CHAPTER 5 - FINDINGS

This chapter will summarize some of the findings as a result of the analysis of conditions and processes. Some of the more interesting "ah hah's" will be addressed as will the key areas of sensitivity and impact. Many of the questions do not lend themselves to this type of summary and so the information will not be repeated An example of this kind of question is "What are the human use and development patterns?"; that question is answered in the information in Chapter 4 and would not be helpful to be displayed again.

CONTEXT

Refugia/Aquatic Core Areas

The best spring chinook habitat currently in the South Fork is above the dam and is within the key watershed designation. The South Fork will contribute to conservation of "habitat" for the at-risk chinook, but will not serve as an anchor for recovery of the population until adult and juvenile fish passage is provided over the dam.

At the scale of the stream reach or watershed, the South Fork below the dam does not serve as a refugia for bull trout or spring chinook because the biophysical disturbances overwhelm the ability of that habitat to provide resilience to the biotic communities. The habitat and associated processes (flow, temperature, substrate, cover) no longer function or occur at natural rates. This is the portion of the watershed that is not included within the Key Watershed designation.

While the South Fork watershed probably does serve as a refugia for bull trout, very little is known of population trends or condition as discussed in this analysis. Recognition of areas critical to the bull trout and comprehensive habitat restoration in the watershed should improve the refugia aspects of the watershed. The role of the reservoir as a refugia at certain life stages of the bull trout is postulated, as well. However, without further knowledge, the role of the reservoir in supporting the population will remain poorly understood.

HUMAN/SOCIAL

Scenic

Past management activities and development of flood control facilities has altered the scenic quality of the South Fork Watershed significantly. The development of Cougar Dam and Reservoir has altered the scenic quality of the lower South Fork in a permanent way, and in a way that reminds one annually during the drawdown period. In addition the area of the watershed has been harvested extensively over the past 40 years leaving a patchwork of shapes and patterns uncommon to the natural landscape. Permanent alterations of the landscape such as the dam and reservoir will remain. However, vegetation alterations from harvest activities are within parameters set by the Forest Plan objectives.

Recreation

Contrary to common belief, dispersed sites in the South Fork watershed are not causing extensive river bank damage or erosion, nor do they occupy an extensive amount of the riparian reserves or floodplain. However, many more sites exist in the watershed than originally believed, and a majority of these sites exceed normal conditions for three of five factors used to measure dispersed site conditions. A significant contributor to the conditions of dispersed sites is unrestricted vehicular access. It is believed that vehicular access into dispersed sites contributes to larger sites, larger barren core area, severely compacted soils, vegetation loss, and tree damage and loss.

It is apparent the level of management presence to monitor use and user activities is insufficient to counter the tendency to leave, trash and other debris in dispersed campsites, or to quickly remove these left behind artifacts of some dispersed campers.

The combination of physical campsite conditions, the presence of camper trash, and human waste in the vicinity of dispersed sites provides an image of an unmanaged situation.

Commodities and Access

The South Fork will have a reduced role in contributing timber related commodities in the future as compared with the past.

Access is generally unrestricted within the South Fork except for 55 miles of seasonal road closures and approximately five miles of year-round closures for wildlife. Road decommissioning is needed in some areas to meet resource needs and to respond to reduced maintenance schedules.

SOIL/WATER/FISH

Soils

The following findings display the effects of previous land management activities on the subwatershed(s) under discussion in the areas of displacement, compaction, nutrient loss and stability, and their relation to natural rates of disturbance in the study area.

Little or no evidence can be found to indicate that yarding of trees or slash disposal as related to timber management activities has resulted in detrimental soil displacement or off site soil movement of any significant degree for any harvested unit in the analysis area. Overland flow, indicative of compaction, but potentially resulting in erosion, was seldom noted in any of the field reconnaissance on the more gently sloping, older plantations.

Sediment delivery from road systems has been of about the same order of magnitude as downslope creep from colluvial processes when considered in approximately the same time frames and viewed over the entire study area. When looking at only the managed landscapes, the same conclusion remains in effect, except for the subwatersheds of Grasshopper and Lower Augusta (PSUBs 13U and 13V, respectively), where roads continue to provide sediment to the

streams at rates above more natural mechanisms. Some of these situations have stabilized over time, and some still persist and produce higher than desirable levels of off site sediment movement.

Sediment from timber management activity is not a significant issue in this basin, except as noted previously. Factors that sideboard these conclusions include the current standards and guidelines (refer to the discussion near the end of this report or more information) approved in 1990 WNFs Land and Resource Management Plan, as well as the Aquatic Conservation Strategy adopted in the Record of Decision for Management of Habitat for Late Successional and Old- Growth Forest Related Species Within the Range of the Northern Spotted Owl.

The analysis indicated that existing compaction, which resulted from unrestricted tractor yarding and tractor piling, is not considered cumulatively significant within the basin. Considerable acreage, primarily in Subwatershed Green Ridge (PSUB 13Q), supports sideslopes that are sufficiently gentle to tractor log. Although overland flow (indicating increased density and poor infiltration) and extensive skid road scars were not noted in many of the existing plantations, it is likely that detrimental compaction exceeded the 20% Regional Standard level in many units in this subwatershed, and these events may have been or may be (or may not be) cumulatively significant. A similar situation exists in Subwatersheds Hardy and Boone Rider (PSUBs 13P and 13R), but much less tractor loggable ground is available, and the resulting cumulative effects are much less evident (if present at all). The remaining subwatersheds generally have sideslopes that are too steep to tractor yard, except for Subwatershed Roaring (PSUB 13J).

Tractor harvest has been most extensive in the Skookum area of Subwatershed Roaring (PSUB 13J). Tractor roads are numerous, but fortunately this site is the least susceptible to adverse effects of compaction. Overland flow conditions (symptomatic of excessive compaction) are not common, and generally located on only the most heavily used road segments. Waterbars on these heavily used spurs are numerous and well spaced, and have effectively controlled most runoff. Subsoiling needs to be a priority in this area with future entries.

Nutrient loss from harvest and slash treatment is not considered significant for subwatersheds in this basin, except possibly for Hardy, Green Ridge, and Boone Rider (PSUBs 13P, 13Q, and 13R). The older timber harvest plantations in all other subwatersheds display a commensurate removal of above ground nutrient matter similar to the natural fires which burned in this area. More recent timber harvest has generally been more benign and retained considerably more organic matter than was displayed by the stand replacement fires. However the Hardy, Green Ridge, and Boone Rider demonstrate the highest concentrations and largest tonnage (100 to 300 tons on some selected sites) of above ground, decomposing organic matter present in the entire South Fork project area. It is also the case that these three subwatersheds contain some of the heaviest concentrations of harvest activity within the South Fork, stretching from the 1950's to the present. For the most part, previous timber management activities have not retained the levels (or the potential for) of on-the-ground organic matter that was originally present. It is likely that the older timber harvest plantations display a commensurate removal of above ground nutrient matter similar to intensive natural fire cycles that occurred in other parts of the South Fork and may have befell these PSUBs at some point in the more distant past. It is equally apparent that the levels of organic debris left in this fire cycle were not achieved for most harvest units. Similar arguments can be put forth for both the Grasshopper

and Upper Augusta Subwatersheds (13U and 13V) as well as the headwaters of the East Fork (13B), but to a much lesser degree. Current standards and guides tend to require debris amounts that begin to reflect the "natural" regime now evident (during this cycle).

It needs to be pointed out that the previous discussion involves three subwatersheds with a total of about 14,000 acres. A wide range of conditions exist, both manmade and natural, and general statements are necessary to capture critical highlights.

Several areas of critical highly dissected sideslopes with shallow, often unstable soils can be found in this study area. These areas display considerable natural, debris chute type, slope instability that appears to be related to the stand replacement fires, as well as flood events. Fortunately, for the most part, harvest units have not been located in the most sensitive areas. However, several road sidecast failures and in unit slope failures have occurred. Field inventories indicate that road sidecast failures, in unit slope failures, and natural failures have tended to occur at a relatively similar frequency, intensity and magnitude over the last four hundred years or so, except for Subwatersheds Hardy, Lower Augusta, and Grasshopper (PSUBS 13P, 13U, and 13V). Often failures have deposited material in similar areas lower in the drainages where several failure regimes are evident. Consequently, it appears that natural rates of slope instability are currently maintained when the entire basin is taken into account.

Several reports are available that suggest that roads and units significantly increase slope instability. In this area, that situation is simply not the case. Reasons for this apparent discrepancy are as follows:

1. Most published articles included inventories from photos and they occurred within 10-15 years after a 100 year storm event.
2. Road construction standards have changed considerably in the last 10-15 years.
3. This investigation included extensive field reconnaissance within the timber.
4. Thirty years of events are now available since the last 100 year storm event.

All these factors together have lead to an under representation of natural failures, and an over representation of management induced debris chute type failures at this time. The subwatersheds of Hardy and Grasshopper, and possibly Lower Augusta, display more incidences of management induced slope than would seem appropriate under natural conditions (at this point in time). Interestingly, the problem is not so much one of increases in sediment, as in reduction of LWD. Extensive slope failures are present along the entire western bank of Hardy Creek below the 1980225 road crossing. Most of the critical failure areas (though not all) occurred where harvest removed stabilizing old growth timber cover from adjacent stream sides. This situation coupled with considerable upland debris chute slope instability in harvest areas has resulted in extensive amounts of sediment to Hardy Creek without the accompanying structure. Where log jams are present, considerable flood plain development is now occurring. In this section, large rocks and boulders also provide substantive amounts of stream structure.

It needs to be restated that fires and slope failures, debris chutes and debris dams are what makes and sustains streams like Hardy, Augusta, and Grasshopper Creeks. Indeed, with all the harvest activity and all the sediment, both Augusta and Hardy Creek support healthy native trout populations and the middle reaches of both drainages also contain recently

discovered populations of the State sensitive tailed frog. As you might suspect, these species were located in the timbered sections of both creeks where log jams and LWD are common. In conclusion, timber management activities have increased slope instability in a few subwatersheds.

Stream Channel Condition and Aquatic Species

Above the Dam

The 1964 flood was a major event whose effects overshadowed and has driven generally all channel changes within the South Fork McKenzie River since 1939. The exception to this statement are the effects that the dam had on the reaches below the dam, and the effects of LWD removal on channel complexity in all channel reaches. Above the dam, the 1964 flood caused significant increases in channel width and area of exposed cobble and gravel bars. The trend up to present has been a recovery from the flood through a narrowing of the channel while cobble and gravel bars become more stable by becoming vegetated. Channel complexity has continued to decline both above and below the dam by reduction in side channels and loss of LWD. LWD is especially important in the upper reach above the dam for channel complexity. Large pieces of wood with root wads still intact should be introduced to this reach, limiting the grouping to no more than one to three trees at any location. Since set-up of log jams was an important component of the system in the past, the trees that are introduced artificially should not be tied down so they remain mobile. Formation of new side-channels will probably not occur until there are greater amounts of LWD and a moderate sized flood event occurs (return interval 10-20 year).

Stream temperature data from the South Fork McKenzie River gauging station above the dam indicate stream temperatures in 1981 were higher than could be explained by environmental factors such as low stream flow or high air temperatures. High rates of timber harvest in the 1970's and early 1980's are probable causes for increased stream temperatures. The trend for high stream temperatures due to harvest are on the downward trend.

South Fork McKenzie River tributaries vary in condition depending on management history, stream type, and landtype through which they flow. Hardy Creek, and the lower two miles of Augusta Creek are the only tributaries identified to be in poor condition directly as a result of management. Increases in peak flows due to harvest within areas of high potential contribution to rain-on-snow, may occur in the following subwatersheds: Hardy, East Fork, Lower Augusta, Loon, Starr, and Grasshopper. High road densities may be contributing to higher peak flows in lower Augusta and Loon, Starr, Hardy, Penny/Ridge, and Grasshopper Creeks. Potential for increased peak flows exist in Roaring River if future harvest units are placed on the southwest facing slope of Roaring Ridge.

Relative sediment yield rates from tributaries to the South Fork McKenzie River have changed since pre-management times as compared to the last 40-50 years. Tributaries that pumped in high amounts of sediment due to fire in the 1800's and early 1900's are now low contributors. These include the East Fork, Walker, French Pete, Rebel, Moss, and Basalt Creeks. Those tributaries whose relative contribution of sediment increased since the 1950's due to management include Hardy, Augusta, Grasshopper, and Cougar Creek.

Some tributary streams are outside desired aquatic habitat condition for pools and instream wood, which has also resulted in reduced habitat complexity. Those streams with pool levels below desired numbers are: Hardy, Cougar, Starr, Augusta, Elk, and lower Roaring River. Those streams with wood levels below desired numbers are: Starr, Balm, lower Augusta, upper Grasshopper, Elk, and lower Roaring River. These are the streams whose levels of pool habitat and wood are much lower than Forest or Regional objectives.

The reduction in habitat complexity within the main South Fork has lowered the capability of the habitat to produce salmon, trout, and other aquatic species. The reduction in side channel habitat throughout the main South Fork equates to a loss in critical salmonid rearing habitat.

Main South Fork pool habitat has been reduced from 1937-38 levels by approximately 60-90%. The greatest loss has occurred above French Pete.

Bull Trout

Five characteristics appear to be particularly important to sustaining bull trout (and other native aquatic species). These are:

1. stream channel stability;
2. habitat complexity (cover especially);
3. substrate composition;
4. temperature; and
5. migratory corridors (Rieman and McIntyre 1993).

Those characteristics which appear to be most outside the range of natural variability in the South Fork watershed are habitat complexity in the main South Fork and the migratory corridor which has been disrupted by Cougar Dam.

The main factors that are affecting the bull trout in the South Fork in terms of habitat complexity are the loss of deep pool habitat and large wood which provide cover and maintain optimal stream temperatures. There may be some reduction of habitat complexity in the Roaring River due to the location of Road 19, possible salvage activity in the lower reach and locations of campground and dispersed sites next to the lower Roaring River.

Information on pool levels exists for 106 reaches in the South Fork that were surveyed between 1988 to present. Those reaches with gradients > 10% are considered to not have specific quantitative objectives, because research has demonstrated that pool habitat varies greatly in high gradient systems. Approximately 74 reaches of the 106 have gradients at or below 10%, and in only two of those reaches do pool objectives come close or meet the objectives. The objectives are from Forest Plan and PNW research and the two sources have very similar objectives.

A few reasons appear to explain not meeting pool objectives. The first is where the streams have been aggraded due to disturbances from management or natural events and the levels of pools are truly below a desired objective.. This includes streams in subwatersheds with high road densities and associated harvest, and in wilderness systems such as French Pete where fire and flood event history have altered the stream habitat.

The second seems to be from the methodology used by the Forest Service in Region 6 to measure pool habitat. The current protocol records only pool habitat that has length greater than the wetted width of the channel. This method does not pick up pool habitat at the channel subunit level. For instance, ODFW records other types of pools (alcoves, backwaters, and isolated pools) that are not as long as the full channel width. These pools provide important fish habitat and are not recorded with the Region 6 Forest Service methodology. The upper South Fork survey by ODFW does come close to meeting pool objectives, while the same area surveyed with the Forest Service methodology in 1994 resulted in pool levels well outside the range of objectives. This area has had very limited management, so in this case it appears reasonable to question if protocol does play a role in the inability to meet pool objectives. The Willamette has added protocol to stream surveys to pick up pocket pool habitat in riffle units, which provides additional information on pools. However, this does not include the full spectrum of pool habitat at the subunit level. The recommendation would be to clarify the pool objectives at the Forest or Regional level and adjust the survey protocol if needed.

The third reason for not meeting pool objectives is the variability of individual surveyors. Protocol has been clarified and quality control has been initiated at the Forest level to help avoid this factor. A quality control test reach has been set up to run survey teams through, and attempts are made to retain experienced, qualified surveyors in succeeding years. Within this analysis this factor showed up in the comparison of two surveys of the Roaring River. One was conducted in 1990 and one in 1994, over the same stream reach (although the 1994 survey extended beyond the 1990 survey end). Both pool habitat and levels of LWD were lower in the 1994 survey, though no actual habitat changes were suspected. This is a factor which is inherent in resource surveys and highlights the importance of quality control at the Forest level.

A testing of the likelihood of the South Fork bull trout population persisting for 100 years or more was conducted by the US Forest Service Intermountain Research Station. The Intermountain Research Station is currently developing a Bayesian Viability Assessment Module as a tool for assessing the population viability of resident salmonids. The model is not ready for distribution or citation at this time (Danny Lee USFS, pers. comm.). Based on information from Blue River Ranger District and this watershed analysis an initial run of the model indicated that there is a likelihood of the bull trout in the South Fork persisting for 100 years or more of around 80-85%. These are informal results and future versions of the model and greater knowledge of the South Fork bull trout population may provide a different outcome.

Sources of cold summer tributary waters were found only in Roaring River, Elk Creek, and the upper South Fork McKenzie (above the mouth of Elk Creek). The low temperatures in Elk Creek were surprising given the extensive riparian harvest and high solar radiation inputs within the lower two miles. It is probable that stream temperatures in Elk Creek would be even cooler with regrowth of the stream canopy, and that the temperatures may be more akin to those found in Roaring River. The Roaring River is a spring fed system that provides critical spawning and rearing area for bull trout.

There is a moderate risk to the South Fork bull trout population viability from:

1. habitat degradation;
2. Road 19 --possible hazardous or toxic spill, direct runoff from road surface into Roaring River which could lead to water quality impacts; and
3. Location of lower developed and dispersed site camp grounds -vulnerability to human disturbance from harassment, poaching, etc.

Data collected from Hidden Lake indicate that the zooplankton populations are stressed and the phosphorous concentrations are high. Monitoring of the lake needs to be performed on a regular basis to determine if the lake is in transition to a more productive trophic status. Also, water samples should be collected and analyzed for phosphorous concentrations from the source pond and springs feeding Hidden Lake. This will help determine whether or not the high phosphorous concentrations in Hidden Lake are natural or introduced from nonpoint source dispersed recreation sites.

Management under the Willamette National Forest Plan has resulted in improved management to aquatic habitat since plan implementation in 1990.

The amendments by the ROD may strengthen the long term improvements to aquatic and riparian habitat by focusing on activities at the scale of an entire watershed.

Below the Dam

Below the dam, the 1964 flood was the equivalent to a flood with a two-year return interval. While the channel widened and area of exposed gravel and cobble bars increased above the dam, the bars actually decreased by 43% below the dam due to the reduction in flow. Channel complexity below the dam has decreased with loss of side channels and LWD, and chute-cutoffs will probably cause channel degradation starting immediately upstream from the chute cutoff, further isolating side channels. Closing off of the chute-cutoffs may prohibit further degradation of the channel. Since large flows are necessary for maintenance and formation of side channels, side channel numbers will continue to go down due to flow regulation from the dam.

The presence of Cougar Dam has blocked the spatial and temporal connectivity between the South Fork McKenzie and the main McKenzie. Both spring chinook and bull trout are physically obstructed to critical upstream areas, which has reduced the strength and resiliency of their populations in the McKenzie basin.

The water quality below the dam has changed due to the effect of water releases on temperature, which has reduced the integrity of the system to benefit survival, growth, reproduction, and migration of the individuals composing the aquatic and riparian community.

The sediment regime cannot be restored or maintained at this time due to the dam, as discussed in the analysis.

Out of the nine Aquatic Conservation Strategy Objectives, there are three which cannot be met at this time in the South Fork Watershed due to the presence and operation of Cougar Dam. They are: Objectives #2, #4, and #5 in the ROD. These involve spatial and temporal connectivity within and between watersheds; maintaining and restoring water quality necessary to support healthy riparian, aquatic, and wetland ecosystems; water quality that maintains biological, physical, and chemical integrity of the system; water quality that benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities; and maintaining and restoring the sediment regime under which aquatic ecosystems evolved, including timing, volume, rate, and character of sediment input, storage, and transport.

VEGETATION/WILDLIFE/WILDLIFE HABITAT/

Upslope Vegetation

The percent composition of current vegetation seral conditions is similar to seral vegetation conditions in 1900. In the last 94 years, a large proportion of the watershed in the higher elevations and Wilderness area has grown into mature and late seral conditions. Since the 1950's, harvest activities in the lower elevations have had a corresponding effect by converting mature and late seral condition to early and young seral conditions. The result is roughly no net change in the seral conditions composition in the watershed over time.

The amounts of current early and late seral conditions appear to be within the range of natural variability, but both are generally at the low end of the ranges.

Though the watershed displays a similar amounts of early and young seral conditions as the past, plantations contain significantly less structure of snags and downed logs.

Current vegetation patterns have more spatial heterogeneity than past conditions. Patch sizes are smaller and numbers of patches are higher. The higher density of early and young seral patches distributed over the watershed have caused the mature and late seral patches to become increasingly more isolated and fragmented.

Fires and harvest activities are the primary disturbance agents to the vegetation in the watershed. Fires of varying intensities and diverse temporal and spatial extent have resulted in an extremely complex mosaic of forest composition and stand age structure. The complexity of forest composition and structure has created a diversity of habitats for biological organisms. Harvest activities has modified 14% of the watershed over the last 50 years. The dispersed cutting patterns has created habitat with high contrast edges for forage and cover, developed an extensive transportation system, and reduced the effectiveness of interior forest habitat.

Riparian Vegetation

Imprints of large scale fires in the 19th century and major floods in 1861 and 1964 dominate major portions of the riparian reserves. Mature alder stands are widely distributed on hundred year floodplains. Young alder and shrub stages are currently mainly restricted to active lower floodplains or to stream margins which have been logged. Stands in the early and young seral stages are concentrated in subwatershed groups outside of wilderness. Conifer communities

common to areas transitional between streamside and upland habitats are mature in the 1800's burns, but largely old-growth adjacent to higher order streams elsewhere in the watershed. Plantations in these areas often represent substantial deviation from the range of natural conditions for typical successional patterns in the riparian in composition, structure, densities, and distribution.

In the absence of major natural disturbance, much of the mature alder habitat will succeed to conifer stands. Shrub and sapling alder areas will be limited to narrow strips adjacent to streams. Location of the road network has permanently altered some riparian habitats in the non-wilderness portion of the watershed. Riparian stands which experienced salvage or selective removals near roads will recover in time to replace large trees and snags. Maintaining the entire stream network in a late seral stage will reduce diversity of seral stages in riparian habitats compared to the past.

Unique Vegetation

A variety of rare and uncommon plants and plant associations are located in the watershed. Three Pacific silver fir plant associations, Pacific silver fir/dwarf Oregon grape (ABAM/BENE), Pacific silver fir/rhododenron-Alaska huckleberry/dogwood bunchberry (ABAM/RHMA-VAAL/COCA), and Pacific silver fir/rhododenron-dwarf Oregon grape (ABAM/RHMA-BENE) are listed as common on the District as a whole but information gained during this analysis indicates that they might actually be uncommon in the South Fork. Additional surveys need to be conducted to determine the extent of these plant associations.

An undescribed plant association was identified in the watershed. This association Douglas-fir/Oregon white oak (PSME/QUGA) is found on dry, droughty sites with south aspects. It is recommended that this association be added to the WNF Rare and Uncommon Forested Plant Associations and managed under the FW-211 guidelines.

Four noxious weeds are present within the South Fork and are distributed throughout the area. Invasion is closely tied to the road system. Maps of the presence of these weeds through time indicate they are increasing except for which is on the decrease after controls have been instituted.
In addition to the noxious weeds present, several exotic plant species occur; wall lettuce (Lactuca muralis) is the most common species. This species appears to be tolerant of a wide range of environmental conditions and habitats (Parendes1994). Wall lettuce is of concern as it is commonly found in riparian zones (WNF Riparian Data 1994).

Oxeye-daisy (Chrysanthemum leucanthemum) is an established exotic species in the Willamette Valley. Recently it has been documented along roadsides in the H.J. Andrews Experimental Forest, WNF (Parendes 1994). This aggressive exotic species is not known to be present in the watershed. All management activities to prevent the introduction of this species is recommended.

The South Fork watershed contains a rich variety of non-forested habitat.. Many of the meadows withir the South Fork have experienced encroachment by conifers through time and continue to experience encroachment today. Some rock outcrops and wet habitat have become exposed due to removal of

exposed due to removal of surrounding trees through harvest. These meadows, rock gardens and wet areas have been mapped and will be monitored through time

Wildlife Habitat

Essentially the South Fork displays much high contrast edge especially on the western side. These managed stands for the most part have low snag levels and range from low to high in the amounts of down wood. The health of the Late Successional Reserve in terms of historic owl pair reproduction indicates that the LSR is in fair-to-good condition by sustaining eight reproducing pairs and having about 70% of its area consisting of NRF habitat. The watershed as a whole has 58% NRF habitat. Critical habitat analysis reveals that it is also in fair to good condition with 55% of its habitat existing as NRF. Within the entire watershed which houses 45 known owl activity centers, 35% have insufficient NRF habitat within their home range, most of which are in the harvest area. However, by direction in the ROD only 100 core habitat areas will be retained in the matrix if surrounding LSR health is sufficient. These 100 acre cores still need to be mapped in the watershed, but ample habitat is available around most activity centers which now only have 80 acres mapped. Dispersal habitat (11/40) was also analyzed by quarter township. Only the Indian Ridge area is of concern from a dispersal standpoint within the watershed. Only 41.9% of this quarter township is in an 11/40 condition. For all other areas in the watershed, 80% meet this 11/40 standard.

Bald eagle and osprey habitat will be impacted by the proposed temperature control construction project by the Corps of Engineers during the drawdown period. However, these species and others would likely be enhanced by improved fish

Results of stream surveys show that tailed frogs are widely distributed, except possibly in the warmest streams in the lower portion of the watershed such as Rush creek. Tailed frogs were found in all streams surveyed this year. In another study of tailed frogs (Hawkins et al. 1988), highest densities occurred in disturbed reaches below forested headwaters. Lowest densities were observed in basins with no remaining forest, and intermediate densities occurred in minimally disturbed basins. The high abundance in partially denuded basins appears to be due to open canopy, leading to abundant algae food, and suitable adult habitat in upstream non-disturbed areas (Sedell et al. 1990). Densities were not estimated in the South Fork watershed, but the findings of Hawkins et al. may help explain the ubiquitous findings of tailed frogs in the South Fork, even in streams that had previously had complete removal of portions of the riparian canopy.populations resulting from the temperature control structures success in the future.

A subjective analysis of pileated woodpecker and American marten habitats compared to the interim riparian reserves indicated that the interim riparian reserves will provide long term interior forest habitat in blocks sufficient for these species. This would occur where class IV streams are highly dissected and close together, essentially creating a block of habitat if it were all late seral. However, this will not occur in most of the lower portion of the watershed until the young habitats within the reserves become mature or late seral stands. Harvesting these existing blocks of pileated woodpecker and marten

habitat in this area outside the reserves until that time is not recommended until sufficient replacement habitat is available.
Results of the elk habitat analysis indicate a general shortage of forage throughout the watershed, and road densities that do not meet forest standards in Hardy, Starr, and Green Ridge emphasis areas.

Stream reaches with levels near Forest or Regional objectives are not considered a priority for restoration, unless, for example, it has been determined that they need more LWD than either Forest or Regional objectives require. Higher levels of LWD than required by Forest or Regional objectives are based on channel type, local geology and soils, and management history. This was the case only for the Boone/Hardy subwatershed group where massive amounts of LWD help to stabilize banks and channel bottoms in the earthflow area. Additions of LWD in these streams should be introduced only where streambanks are vegetatively stable.

Habitats of this forest zone are well distributed in all seral stages throughout the watershed with the exception of early seral habitats in the wilderness and high Cascades areas. Habitat conditions are considered good for most species based on relative distribution and connectivity of the early, mid, and late seral habitats they are associated with. The exception to this is in harvest units without the normal legacy of structural components such as snags, LWD, or plant diversity occurring in natural stands.