4.0 Environmental Consequences

This chapter describes the potential environmental consequences of the No Action alternative and two alternatives that would involve suction dredging. The descriptions of potential impacts are organized by resource area; where potential impacts are different in one creek or another, this is covered under the resource at issue. The chapter is organized as follows:

4.1 Hydrology and Stream Discharge
4.2 Stream Geomorphology
4.3 Water Quality
4.4 Fisheries
4.5 Instream Habitat
4.6 Aquatic Invertebrates
4.7 Threatened and Endangered Fish
4.8 Wildlife
4.9 Riparian Vegetation
4.10 Recreation
4.11 Visual Resources
4.12 Noise
4.13 Socioeconomics
4.14 Heritage Resources
4.15 Nez Perce Treaty Rights and Traditional Uses
4.16 Cumulative Effects
4.17 Irreversible and Irretrievable Commitment of Resources

The discussion of potential impacts focuses on direct impacts, which are those caused by the action and that occur at the same time and place (40 CFR 1508.8(a)). Both the direct and indirect impacts are discussed by resource in sections 4.1 to 4.15. Section 4.16 addresses cumulative impacts, which result from the incremental impact of the action when added to the impacts of other past, present, and reasonably foreseeable actions (40 CFR 1508.7).

4.1 Potential Effects on Hydrology and Stream Discharge

4.1.1 Alternative 1: No Action

Hydrologic conditions, such as water yield, peak runoff, and annual sediment yield, within any watershed are a function of land use activities and management. Land use activities and management goals are specified within the guidelines of the Forest Plan (USFS 1987) and would not change as a result of any alternative. These conditions would remain the same under the No Action alternative and for other alternatives. Under this alternative, not approving small-scale suction dredging plans of operations would not affect stream flow or annual sediment yield within the Lolo Creek or Moose Creek watersheds. There would continue to be an elevated sediment yield from the Lolo #5 mining claim on Lolo Creek, and from the unimproved road crossing on Independence Creek.

4.1.2 Alternative 2: Suction Dredging

Hydrologic conditions, such as water yield, peak runoff and annual sediment yield within any watershed are a function of land use activities and management. Watershed conditions and management would remain the same under Alternative 2 as under the No Action alternative. Suction dredging would not introduce sediment to or increase sediment in the Lolo Creek or Moose Creek study areas but rather would relocate it by removing it from the substrate, passing it through the suction dredge, and replacing it into the creek, where it would settle out within a short distance. Thus, allowing approval of small-scale suction dredging plans of operations would not affect the amount of stream flow, water yield, or annual sediment yield produced in either the Lolo Creek or Moose Creek watersheds.

4.1.3 Alternative 3: Suction Dredging and Stream Improvement Projects

Potential impacts from suction dredging under this alternative would be the same as under Alternative 2. During construction, there would be a temporary increase in sediment yield from the Lolo#5 project on Lolo Creek. These would be reduced by the use of standard construction erosion control and runoff practices. Over the longer term, there would be a permanent reduction in sediment yield from this reach of Lolo Creek.

Similarly, in Independence Creek construction of a properly designed ford or crossing structure would increase sediment during construction. After completion of construction, the newly improved crossing would slightly reduce sediment yield in Independence Creek from current levels.

4.2 Potential Effects on Stream Geomorphology

4.2.1 Alternative 1: No Action

Channel geomorphologic conditions would be expected to remain essentially unchanged under the No Action alternative. Minor impacts to channel banks, and channel conditions that result from other small-scale uses such as fishing, camping, wading, and swimming would still occur.

Bank stabilization and reclamation proposed for the abandoned Lolo #5 mining claim on Lolo Creek would not be conducted under the No Action alternative. Unstable banks in the area would remain the same, and would continue to provide an exposed source of sediments to the creek. The channel in the area of the claim would remain channelized, which can result in increased channel scour both upstream and downstream of the site. These impacts could propagate over time, affecting additional lengths of the channel each year.

Installation of a drainage device or ford with concrete planking at the Forest Road 5440 crossing on Independence Creek would not be conducted under the No Action alternative. The present road crossing is a ford that serves as a source of sediment (from localized scouring of the channel) to downstream Independence Creek and Moose Creek. Improperly designed or unstable road crossings can locally affect stream channel morphology. These effects cause

erosion of the channel bottom or channel banks. In time, changes to channel morphology could be propagated both up and downstream until the stream comes back into equilibrium.

4.2.2 Alternative 2: Suction Dredging

In-stream structures, such as large boulders and large woody debris, provide local stability to a channel. These structures control stream gradient, flow direction, or produce localized pools or cover for fish. Removal of large boulders or other large structures by suction dredge operators could locally affect the energy and direction of stream flow and cause the channel to change over the long term by eroding the channel bottom or channel banks. In time, these changes could be propagated both up and downstream until the stream comes back into equilibrium. The terms to which prospective operators must agree in order to be approved stipulate that the creek cannot be dammed (condition 11, as described in chapter 2), large woody debris and large boulders cannot be moved (conditions 17 and 18), and tailings cannot be piled on banks or in a manner that stream flow is directed into a bank (condition 16). Long-term impacts to channel morphology would not be expected if terms listed above were followed.

Suction dredging typically involves dredging one or several cone-shaped holes in the streambed, with the excavated material then placed in a pile or placed into a previously dredged hole. A single hole typically involves removal of one or a few cubic yards of material. Small-scale suction dredging would cause impacts to localized areas of the channel bottom by moving substrate materials, and some redirection of stream flow could result from moving and piling bottom materials in the channel. While dredging activities would cause a temporary disruption of channel substrate materials, the terms and conditions (condition 21) state that all displaced substrate materials must be replaced after dredging activities are completed. In addition, the Forest Service will monitor all active sites at least five times during the mining season, and again after reclamation is complete, to monitor potential changes in morphology. If these stipulations are followed, impacts would be temporary and not result in long-term alteration of the channel morphology or stream equilibrium.

The bank stabilization and reclamation proposed for the abandoned Lolo #5 mining claim on Lolo Creek and the installation of a drainage device or ford with concrete planking at the Forest Road 5440 crossing on Independence Creek would not be completed. Long-term impacts of not completing these projects would be the same as those discussed for the No Action alternative.

4.2.3 Alternative 3: Suction Dredging and Stream Improvement Projects

The bank stabilization and reclamation proposed for the abandoned Lolo #5 mining claim on Lolo Creek and the installation of a drainage device or ford with concrete planking at the Forest Road 5440 crossing on Independence Creek would be conducted under this alternative. Potential impacts on stream geomorphology from suction dredging would be the same as under Alternative 2.

The bank stabilization activities on Lolo Creek would directly reduce bank erosion, which alters the stream channel morphology and sedimentation of the creek. Restoration of the stream channel to match expected stream gradients, natural pool-riffle ratios and channel sinuosity

would mitigate impacts associated with increased stream flow velocities and channel erosion that result from the current channelized condition.

Installation of a properly designed and stable ford or other crossing structure at the Forest Road 5440 crossing on Independence Creek should not significantly affect stream geomorphology.

4.3 Potential Effects on Water Quality

4.3.1 Alternative 1: No Action

There would be no potential impacts from accidental spills or discharge of wastes or chemicals to the stream from suction dredging activities under this alternative. Accidental spills of chemicals or wastes near or in streams could still potentially occur from camping and other activities that would occur even without suction dredging.

Fine sediment and turbidity levels in Lolo, Deadwood, Independence, and Moose Creeks would remain low under the No Action alternative. Low levels of sediment and turbidity would continue to be caused by nearby roads and camping activities near the streams.

Under the No Action alternative, historic dredge tailings and overburden materials in the Collette Mine area at Lolo #5 would continue to provide localized delivery of sediments to Lolo Creek. Erosion of unstable stream banks in this area would continue to be a source of sediment to the creek.

The existing Forest Road 5440 crossing over Independence Creek would continue to be source of sediment to downstream Independence Creek and Moose Creek. Localized scouring of the channel and the resulting increases in sediment and turbidity would remain unchanged under the No Action alternative.

4.3.2 Alternative 2: Suction Dredging

Potential impacts to water quality could result from accidental spills of chemicals or wastes near or in the streams by suction dredge operators. A number of the terms and conditions required for approval under this alternative are designed specifically to prevent or minimize spills, including conditions intended to keep refuse and human wastes away from water (condition 8), to ensure fuels are stored and used safely (conditions 19 and 20), to prohibit the use of hazardous or refined substances to recover gold (condition 29), and to avoid dispersal of any mercury encountered in old dredged material (condition 29). These conditions will prevent any significant impacts from spills, and Forest Service inspections under this alternative would ensure that operators are following the stipulated conditions.

Suction dredging that would be approved under this alternative occurs in the confines of the stream channel (condition 1) and does not result in the discharge of any new sediment to the creeks. The suction dredge pulls stream sediment, gravel and small rocks, and other materials (collectively, the “overburden”) from the stream bottom, along with any gold. All this material is routed through a sluice box, which channels the water and other material over a series of riffles

that serve to create pockets of slow water immediately behind each riffle -- the heavier material, including any gold, settles behind the riffles and the rest goes directly back into the stream. Dredging can entrain and discharge fine sediments from the stream bed material and increase turbidity[9] in the stream immediately downstream of the discharge point. Idaho DEQ requires that background turbidity levels not be increased by more than 50 NTU[10] instantaneously or 25 NTU for more than 10 days (IDEQ 2000). The degree that turbidity is increased by dredging is expected to be highly variable and dependent on the amount of very fine sediments (i.e. silts and clays) that occur in the bed material and the velocity of the stream flow. As discussed in Chapter 3, the size and amount of sediment that can be carried by a stream is related to the stream flow velocity.

As noted in Chapter 3, Lolo Creek contains relatively little very fine sediments even though cobble embeddedness is relatively high. Figure 3-1 shows that a very small fraction (less than one percent) of sampled bed material in Lolo Creek consists of fine materials (<0.25 mm). Stream flow velocities during the permissible operating season in July and August also are low, with values of 1.29 and 0.93 feet per second, respectively (Table3-5). At these flow levels, suspended particles would settle out very quickly. It is very unlikely that increases in turbidity above the 50 NTU limit would occur as a result of suction dredge operations in Lolo Creek. Any increases in turbidity at all would be for a very short duration while the dredge is operating, and any fine sediments that may be released would drop out within a short distance downstream, particularly in areas where stream velocities are greatly slowed, such as a pool. These extremely localized and temporary increases would not be significant compared to the background total sediment loads of 1,541 and 500 pounds per day in July and August, respectively (Table3-4).

Figures 3-6 and 3-7 in Chapter 3 show particle size distributions for Independence and Moose Creeks. These data suggest that a somewhat larger fraction of fine materials may exist in these creek substrates than is found in Lolo Creek although data are not available for very small size fractions that would include silt and clay material. Size fraction data are not available for Deadwood Creek, but particle size distribution of the Deadwood Creek substrate would be expected to be similar to Moose and Independence Creeks because of similar historic watershed activities and impacts.

These data suggest that it is more likely that detectable increases in turbidity would occur during suction dredge operations in these creeks. However, low observed background turbidity levels (Table 3-13, 3-14, and 3-15 for Deadwood, Independence, and Moose Creek, respectively) suggest that levels of very fine sediment that could potentially increase turbidity are low. Low stream velocities in July and August, which are also observed in these creeks (Table 3-16), should prevent long-distance transport of even fine sediment disturbed and suspended by suction dredge operations, since suspended particles would settle out within a short distance.

To ensure that any increase in turbidity is short-lived and localized, condition 15 (see Chapter 2) requires that operators visually monitor the stream for 300 feet downstream for the first half hour

[9] Turbidity results from an increase of suspended fine sediment that reduces water clarity.
[10] As noted in Chapter 3, Nephelometric Turbidity Units are measures of turbidity that result from a photogrammetric method of measuring light transmission through water. As turbidity increases, more light is scattered by suspended particles in the water and less light is transmitted through the water.

of operation. If they observe noticeable turbidity, they are required to cease or reduce operations until there is no increase visible 300 feet downstream.

Significant increases in turbidity, potentially above the 50 NTU standard, would be expected only if dredging activities extend into channel banks, since banks would be a ready source of fine sands, silts, and clays. Operators must agree not to undercut, destabilize, or otherwise disturb streambanks (condition 10), and Forest Service inspections will ensure compliance and minimize the potential for bank disturbance and consequent increases in turbidity.

Under this alternative, the Lolo #5 areas and the Forest Road 5440 crossing would continue to contribute sediment and increase turbidity in downstream areas.

4.3.3 Alternative 3: Suction Dredging and Stream Improvement Projects

Potential impacts to water quality that could result from camping, vehicular traffic, and other non-mining activities would be the same as under Alternative 1, and potential impacts from suction dredging activities under this alternative would be the same as those under Alternative 2.

Regrading and stabilization of the tailing materials and disturbed areas at the Lolo #5 mining claim would be conducted under this Alternative, and this would stabilize exposed stream banks and reduce or eliminate further sedimentation and increases in turbidity from this area. Exposed sediment sources from piles of dredge tailings and overburden materials would be regraded and reclaimed to prevent future erosion and delivery of sediments to Lolo Creek. There would be localized increases in turbidity during construction but the use of standard best management practices would mitigate these increases substantially. The net effect of this project would reduce sediment loadings into Lolo Creek and improve water quality over the longer term.

Similarly, installation of a drainage device or ford with concrete planking at the Forest Road 5440 crossing of Independence Creek would stabilize the channel and reduce the sediment and turbidity that result from and around the current ford. Again, there would be increases during construction but reductions over the longer term.

4.4 Potential Effects on Fisheries

4.4.1 Alternative 1: No Action

Ongoing recreational fishing would continue under this alternative, but this should not affect the long-term viability of any fish population or species. There could be spills from camping or other activities, as described in section 4.3.1.

The area disturbed by past mining in the Lolo #5 area would not be restored under this alternative. The stream would remain channelized, banks would remain unstable, and there would continue to be increased sediment loadings. All of these elements result in reduced habitat quality, which would affect the use of the area by fish.

Installation of a drainage device or ford with concrete planking at the Forest Road 5440 crossing on Independence Creek also would not be conducted under this alternative. The present road crossing is a ford that serves as a partial fish barrier during low flows and also a source of sediment (from localized scouring of the channel) to downstream Independence Creek and Moose Creek.

4.4.2 Alternative 2: Suction Dredging

The effects of camping and other activities, and of not implementing the stream improvement projects, would be the same as under Alternative 1.

The total habitat area of Lolo Creek within the project area is 189,315 square meters (Clearwater BioStudies, Inc. 1999a). Because small suction dredges use nozzles from two to five inches in diameter, the substrate size fractions subject to entrainment range from silt fines to small rubble (3-5 inches diameter). These size fractions comprise about 99,036 square meters or 52 percent of the streambed in the Lolo Creek project area. Thus, a reasonable maximum level of disturbance by dredge operators could occur to about one-half of the aquatic substrate habitat.

As noted in chapter 1, there could be up to 18 proposed plans for operation in Lolo Creek. If 18 suction dredges operated the entire season, then the estimated total disturbance could reach 8 square meters of stream bottom per day for 46 days. This would result in 6480 square meters of direct disturbance (8 square meters x 18 operations x 46 days) during a season, which would represent about 7 percent (6480 ÷ 99,036) of aquatic habitat.[11]

Based on past dredging operations, potential maximum downstream measurable indirect effects from turbidity and sedimentation would occur within 100 meters (325 feet) of direct operations (based on research from Royer *et al*. 1999), so this would add another 9,000 square meters to the potentially disturbed area (100 meters length x 5 meters width x 18 operators). Thus, there could be indirect effects over about 9 percent of the aquatic habitat in Lolo Creek (9,000 ÷ 99,036). As noted in section 4.3.2, there is very little fine material (material <0.25 mm in diameter) in Lolo Creek and so the potential for added turbidity is relatively low. As a result, effects from turbidity would not occur in nearly this large an area.

When a similar approach is applied to the Moose Creek study area, up to 38 simultaneous dredge operators would impact approximately 80 percent of the aquatic substrate habitat. The maximum area of potential direct disturbance would be about 10 percent of the available habitat area meeting substrate sizes, and about 9 percent of total aquatic habitat for potential indirect impacts.[12]

[11] This is the maximum area that could be disturbed, but the area that is reasonably likely to be disturbed in any given year would be much smaller. In 2001, for example, there were only eight section dredge operations in Lolo Creek. Of these, only two dredged for close to a full season (46 days), while the other six were active for only one or two weeks.

[12] Again, this is the maximum area, and again the actual area disturbed would be much less. In 2001, the Forest Service received 11 proposed plans of operations for Moose Creek, Independence Creek, and Deadwood Creek. Of these, only three dredged for the full season, while the rest dredged from a weekend or two up to several weeks.

The window for dredging operations would occur from July 1 to August 15 (condition 1). This would minimize impacts to most larval and juvenile fish, and occurs after steelhead trout and bull trout emerge from the substrate.

Potential impacts from mortality and injury. Salmonid alevins are the larval stage between the egg and the free-swimming fry or juvenile. They develop from eggs deposited in gravels of the redd. Dredge-related mortality of eggs, larvae, and alevins can occur in three ways. First, they could be crushed underfoot when operators cross streams while moving in gear and mining equipment. Redds are typically located in shallow, flat-gradient stream areas that afford good footing for those crossing a stream. Secondly, debris tailings and fine sediment could be deposited on a redd, trapping or suffocating alevins from excess fine sediment deposition or oxygen depletion.

Thirdly, eggs, larvae, and alevins could be entrained through the intake pipe. Griffith and Andrews (1981) found high mortality of entrained eggs of cutthroat trout before eye-up but mortality was less as eggs matured. Cutthroat trout sac fry suffered more than 80 percent mortality from suction dredging entrainment compared to a 9 percent natural mortality rate. They speculated that entrainment would likely kill larvae of other fish species and that eggs, larvae, and fry surviving entrainment could suffer from subsequent predation and stress. Juvenile and adult salmonids would likely avoid or survive passage through a suction dredge (Harvey and Lisle 1998). Post-emergent salmonids would also be vulnerable until they are large enough to avoid entrainment. Juvenile and adult salmonids would normally be able to avoid entrainment (Harvey *et al*. 1995).

Steelhead trout and chinook salmon would be more likely to be affected in Lolo Creek due to the potential for more spawning and egg deposition in areas that could be dredged (see Table 3-6 in Chapter 3). However, the likelihood of impacts in Lolo Creek is considered to be very low due to the small area of disturbance that may overlap with spawning habitat and the fact that suction dredging operations would not begin until most steelhead have emerged from the redds, and would end before most chinook spawn (August 15 through September 15, as specified in condition 1). Suction dredge operations are only allowed to be located in areas of large substrate not preferred for spawning steelhead trout and bull trout (condition 3). In addition, operators must meet with a Forest Service fisheries biologist who will inspect the site area for redds prior to commencement of dredging and not allow dredging in areas where redds are found (condition 5). Further, to avoid fish entrainment, operators are required to use a 3/32 mesh screen for their pump intake hoses (condition 26). All of these conditions, combined with the fact that the Forest Service will inspect the operations at least five times during the suction dredge season to ensure compliance, will reduce the potential for any significant impacts on fish.

Potential impacts from disturbance and dislocation. Suction dredging could disturb salmon holding in deep pools during summer, particularly if numerous dredges are operating or water temperatures are elevated (Somer and Hassler 1992).

Dredge piles that span the stream channel are not permitted (condition 11), although some operators may create temporary partial barriers in order to increase flotation of their dredge in shallow areas of the creeks. Temporary dredge piles that span a substantial portion of the stream

width could affect the normal feeding and escapement behavior for juvenile salmonids and other small fishes (Harvey and Lisle 1998). This could cause the affected fish to undergo stress and reduced vigor, or fall prey to predators. These temporary dredge piles would be broken down by the end of the operating season, (condition 21) and any residual change in the bottom would not persist through the normal peak flow events. When large amounts of substrate are deposited over cobble habitats, riffle sculpin (*Cottus gulosus*) could be displaced (Harvey 1986). Since cobble substrates are usually not limited in stream reaches of Lolo and Moose creeks, riffle sculpin could quickly disperse to new suitable locations.

Aquatic invertebrates in the substrate are dislodged or otherwise disrupted by dredging operations (see section 4.6.2). Displacement of these invertebrates creates a short-term attraction for fish feed on them near and immediately downstream of the suction dredge. In the longer-term, over the course of the seasonal operations, suction dredging will deplete some invertebrates that are used as a food source by a variety of fish species and life stages. This would occur in the immediate vicinity of the dredged areas and local fish would be forced to relocate to find food. Fish relocating to new feeding areas may experience increased stress due to predation, exposure to suboptimal habitat conditions, or increased competition with other fish.

Potential impacts from changes in water temperature. Elevated water temperature affects fish metabolism, development, and activity. It lowers the amount of oxygen available to fishes and can induce stress, disease, and mortality. Juvenile and resident salmonids are at risk when temperature exceeds 23-25 degrees Celsius (Spence *et al*. 1996).

Suction dredging would not affect stream temperature except possibly in the actual site where dredging is occurring. Shade trees would not be cut and the width-to depth ratio of dredged channels would not be sufficiently increased to cause solar radiation to increase stream temperature. Pool temperature could be slightly reduced in excavated pools if cooler groundwater is intercepted or deepened pools cause stream flows to stratify. This effect would have little influence on stream temperature beyond the immediate area of suction dredging operations. Even this would be temporary since pools have to be filled by the end of the mining season (condition 21) — in practice, individual pools are only short-lived since operators fill older pools as they move into new areas during the season. However, the influences of suction dredging in streams with elevated water temperatures could produce synergistic effects (USFS 2001c).

Potential impacts from changes in sediments and turbidity. Fine sediment and turbidity could increase temporarily immediately downstream of active dredges, as described in sections 4.1.2 and 4.3.2. In those areas where small amounts of fine sediment are being worked and stream flows are high, only small increases in turbidity would be detectable and the effects would be small and short duration. If large amounts of fine sediments are encountered and stream flows are low or moderate, detectable increases in turbidity could occur at the site and could extend a hundred feet or more downstream.

Royer *et al*. (1999) evaluated effects from both 8-inch and 10-inch commercial suction dredge operations. They found that although turbidity and total filterable solids increased downstream of the dredge, the values returned to upstream levels within 80-160 m downstream of the dredge.

Turbidity values for the 8-inch dredge were approximately 25 NTUs in the immediate area of suction dredging operations, but fell to less than 5 NTUs within 40 m downstream. Further, the effect of the turbidity plume was limited to approximately seven percent of the river width. It should be noted that the maximum size nozzle for suction dredges that could be approved would be five inches, so the effects of the smaller dredge would be much less than those reported for larger dredges.

Research has found the feeding ability and health of sculpin and salmonids are not significantly impaired by the increased turbidity of suction dredging (Hassler *et* al. 1986). While significant increases in turbidity can stress juvenile salmonids, especially through gill irritation, it would not likely cause mortality (Bash *et al*. 2001). In areas of concentrated suction dredging, the amount of fine sediment deposition would be cumulative. Mobilized fine sediment would settle downstream within slow water velocity areas such as pools. It is unlikely enough fine sediment would be deposited to measurably reduce pool size. However, significant increases in deposited fine sediment could reduce overall habitat quality for salmonids by filling in of interstitial spaces used by juveniles and by reducing the distribution, diversity, and abundance of benthic invertebrates used as prey items (Hassler *et al*. 1986). Fine sediment deposited during the operating season would likely be routed through the stream system during the normal peak flow event.

The substrate sizes in Lolo Creek and Moose Creek are dominated by cobbles and boulders (Tables 3-7 and 3-18 in Chapter 3) and large quantities of fines are not expected. In addition, suction dredging often targets bedrock cracks below the gravel/cobble layer, where even fewer fines are located.

Potential impacts from chemical contamination. As noted in section 4.3.2, fuel, oil, and grease could be spilled into the creeks and affect aquatic resources. However, these products would be stored in areas and used in a way that minimize the opportunity for accidental spillage into the stream. Refilling instream equipment is limited to one gallon at a time in the presence of absorbent material. As noted in section 4.3.2, several conditions with which operators must comply would take place should prevent any such impacts.

4.4.3 Alternative 3: Suction Dredging and Stream Improvement Projects

The potential impacts from camping and other non-dredging activities would be the same as under Alternative 1.

Potential impacts from mortality and injury. Fish mortality and injury from suction dredging under this alternative would be the same as under alternative 2. In addition, the Lolo #5 restoration project in Lolo Creek could crush any eggs, larvae, and alevins in the project area or trap or suffocate alevins from sediment deposition. A Forest Service biologist will inspect the project area and immediately downstream for redds prior to construction, and the Forest Service will consult with NOAA Fisheries and the USFWS to develop appropriate mitigation if there are active redds. Improvement of the Independence Creek road crossing should not kill or injure fish.

Potential impacts from disturbance and dislocation. Potential impacts of suction dredging by disturbing or dislocating fish under this alternative would be the same as under alternative 2. The Lolo #5 restoration project would cause juvenile and adult fish in the project area to move upstream or downstream at least until construction was complete. Dislocated fish could experience increased stress and reduced vigor, or they could fall prey to predators. The restoration project also could disturb fish for a short distance downstream. Following project completion, fish would be expected to repopulate the areas, which would have significantly improved habitat. The Forest Service will review appropriate mitigation measures and consult with NOAA Fisheries and the USFWS prior to implementation of the project.

Similarly, construction of the Independence Creek crossing improvement could disturb fish immediately downstream of the project, but effects, mitigation, and construction would be similar to those described above.

Potential impacts from changes in water temperature. Potential impacts of suction dredging on water temperature under this alternative would be the same as under alternative 2. Neither of the restoration projects should have any significant impact on water temperature. The Lolo #5 restoration project could lead to long-term improvements by improving bank stability and providing more suitable ground for vegetation.

Potential impacts from changes in sediments and turbidity. Potential impacts on fish from changes in sediments and turbidity caused by suction dredging would be the same as under alternative 2. As noted previously, the Lolo #5 restoration project and the Independence Creek crossing improvement would temporarily increase sediment load and turbidity in Lolo Creek, and this could stress juvenile salmonids. The application of construction best management practices should reduce the potential impacts. By stabilizing banks and reducing sediment loads, the long-term reduction in sediment resulting from the project should improve habitat quality.

Potential impacts from chemical contamination. Potential impacts on fish from chemical contamination caused by suction dredging would be the same as under alternative 2. Construction equipment used for the stream improvement projects will use fuel, oil, and grease. These could leak or be spilled into the water and affect aquatic resources. Best management practices that are standard for Forest Service construction projects would substantially reduce the possibility that leaks or spills would occur. Improperly managed sanitary wastes from on-site workers also could contaminate streams. Each of the projects would be serviced by portable toilet facilities while workers are on-site, which will eliminate these potential impacts.

4.5 Potential Effects on Instream Habitat

4.5.1 Alternative 1: No Action

There would be no significant impacts under this Alternative. The only impacts would come from recreational use of the streams, which would be insignificant.

4.5.2 Alternative 2: Suction Dredging

Impacts on substrate. There is no limit to the amount of substrate material that could be dredged in a particular claim or river segment, provided individual operators are at least 100 feet apart. Deposited substrate material could be piled or spread out. In addition, rock too large to pass through the dredge nozzle (generally greater than 5 inches) would typically be hand-piled in or along the stream channel. The hand-placed rock would have the potential to deflect stream flows and cause localized scour and deposition. Operators would not be allowed to move large, stable boulders over 12 inches in diameter (condition 18), and smaller substrate materials would have to be replaced in the dredge holes by the operators by August 15 (condition 21). In addition, any remaining dredge piles of substrate would be transported directly downstream of the dredged area and/or flattened during normal high flow events, except in drought years. Fine sediment would be redistributed and deposited in small areas downstream. In general, there would be no impact on the substrate except during the time an area is being actively dredged.

Potential impacts on large stable woody debris. Dredging of sediments could destabilize large instream wood, potentially reducing its stability and causing it to move from its natural location. Destabilizing instream wood could reduce pool frequency and quality and streambank stability. However, operators may not remove or otherwise disturb instream wood (generally larger than six inches in diameter and three feet in length) (conditions 17 and 18), so there should be no effects on woody debris.

Some operators may request authorization to cut streamside shrubs or trees that are a hazard to their operations. If approved, this could reduce stream shade. Felled trees recruited to stream systems would have less ability to form quality pool habitat than intact trees because they lack their stabilizing root wad. This has never been a problem in the past, and Forest Service rules concerning tree cutting should continue to prove sufficient to prevent impacts.

Potential impacts on stream channel conditions. Small suction dredging operations could increase pool frequency where dredging excavates pools and could decrease pool frequency where pools are filled by deposited tailings. An increase in pool frequency could temporarily improve stream channel diversity, a condition beneficial to many fishes and aquatic organisms. However, if excavated pools dry up during late summer, fish and aquatic organisms using them could become stranded and lose vigor or die from intolerable environmental conditions or succumb to predation. One of the approval conditions (condition 21) calls for backfilling all excavated pools by the end of the mining season on August 15, so this should not become a problem.

Suction dredging could alter pool dimensions and quality through excavation, dredge pile deposition, or changes in channel morphology. Excavating pools could substantially increase their depth and increase cool groundwater inflow. This could reduce pool temperature (Harvey and Lisle 1998). If pools were excavated to a depth greater than three feet, salmonid pool habitat could be improved. In addition, if excavated pools reduce pool temperatures, they could provide important coldwater habitats for salmonids living in streams with elevated temperatures. As

noted above, operators must fill all deepened pools by the end of each mining season (condition 21), so any benefit would be temporary.

Dredge operators may not dam streams (condition 11), but some operators may build temporary rock barriers partially across the channel to facilitate flotation of dredges. These small barriers would usually be needed for a few hours to a few days. If properly constructed, they generally would not block adult fish passage but could inhibit normal juvenile salmonid feeding behavior and escapement from predators while in place. Operators would have to break down all dredge piles by the end of the operating season (condition 21). Overall, any impacts from suction dredging would be very localized and minor.

4.5.3 Alternative 3: Suction Dredging and Stream Improvement Projects

Potential impacts on substrate. The potential impacts of suction dredging on stream substrates under this alternative would be the same as under alternative 2. The restoration of Lolo #5 may require restructuring of what is now the substrate in that reach of Lolo Creek. One goal of the restoration project will be to create a stream channel with a substrate that more nearly matches natural conditions. The project also should improve the downstream substrate by reducing bank erosion that serves as a source of fine material. Similarly, the Independence Creek crossing improvement would reduce sediment erosion and improve the downstream substrate.

Potential impacts on woody debris. The potential impacts of suction dredging on woody debris under this alternative would be the same as under alternative 2. The Lolo #5 restoration project may require the removal of current woody debris, but this would be matched by the placement of woody debris in the final design. The Independence Creek stream-crossing project should have no effect on woody debris.

Potential impacts on stream channel conditions. The potential impacts of suction dredging on stream channel conditions under this alternative would be the same as under alternative 2. The Lolo #5 project would significantly improve channel conditions by restoring the channel to more closely match natural stream gradients, pool-riffle ratios, and channel sinuosity. The Independence Creek improvement project should have no effect on the stream channel.

Potential impacts on bank stability. The potential impacts of suction dredging on bank stability under this alternative would be the same as under alternative 2. The banks of Lolo Creek through the Lolo #5 area are currently unstable as a result of past large-scale mining. One of the major goals of the restoration project would be to improve bank stability. The bank stabilization activities would directly reduce bank erosion, which alters the stream channel morphology and sedimentation of the creek. The Independence Creek improvement project should have no effect on bank stability.

Potential impacts on flow/hydrology. The potential impacts of suction dredging on flow/hydrology under this alternative would be the same as under alternative 2. Neither the Lolo #5 nor the Independence Creek crossing project would affect flow or hydrology.

4.6 Potential Effects on Aquatic Invertebrates

4.6.1 Alternative 1: No Action

There would be no suction dredging and, therefore, no potential impacts from mining to aquatic invertebrates in either creek under this Alternative.

4.6.2 Alternative 2: Suction Dredging

The operation of small-scale suction dredges would displace some insects downstream but should result in minimal amounts of injury or mortality to aquatic insects. For a short period, while insects were in the water column before settling back into the substrate, they would be more susceptible to being eaten by fish or other aquatic organisms. This would be temporary.

Suction dredging effects on immature fish, aquatic insects, and other invertebrates were assessed in the Yankee Fork (tributary to the Salmon River near Stanley, Idaho) and Bums Creek (tributary to the South Fork Snake River) in 1980 by Griffith and Andrews (1981). They found that less than one percent of 3,623 macroinvertebrates entrained through a three-inch dredge nozzle displayed injuries or died within 24 hours. The mortality rates varied by species but were highest among emerging mayfly species. Re-colonization of the dredged areas by aquatic invertebrates was largely complete after 38 days.

Exposure of previously buried substrate and covering of existing substrate can locally reduce abundance of benthic invertebrates. However, most aquatic invertebrates species have a life history capability of re-colonizing disturbed sites within several weeks.

Royer *et al*. (1999) found that the density of aquatic invertebrates was greatly reduced in the first 10 meters downstream of an 8-inch commercial suction dredge. The abundance and diversity of invertebrates returned to values seen at the upstream reference site within 80 to 160 meters downstream of the dredge. The authors reported substantial recovery of invertebrate diversity within one year after dredging. Royer *et al*. (1999) also evaluated the impacts of small-scale recreational suction dredging on invertebrates approximately five weeks after dredging operations. They found that aquatic invertebrate density, taxa richness, and EPT richness were not significantly different between the dredged areas, 35 meters downstream, and upstream reference sites. Where dredging moves substantial amounts of substrate occupied by aquatic mollusks, re-colonization would take longer because of their low dispersal rates and limited distribution within river systems (Harvey and Lisle 1998). Small-scale operations such as those on Lolo and Moose Creeks would not move substantial amounts of substrate.

As noted previously, dislodged fine sediment would be distributed downstream of the dredged area and could temporally fill interstices in gravel and cobble, reducing available macroinvertebrate habitat in the immediate area. Scouring action during the next high flow would likely clear out any such sediment accumulations and allow aquatic insects to re-colonize the habitat. However, continued intensive dredging of multiple claims could cumulatively reduce the habitat quality over specific areas. Thomas (1985) reported significantly lower

aquatic insect abundance in a 35-foot section of stream that had just been dredged, compared to a site downstream of the operation, although re-colonization was substantially complete within one month after dredging. The low percentage of fine sediment, particularly in Lolo Creek, would significantly reduce the likelihood, and the extent, of potential temporary impacts.

4.6.3 Alternative 3: Suction Dredging and Stream Improvement Projects

Potential effects from suction dredging under this alternative would be the same as under Alternative 2.

The Lolo #5 restoration project would disturb the entire stream width for over 1,000 feet of Lolo Creek, and this would kill or displace aquatic invertebrates in this area. Fine sediment in the disturbed area would be washed downstream and could temporarily reduce macroinvertebrate habitat. High-flow scouring would clear out any sediment accumulations and allow recolonization. Over the longer term, stabilizing banks and creating a stable channel would reduce sediment transport and improve habitat for aquatic invertebrates.

The Independence Creek improvement project, similarly, would disturb the full width of the creek and result in increased sedimentation immediately downstream until seasonal high flows scoured out accumulated sediments. Following completion of the project, the upstream reach of Independence Creek will be open to migrating fish.

4.7 Summary of Potential Impacts to Threatened and Endangered Fish

4.7.1 Alternative 1: No Action

There would be no potential impacts on threatened and endangered fish under this alternative.

4.7.2 Alternative 2: Suction Dredging

Potential Impacts on Chinook Salmon. There would be no significant impacts to fall-run chinook salmon from suction dredging in Lolo Creek because the closest essential fish habitat for fall-run chinook is over 25 miles downstream. There would be no impacts in Moose Creek because the Dworshak Dam over 100 miles downstream provides a complete barrier to anadromous fish migration.

Similarly, there are no spring-run chinook in Moose Creek. In Lolo Creek, spring chinook salmon are supplemented by hatchery fish and the creek supports sizable densities of chinook. Short-term impacts to juveniles could occur during the dredging window, but the dredging operation season of July 1 through August 15 occurs after the previous year brood offspring are out of the gravel and prior to spawning. Any impacts would be limited to displacement or avoidance during the hours of dredging activity and localized reductions in macroinvertebrate food availability. There could also be a temporary food abundance due to displacement of aquatic invertebrates out of the substrate.

Potential Impacts on Steelhead Trout. The Lolo Creek steelhead population is a combination of natural and hatchery fish, and it produces very few natural steelhead due to poor adult returns and habitat conditions. The dredging season occurs after most steelhead emerge from the substrate. Small-scale suction dredge operations would have a negligible impact on adult steelhead or their spawning gravels because spawning occurs several months after dredging, during the next year's spring flows that naturally redistribute the substrate, and after recolonization by macroinvertebrates. Short-term impacts to juvenile steelhead trout could occur during the dredging season from fish being displaced away from dredging activity and from localized reductions in macroinvertebrate food availability. There could also be a temporary food abundance due to displacement of aquatic invertebrates out of the substrate.

The Biological Opinion for suction dredging in Lolo Creek (USFWS 2003) stated that the 18 projects proposed for 2003 suction dredging would not likely jeopardize the continued existence of the Snake River steelhead. Due to the natural redistribution of substrate and re-colonization of the dredge areas between August 15 and July 1 every year, the potential even for cumulative impacts from many years of small-scale suction dredge operations is minimal. No dredging will be allowed in areas where steelhead are known to spawn, or in areas the Forest Service identifies as spawning habitat (condition 5). This will prevent any impacts on steelhead spawning.

As with chinook salmon, steelhead trout do not exist in the Moose Creek drainage due to the presence of Dworshak Dam.

Potential Impacts on Bull Trout. In the Lolo Creek project area, no bull trout were identified during 1996-1999 and 2001 monitoring, despite extensive fish surveys, and only six bull trout were identified from 570 survey stations in Lolo Creek from 1987 to 1994. No bull trout were observed by the Forest Service during 2002 monitoring. The suction dredge operating season (Lolo Creek condition 1a) is during a period that minimizes the likelihood of bull trout being present or spawning in the project area. In August 2002, the U.S. Fish and Wildlife Service concurred with the Forest Service's determination that small-scale suction dredging proposal for the 2002-2003 season "may affect, but is not likely to adversely affect" bull trout in Lolo Creek (USFWS 2002). Any effects that did occur would likely be as described under section 4.4.2 above.

In the Moose Creek project area, bull trout presence has been documented by several sources, but bull trout numbers were relatively low up to the year 2000. Between 1984 and 2001 bull trout were found at only 7 out of 97 snorkeling stations. However, higher numbers of adult bull trout have been found in snorkeling surveys since 2000 (USFWS 2003). Moose Creek, which is proposed as critical habitat, has good habitat for bull trout rearing but less than one percent of the stream is available for spawning habitat (Clearwater Biostudies, Inc. 1991). The impacts of small-scale suction dredging on bull trout eggs, alevins, or fry are expected to be minimal because bull trout hatch in January and February, remain in the gravel until only April or May, and then leave the gravel before the dredging season opens on July 1. Disturbance to fry would be limited to short-term impacts that would occur during the dredging season, such as temporary displacement during the hours of dredging activity and localized reductions in macroinvertebrate food availability. The impacts to instream habitat conditions would be minimal, as discussed in section 4.5.

No dredging will be allowed in areas where bull trout are known to spawn, or in areas the Forest Service identifies as spawning habitat (condition 5). This will prevent any impacts on bull trout spawning.

Westslope Cutthroat Trout. Impacts to cutthroat trout would be similar to those for steelhead trout and bull trout described above. Cutthroat trout populations are higher relative to steelhead and bull trout and much of their spawning habitat is in the small tributary streams. Potential impacts would be as described in section 4.4.2.

4.7.3 Alternative 3: Suction Dredging and Stream Improvement Projects

Potential effects to threatened and endangered species from suction dredging under this alternative would be the same as under Alternative 2.

In Lolo Creek, there could be short-term effects on chinook salmon, steelhead, bull trout, and west slope cutthroat trout from the Lolo #5 restoration project. During construction, any fish in the project area would be killed, dislocated, or otherwise disturbed. However, most or all fish would vacate the area as disturbance began, so there should be little to no mortality of adults or juveniles. Construction would also kill any eggs or alevins in the gravels. As noted above, sedimentation would increase immediately downstream of the project area; if there are redds or spawning habitat immediately downstream, they could be smothered with sediment, trapping or suffocating alevins from excess fine sediment deposition or oxygen depletion. Best management practices will reduce sedimentation as much as possible. The July 1 to August 15 operating window (Condition 1a) also reduces the risk of killing eggs or alevins during restoration. A Forest Service biologist will survey Lolo Creek in the Lolo #5 project area and immediately downstream for redds and spawning habitat. If redds or spawning habitat are identified, the Forest Service would develop appropriate avoidance and/or mitigation measures and consult with the USFWS and NOAA Fisheries, as appropriate, prior to project implementation. After completion, the Lolo #5 restoration project would improve habitat in this reach of Lolo Creek and immediately downstream, and may increase the amount of spawning habitat for these species.

Neither chinook salmon nor steelhead are present in the Moose Creek watershed, so the Independence Creek crossing project would have no effect on either individual fish or populations. The project would not have an adverse effect on bull trout or west slope cutthroat trout unless there were active redds or spawning habitat immediately downstream of the crossing. If there were, they could be covered with sediment caused by construction.

The July 1 to August 15 operating window (Condition 1a) decreases the likelihood of spawning fish being present during construction. In any event, a Forest Service biologist will survey the reach of Independence Creek immediately downstream of the crossing to evaluate whether there are any redds or spawning habitat. If there are, the Forest Service will develop appropriate mitigation measures and consult with the USFWS prior to project implementation.

4.8 Potential Effects on Wildlife

4.8.1 Alternative 1: No Action

Wildlife would continue to tend to avoid occupied campsites due to noise and the presence of humans. Seasonal hunting would continue to affect individual game animals.

4.8.2 Alternative 2: Suction Dredging

The potential effects on wildlife by camping and other non-dredging activities, and by the presence of humans in the area, would be the same as under Alternative 1.

Potential impacts of suction dredging on terrestrial wildlife would be predominantly within the riparian zone along the streams. Management indicator or sensitive wildlife species possibly affected by suction dredging would include belted kingfisher and boreal toad nesting. The presence of suction dredge operators could disturb kingfishers nesting in the immediate vicinity of their operations and thus reduce breeding success. Once eggs hatch, brood rearing by kingfishers is essentially complete prior to the dredge operating season, so there would be no effects on rearing young. Foraging individuals could be locally disturbed and move away from dredging operations to hunt. Aquatic amphibians (e.g., boreal toad) could be affected through entrainment of eggs and young in the early stages of development. Approval conditions prohibit suction dredging into the banks of streams (condition 16), which are the areas that could potentially cover amphibian eggs and preferred habitat, and this would reduce the potential for impacts.

Potential impacts to threatened, endangered, or sensitive wildlife species would be negligible. Additionally, lynx, and gray wolves are not known to inhabit the project areas. For at least 10 months of the year, the temporary noise and other human impacts associated with small-scale dredging would not likely jeopardize the continued existence of the gray wolf (USFWS 2002), and would result in no adverse effect on bald eagles, lynx, or their habitats (USFS 2002a,b).

4.8.3 Alternative 3: Suction Dredging and Stream Improvement Projects

The potential effects on wildlife by camping and other non-dredging activities, and by the presence of humans in the area, would be the same as under Alternative 1. The effects on wildlife from suction dredging under this alternative would be the same as under Alternative 2.

During construction of the Lolo #5 restoration project and installation of a drainage device or ford with concrete planking at the Forest Road 5440 crossing on Independence Creek, noise and human activity would cause wildlife to avoid the areas, at least during the hours of operation. Individual kingfishers and boreal toads could be disturbed and dislocated, and toads could be killed.

4.9 Potential Effects on Riparian Vegetation

4.9.1 Alternative 1: No Action

There could be impacts on riparian vegetation from streamside campers, berry-pickers, and others, but this should continue to be localized and minor.

4.9.2 Alternative 2: Suction Dredging

Potential impacts on riparian vegetation under this alternative would be the same as under Alternative 1.

Riparian vegetation and wetland plant communities would not be substantially altered as a result of approving plans of operation for suction dredging in either study area. Stream banks are generally well vegetated and cobbles and boulders provide armor to the banks. Equipment would be manually moved across the riparian zone to the dredge site. In much of the study areas, this consists of a narrow strip of habitat between the streams and the Forest Service roads. Moving equipment to the stream banks may trample existing vegetation. Areas along streambanks that are disturbed as a result of suction dredging operations (including camping) have to be revegetated or otherwise restored at the end of the operating season (condition 23).

Suitable habitat for Macfarlane's four-o'clock *(Mirabilis macfarlanei),* water howellia *(Howellia aquatilis)* and Ute ladies'-tresses, *(Spiranthes diluvialis)* was modeled as part of the Endangered Species Act consultation process for ongoing projects. The Lolo Creek and Moose Creek watersheds did not contain suitable habitat for the three federally listed plants. Spalding's catchfly *(silene spalding)* is found in mesic fescue grasslands and ponderosa pine-Idaho fescue savannas, neither of which are found along, or are affected by, the valley bottom of the stream for mining, therefore, there will be no effect to any of these species (USFS 2002a, b).

Several sensitive plant species may be found in riparian areas of the Lolo and Moose Creek drainages (see Table 3-12 in section 3.2.6). Approval conditions provide substantial protection for vegetation along streams, thereby minimizing impacts that may occur to sensitive plants. In addition, areas within 300 feet of Lolo Creek are within the Riparian Habitat Conservation Area, which provides protection from major disturbances of riparian vegetation. The BAs for both Lolo Creek and Moose Creek (USFS 2002a, b) concluded that suction dredging would have no impact on sensitive plant species.

4.9.3 Alternative 3: Suction Dredging and Stream Improvement Projects

Potential impacts on riparian vegetation under this alternative would be the same as under Alternative 2. Impacts to riparian vegetation and wetland plant communities from approved suction dredging would be the same as under Alternative 2. The restoration of Lolo Creek in the Lolo #5 area would have a short-term adverse effect on the existing vegetation and wetlands during construction, but would ultimately increase channel stability and increase the stability and quality of riparian habitat by reducing future damage from high stream flows. The Forest

Service would identify and delineate any jurisdictional wetlands in the Lolo #5 project area and comply with any applicable requirements under §404 of the Clean Water Act.

4.10 Potential Effects on Recreation

4.10.1 Alternative 1: No Action

Under the no action alternative, the Forest Service would not approve proposed plans of operations. Because most operators consider that their suction dredging has a significant recreational component, this type of recreation would decrease in the project areas. This decrease would likely be offset by other recreationists using the same campsites.

There would be no change in the Recreation Opportunity Spectrum (ROS) under this alternative.

4.10.2 Alternative 2: Suction Dredging

There should be minimal or no impacts to total recreation visitation and no change in the ROS in either watershed under this alternative. Most people camping in the immediate vicinity of current suction dredging operations are miners, so the impacts of noise from the suction dredge pumps and/or compressors would not be expected to be annoying, or not as annoying as they would be to non-miners. Because non-mining campers generally prefer other areas for camping while mining is occurring, it is likely there would be no increase or decrease in campsite concentration, and thus no overall change in the number of recreational visitors.

Suction dredge operations would generally make the areas unproductive for recreational fishing during the mining season and to some extent continuing until insects and other food organisms re-establish populations in the substrate. However, these streams are unlikely to attract significant fishing activity since there are more productive streams near each watershed. Thus, there would be no significant impact on recreational fishing.

During the 45-day mining period each year, visitors to either of the historic trails in the Lolo Creek area could be annoyed by noise or by evidence of modern man. See Section 4.12 for potential noise levels.

4.10.3 Alternative 3: Suction Dredging and Stream Improvement Projects

The potential effects of suction dredging under this alternative would be the same as under Alternative 2. In addition, there would be some minor effects on recreational use from implementation of the stream improvement projects under this alternative.

Heavy equipment would be needed for both the stream restoration in Lolo Creek and the crossing improvement project on Independence Creek. This should not affect suction dredge operators. There would be noise and visual disturbance for the duration of the construction projects, however, which could have a minor effect on other recreational visitors. Because there are abundant other areas with the same or better recreational opportunities, there would be no

significant effect on recreation from this alternative, and no change to the ROS in either watershed.

4.11 Potential Effects on Visual Resources

4.11.1 Alternative 1: No Action

No change to the Visual Quality Objectives (VQOs) would be expected, and no impacts to visual resources would occur under this alternative.

4.11.2 Alternative 2: Suction Dredging

Overall, neither of the study areas is very diverse, with a low to moderate degree of inherent scenic attractiveness. The VQOs of the travel routes and trails near Lolo Creek are managed from Retention to Partial Retention (see section 3.2.8). It is not expected that there would be any change to VQOs under this alternative.

It is possible that suction dredge operations could be seen from either of the historic trails but this is unlikely due to topographic and vegetative screening. Views from the Lolo Creek Campground area would also be limited. Similarly, in both creeks some suction dredge operations could be visible to visitors on nearby roads, but this is unlikely due to topographic and vegetative screening.

4.11.3 Alternative 3: Suction Dredging and Stream Improvement Projects

The impacts from suction dredging would be the same as Alternative 2. During implementation of the stream restoration project in Lolo Creek and the crossing improvement on Independence Creek, heavy equipment would be visible from the road and nearby trails for the duration of the projects. It is not expected that there would be any change to VQOs under this alternative.

4.12 Potential Effects from Noise

The Federal Interagency Committee on Urban Noise defined noise impact zones and established guidelines for land use compatibility. These guidelines identified residential uses, unless treated with adequate noise insulation, as incompatible with noise exposure levels of DNL 65 decibels (dB) and higher. However, these guidelines apply to urban or urban type settings and not wildland settings. Guidelines have not been developed for natural or wildland settings. For this analysis, impacts from noise focus on hearing loss and annoyance.

Noise-induced hearing loss is caused by exposure to excessive noise. Federal workplace standards for protection from hearing loss allow a time-average level of 90 dB over an 8-hour work period, or 85 dB averaged over a 16-hour period. Because the average miner works the claim for less than 6 hours per day, it is unlikely that the noise from pumps and/or compressors used for the dredge mining would cause a health impact.

The primary effect of engine noise on exposed visitors is one of annoyance. Noise annoyance is defined by EPA as any negative subjective reaction on the part of an individual or group (USEPA 1972). Although not measured, it is likely the background noise level in these study areas are in the 25 to 45 decibel range (see section 3.2.9).

4.12.1 Alternative 1: No Action

Both the Lolo Creek and Moose Creek drainages are in heavily forested natural environments. The creeks, wind, local topography, and vegetation all influence the acoustical environment. Similarly, noise from generators and other equipment on campsites, and from passing vehicles on Forest Service roads, would be audible to visitors. In Lolo Creek, the primary sensitive noise receptors in the study area would be visitors in the Lolo Creek Campground and on the Nez Perce National Historic Trail or Lewis and Clark National Historic Trail. There are no sensitive noise receptors in the Moose Creek area other than non-mining recreational visitors. As shown on Figure 3-4 in Chapter 3, noise from the sources expected under this alternative could be expected to range from background up to about 75dB, with the louder noises likely to be of short duration and/or at some distance to receptors.

4.12.2 Alternative 2: Suction Dredging

Potential impacts on noise levels from traffic and recreational use would be the same as under Alternative 1. Noise from a small-scale suction dredge operation would involve noise associated with the pump used to dredge material from the stream bottom and in some cases an air compressor used to supply air to the dredge operator. There is no blasting associated with suction dredge mining. Operators typically use dredges powered by engines rated at 10 horsepower (hp) or less, but can use up to 15 hp engines to power their dredges. The maximum noise level for gasoline engines rated at 12 hp to 15 hp could range up to 85 dB at very close range (see Figure 3.4 in section 3.2.9 and Table 4-1 below). The actual noise levels would depend on many variables, including distance between the receptor and the source, wind, atmospheric pressure, other weather conditions, topography, time of day, etc

Table 4-1. General Noise Levels of 18 Horsepower Engine

Distance (Meters)	*Decibel Level*
4	85
50	63
100	57
150	53
300	47

Notes: based on Briggs and Stratton 18 hp engine

Unlike a resident, who is exposed to repeated noise events over time, a visitor may or may not experience a noise event during a visit. The people potentially affected during the mining periods would mostly be the miners themselves, hikers, fishermen, and other dispersed campers in the area.

The historic trails in the area (see section 3.2.9) are considered noise-sensitive areas due to their historic significance and their location in a wildland area. In the upper end of the Lolo Creek study area, as shown on Figure 2-1, the Nez Perce National Historic Trail passes within about 200 meters of sections of Lolo Creek where suction dredge operations may occur. During the 45-day dredging season, hikers on the trail may be able to hear pump and/or compressor noise under favorable conditions (existence of active operation, wind, direction and speed, for example). At this distance, noise would be only slightly elevated over "background" (57 dB at 100 meters, compared to "background" that ranges up to 45dB); this would last only as long as it took the listener to traverse the area, which should not be an extended period, since the trail only parallels Lolo Creek for three to four miles and is close to the creek for much less than that.

The Lewis and Clark trailhead is about 0.75 miles from Lolo Creek. It is unlikely that noise from suction dredging would even be heard under the most favorable conditions.

4.12.3 Alternative 3: Suction Dredging and Stream Improvement Projects

Noise from suction dredging under this alternative would be the same as under Alternative 2. There would be noise from the heavy machinery used for both projects, both engine noise and the "beeping" signals used when machinery is in reverse gear. The noise level about 50 feet from a heavy truck would be approximately 70-80dB, somewhat higher than the noise from a suction dredge pump at the same distance. Noise levels would decrease at increasing distances.

4.13 Potential Effects on Socioeconomics

For purposes of evaluating the economic impacts of suction dredging as a result of each alternative action, the estimated expenditures that would occur as a result of actions under the alternative were compared to the total income of the nearest county with a sizable city. In the case of Lolo Creek, this would be Clearwater County, which also is the residence of most prospective operators and the residence of many other Forest visitors and campers. In 2000, as noted in section 3.2.10 in Chapter 3, the per capita income of the 8,930 residents of Clearwater County was $15,463 (Department of Commerce, 2001). For Moose Creek, the nearest city is Missoula, which is located in Missoula County, Montana. In 2000, as noted in section 3.3.10, the county had a population of 95,802 and a per capita income of $17,808 (Department of Commerce, 2001).

4.13.1 Alternative 1: No Action

Visitors to Clearwater National Forest come from across the country, but a large majority are from the Pacific Northwest. Most visitors reside in northern Idaho, eastern Washington, and northeast Montana, with fewer visitors from increasing distances.

As noted previously, the Forest Service assumes that the number of visitors and campers in the Lolo Creek study areas would be approximately the same whether suction dredging plans of operations are approved or not. For purposes of this analysis, it is assumed that there would be

36 campers along Lolo Creek from July 1 through August 15, and 60 campers along Moose Creek.[13]

Also for purposes of this analysis, the Forest Service assumed that expenditures for each visitor under Alternative 1 would be approximately $50 per day (for food, fuel, camping supplies, and other supplies) while camping or visiting the National Forest, and that all of that amount would be spent in Clearwater County. This approach significantly overestimates expenditures and any resultant economic impacts, since it is very unlikely that there would be this many operations in any given year and all expenses would not be concentrated in one county.

In Lolo Creek, estimated expenditures would be $82,800 per year[14]. Even this overestimated amount, concentrated in Clearwater County, would amount to less than 0.06 percent of the county's total annual income.[15] This would have a negligible effect on county or larger-scale economies. In Moose Creek, total expenditures would be $138,000 per year.[16] This overestimated amount, concentrated in Missoula County, would amount to less than 0.01 percent of the county's total annual income.[17] This level of expenditure would have a negligible effect on county or larger-scale economies.

As noted in section 3.2.10 and 3.3.10, the amount of gold that is recovered by small-scale suction dredge operators is not known, so the loss of income that would result from not approving suction dredge plans of operations cannot be accurately estimated. Several of the dredge operators state that the gold recovered supplements their income. Only one of the prospective operators is known to rely on suction dredging as their sole source of income, or even as a major source of income. However, the Forest Service does not believe the total amount is significant, and so the loss of income under this alternative would not have a significant effect on local or larger-scale economies.

4.13.2 Alternative 2: Suction Dredging

The socioeconomic effects from suction dredging would be the same as under Alternative 1 except for expenditures made specifically to support the suction dredging operations. Suction

[13] The assumption is based on the maximum number of operations that the Forest Service believes could be active in any year (up to 18 in the Lolo Creek study area and up to 30 in the Moose Creek study area, as described in Chapter 2), and on an assumption that each operation would involve two persons visiting or camping. Further, the overall assumption is based on the expectation that, in the absence of mining, other visitors would desire about the same degree of solitude and so would camp at the same density as suction dredge operators. The camping season is assumed to be the same as the dredging season.

[14] 36 campers × $50/camper/day × 46 days/year = $82,800/year

[15] Total income in Clearwater County = 8,930 residents × $15,463 per capita income = $138,084,590. Total expenditures in Clearwater County = $82,800. Percentage of income expended on camping would be total expenditures divided by total income: $82,800 ÷ $138,084,590 = 0.0006, or 0.06 percent.

[16] 60 campers × $50/camper/day × 46 days/year = $138,000/year

[17] Total annual income in Missoula County = 95,802 residents × $17,808 per capita income = $1,706,042,016. Total expenditures in Clearwater County = $138,000. Percentage of income expended on camping would be total expenditures divided by total income: $138,000 ÷ $1,706,042,016 = 0.00008., or 0.008 percent.

dredges cost approximately $5,000 and they last for approximately 10 years before having to be replaced. In addition, each operator could expect to spend about $200 per year for fuel and maintenance costs. Total expenditures for each operator would thus be about $700 per year.[18]

Expenditures for suction dredging for the 18 Lolo Creek operators would be an estimated $12,600 (18 × $700 = $12,600). Combined with expenditures from camping ($82,800, as calculated under Alterative 1), total expenditures due to Lolo Creek operations would be $95,400 per year. This would be less than 0.07 percent of Clearwater County's total annual income, which would have a negligible effect on county and larger-scale economies.

Expenditures for suction dredging for the 30 Moose Creek operations would be an estimated $21,000 year (30 x $700/year). Combined with expenditures from camping ($138,000, as calculated under Alternative 1), total expenditures due to Moose Creek suction dredging would be $159,000. This would be less than .01 percent of Missoula County's total annual income, which would have a negligible effect on county and larger-scale economies.

The Forest Service does not know the amount of gold recovered by small-scale suction dredge operations, so cannot estimate the economic effect of the increased income from mining. However, the Forest Service does not believe it would have a significant effect on county or larger-scale economies.

4.13.3 Alternative 3: Suction Dredging and Stream Improvement Projects

The socioeconomic effects from camping and other visitors would be the same as under Alternative 1, and the effects from approving suction dredge operations would be the same as under Alternative 2. The two stream improvement projects under this alternative would be completed within Clearwater National Forest budgets; if these two projects were not implemented then other projects would be substituted, and total Forest expenditures in the area would remain unchanged. Thus, there would be no additional socioeconomic effects under this alternative.

4.14 Potential Effects on Heritage Resources

Under Federal law, impacts to heritage resources may be considered adverse if the resources are significant. Significant resources are generally eligible for, or listed in, the National Register of Historic Places (NRHP) or have significance for traditional cultural groups. An NRHP-listed or -eligible resource is an historic property. An action results in impacts to a historic property when it alters the resource's characteristics, including relevant features of its environment or use, in such a way that it no longer qualifies for listing in the NRHP. Impacts to traditional resources, which may or may not be eligible for the NRHP, are identified in consultation with the affected groups, such as Native American tribes.

[18] $5,000 /10 years + $200/year = $700/year.

4.14.1 Alternative 1: No Action

No impacts to heritage resources will occur as a result of suction dredging or stream improvements in either study area under the No Action Alternative. Heritage resources would continue to be managed in compliance with Federal law and Forest Service regulations.

4.14.2 Alternative 2: Suction Dredging

Suction dredging could affect heritage resources in both the Lolo Creek and Moose Creek study areas. When a heritage resources inventory is completed in either study area, suction dredge operations have the potential to adversely affect historic mining sites and Native American resources along, and within, the creeks. Inventory, evaluation, and claims research are likely to identify NRHP-eligible heritage resources in the area.

Reaches of creeks in both study areas have been subject to major disturbance from past large-scale mining and the stream channels may have been moved as a result. It is possible that artifacts of mining operations, or of Native American occupation or activities, could have been covered with mine tailings or other disturbed materials that now are in the stream channel that could be suction dredged. Forest Service regulations and policy require that discovery of any potential heritage resource be left alone and reported to the Forest archaeologist. Should a suction dredge operator uncover a resource while working, work would have to be stopped immediately, pending inspection by the Forest archaeologist. If the Forest archaeologist identifies NHRP-eligible resources, mitigation measures would be identified in consultation with the Idaho State Historic Preservation Office and (if Native American resources are potentially affected) tribal groups.

As noted in Chapter 3, Moose Creek and its tributaries hosted extensive historic mining activities beginning in the late 19th century (1860s) and continuing through the 20th century. There are many mining sites and features along the creek, including the location of the NRHP-eligible Johnson/Pollock Cabin (10CW146) used from about 1880 through the 20th century. During nearly 150 years of mining, the configuration of the drainages in the study area have changed. Since claims were located throughout the drainage bottoms, it is likely that the stream now flows through claims that were worked in the 19th century. Sites may also be located in the creek matrix or fill zones along the creek margins. Until a formal determination of NRHP-eligibility is made, all claim sites that are historic in age are treated as eligible for inclusion in the NRHP.

4.14.3 Alternative 3: Suction Dredging and Stream Improvement Projects

Potential impacts from approving suction dredge plans of operations would be the same as under Alternative 2. In addition, the Lolo #5 stream improvement project under this alternative would have the potential to adversely impact archaeological or architectural/engineering resources in both the Lolo Creek. Although a heritage resources inventory has not yet been completed in the study area, ground-disturbing actions associated with stream improvement projects have the potential to adversely affect historic mining sites and Native American resources along, and

within, the creeks. Inventory, evaluation, and claims research are likely to identify NRHP-eligible heritage resources in the area.

Ground-disturbing actions associated with restoration work could adversely affect the historic mining sites along the creeks, some of which are eligible for the NRHP. Earth-moving in the Lolo #5 project area could reveal heritage resources (e.g., flumes or sluice boxes) buried under tailings piles. Work will be stopped immediately if any such resources are identified during construction, pending inspection by the Forest archaeologist. If the Forest archaeologist identifies resources eligible for the National Register of Historic Places, mitigation measures would be identified in consultation with the Idaho State Historic Preservation Office and (if Native American resources are potentially affected) tribal groups.

Compliance with §106 of the National Historic Preservation Act, including survey and eligibility evaluation of potentially affected resources, would be completed prior to beginning restoration work in Lolo Creek. If NHRP-eligible resources are found within the area of potential effect, mitigation measures would be identified in consultation with the Idaho State Historic Preservation Office and tribal groups (if Native American resources are potentially affected). Mitigation measures could include avoidance of significant site features through project design, data recovery excavation, or Historic American Buildings Survey/Historic American Engineering Record recording of affected heritage resources.

Installation of a properly designed stream crossing on Independence Creek would disturb only the existing ford and a small area around the ford.

4.15 Potential Effects on Nez Perce Treaty Rights and Traditional Uses

The remainder of this section describes the potential impacts of the alternatives on tribal treaty rights.

As noted in section 3.4 of Chapter 3, the Nez Perce Tribe has "… the right of taking fish at all usual and accustomed places...together with the privilege of hunting, gathering roots and berries…." Historically, hunting included such game animals as deer, elk, moose, bear, mountain sheep and goats (Nez Perce Tribe 2002). Small game included rabbit, squirrel, badgers, and marmots. Birds, such as ducks, geese, ruffed grouse, and sage hens were also hunted (Nez Perce Tribe 2002). Estimates suggest that the majority of Nez Perce historical resource use focused on the acquisition of fish, including Chinook, coho, chum and sockeye salmon, and lamprey (USFS 2002). Non-anadromous fish included dolly varden, lake and cutthroat trout, squawfish, suckers and sturgeon. Roots gathered for winter storage included camas, bitterroot, khouse, wild carrot, wild potato, and other root crops (Nez Perce Tribe 2002). Fruit collected included serviceberries, gooseberries, hawthorn berries, thorn berries, huckleberries, currants, elderberries, chokecherries, blackberries, raspberries, and wild strawberries. Pine seeds/nuts, sunflower seeds, and black moss were also collected (Nez Perce Tribe 2002).

4.15.1 Fishing

4.15.1.1 Alternative 1: No Action

Impacts to tribal treaty rights or traditional uses relating to fish are not expected under this alternative. Tribal fishing would continue as it presently does. The Nez Perce Tribe would continue to operate the hatchery on Yoosa Creek in the Lolo Creek watershed, and continuing activities under this alternative are likely to have no effect.

4.15.1.2 Alternative 2: Suction Dredging

Impacts to tribal fishing access and traditional tribal resources could occur under this alternative. During the July 1 to August 15 mining season, the areas being mined may not be the most desirable for tribal fishermen. Dredging noise, activities in and near the streams that scare away fish, and the presence of non-tribal members may make for a climate that is less than optimal for this traditional practice. As noted in section 4.4 (Fisheries), suction dredge operations may also affect isolated fish (either adult or juvenile), but would not affect the survival of any species.

The Nez Perce Tribe has identified salmon as an integral part of tribal religion, culture, and physical sustenance, and has indicated that the annual return of the salmon allows the transfer of traditional values from generation to generation (CRITFC 2002). The tribe has indicated that Lolo Creek is an important stream in restoration efforts for chinook salmon in the Clearwater River Subbasin (Mancuso 1996). Spring Chinook are present in Lolo Creek during the July 1 to August 15 suction dredge season, and the Clearwater National Forest has initiated contact with the Nez Perce Tribe to identify other potential impacts to tribal fishing.

4.15.1.3 Alternative 3: Suction Dredging and Stream Improvement Projects

Potential effects to tribal fishing access from suction dredging under this alternative would be the same as those identified for Alternative 2. In addition, restoration of the Lolo #5 claim area would improve fish habitat in this reach of Lolo Creek, which would have a beneficial effect on tribal fishing. A potential beneficial effect on tribal fishing also could result from the removal of the partially fish-blocking ford on Independence Creek and the installation of a drainage device and/or ford with concrete planking at the Forest Road 5440 crossing of Independence Creek. This would improve upstream access to nearly four miles of Independence Creek. The present ford is a partial barrier to fish migrating upstream for spawning during low flows, and removal of the ford would result in a minor enhancement of populations of those species. Clearwater National Forest has initiated contact with the Nez Perce Tribe to identify other potential impacts to tribal fishing.

4.15.2 Hunting

4.15.2.1 Alternative 1: No Action

Impacts to tribal hunting are not expected under this alternative. Tribal hunting on Forest land would continue as it presently does.

4.15.2.2 Alternative 2: Suction Dredging

Suction dredging could affect tribal hunting and traditional tribal resources during the mining season by causing game animals to avoid the area. An incremental impact from approval of dredge mining could be noise-induced avoidance of the stream corridors by wildlife in the vicinity of suction dredge operations during daylight hours. Any increase in game animal avoidance should be minimal. The sites would continue to be used for camping, and the nearby roads would remain in use as under the No Action alternative. The Clearwater National Forest has initiated contact with the Nez Perce Tribe to identify other potential impacts to tribal hunting under this alternative.

4.15.2.3 Alternative 3: Suction Dredging and Stream Improvement Projects

Impacts to tribal hunting and traditional tribal resources under this alternative would be similar to those identified for Alternative 2. In addition, tribal hunting could be affected during stream improvement projects when construction equipment is operating, due to avoidance of the areas by game animals. This impact is expected to be temporary, ending when construction is complete. The Clearwater National Forest has initiated contact with the Nez Perce Tribe to identify other potential impacts to tribal hunting under this alternative.

4.15.3 Gathering Activities

4.15.3.1 Alternative 1: No Action

Impacts to tribal gathering are not expected under this alternative. Tribal gathering on Forest land would continue as it presently does.

4.15.3.2 Alternative 2: Suction Dredging

Direct impacts to tribal gathering from suction dredging are not expected under this alternative. Camas, whitebark pine seeds, berries, and other commonly gathered foods are not found in the stream channel, and are not expected to be directly affected. Historically gathered foods are listed above.

Indirect impacts to adjacent tribal gathering areas could occur. In October of 2001, the BLM contacted the Nez Perce Tribal Ethnographer, Josiah Pinkham regarding traditional resources. On November 12, 2001, two BLM staff members toured part of the present project area with Pinkham as part of another project that overlaps the Lolo Creek study area (Bricktrout and

White/White timber Sales). At that time, Pinkham identified six traditional gathering areas, one of which is on the bank of Lolo Creek. Additional areas could also lie in the Lolo Creek study area. The exact location of traditional resources is considered confidential and is not provided to members of the public. The Clearwater National Forest has initiated contact with the Nez Perce Tribe to identify potential impacts to tribal gathering resources in the Lolo Creek area.

4.15.3.3 Alternative 3: Suction Dredging and Stream Improvement Projects

The effects on gathering under this alternative would be the same as described for Alternative 2. In addition, potential impacts to streamside gathering areas could occur during stream improvement projects in the Lolo Creek area. The Clearwater National Forest has initiated contact with the Nez Perce Tribe to identify whether potential impacts to tribal gathering would occur under this alternative.

4.16 Potential Cumulative Effects

4.16.1 Potential Cumulative Effects in Lolo Creek Watershed

In the past, Lolo Creek has been impacted by road construction, timber harvest, mining, and grazing practices that added sediment to the stream. Except for channelization, excess sedimentation, and bank instability caused by past mining on Collette's abandoned mining claims (Lolo #5), the watershed is recovering due to the lighter intensity of management and improved management practices.

Impacts from these former activities (mostly road construction and timber harvest) are still evident in the stream channels. Although instream conditions are considered static, modeling indicates the current trend is hydrologic recovery in the watershed and decreasing sediment delivery to the stream channels. Therefore, instream recovery is expected to slowly occur in the next several decades. Lee MacDonald's research (MacDonald 1989) also suggests that cumulative effects, both in the form of water and sediment yield, are impossible to detect in streams of this size. Jones (2001b) has also shown an improving trend in cumulative watershed sediment effects on a Forest-wide scale.

Table 4-2 identifies recent, ongoing, and known future actions in the Lolo Creek watershed (the larger upstream watershed, not only the study area). In general, these include timber harvest, cattle grazing, and road maintenance. In addition, the trail system has been upgraded in the recent past to prepare for the anticipated increase in visitors for the Lewis and Clark Bicentennial. The Forest Service also will upgrade Lolo Creek Campground.

Timber harvest. The total acreage of the 13 timber projects in Table 4-2 is about 9,000 acres, about six percent of the Lolo Creek watershed. Ongoing and planned timber harvest or burning projects are designed to meet the Forest Plan "No Effect" (on streams) standard or the Forest Plan Lawsuit Settlement Agreement, so there would be no additional effects on sediment loadings. There would be some local noise, and projects may be visible from some vantage points.

Table 4-2. Activities Considered for Cumulative Effects Analysis in Lolo Creek Watershed

Activity	*Impact Area*	*Watershed*	*Completion*
Timber-related			
Austin Salvage	39 ac	Lolo	Completed 2001
Dutchman Salvage	64 ac	Lolo	Completed 2001
5028 Timber Sale	18 ac	Lolo	Completed 2001
Molly Mud	103 ac	Lolo	Completed 2000
Dan Weaver	246 ac	Lolo	Ongoing 2003-2004
Johnson Gold	394 ac	Lolo	Ongoing 2001-2002
Knoll Creek Bugs	145 ac	Lolo	Ongoing 2002
North Mud	46 ac	Lolo	Ongoing 2003-2004
514 Salvage	90 ac	Eldorado	Ongoing 2003
Four Dollar	24 ac	Eldorado	Ongoing 2003
Lost Hat Salvage	22 ac	Lolo	Ongoing 2002-2003
White White	7,000 ac	Lolo	Planned 2004-2005
Brick Trout	890 ac	Eldorado	Planned
Watershed Restoration			
Road Decommissioning	20.4 mi	Lolo	Planned
Road Long Term Storage	14.9 mi	Lolo	Planned
Culvert Replacement/Removal (8)	14 river miles	Lolo	Planned
Other			
Lolo Creek Campground Improvement Project	5 ac	Eldorado	Planned 2003-2005
Lolo Resource Protection EA	5 ac	Eldorado	Planned 2002
Cattle Grazing	Tbd	Lolo	Planned 2004
Routine road maintenance	24 miles	Lolo	Ongoing
Lewis & Clark bicentennial - Trail improvements through 2004 - Increased visitors through 2006	n/a	Lolo	Through 2006

Grazing. There are two cattle grazing allotments within the Lolo Creek Suction Dredging analysis area -- the Musselshell Allotment and the Eldorado Canyon Allotment. Cattle can damage riparian vegetation and streambanks in the flat areas near Lolo. This damage is most apparent in those small selected areas where the animals congregate and bed down. Both grazing and trampling can damage riparian vegetation. The flat areas favored by cattle are those with good feed (grass), water, and some shade. In and near the Lolo Creek study area, these conditions occur in only a few places, since the area only supports a grass cover in Musselshell Meadows, the meadows along Lolo Creek, and on Forest Service roads that were seeded to grass to help prevent erosion.

Cattle prefer to stay in the Musselshell Meadow complex and use Road 100 to access the meadows along Lolo Creek and do venture into the analysis area. Cattle have been seen on some of the roads within the analysis area, but do not seem to stay there once available grass has been grazed. In recent years, grazing impacts have been reduced through fencing, monitoring, and

permit administration. Within the Lolo Creek study area, fences are maintained between Lolo Creek and Forest Road 100 to keep the cattle out of the creek.

Road maintenance. The Forest Service does routine maintenance on 24 miles of roads in the Lolo Creek study area. Routine maintenance involves clearing roads of fallen rocks and trees as well as checking culverts and ditches for obstructions and unplugging if needed to maintain drainage. Road graders are used as needed; the 103 road was bladed in 2002 and 2003. Gravel is added to roads as needed as well; 103 was also spot-graveled in 2002 and 2003. The use of best management practices and Forest Service guidelines prevents sediment from reaching the creek. The presence of heavy equipment would create some noise during the short period of time the equipment was in any specific area, but this would be minor and very short-term.

Small-scale suction dredging. The Forest Service anticipates that suction dredge mining will not contribute to cumulative impacts in Lolo Creek except as described in the descriptions of potential impacts to the various resource areas.

4.16.2 Potential Cumulative Effects in Moose Creek Watershed

In the past, the Moose Creek study area has been affected by road construction, timber harvest, and mining, all of which added sediment to the stream and degraded aquatic habitat. The watershed is recovering due to the lighter intensity of management and improved management practices.

Impacts from these former activities are still evident in the stream channels. Instream conditions are now considered static, modeling indicates the current trend is hydrologic recovery in the watershed and decreasing sediment delivery to the stream channels. Therefore, instream recovery is expected to slowly occur in the next several decades. Lee MacDonald's research (MacDonald 1989) also suggests that cumulative effects, both in the form of water and sediment yield, are impossible to detect in streams of this size. Jones (2001b) has also shown an improving trend in cumulative watershed sediment effects on a Forest-wide scale.

Road maintenance is the only significant Forest Service management action undertaken in the recent past or currently, and is the only action currently planned. There are 41 miles of roads in Moose Creek analysis area, or which 12 miles of Forest Roads 255 and 5434 are routinely maintained as needed. Both roads were bladed in 2003, and the 255 road was resurfaced with gravel about five years ago. Other roads in the drainage are not graded until there is a timber sale or other need, and gravel is only added as needed. The use of best management practices and Forest Service guidelines prevents sediment from reaching the creek. The presence of heavy equipment would create some noise during the short period of time the equipment was in any specific area, but this would be minor and very short-term.

4.17 Irreversible and Irretrievable Commitment of Resources

Gold and fossil fuels are the only natural resources that would be committed irreversibly. The amount of gold recovered by suction dredge operations is not known, but is not likely to be significant at the levels considered in this EIS. Relatively small amounts of fuel are used by

small gas engines driving suction dredge pumps and compressors, and their use would have no effect on regional supplies. In addition, occasional fish may be killed, as described in section 4.4. The Forest Service in consultation with regulatory agencies has determined that this mortality would not threaten the survival of any threatened or endangered species.