	0.46 miles	0”- 4” lift rock , dust abatement at gate.
18-1-5.1 (BC)	0.38 miles	0”- 4” lift rock –grade and brush
17-1-7 (SC)Seg.A 0.1 Pvt.Seg. B 1.05 BLM	1.15 mile	0”- 4” lift rock – 1 stream crossing replacement
17-1-7.1 (SC)	0.74 mile	0”- 4” lift rock - 1 stream crossing replacement
17-1-8 (SC) Seg.A 2.05 Pvt.Control Seg. B 0.34 BLM	2. 39 mile	Maintenance - spot rock.
16-1-31.1 (SC)	2.49 mile	3 stream culvert replacements, 3-6 cross drain replacements. Spot rock.
16-2-35 (SC)	2.1 mile	Maintenance only
18-1-25A2 (WJ)	0.9 mile	Maintenance rock as needed
18-1E-19.1 (WJ)	0.71 mile	Brush, grade 0”- 4” lift rock for winter haul. 2 to 3 stream crossing replacements or removal.
18-1E-19.2 (WJ)	1.02 mile	Brush and grade spot rock; 2 - 4 stream crossing replacements (design).
18-1-15.1 (WJ) Seg.A-0.55Seg.B-0.18 Private control Seg.C-0.64	1.37 mile	0”-4” lift rock - replace 1 – 2 cross drains.
18-1-9.3 (WJ)	0. 74 mile	Brush and grade
18-1-9.4 (WJ)	0. 19 mile	Brush and grade
WY 18-1-15A (WJ)	0.37 mile	Private control
WY 18-1-15.2A (WJ)	0. 62 mile	Private control
WY 18-1-25.1 (WJ)	0.02 mile	Private control
WY 18-1-25A1 (WJ)	0.8 mile	Private control
WY 18-1-9 Improvement (WJ)	0.25 mile	Private control –brush and widen – no ditch - Native
WY - 16-1-19 (SC) Workman Road	1 mile	Private Control
WY 1000 Mainline (SC)	1 mile	Private control - grade
WY 1800C (SC)	0.27 miles	Private control - brush
Total BLM Roads	**16.71 miles**	
Total Private Roads	**8.74 miles**	

Table 13 Hills Camp Thinnings Roads Alternative 4 – Proposed Road Construction, Maintenance, and Improvement		
Temporary Road Construction	**Length**	**Comments**
Spur BC 35 A,C	0.11 miles	Native - Optional locations
Spur SC33B	0.1 miles	Native
Spur SC33A	0.19 miles	Native
Spur WJ 07A	0.38 miles	Native
Spur WJ 07A1	0.1 miles	Native – optional
Spur WJ 07B	0.13 miles	Native
Spur WJ 07C	0.11 miles	Native
Spur WJ 07D	0.04 miles	Native
Spur WJ 07E	0.10 miles	Native
Spur WJ 09C	0.40 miles	Native
Spur WJ 09A	0.11 miles	Native
Spur WJ 09E	0.11miles	Native
Spur WJ 09B	0.25 miles	Native
Spur BC 5 A	0.15 miles	Native – ridgetop location
Spur BC 5 B	0.13 miles	Native –optional location
Spur BC 5 C	0.32 miles	Native
Spur WJ 19A	0.19 miles	Native
Spur WJ 19C	0.04 miles	Native
Total	**2.96 miles**	
Proposed Haul Route Road Maintenance by Road Number for Alternative 4		
17-1-3 / -3.6 (SC)	1.2 mile	Grade only
17-1-4.3 (SC)	1.1 mile	Brush, pull ditches, grade and spot rock
17-1-4.1 (SC)private control	0. 7 mile	Grade and maintain –add rock as needed.
18-1-7.3 (WJ)	1.16. mile	1 cross drain replacement. 0”-4” lift rock and dust abatement at house.
17-1-34 (BC)	0.94 mile	1 stream culvert replacement and 1 cross drain repl. 0 - 4” lift rock
17-1-32 (BC)	0.46 miles	0”- 4” lift rock , dust abatement at gate.
18-1-5.1 (BC)	0.38 miles	0”- 4” lift rock –grade and brush
17-1-7 (SC)Seg.A 0.1 Pvt.Control Seg.B 1.05 BLM	1.15 mile	0”- 4” lift rock – 1 stream crossing replacement
17-1-7.1 (SC)	0.74 mile	0”- 4” lift rock - 1 stream crossing replacement
17-1-8 (SC) Seg. A 2.05 Pvt.Control Seg.B 0.34 BLM	2. 39 mile	Maintenance - spot rock.
16-1-31.1 (SC)	2.49 mile	3 stream culvert replacements, 3-6 cross drain replacements. Spot rock.
16-2-35 (SC)	2.1 mile	Maintenance only
18-1-25A2 (WJ)	0.9 mile	Maintenance rock as needed
18-1E-19.1 (WJ)	0.27 mile	Brush, grade 0”- 4” lift rock for winter haul.
18-1E-19.2 (WJ)	1.02 mile	Brush and grade spot rock; 2 - 4 stream crossing replacements (design).
18-1-15.1 (WJ) SegA 0.55 Seg.B0.18Private control C-0.64	1.37 mile	0”-4” lift rock - replace 1 – 2 cross drains.
18-1-9.3 (WJ)	0. 74 mile	Brush and grade
18-1-9.4 (WJ)	0. 19 mile	Brush and grade
WY 18-1-15A (WJ)	0.37 mile	Private control
WY 18-1-15.2A (WJ)	0. 62 mile	Private control
WY 18-1-25.1 (WJ)	0.02 mile	Private control
WY 18-1-25A1 (WJ)	0.8 mile	Private control
WY 18-1-9 Improvement (WJ)	0.25 mile	Private control –brush and widen – no ditch - Native
WY - 16-1-19 Workman Road (SC)	1 mile	Private Control
WY 1000 Mainline (SC)	1 mile	Private control -
WY 1800C (SC)	0.27 miles	Private control - brush
BLM Roads Haul Route	**16.27**	
Private Roads –Haul Route	**7.36 miles**	

Table 14: Proposed Road Decommissioning (miles are approximate numbers) ALT.4		
Full Decommission (permanent)	**Length**	**Comments**
Spur SC33B	0.01 miles	Barricade and Till
Spur SC33A	0.19 miles	Barricade and Till
Spur BC 5C	0.22 miles	Barricade and till
Spur BC 5D	0.09 miles	Till
Spur WJ 07A	0.38 miles	Native
Spur WJ 07A1	0.1 miles	Native – optional
Spur BC 35A	0.06 miles	Barricade and till
Spur BC 35C	0.06 miles	Barricade and till
Spur WJ 9A	0.11 miles	Barricade and till
Spur WJ 9E	0.11 miles	Barricade and till
Spur WJ 9B		Barricade and till
Spur WJ 7C	0.11 miles	Barricade and till
Spur WJ 7D	0.04 miles	Till
Spur WJ 7E	0.10 miles	Barricade and till
Spur WJ 7B	0.13 miles	Barricade and till
Spur WJ 19A	0.19 miles	Barricade and till
Spur WJ 19C	0.04 miles	Barricade and till
Spur BC 5A	0. 15 miles	Barricade and till
Spur BC 5B	0. 13 miles	Barricade and till
Spur WJ 9C	0.40 miles	Barricade and till
Total	2.62 miles	

Table 15: Fish Present in Area Streams	
Common Name	**Scientific Name**
Chinook Salmon	*Oncorhynchus tshawytscha*
Rainbow Trout	*Oncorhynchus mykiss*
Cutthroat Trout	*Oncorhynchus clarkii*
Mountain Whitefish	*Prosopium williamsoni*
Largescale Sucker	*Catastomus macrocheilus*
Sculpin Species	*Cottidae sp.*
Dace	*Rhinichthys osculus*
Redside Shiners	*Richardsonius balteatus*

Table 16: **Hydrologic Unit, Timber Sale Unit Location, and Nearby Stream Names**

10th Field HUC (Watershed)	12th Field HUC (Sub-Watershed)	Unit Name	Major Stream Below Unit
McKenzie River 1709000407	McKenzie River-Walterville Canal 170900040706	Boulder Creek 5	Cedar Flat Creek
		Boulder Creek 35	Boulder Creek
		Wild Jack 9	Cedar Creek
	Camp Creek 170900040705	Solomon Creek 7	Camp Creek tributary
		Solomon Creek 33	Wegner Creek
Pudding Creek-Middle Fork Willamette River 1709000110	Hills Creek 170900011003	Wild Jack 7 (east portion)	Headwaters Cedar Creek
		Wild Jack 9	Cedar Creek tributary
	Mill Race-Middle Fork Willamette River	Wild Jack 7 (west portion)	Headwaters Wallace Creek
Little Fall Creek 1709000108	Lower Little Fall Creek 170900010802	Wild Jack 19	Little Fall Creek

Table 17: Down Logs & Snags in Harvest Areas

DOWN LOGS					SNAGS				
Avg. Linear Ft./ Ac.- All Units Combined					Avg. / Ac. > 15 Ft. Tall - All Units Combined				
	Diameter Range (inches at large end)					Diameter Range (dbh)			
Decay Class	8 to 15	16 to 19	> 20	Avg. Total	Decay Class	8 to 15	16 to 19	> 20	Avg. Total
1	3	8	3	13	1	0.6	0	0	0.6
2	71	31	15	117	2	0	0	0	0
3	88	26	13	126	3	0	0	0	0
4	81	77	331	489	4	0	0	0	0
5	96	51	165	312	5	0	0	0	0
Avg. Total	339	192	526	1057	Avg. Total	0	0	0	0.6

Shaded cells are typical size & decay class characteristics preferred by associated wildlife species: Current conditions: Down logs 343 lf/ac. and no Snags. ***@****=8-11 in. diam. only.*

Table 18:
Current Federal Land Habitat in Nearby NSO Site Core Areas & Provincial Home Ranges & Acres Affected by Harvest
(Harvest Would Not Affect Site Nest Patch Areas)

		Current Habitat in Site Core Area (CA)								
Site Name	**IDNO**	**Dispersal/Forage Habitat**		**Suitable Nesting Habitat**		**All Habitat**		**Acres & Percent of "All Habitat" in CA Modified by Harvest Under Action Alternative 2** [3]		
		Ac.	***Per cent*** [1]	**Ac.**	***Percent*** [1]	**Ac.**	***Per cent*** [1]	**Ac.**	***Percent***	**Harvest Unit**
CEDAR WALLACE CREEK	1938O	**316**	*63%*	**0**	*0%*	**316**	*63%*	**0**		
HILLS CREEK	3404O	**303**	*60%*	**32**	*6%*	**336**	*67%*	**0**		
OSBORN KNOB	1939A	**149**	*30%*	**25**	*5%*	**173**	*34%*	**37**	*25%*	Boulder Creek
OSBORN KNOB	1939O	**79**	*16%*	**133**	*26%*	**212**	*42%*	**0**		
[1] *Percent of 503 ac., the total area of the CA*										

		Current Habitat in Site Provincial Home Range (PHR)								
Site Name	**IDNO**	**Dispersal/Forage Habitat**		**Suitable Nesting Habitat**		**All Habitat**		**Acres & Percent of "All Habitat" in PHR Modified by Harvest Under Action Alternative 2** [3]		
		Ac.	***Percent*** [2]	**Ac.**	***Percent*** [2]	**Ac.**	***Per cent*** [2]	**Ac.**	***Percent***	**Harvest Unit**
CEDAR WALLACE CREEK	1938O	**663**	*23%*	**16**	*1%*	**679**	*23%*	**22**	*3%*	Wild Jack
HILLS CREEK	3404O	**934**	*32%*	**115**	*4%*	**1049**	*36%*	**11**	*1%*	Wild Jack
OSBORN KNOB	1939A	**355**	*12%*	**281**	*10%*	**636**	*22%*	**148**	*23%*	Boulder Creek
OSBORN KNOB	1939O	**255**	*9%*	**173**	*6%*	**428**	*15%*	**83**	*19%*	Boulder Creek
[2] *Percent of 2895 ac., the total area of the PHR*						[3] *Only dispersal/forage habitat would be modified by harvest. Slight differences in habitat modified by each Action Alternative are discussed in the Environmental Effects section.*				

Table 19: Special Status Species (Botany)That Have Been Eliminated from further Analysis		
Species	Status	Reason Considered but Not Analyzed Further
Cimicifuga elata	Bureau sensitive	Surveys have not been completed for this species, but will be done prior to project implementation. If found appropriate mitigations would be applied.
Lathyrus holochlorus	Bureau Sensitive	Surveys have not been completed for this species, but will be done prior to project implementation. If found appropriate mitigations would be applied.
Pellea andromedifolia	Bureau Sensitive	Surveys have not been completed for this species, but will be done prior to project implementation. If found appropriate mitigations would be applied.
Asarum wagnerii	state candidate	Surveys have not been completed for this species, but will be done prior to project implementation. If found appropriate mitigations would be applied.
Sidalcea campestris	state candidate	Surveys have not been completed for this species, but will be done prior to project implementation. If found appropriate mitigations would be applied.

Table 20: Special Status Species (Wildlife)That Have Been Eliminated from further Analysis		
Species	Status	Reason Considered but Not Analyzed Further
FRINGED MYOTIS & TOWNSEND'S BIG EARED BAT	BLM Sensitive	Overall, the chance of effects to these species is low due to the low amount of low quality habitat in the project area.
HARLEQUIN DUCK	BLM Sensitive, Migratory Bird, and Bird of Conservation Concern	Due to no-harvest buffers of at least 100 feet on potential nesting streams, it is unlikely that any potential nests or nearby habitat would be modified by project actions.
SALAMANDER SLUG	BLM Sensitive	Potential habitat in leaf litter and other detritus could be impacted by project activities, but this type of habitat is likely to remain in the project area post-harvest. The best large well-decayed down log habitat in the project area, is in the untreated portions of Riparian Reserves both in and near proposed harvest area. The remaining lower quality habitat in treated Riparian Reserves and Matrix lands would be protected and reserved by project design features.
OREGON SLENDER SALAMANDER	BLM Sensitive	The best habitat for the species is in/near Riparian Reserves and other cool, mesic portions of stands. Retention of existing down log habitats would reserve most of these habitats for the species. However, existing down log habitat would continue to decay and become less functional over the next few decades, and probably would not be replaced by natural stand processes until harvest units are well into the mature-seral stage *(see effects to down logs under Section 3.5.1.2).* Due to harvest rotation ages on Matrix lands, recruitment of new habitat would only occur in Riparian Reserves. Additionally, depending on the amount of soil compaction, physical damage to some logs during logging, and changes to local moisture conditions, the quality and function of some down log and soil habitat could be degraded for 5-15 years until stand canopy cover increases (longer for soil compaction). This could cause displacement of some individuals. Untreated Riparian Reserves should provide refugia for some individuals in the project areas.

APPENDIX C: Maps

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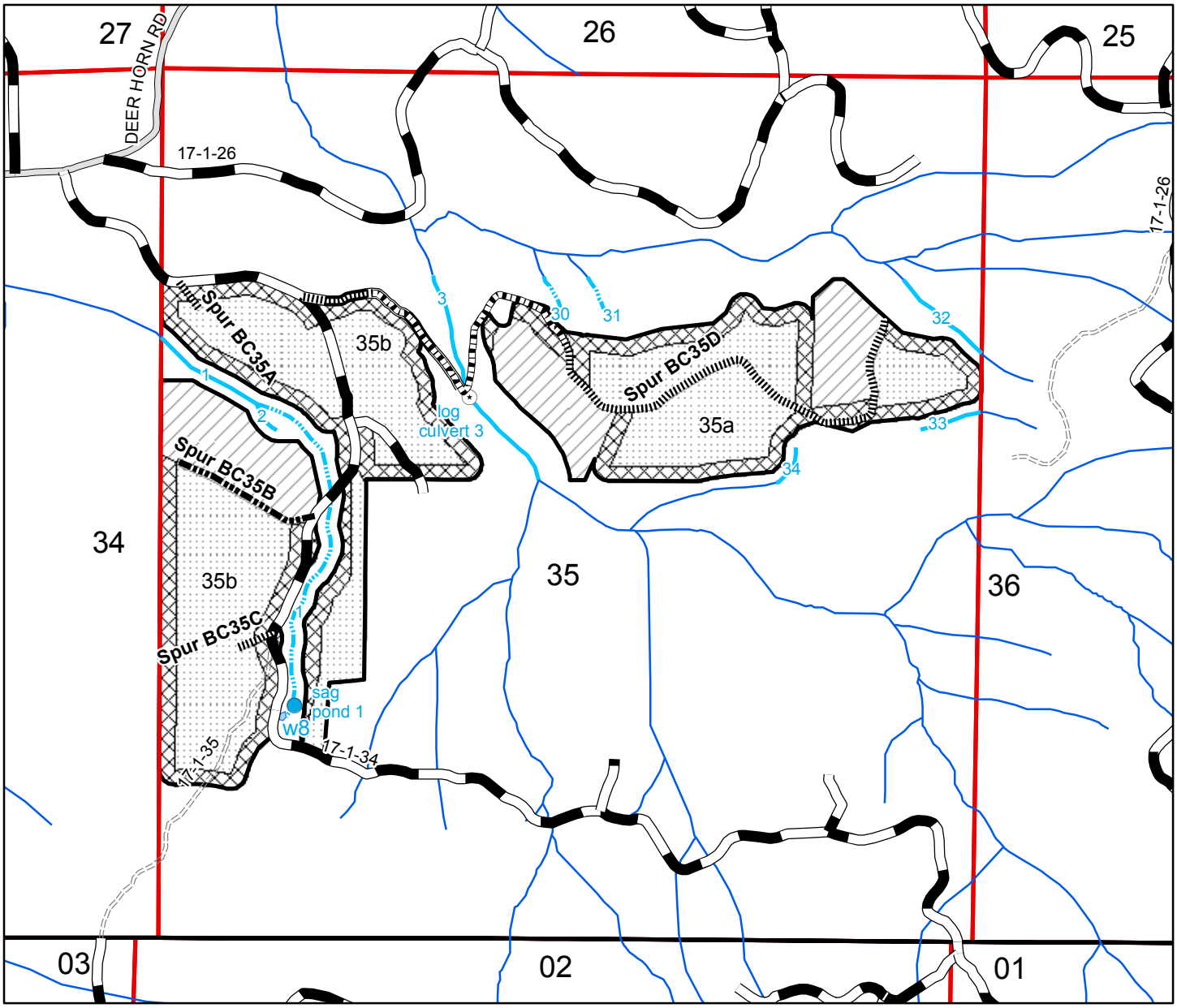
ENVIRONMENTAL ASSESSMENT
BOULDER CREEK, T.17S., R01W., SEC. 35



- Groundbased Logging
- Skyline Logging
- Winch Logging
- Harvest Area Boundary
- Road Construction - Native Surface
- Road Construction - Optional Rock
- Road Construction - Rock
- County Road
- Existing Decommissioned Road
- Existing Closed Road
- Other Existing Road
- Stream - Not Field Checked
- Stream - Intermittent
- Stream - Perennial
- Sag Pond
- Culvert
- Wetland

ALT 2

N

0 500 1000 1500 Feet

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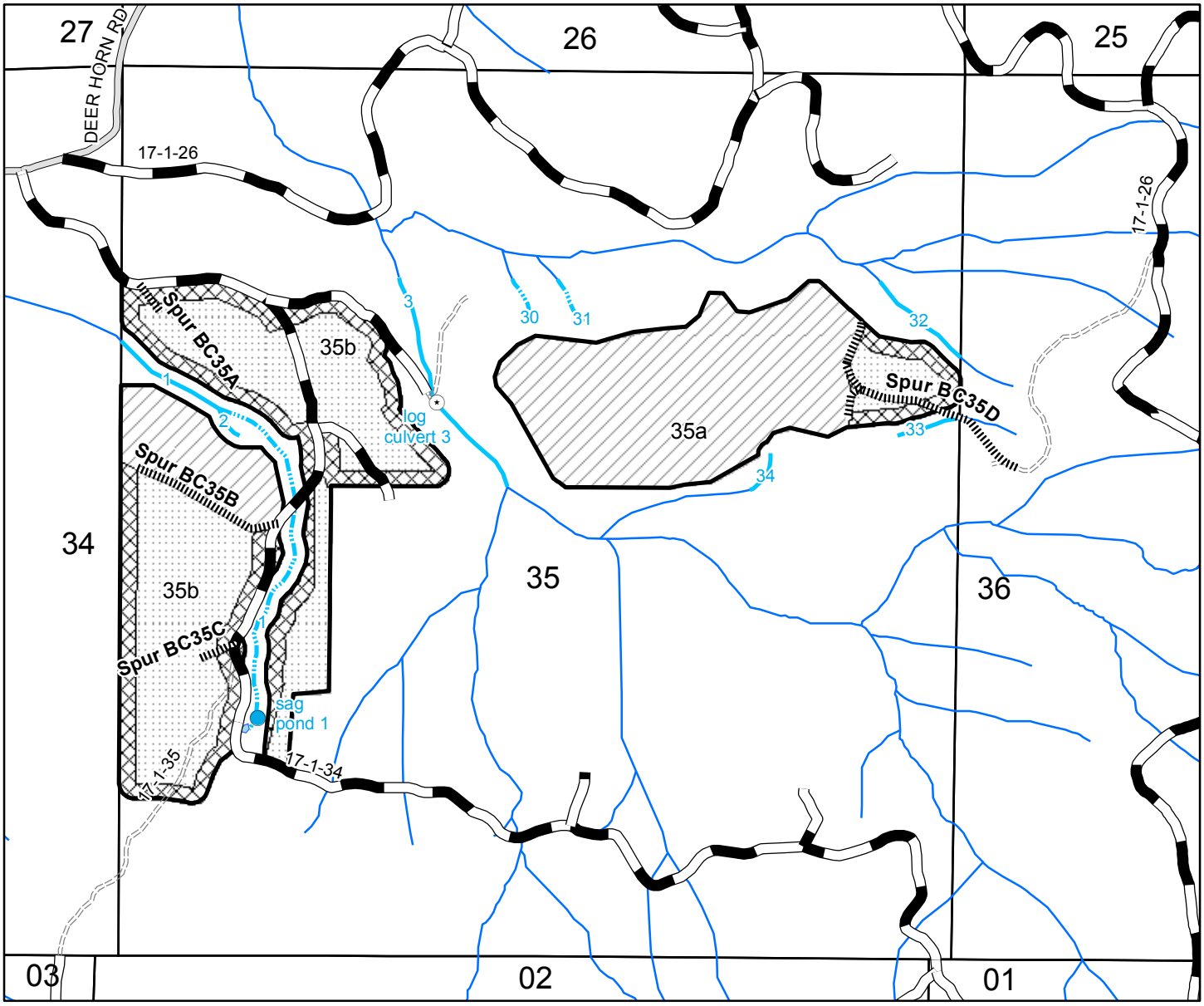
BOULDER CREEK, T.17S., R01W., SEC. 35



- Groundbased Logging
- Skyline Logging
- Winch Logging
- Unit Boundary
- **Road Construction - Native**
- **Road Construction - Optional Rock**
- **Road Construction - Rock**
- County Road
- Existing Decommissioned Road
- Existing Closed Road
- Other Existing Road
- **Stream - Not Field Checked**
- **Stream - Intermittent**
- **Stream - Perennial**
- **Sag Pond**
- **Culvert**
- **Wetland**

ALT 3

N

0 500 1000 1500 Feet

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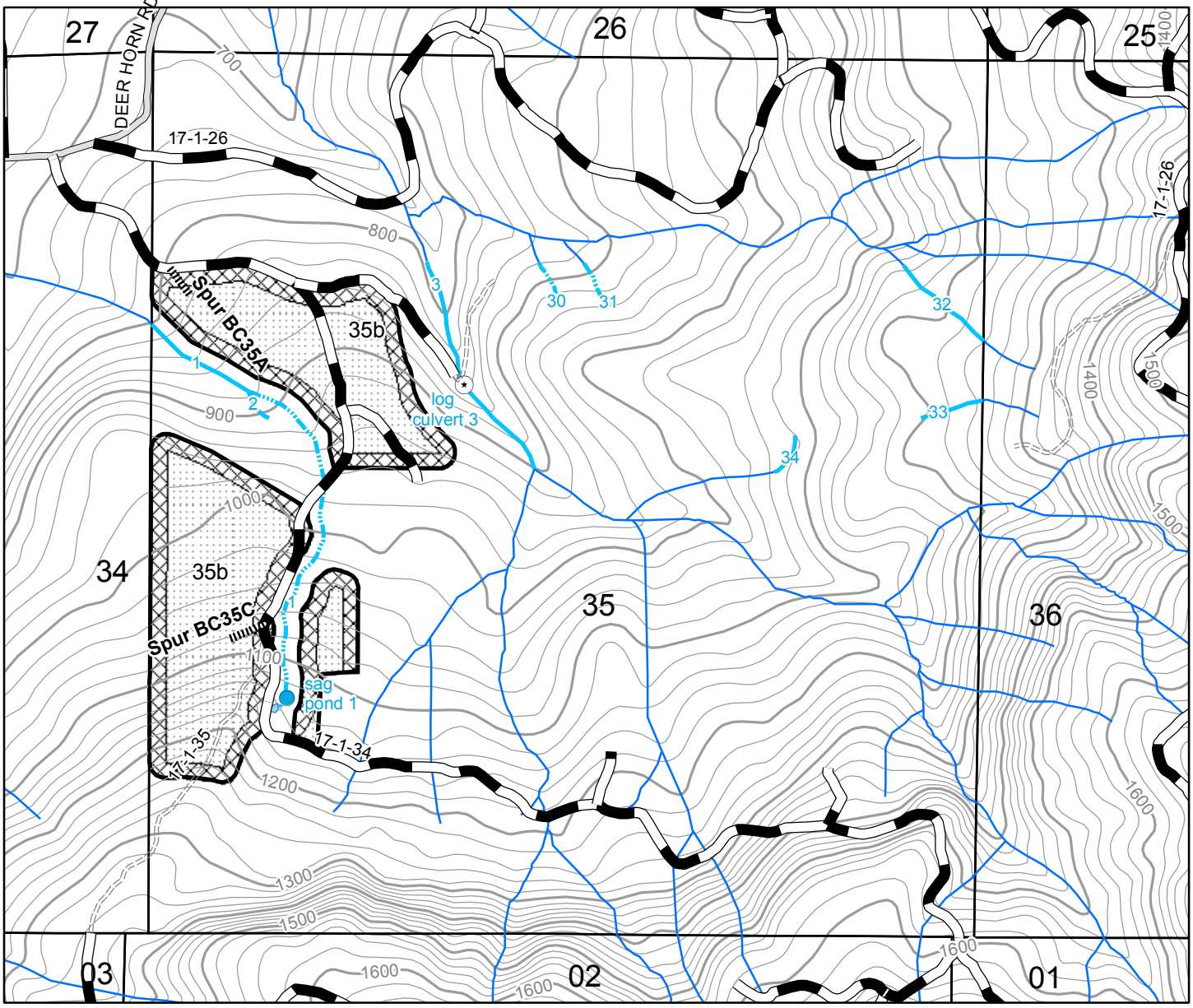

- Groundbased Logging
- Skyline Logging
- Winch Logging
- Unit Boundary
- **Road Construction - Native Surface**
- County Road
- Existing Decommissioned Road
- Existing Closed Road
- Other Existing Road
- **Stream - Not Field Checked**
- **Stream - Intermittent**
- **Stream - Perennial**
- **Sag Pond**
- **Culvert**
- **Wetland**

ALT 4

N

0 500 1000 1500 Feet

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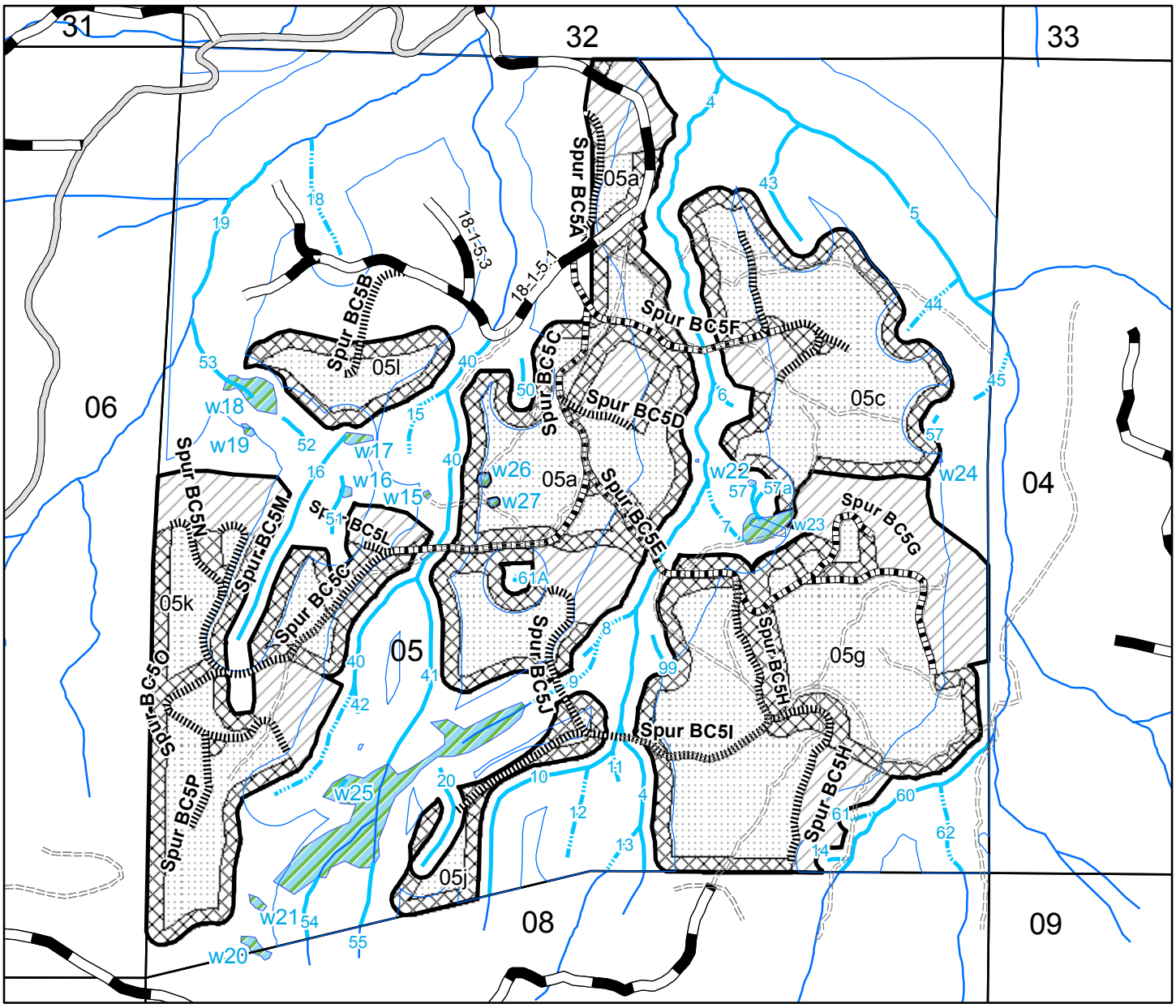
Boulder Creek, T.18S., R01W., Sec05



- Groundbased Logging
- Skyline logging
- Winch Logging
- Unit Boundary
- Road Construction - Native
- Road Construction - Optional Rock
- Road Construction - Rock
- County Road
- Existing Decommissioned Road
- Existing Closed Rd
- Other Existing Road
- Stream - Not Field Checked
- Stream - Intermittent
- Stream - Perennial
- Sag Pond
- Seep
- Landslide
- Culvert
- Wetland

ALT 2

N

0 500 1000 1500 Feet

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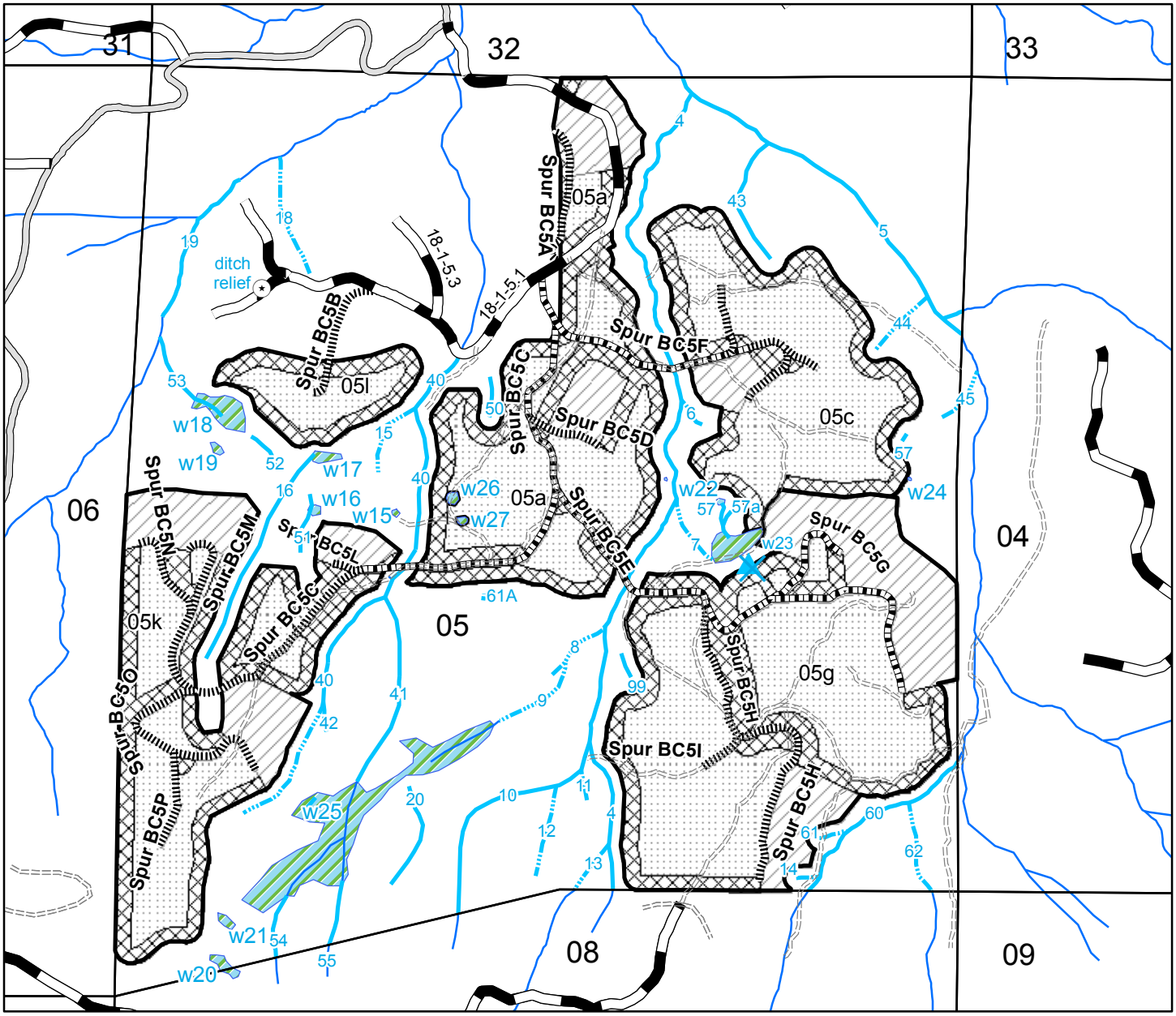
T18S-R01W Sec 05



- Groundbased Logging
- Skyline Logging
- Winch Logging
- Unit Boundary
- Road Construction - Native Surface
- Road Construction - Optional Rock
- Road Construction - Rock
- County Road
- Existing Decommissioned Road
- Existing Closed Rd
- Other Existing Road
- Stream - Not Field Checked
- Stream - Intermittent
- Stream - Perennial
- Sag Pond
- Seep
- Landslide
- Culvert
- Wetland

ALT 3

N

0 500 1000 1500 Feet

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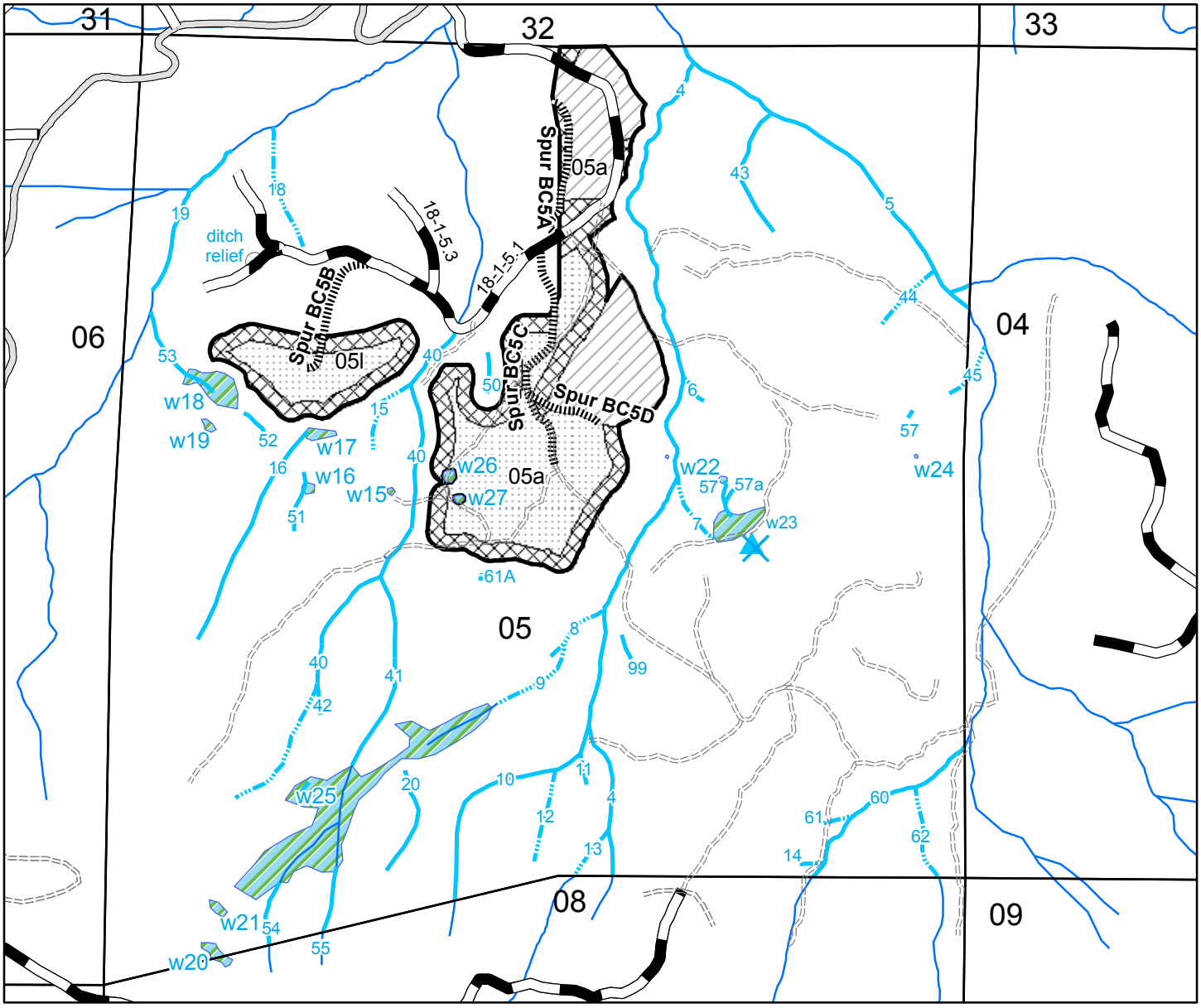
T18S-R01W Sec 05



- Groundbased Loging
- Skyline Logging
- Winch Logging
- Unit Boundary
- New Construction - Native
- County Road
- Existing Decommissioned Road
- Existing Closed Roadd
- Other Existing Road
- Stream - Not Field Checked
- Stream - Intermittent
- Stream - Perennial

HydroPoints

Description

- Seep
- Landslide
- Culvert
- Wetland

ALT 4

N

0 500 1000 1500 Feet

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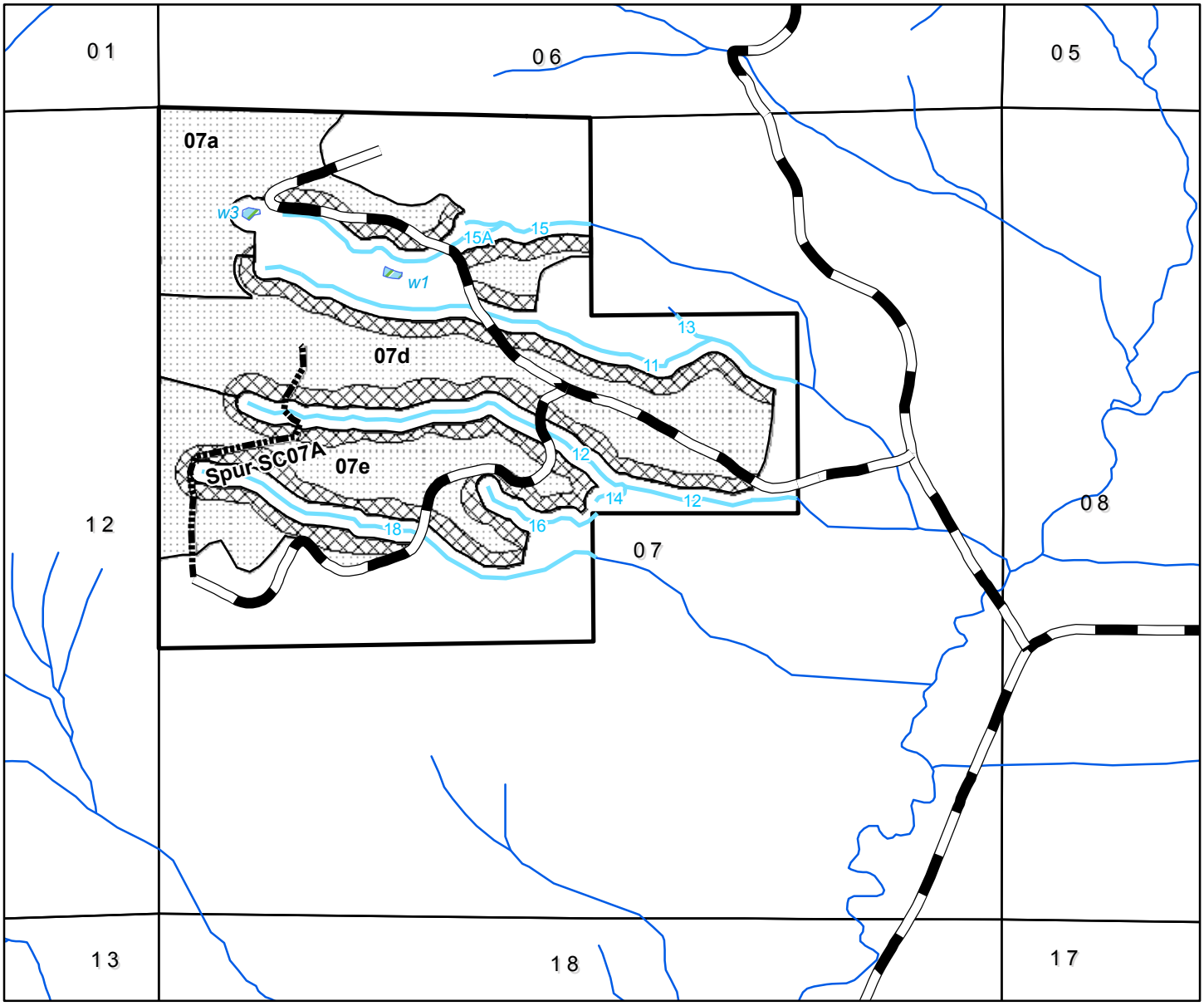
Solomon Creek, T.17S., R.01W., Sec 07



Ground Base
Winch
Unit Boundary
Road Construction - Optional Rock
County Road
Existing Decommissioned Road
Existing Closed Road
Other Existing Road
Stream
Field Check Stream
Wetland

Alt 2

N

0 500 1000 1500 Feet

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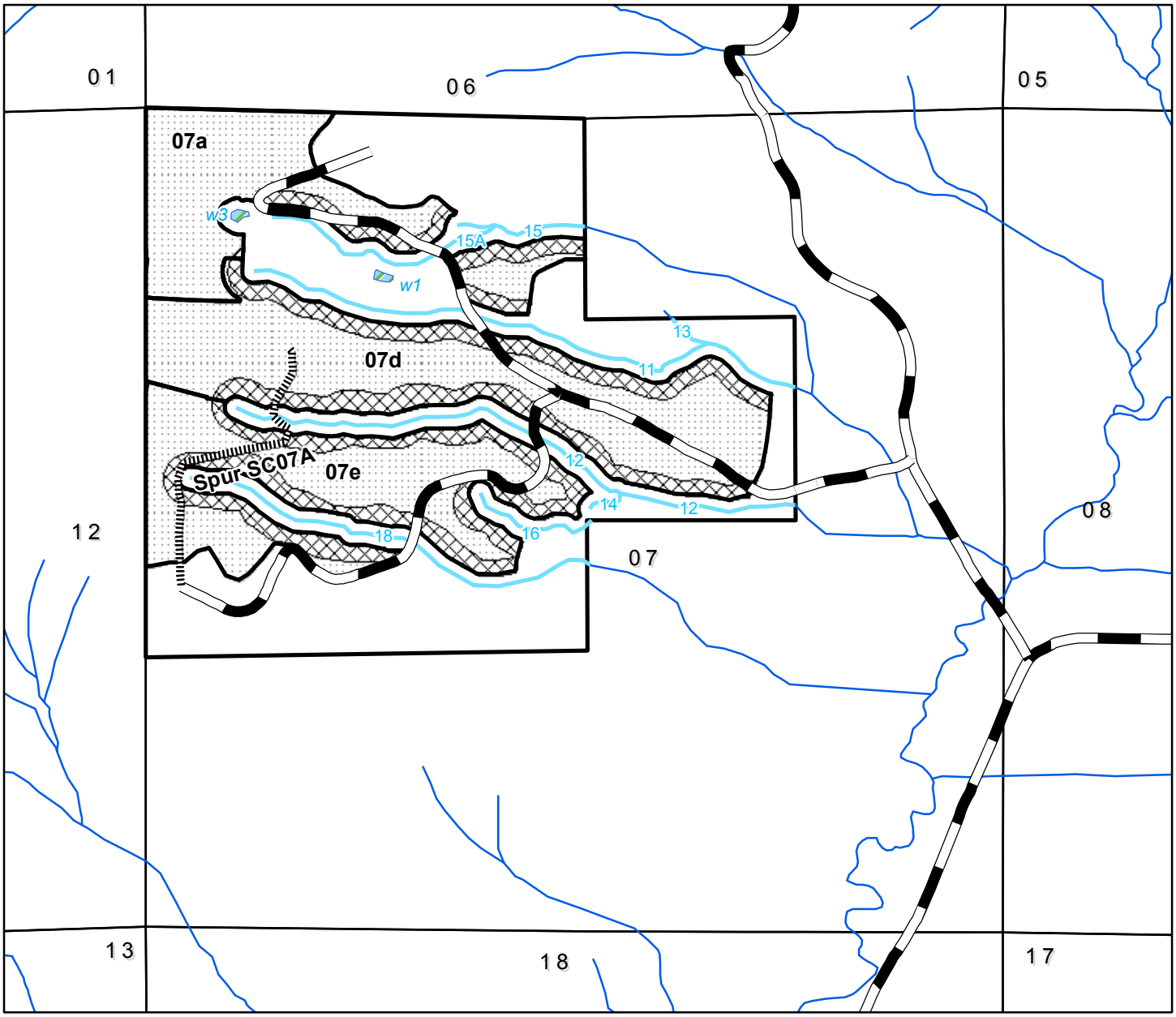

- Ground Base
- Winch
- Unit Boundary
- Road Construction - Native
- County Road
- Existing Decommissioned Road
- Existing Closed Road
- Other Existing Road
- Stream
- Field Check Stream
- Wetland

Alt 3

N

0 500 1000 1500 Feet

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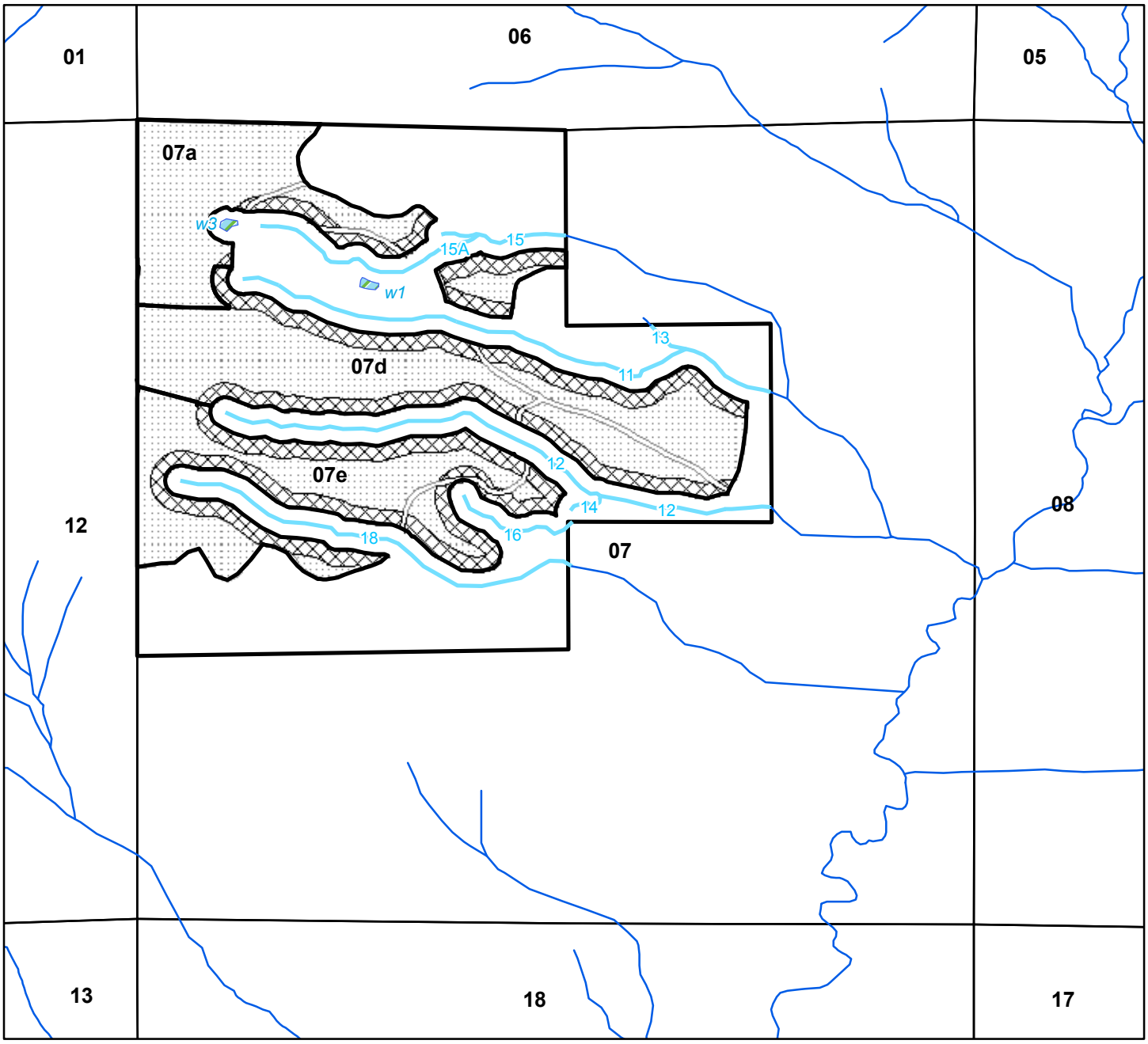

Ground Base
Winch
County Road
Existing Decommissioned Road
Existing Closed Road
Other Existing Road
Stream
Field Check Stream
Wetland

Alt 4

N

0 500 1000 1500 Feet

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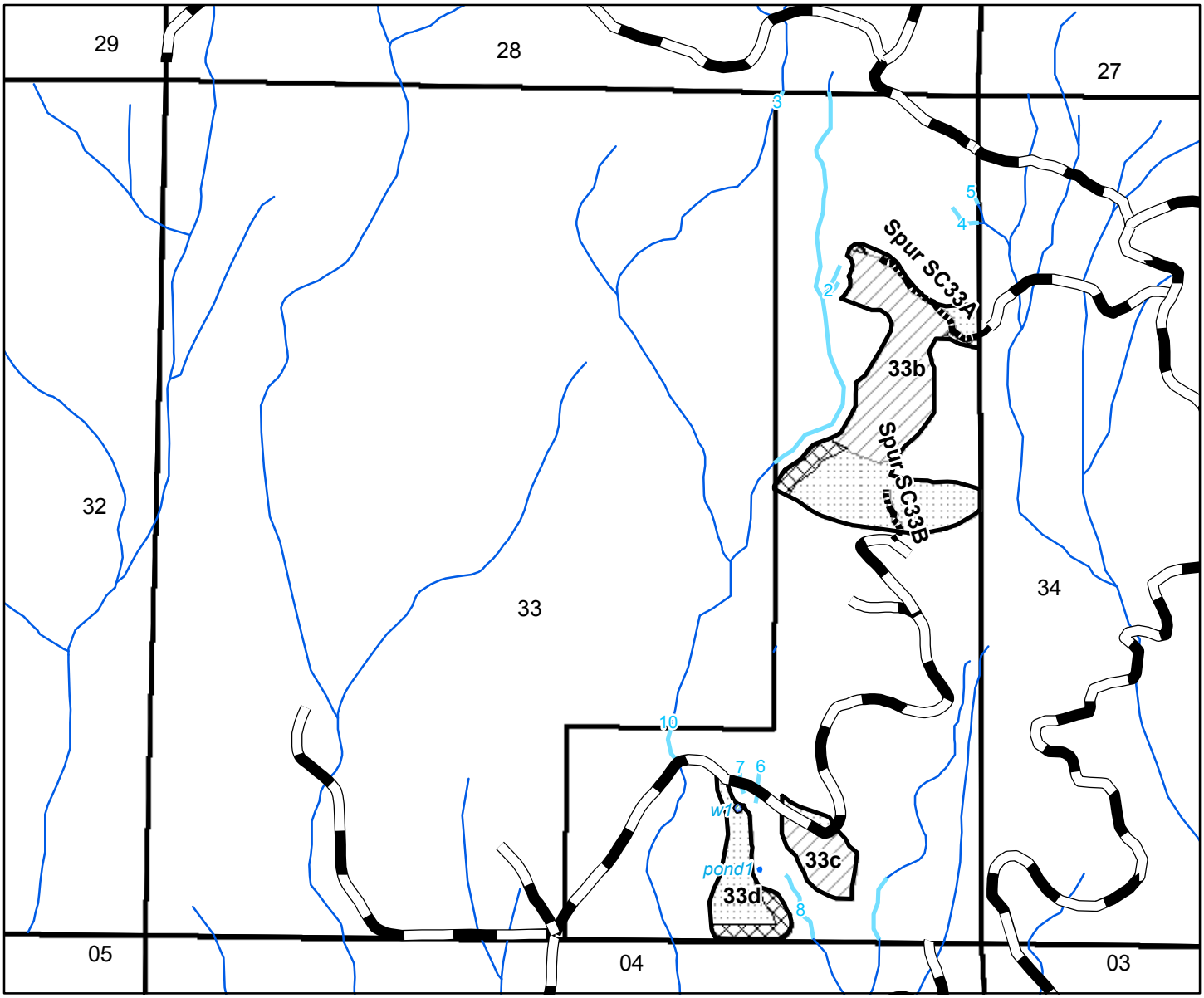
Solomon Creek, T.16S., R.01W., Sec 33



Ground Base
Skyline
Winch
Unit Boundary
Road Construction - Optional Rock
County Road
Existing Decommissioned Road
Existing Closed Road
Other Existing Road

Stream
Field Check Stream
Pond
Wetland

Alt 2

N

0 500 1000 1500 Feet

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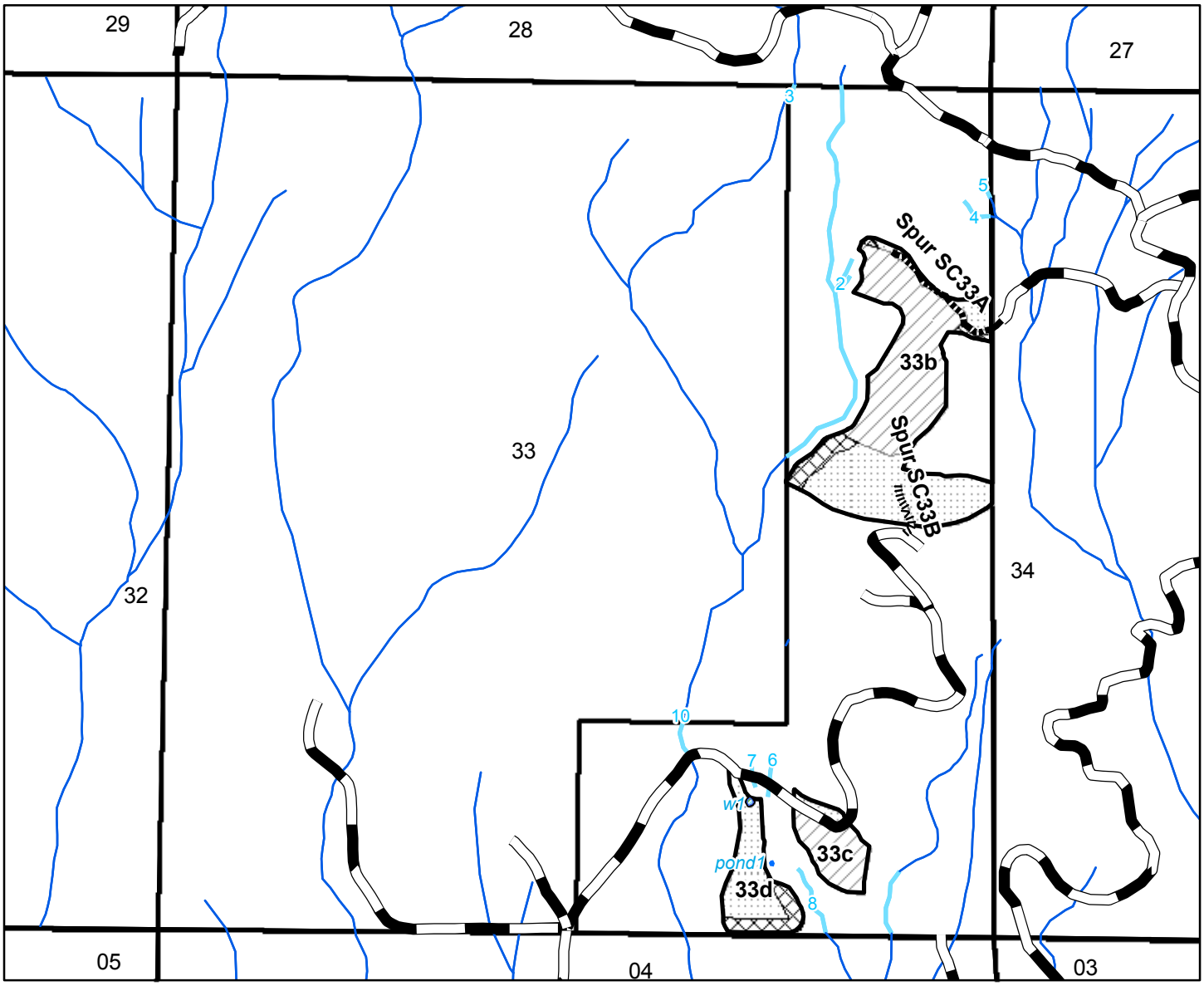

- Ground Base
- Skyline
- Winch
- Unit Boundary
- Road Construction - Native
- Road Construction - Optional Rock
- County Road
- Existing Decommissioned Road
- Existing Closed Road
- Other Existing Road
- Stream
- Field Check Stream
- Pond
- Wetland

Alt 3

N

0 500 1000 1500 Feet

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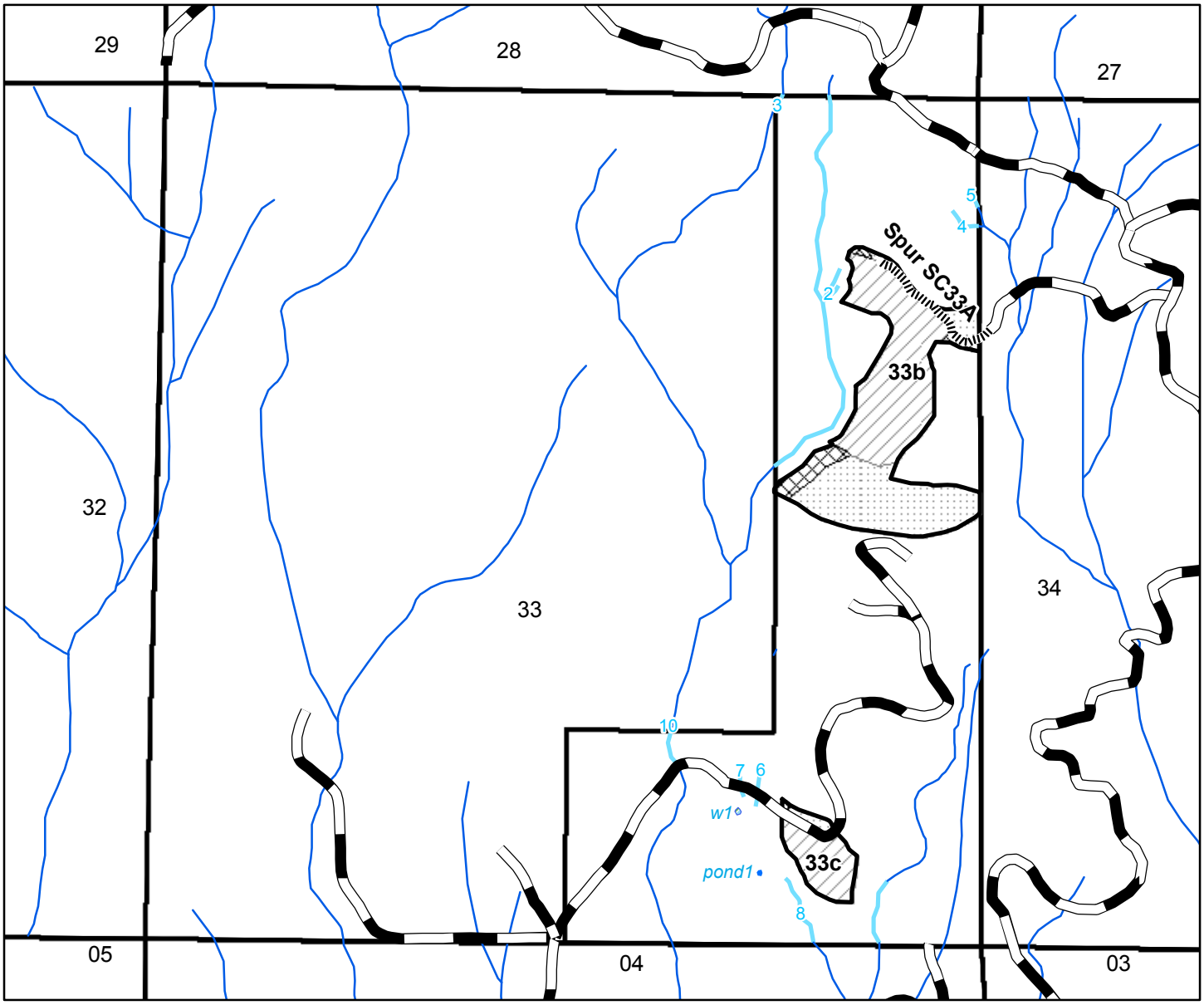

- Ground Base
- Skyline
- Winch
- Unit Boundary
- Proposed Road Construction - Native Surface
- County Road
- Existing Decommissioned Road
- Existing Closed Road
- Other Existing Road
- Stream
- Field Check Stream
- Pond
- Wetland

Alt 4

N

0 500 1000 1500 Feet

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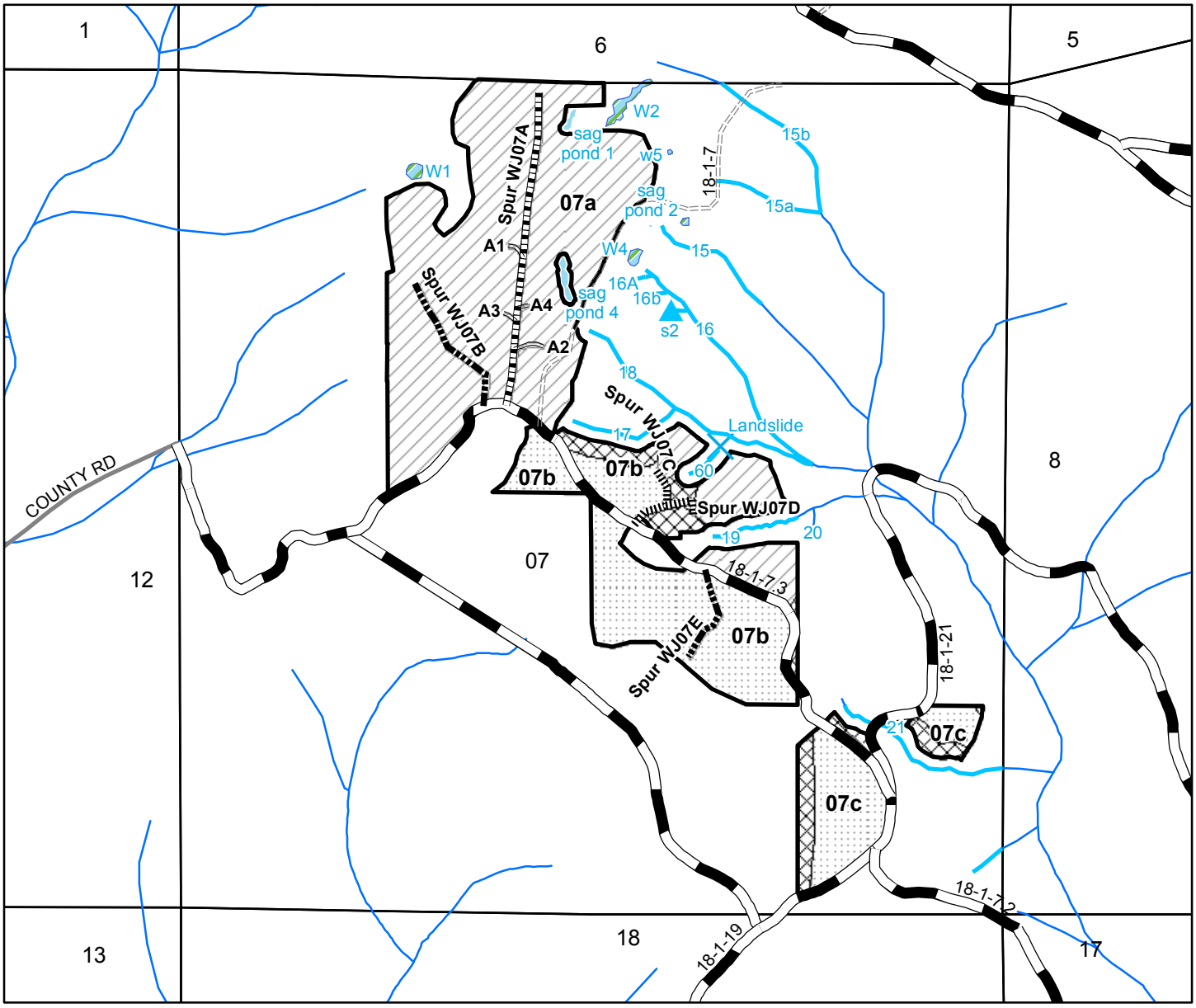
Wild Jack, T.18S.,R.01W., Sec 07



Ground Base
Skyline
Winch
Unit Boundary
Road Construction - Rocked
Road Construction - Native Surface
Road Construction - Native, Optional Location
Road Construction - Optional Rock

County Road
Existing Decommissioned Road
Existing Closed Rd
Other Existing Road
Stream - Not Field Checked
Field Checked Stream
Pond
Wetland
Landslide
Seep

Alt 2

N

0 500 1000 1500 Feet

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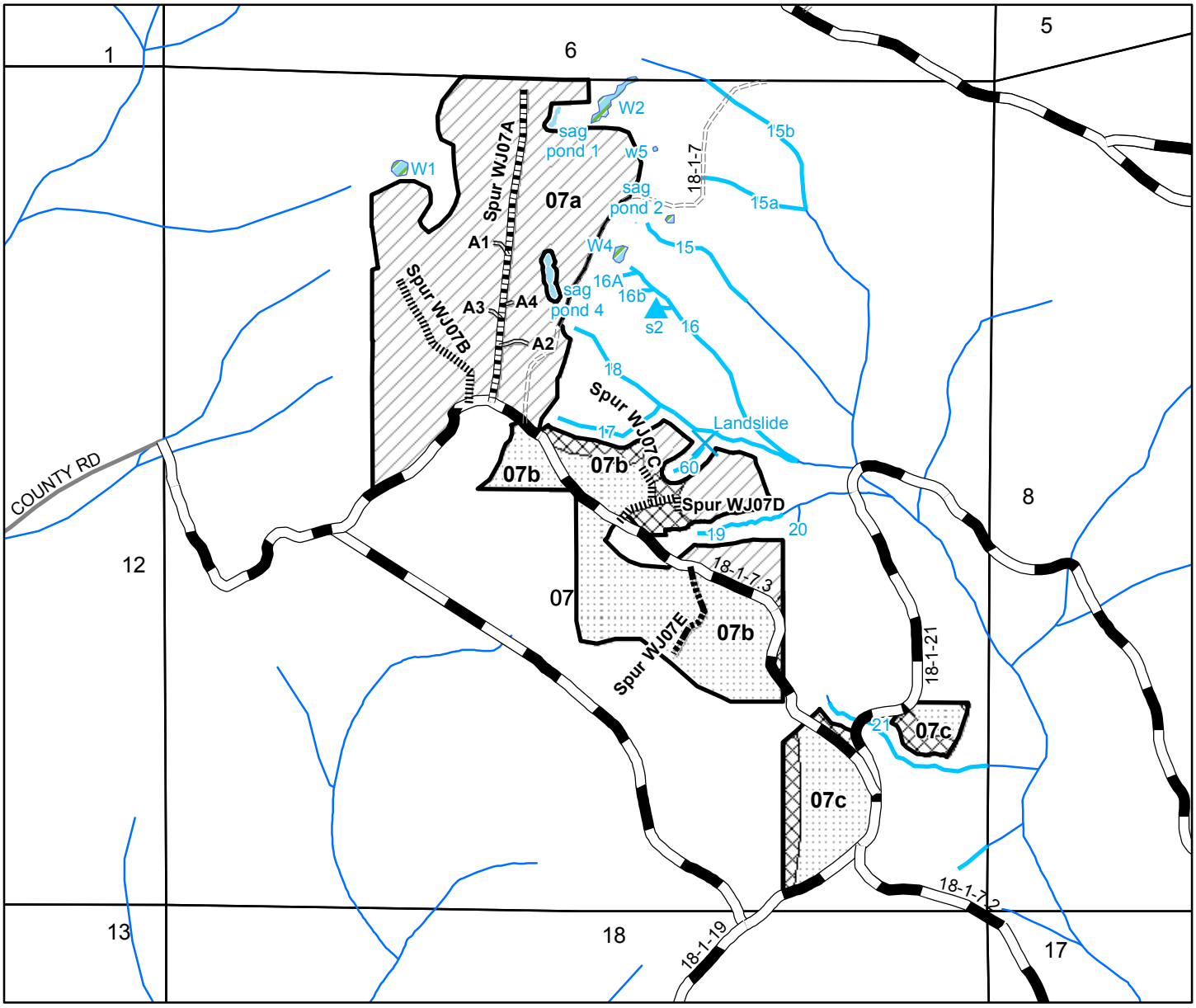

- Ground Base
- Skyline
- Winch
- Unit Boundary
- Road Construction - Native, Optional Location
- Road Construction - Native Surface
- Road Construction - Rocked
- Road Construction - Optional Rock
- County Road
- Existing Decommissioned Road
- Exixting Closed Road
- Other Existing Road
- Stream - Not Field Checked
- Field Checked Stream
- Pond
- Wetland
- Landslide
- Seep

Alt 3

N

0 500 1000 1500 Feet

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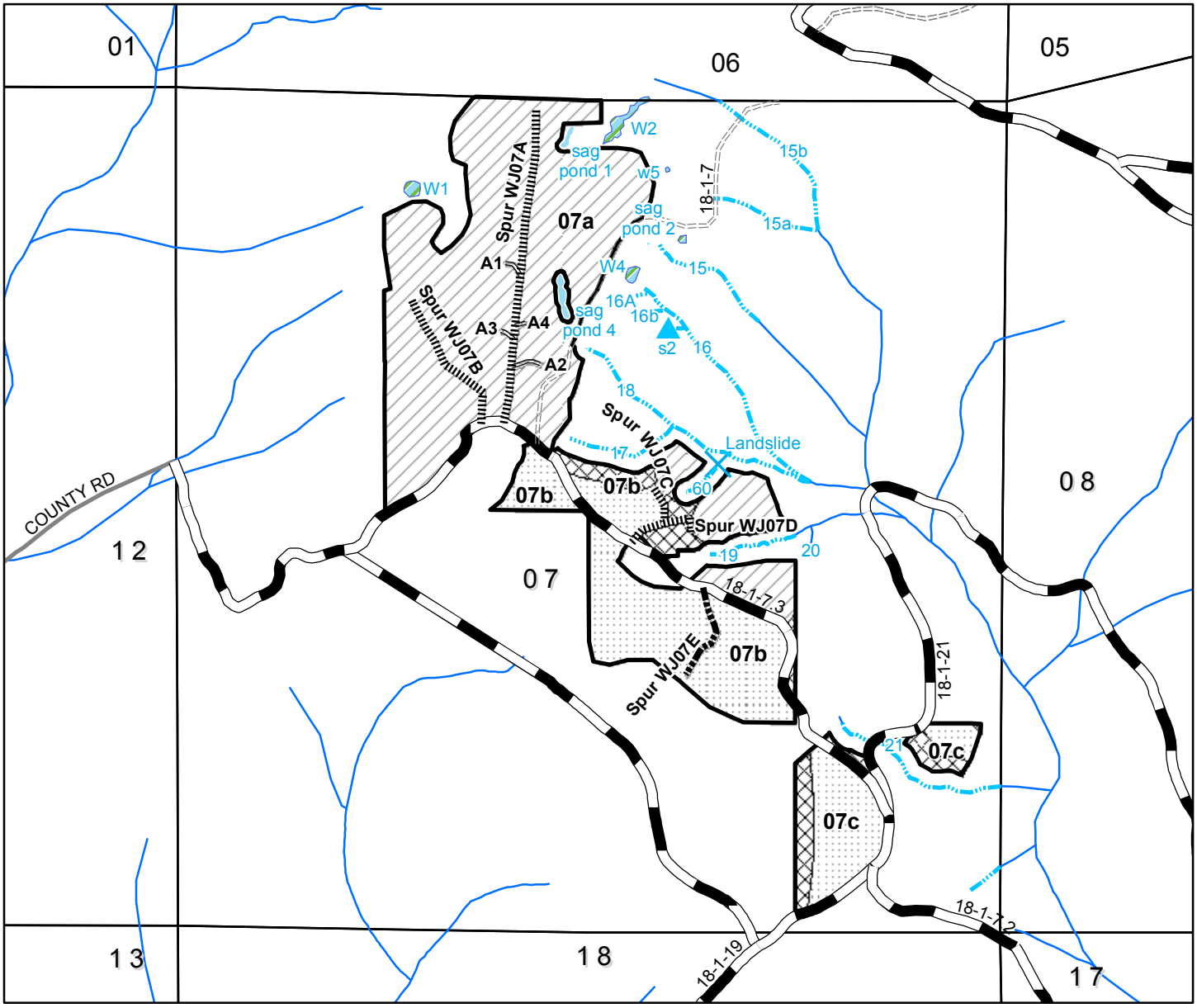

Ground Base
Skyline
Winch
Unit Boundary
Road Construction - Native Surface
Road Construction - Optional Rock
Road Construction - Native, Optional Location

County Road
Existing Decommissioned Road
Existing Closed Road
Other Existing Road
Stream - Not Field Checked
Field Checked Stream
Pond
Wetland
Landslide
Seep

Alt 4

N

0 500 1000 1500 Feet

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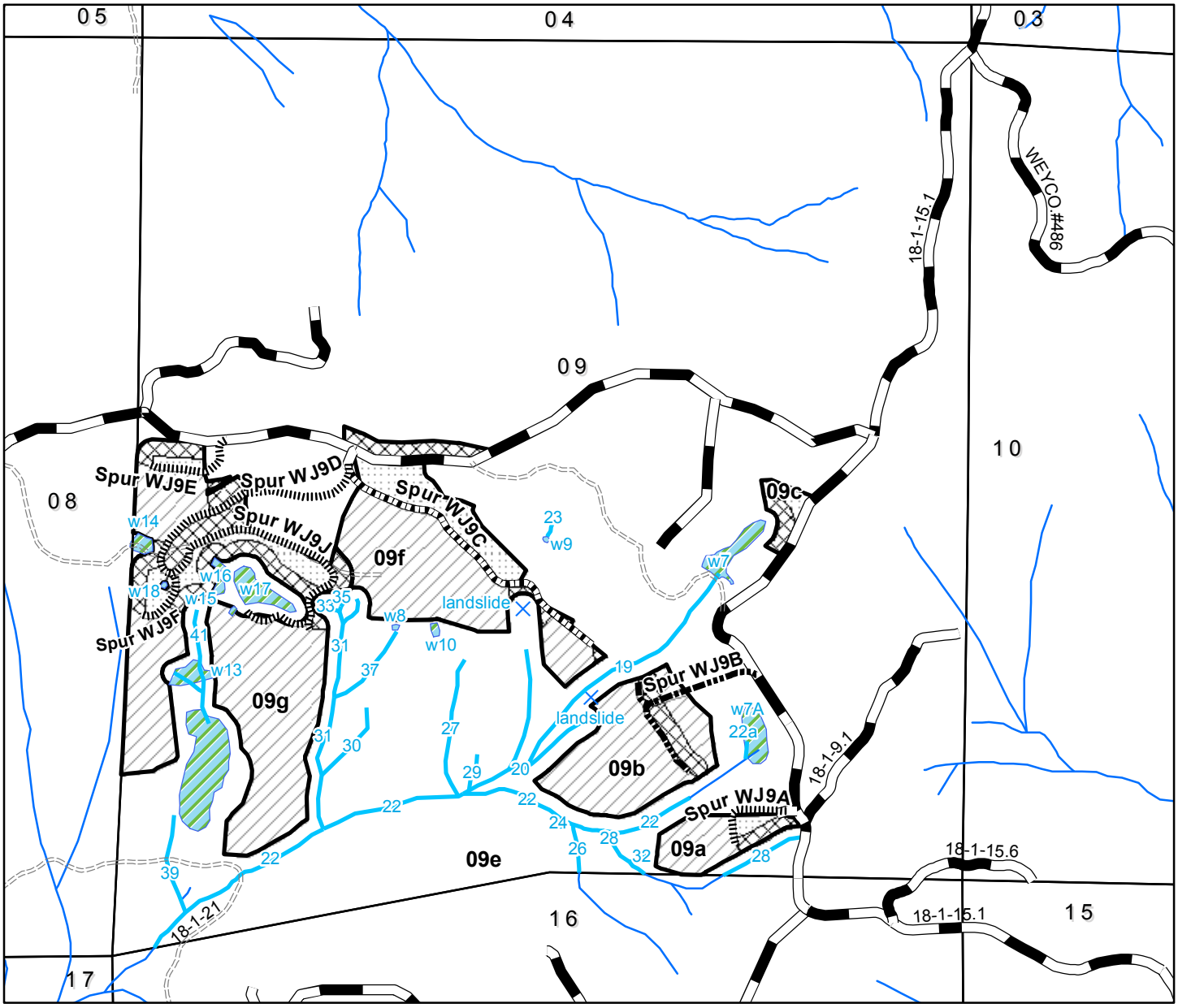

Ground Base
Skyline
Winch
Unit Boundary
Road Construction - Native Surface
Road Construction - Optional Rock
Road Construction - Rock
County Road
Existing Decommissioned Road
Existing Closed Road
Other Existing Road
Stream - Not Field Checked
Field Checked Streams
Culvert
Landslide
Pond
Wetland

Alt 2

N

0 500 1000 1500 Feet

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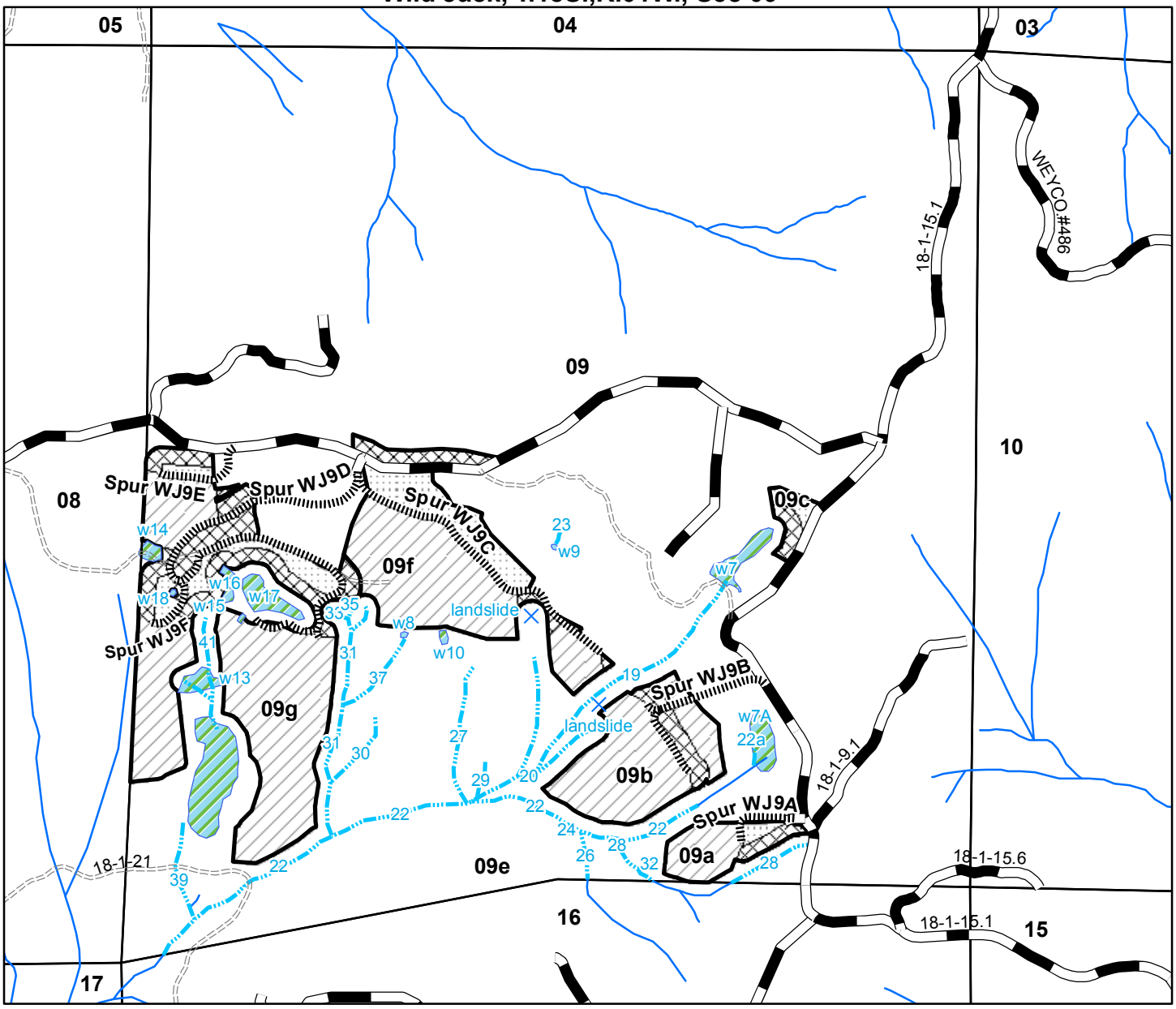
Wild Jack, T.18S.,R.01W., Sec 09



Ground Base
Skyline
Winch
Road Construction - Native Surface
Road Construction - Optional rock
Road Construction - Rock

County Road
Existing Decommissioned Road
Existing Closed Road
Other Existing Road
Stream - Not Field Checked
Field Checked Stream
Pond
Wetland
Culvert
Landslide

Alt 3

N

0 500 1000 1500 Feet

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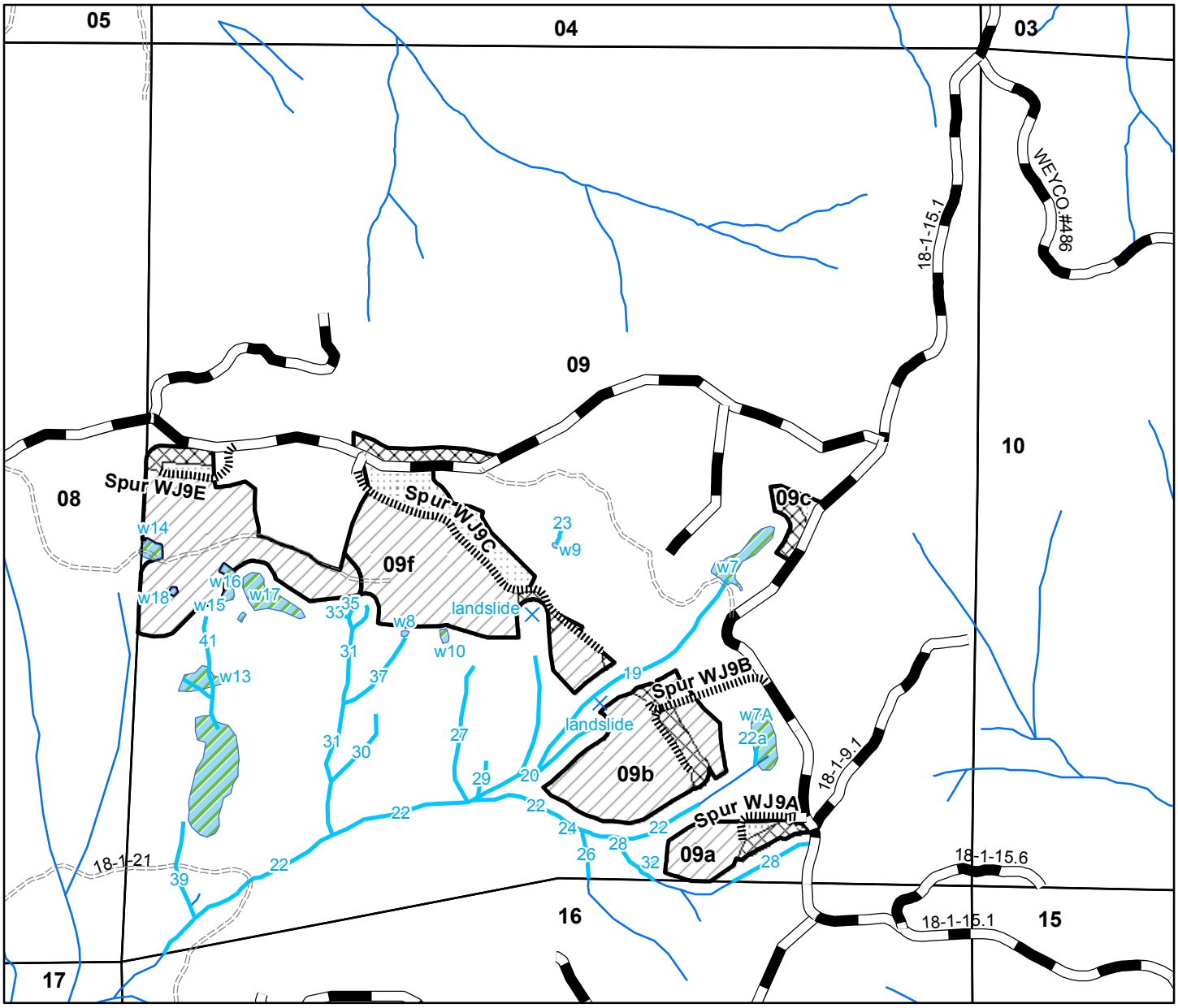
BUREAU OF LAND MANAGEMENT

ENVIRONMENTAL ASSESSMENT
Wild Jack, T.18S.,R.01W., Sec 09



Ground Base
Skyline
Winch
Unit Boundary
Road Construction - Native Surface

County Road
Existing Decommissioned Road
Existing Closed Road
Other Existing Road
Stream - Not Field Checked
Field Checked Stream
Culvert
Landslide
Pond
Wetland

Alt 4

N

0 500 1000 Feet

02/15/11

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Oregon State Office
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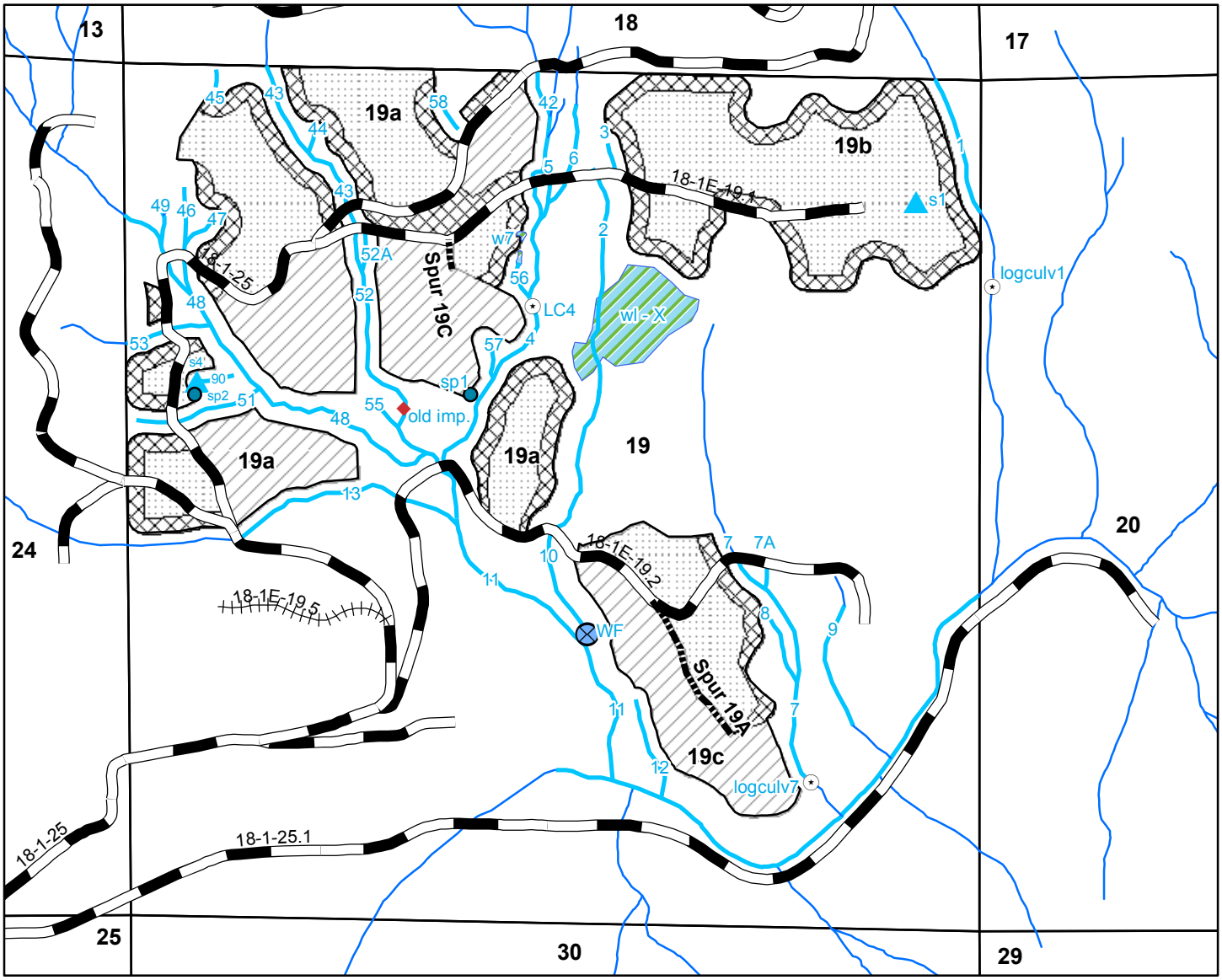
Portland, Oregon 97208-2965

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
ENVIRONMENTAL ASSESSMENT
Wild Jack, T.18S.,R.01E., Sec 19



- Ground Base
- Skyline
- Winch
- Unit Boundary
- Road Construction - Optional Rocked
- County Road
- Existing Decommissioned Road
- Existing Closed Road
- Other Existing Road
- Stream - Not Field Checked
- Field Checked Stream
- Culvert
- Landslide
- Plug
- Spring
- Seep
- Waterfall
- Pond
- Wetland

ALT 2

N

0 500 1000 1500 Feet

02/15/11

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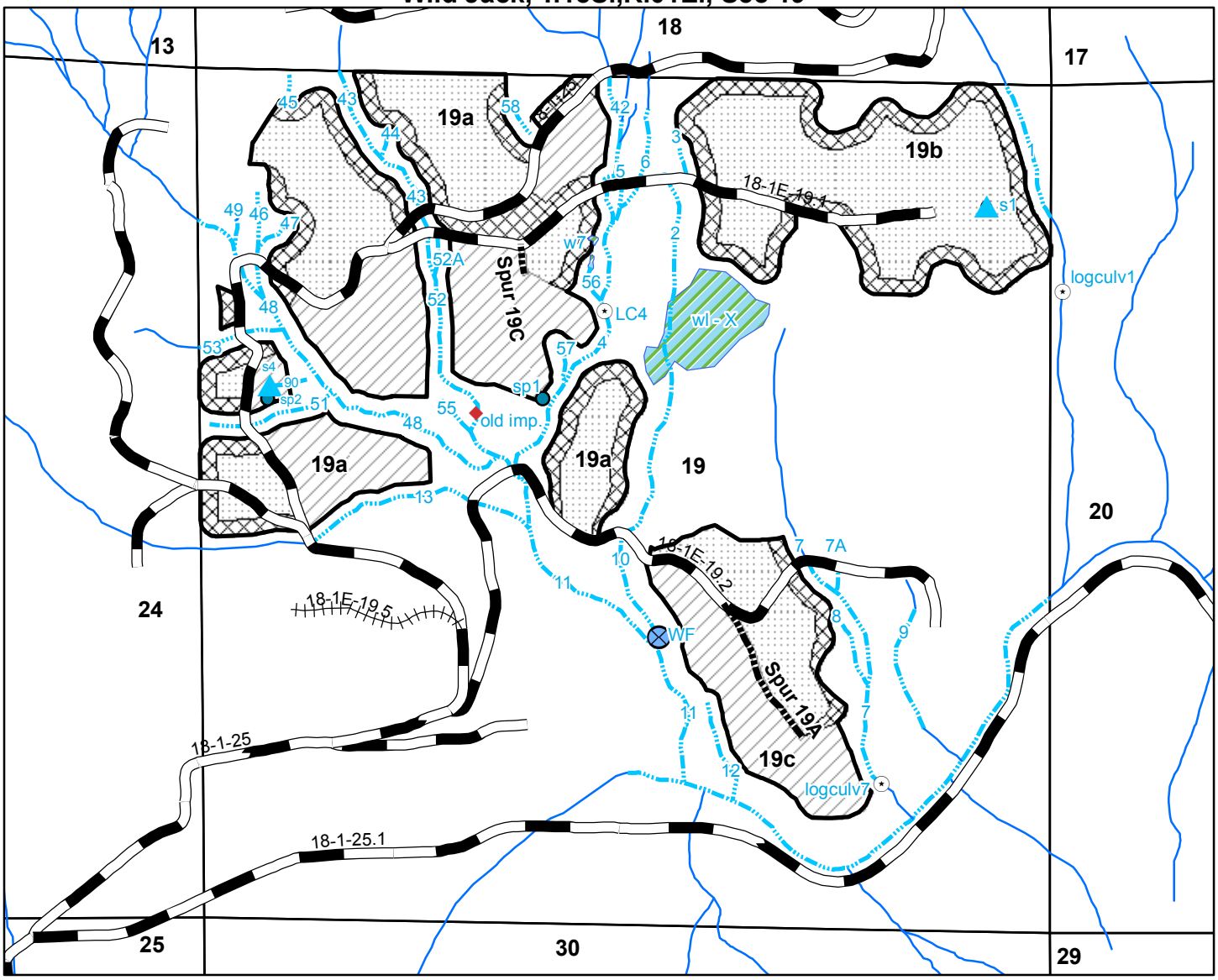

- GB
- Skyline
- Winch
- Unit Boundary
- Road Construction - Optional Rock
- County Road
- Existing Decommissioned Road
- Existing Closed Road
- Other Existing Road
- Stream - Not Field Checked
- Field Checked Stream
- Culvert
- Landslide
- Plug
- Seep
- Spring
- Waterfall
- Wetland

ALT 3

N

0 500 1000 1500 Feet

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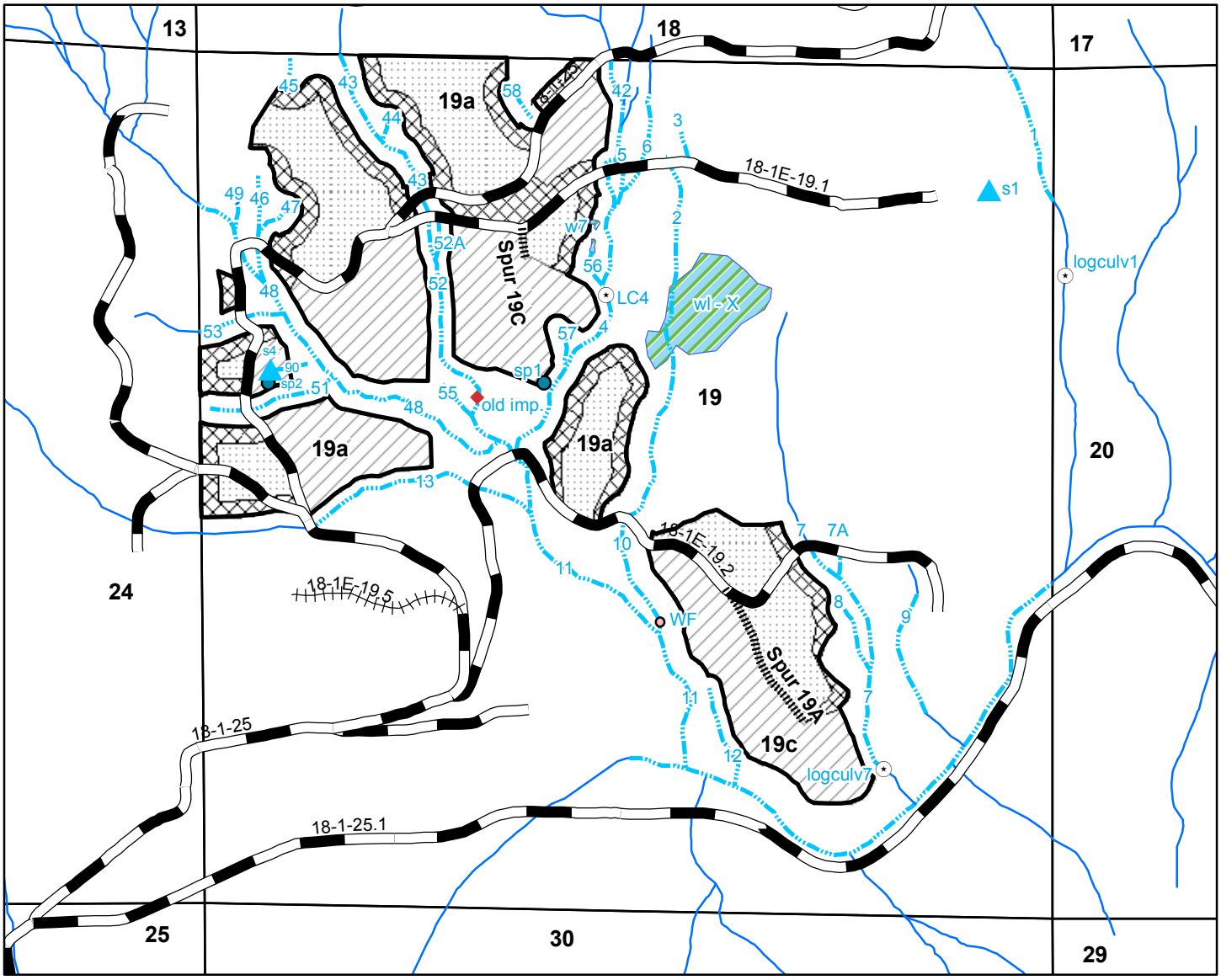
ENVIRONMENTAL ASSESSMENT
Wild Jack, T.18S.,R.01E., Sec 19



- Ground Base
- Skyline
- Winch
- Unit Boundary
- Road Construction - Native Surface
- County Road
- Existing Decommissioned Road
- Existing Closed Road
- Other Existing Road
- Stream - Not Field Checked
- Field Checked Stream
- Culvert
- Landslide
- Plug
- Seep
- Spring
- Waterfall
- Wetland

ALT 4

N

0 500 1000 1500 Feet

02/15/11

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