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This Executive Summary and other portions of this FEIS document can be found on the internet: http://www.dnrc.mt.gov/eis_ea.html or call Mike McMahon at 406-881-2670.

Persons with disabilities who need an alternative, accessible format of this document should contact DNRC at the address or phone number shown above.

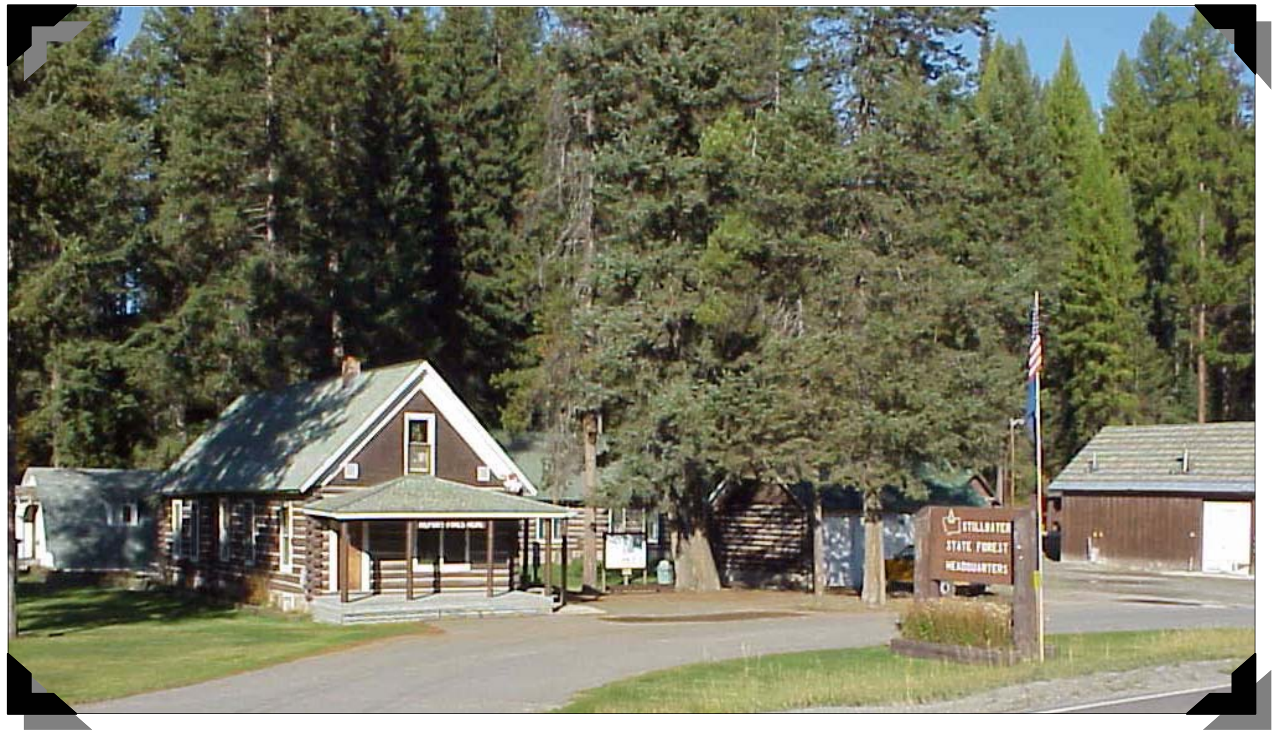
West Fork of Swift Creek Timber Sale Project

Final Environmental Impact Statement

Executive Summary

January 2005

Department of Natural Resources and Conservation



Stillwater State Forest, Montana Department of Natural Resources and Conservation (DNRC), is planning the West Fork of Swift Creek (West Fork) Timber Sale Project. The proposed sale area is located approximately 20 air miles north of Whitefish, Montana and west of Upper Whitefish Lake. Harvesting would take place in Sections 18, 19, 20, and 28 in Township 34 north, Range 23 west, and Section 13, Township 34 north, Range 24 west. The *VICINITY MAP can be found on page 5 and the TIMBER HARVESTING ALTERNATIVE MAP* is presented on page 6.

In October of 2004, Stillwater Unit produced the Draft Environmental Impact Statement (DEIS) for the West Fork Timber Sale Project. This DEIS included a 30-day comment period, open until November 20, for anyone that would like to respond.

This Executive Summary is part of the Final Environmental Impact Statement (FEIS) for the West Fork Timber Sale Project.

The FEIS presents:

- Corrections, updates, and additions to the DEIS (any significant changes are bolded and italicized).
- The Proposed Decision from the project decisionmaker.
- Copies of letters of comments received on the DEIS; our responses to those comments are opposite the letters.

This Executive Summary:

- Is designed in accordance with the Montana Environmental Policy Act (MEPA) rules.
- Is written so that, with the supporting photographs and map, it is easily understood.
- Briefly describes the project proposal and the alternatives that have been considered.
- Updates the DEIS Executive Summary.
- Informs you of the next step in this project.

Johnson Creek. The possible effects of logging and roadwork to the creeks and specific fisheries habitats were also analyzed. Overall, the effects to fisheries should be negligible, and the reduction of sediment going into the streams from the roadwork that would be done with this project would likely have a positive effect.

The Proposed Decision Within the FEIS and What is to Follow

Robert L. Sandman, Northwest Area Manager, is the decisionmaker for this project. He has included his proposed decision as a part of this FEIS. His proposed decision is not the final decision. No sooner than 15 days after the FEIS is published, Mr. Sandman may write a Decision Memo to accept the proposed decision as the final decision *or* he may write a complete Record of Decision for the project.

In general, the Proposed Decision selects Action Alternative B and would implement the Alternative Practice that allows DNRC to use roads currently restricted to motorized vehicles. The rationale for choosing Action Alternative B includes:

- The largest amount of revenue would be provided to the school trusts.
- Approximately 9.5 mmbf of timber would be contributed to DNRC’s annual harvest requirements (sustained yield ARM).
- The costs of road repairs and amount of money being made from the timber sale would show a better balance (costs versus revenue).

Action Alternative B proposes harvesting old-growth timber from stands that are mainly subalpine fir and Engelmann spruce. Currently, Stillwater State Forest has more older stands of subalpine fir and Engelmann spruce than our analysis indicates is needed. Several of these stands have been partially harvested in the past.

Following publication of the final decision on this project, such sale-related chores as flagging unit boundaries, marking trees to be left or trees to be cut, flagging boundaries of sensitive areas such as Streamside Management Zones (SMZ), and staking roads for reconstruction would be completed.

After these tasks are completed, a Timber Sale Contract would be prepared. The Timber Sale Contract would need Land Board approval before being offered for sale by public bidding. This project could be sold in the late spring or early summer of 2005.

– use skid trails that have been used in past operations when possible; and
– leave larger pieces of logging debris on the ground following the harvest.

DNRC estimates that less than 15 percent of the harvested areas would have some level of soil compaction.

WILDLIFE

THREATENED AND ENDANGERED SPECIES

Gray Wolf, Bald Eagle, and Canada Lynx

With the mitigation measures incorporated into the design of the project, the effects to gray wolves, bald eagles, and Canada lynx are expected to be minor under both action alternatives.

Grizzly Bear

Grizzly bears could be displaced from some areas where habitat is currently available. Displacing bears from quality habitats could affect grizzly bear survival and reproduction to an unknown degree.

If Action Alternative B, with additional mitigation measures for road restrictions, or Action Alternative C is selected, negligible effects to grizzly bears are expected.

If, instead, Action Alternative B is implemented with the Alternative Practice, the project would temporarily exceed the open-road density and decrease security-core habitat below the 1996 baseline level for grizzly bears. Due to open-road disturbance, grizzly bear habitat would be reduced for 2 nondenning seasons, which would likely displace grizzly bears from 732 acres. In addition, due to the removal of native culverts, 1,052 acres of potential security core would be affected for about 1 week in late summer.

Displacing grizzly bears from quality habitats could affect bear survival and reproduction to an unknown degree.

SENSITIVE SPECIES

Fisher

Under either action alternative, habitat structure for fishers would be removed. Higher quality habitat would be retained in the no-harvest buffers around the major streams in the project area, and deadwood would be retained throughout the proposed harvest units. More habitat would be affected under Action Alternative B than C.

Pileated Woodpecker

Under either action alternative, habitat structure for pileated woodpeckers in the harvest areas would be removed. Due to the high elevation of the project area, the quality of pileated woodpecker habitat is expected to be low. By retaining deadwood throughout the harvest areas, important habitat structure for pileated woodpeckers would be retained. The effects of both action alternatives would be about the same.

BIG GAME

Under each action alternative, some minor displacement of big game would occur. Action Alternative B would produce more effects than Action Alternative C.

FISHERIES

The fisheries analysis considered the presence of bull trout and westslope cutthroat trout in the West Fork, Stryker Creek, and

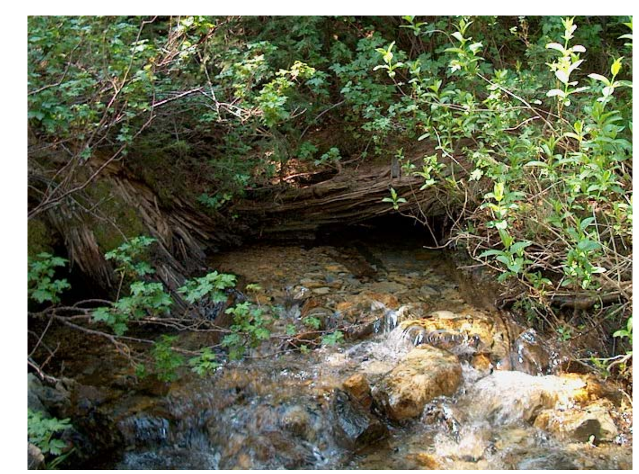
DNRC has the task of managing State school trust lands. The primary purposes of this timber sale project are to provide income for the school trust, grow new stands of healthy trees, and improve the growth and vigor of trees remaining in the timber stands. This project follows the *State Forest Land Management Rules (Annotated Rules of Montana 36.11.401* through *36.11.450)* and is based on the premise that, for the foreseeable future, timber management will continue to be the primary source of revenue. Also that timber management will be the primary tool for achieving biodiversity objectives on State forest lands.

This proposed timber sale project would log 5 to 9.5 million board feet (1,250 to 2,000 log truck loads) of timber. Trees would be harvested from 938 to 1,270 acres, depending on the alternative chosen.

In addition to harvesting timber:

– At least one wooden bridge in the project area would be replaced with a 75-foot steel bridge to improve access, water quality, and safety. Currently, this bridge on Stryker Basin Road cannot support heavy machinery or fire engines.
– Several deteriorating log and earthen stream crossings would be removed.
- Approximately 3 miles of new road would be built to access harvest areas; following harvesting operations, these roads would be grass seeded and closed to prevent motorized use.
- Roads used for hauling would be improved/repaired to improve drainage, water quality, and safety.
- Logged areas would be prepared to grow new trees by either broadcast burning or piling slash and scarifying the ground to allow seeds to germinate or trees to be planted.

The West Fork bridge is no longer able to support the weight of heavy equipment and fire engines and would be replaced with a 75-foot steel bridge.



Several deteriorating log and earthen stream crossings, like this one, would be removed.

Public Concerns

In April of 2001, DNRC mailed a letter to let the public know that the West Fork of Swift Creek area was being considered for a timber sale proposal. The letter and an information pamphlet (Initial Proposal) provided the project's objectives, maps, an overview of past timber harvesting, and the potential for a new timber harvest. The letter also asked for responses if there were concerns about a timber sale in this area; 10 responses were received.

A team made up of foresters, a wildlife specialist, a hydrologist, a fisheries biologist, an engineer, and an economist was formed to study the public's concerns and the West Fork area. This team is called an Interdisciplinary Team (ID Team).

By discussing the concerns and studying the area, we found that effects of the proposed timber sale project would have on the following resources or issues needed to be explained.

- Vegetation (trees, including old growth)
- Hydrology (water)
- Soils
- Fisheries
- Wildlife
  - Threatened and Endangered Species
    - Bald eagle
    - Canada lynx
    - Gray wolf
    - Grizzly bear
  - Sensitive Species
    - Fisher
    - Pileated woodpecker
  - Big Game Species (deer, elk, and moose)
- Economics
- Management of roads

Summary of Effects

TREES AND OTHER VEGETATION

DNRC is guided to manage Stillwater Forest for appropriate representations of age classes and types of forests. Some areas of the forest should grow mostly Engelmann spruce, while other areas should grow a mix including western white pine or western larch. One objective for this project is to harvest a portion of the timber in an area and regenerate the area with the appropriate species of trees. Action Alternatives B and C would both regenerate some western larch and western white pine trees to assure that they will continue to be a part of the forest.

DNRC is also concerned about managing for age classes on the forest. We have a young age class that covers 0- to 39-year-old timber stands. According to our data, this age class is underrepresented on Stillwater Forest compared to the timber that was historically present. We also have age-class groups of 40 to 100 years old, 100 to 150 years old, and 150 years old and older.

According to our analysis, Stillwater Forest has about 19,000 more acres in the oldest age class (150 years and older) than was present around 1900. Action Alternative B would reduce this age class by about 1 percent and, in turn, increase the youngest age class by the same amount. Action Alternative C would reduce the oldest age class by approximately 0.7 percent and increase the youngest age class by that amount.

DNRC also considers old-growth forests in their analysis. Approximately 8.7 percent of Stillwater Forest meets the old-growth definition. Action Alternative B would harvest approximately 286 acres of old-growth timber. Action Alternative C and No-Action Alternative A would not harvest old growth. All alternatives meet the SFLM Rules in relation to old-growth management.

WATERSHED AND HYDROLOGY

In the watershed and hydrology analyses, specialists looked for areas where soil could erode into the West Fork, Johnson Creek, Stryker Creek, or any of their tributaries. With the repair of roads and culverts and the removal of deteriorated bridges, the amount of sediment that would reach the streams would be reduced.

Following the harvesting of live trees, the amount of snowfall and rain that flows into creeks increases primarily because the larger trees that have been harvested no longer use that water. Therefore, the amount of water running through the streams in the West Fork and main Swift Creek watersheds may increase slightly. This slight increase would continue for several years, but would not noticeably change the quality of the water in these streams and Whitefish Lake.

SOILS

DNRC is concerned that logging would compact and displace soil, which may prevent trees from growing as fast or as large as in the past. Therefore, DNRC would:

- limit logging operations to periods when the soil is dry;

Alternatives:

GENERAL DIFFERENCES

Action Alternative B has several differences than No-Action Alternative A and Action Alternative C. These are:

- Action Alternative B proposes to harvest the same areas as Action Alternative C, plus an additional 332 acres in another part of the project area.
- These additional acres in Action Alternative B are accessed by roads that are currently restricted from public motorized use. The SFLM Rules guide us to look for other roads to temporarily "restrict" while the additional 332 acres are being logged.
- Action Alternative B proposes to harvest approximately 286 acres in stands that meet DNRC's old-growth definition, while Action Alternative C does not enter old-growth stands.
- Logging operations for Action Alternative B would be more difficult than logging operations under Action Alternative C. Specialized skyline cable equipment would be required to reach some areas.
- The value of the timber in Action Alternative B is higher due to the size and quality of the trees and the high number of trees per acre.

GENERAL SIMILARITIES

In addition to other information provided in this summary:

- Both action alternatives would harvest areas that were logged in the 1940s and 1950s. These areas, now full of Engelmann spruce and subalpine fir, should be growing more western larch and western white pine.
- Both action alternatives would temporarily restrict 2 miles of roads that are currently open to public motorized use.

This broken native bridge is located on a stream in Section 30. Under Action Alternative B, this bridge would be removed and the banks would be restored to prevent debris from falling into the stream.

Excess slash on a regeneration-harvest area would be piled and burned. The preferred tree species would be planted in the harvest area. This is an example of Harvest Area III after harvesting.

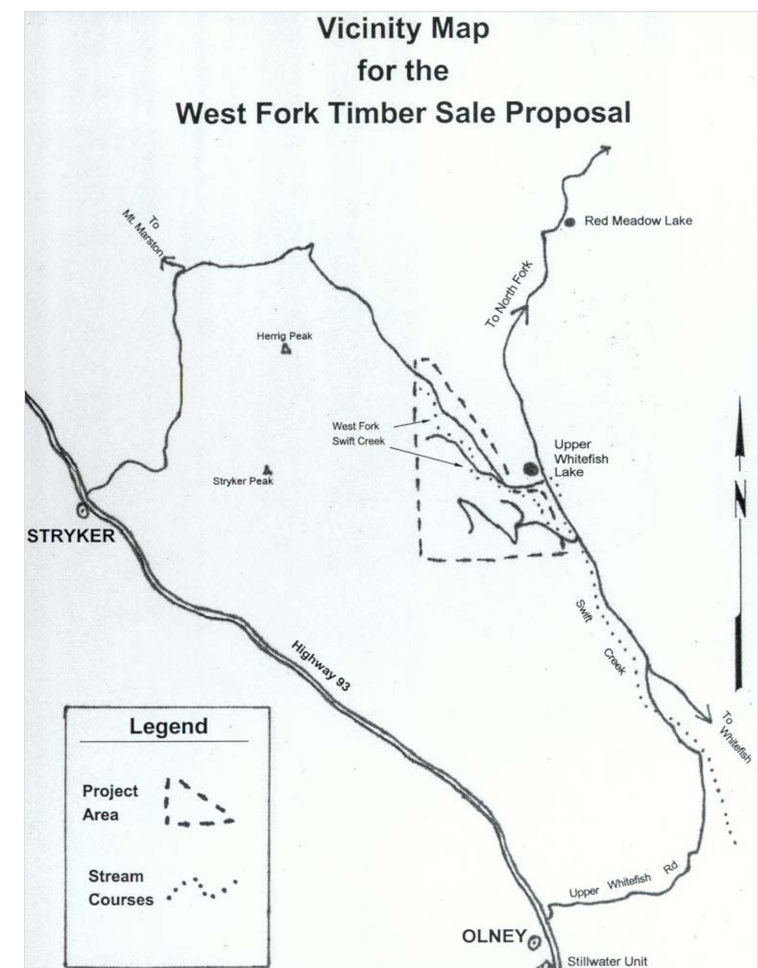
Developing the Project and Displaying the Concerns

During the period when the ID Team was developing plans for the timber sale, the State Board of Land Commissioners (Land Board) in Helena adopted the State Forest Land Management Rules (SFLM Rules). These rules provide guidance on how DNRC will manage their forests and deal with specific items that need to be considered when planning and conducting a timber sale. The ID Team was directed to follow these rules as they worked to finalize the timber sale proposal.

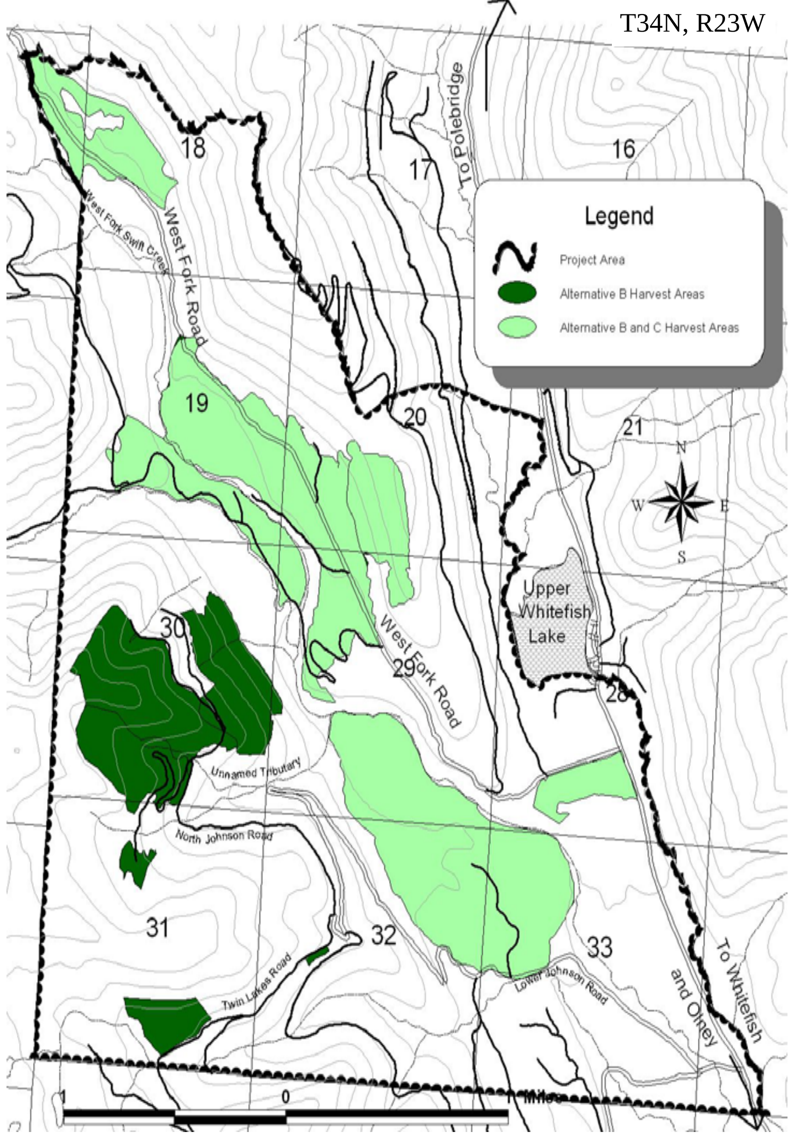
In general these rules cover management for/of:

- biodiversity (the forest conditions are managed for an appropriate mix of stand structures and forest types);
- roads;
- watersheds;
- fisheries;
- wildlife species, including those listed as threatened, endangered, and sensitive, and big game;
- weeds; and
- economics.

The SFLM Rules may be found on the web at: www.dnrc.state.mt.us/trust/fmb.htm



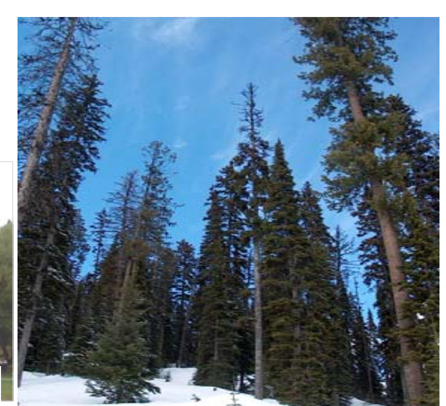
Timber-Harvesting Alternative Map



The Legislature allocates most money made from timber sales to subsidize schools such as the West Valley and Bissell grade schools in Flathead County.

Skyline harvesting equipment like this 'line machine' would be used to harvest trees from the steeper areas.

Trees, such as this dying and dead subalpine fir, would be harvested with both action alternatives.

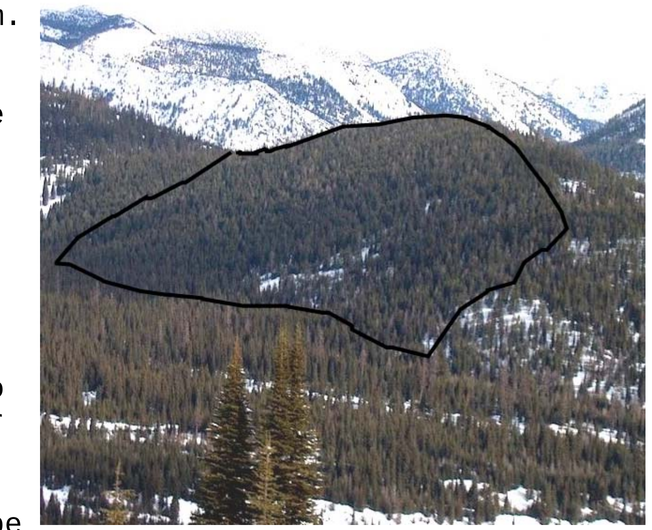


The timber stand conditions include poor tree crowns.

Alternatives

After studying the list of concerns, 3 possible choices (alternatives) were developed by the ID Team. Each alternative was designed to address a particular concern or group of concerns.

- ***No-Action Alternative A***
  - No trees would be cut.
  - No roads would be improved.
  - Road maintenance projects, access to fight fires, recreation, and timber salvaging would continue as now.
  - No money would be contributed to the school trust funds or the Forest Improvement Program.
- ***Action Alternative B***
  - 1,270 acres of timber would be harvested.
  - 9.5 million board feet of timber would be purchased by sawmills.
  - 31 miles of road would be improved and 3.4 miles of new roads would be built.
  - 2 bridges would be replaced to allow access to more acres for forest-management and fire-protection activities.
  - Approximately $680,000 would be contributed to the school trust funds and $630,000 would be contributed to the Forest Improvement Program.
- ***Action Alternative C***
  - 938 acres of timber would be harvested.
  - 5.7 million board feet of timber would be purchased by sawmills.
  - 24.5 miles of roads would be improved and 3.1 miles of new roads would be built.
  - 1 bridge would be replaced to allow access to more acres for forest-management and fire-protection activities.
  - Approximately $360,000 would be contributed to the school trust funds and $380,000 to the Forest Improvement Program.



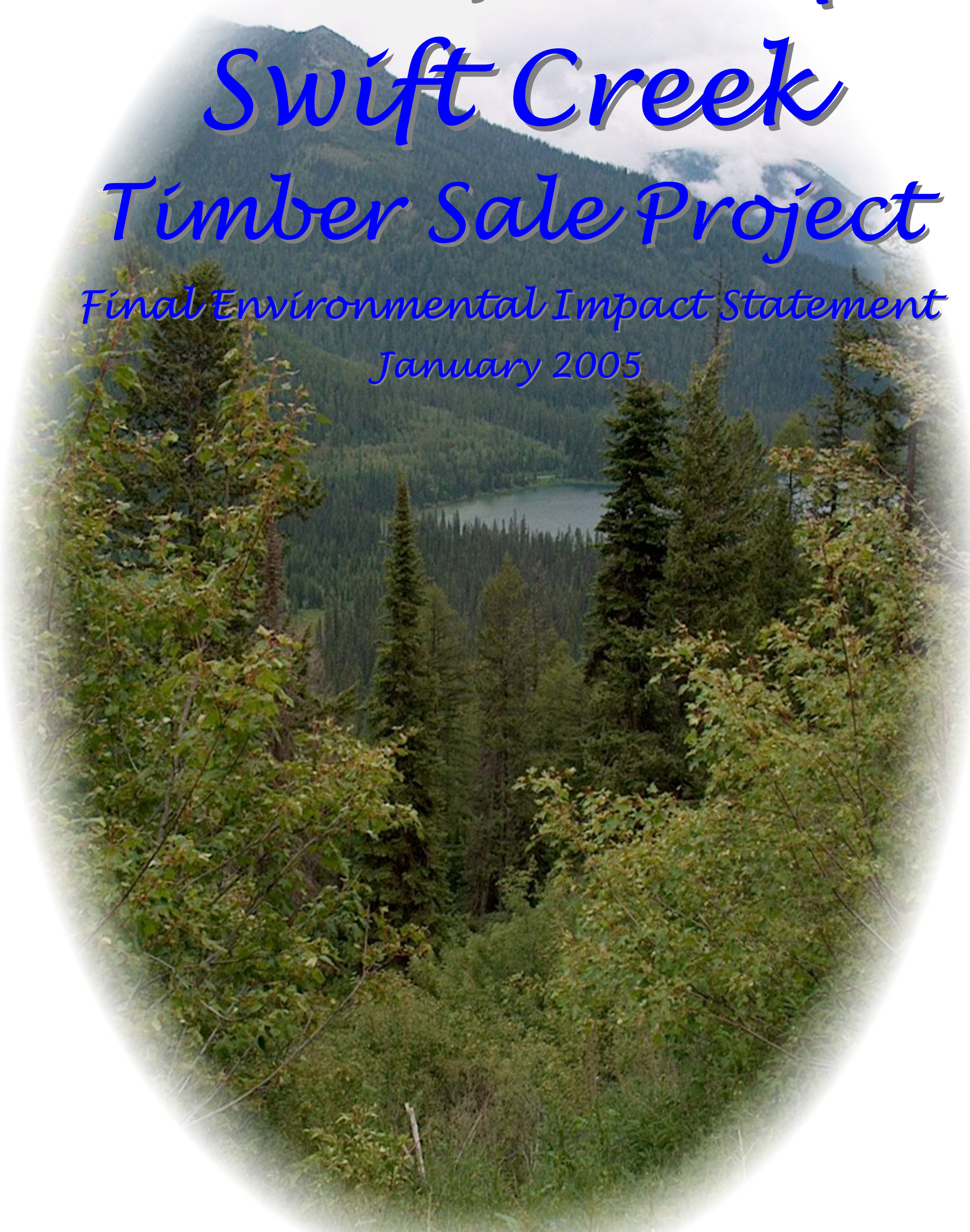
A landscape view of proposed Harvest Area I. Approximately 72 acres would be commercially thinned.

Though erosion-control measures would be taken, temporary increases in sediment to the streams would occur during the installation of culverts or bridges. Once installed, the annual sediment delivery would decrease to less than the current amount.

West Fork of Swift Creek Timber Sale Project

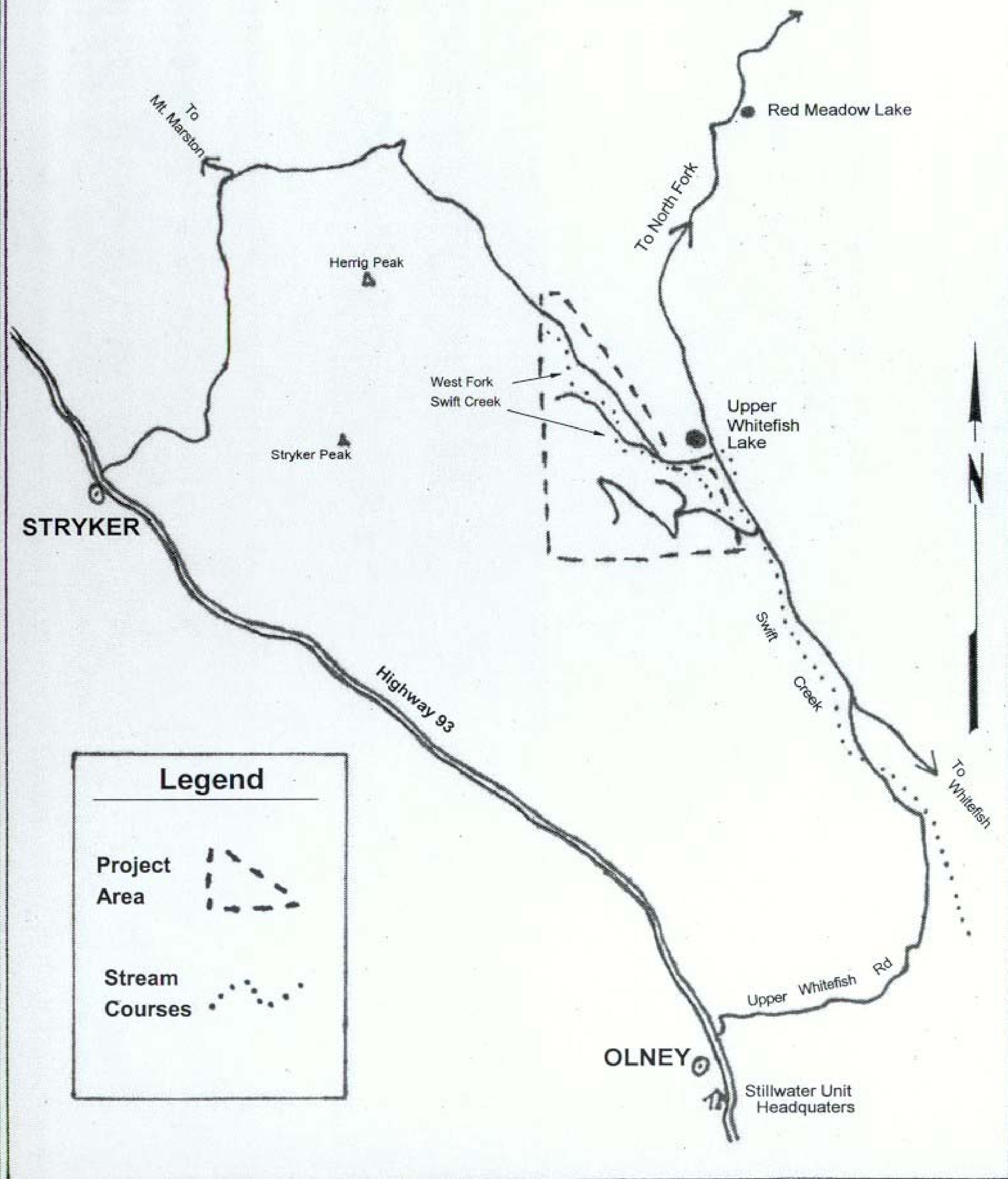
Final Environmental Impact Statement

January 2005



Department of Natural Resources and Conservation

Vicinity Map
for the
West Fork Timber Sale Proposal



WEST FORK OF SWIFT CREEK TIMBER SALE PROJECT
FINAL ENVIRONMENTAL IMPACT STATEMENT

January 2005

Enclosed is a copy of the West Fork of Swift Creek Timber Sale Project Final Environmental Impact Statement (FEIS).

The proposed project is located approximately 20 miles northwest of Whitefish, Montana in Stillwater State Forest.

This project was designed to generate income for the school trust, regenerate new stands of trees, improve tree growth of the trees retained in the harvest areas, and provide some substantial improvements to the transportation infrastructure on Stillwater State Forest.

The Department does not present a preferred alternative of the 2 action alternatives analyzed in the FEIS at this time. The proposed harvests include No-Action Alternative A, which treats 0 acres and harvests no volume; Action Alternative B treats approximately 1,270 acres and harvests 9.5 million board feet (mmbf); and Action Alternative C treats approximately 938 acres and harvests 5.7 million board feet (mmbf).

My proposed decision in the FEIS is Action Alternative B. I anticipate making my final decision in February 2005.

This FEIS is written in the format that can be understood by any interest level and incorporates pictures in the Executive Summary to promote project understanding. The FEIS consolidates Chapters III and IV into a single section (*CHAPTER III – EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES)* that summarizes the analysis in plain English. The tabbed appendices contain the bulk of the scientific analysis information, which will need to be used for scientific, technical, or legal review. Following review of the Draft Environmental Impact Statement (DEIS) and the comments received on the DEIS, no major changes were considered necessary. Some minor corrections and additions were made to the DEIS; any changes, other than grammatical, are shown in a bold, italicized, slightly larger print in the FEIS.

APPENDIX H - COMMENTS AND RESPONSES displays the comments made by responders to the DEIS and DNRC’s reply to the comments that required a response.

Sincerely,

Robert L. Sandman
NWLO Area Manager
Northwestern Land Office

RLS:bm/mb
Enclosure
Cc: West Fork TS file

FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS) PREFACE

The Department of Natural Resources and Conservation (DNRC) wishes to present a document that all interested parties could, regardless of their knowledge level, read and be able to fully comprehend the project and its analysis.

We must also have a document that is scientifically and legally sound. In the past, our experience has been that to produce a document that is easy to understand by all interested people and still withstand the appropriate scientific or legal review is extremely difficult.

The updated Executive Summary of the Final Environmental Impact Statement (FEIS) is designed to encompass the Montana Environmental Protection Act (MEPA) rules. This information is written so that, with the supporting photographs and maps, the Executive Summary is easily understood.

The body of the FEIS was redesigned to combine Chapters III and IV into a single chapter, *CHAPTER III - EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES*. The analyses and conclusions that were completed by the Interdisciplinary Team (ID Team) are summarized in plain language, thus ensuring that all interested parties, regardless of their scientific or technical abilities, are able to understand this proposal and its effects.

The members of the ID Team prepared the resource appendices; the discussions include citations from other sources, such as research documents, environmental assessments, etc. The lengthy discussions of methodologies, research, monitoring, baseline studies, analyses, etc., have been completed by the ID Team and are presented in the appendices. Because the analysis work requires highly advanced technical procedures and terminology, the information in the appendices needs to be utilized for any scientific, technical, or legal review. *APPENDIX H - COMMENTS AND RESPONSES* displays the comments made by responders to the DEIS and DNRC’s reply to the comments that required a response.

Any additions to the Draft Environmental Impact Statement (DEIS), other than grammatical corrections, are shown in a bold, italicized, and slightly larger print.

TABLE OF CONTENTS

CHAPTER I
PURPOSE AND NEED

DESCRIPTION OF PROPOSED ACTIONS

Stillwater Unit, Montana Department of Natural Resources and Conservation (DNRC), is proposing the West Fork of Swift Creek (West Fork) Timber Sale Project west of Upper Whitefish Lake on Stillwater State Forest. The project includes:

- harvesting timber,
- replacing up to 2 bridges,
- removing several deteriorating log and earthen stream crossings, and
- improving drainage on roads leading to the harvest areas.

If a harvest alternative were selected, 5 to 10 million board feet (mmbf) of timber would be harvested from 948 to 1,278 acres. In addition, depending on the alternative, 1 or 2 wooden bridges in the project area, which cannot support heavy machinery or fire engines, would be replaced. The wooden bridge on Stryker Basin Road would be replaced with a 75-foot steel bridge; a 30-foot wooden bridge on North Johnson Road would be replaced with a temporary 30-foot steel bridge. Also, several older stream crossings in Stryker basin, originally constructed with logs and covered with dirt, are collapsing. This proposal would remove the collapsing structures and stabilize the streambanks.

The project area for the timber sale is located approximately 20 air miles northwest of Whitefish, Montana in Sections 18, 19, 20, 28, 29, 30, 31, 32, and 33, Township 34 north (T34N), Range 23 west (R23W) and Section 13, T34N, and R24W. The collapsing stream crossings are located in Section 25, T34N, R24W (see *VICINITY MAP,* back of front cover).

PURPOSE OF PROPOSED ACTION

The primary objectives of this harvest are to generate income for the school trust, regenerate new stands of trees, and improve the growth of trees remaining in the harvest areas.

The lands involved in the proposed project are held by the State of Montana for the support of specific beneficiary institutions, such as public schools, State colleges and universities, and other specific State institutions, such as the school for the deaf and blind (*Enabling Act of February 22 1889: 1972 Montana Constitution Article X, Section 11*). The Board of Land Commissioners (Land Board) and DNRC are required by law to administer these trust lands to produce the largest measure of reasonable and legitimate return over the long run for these beneficiary institutions, *Section 77-1-2-2, Montana Codes Annotated* (MCA).

On May 30, 1996, DNRC released the Record of Decision on the State Forest Land Management Plan (SFLMP). The Land Board approved the SFLMP's implementation on June 17, 1996. On March 13, 2003, the Department adopted Administrative Rules for Forest Management (Rules) (*Administrative Rules of Montana* [*ARM] 36.11.401* through *450*). The SFLMP outlines the management philosophy and the proposal will be implemented according to the Rules. The philosophy is:

Our premise is that the best way to produce long-term income for the trust is to manage intensively for healthy and biological diverse forests. Our understanding is that a diverse forest is a stable forest that will produce the most reliable and highest long-term revenue stream… In the foreseeable future, *timber management will continue to be our primary source of revenue and our primary tool for achieving biodiversity objectives.*

PROPOSED OBJECTIVES

In order to meet the goals of the management philosophy adopted through a programmatic review of the SFLMP and the Rules, DNRC has set the following specific project objectives:

- Harvest 4 to 10 mmbf of sawtimber to generate revenue for the appropriate school trusts. The sale would also provide a sufficient amount of sawlog volume to contribute to the sustained yield for DNRC, as mandated by *State Statute 77-5-222, MCA*.
- Improve the long-term productivity of timber stands by increasing stand vigor, reducing incidence of insect infestations and disease infections, and regenerating portions of stands where timber-stand growth is decreasing. Actions would be done in a manner that maintains site productivity and favors the retention and regeneration of appropriate tree species (desired future conditions [*ARM 36.11.405*]).
- Replace the bridge across the West Fork in Section 29, T34N, R23W.
- Provide for additional benefits and maintain options for sustained revenue to the school trusts by completing site improvements on existing roads to improve drainage, water quality, and safety as recommended by current Best Management Practice Standards (BMPs) for Forestry.

ENVIRONMENTAL IMPACT STATEMENT PROCESS

EIS DEVELOPMENT

This EIS was prepared in compliance with the Montana Environmental Policy Act (MEPA), which requires State government to include the consideration of environmental impacts in its decisionmaking process. Agencies are also required to inform the public and other interested parties about proposed projects, environmental impacts that may result, and alternative actions that could achieve the project objectives.

PUBLIC SCOPING

Public scoping occurs in the initial stage of an EIS and is used to inform the public that a State agency is proposing an action. The public has the opportunity to express their comments or concerns about the possible impacts of the project.

In April 2001, DNRC solicited public participation in the West Fork Timber Sale Project proposal by placing notices in the Whitefish Pilot and Kalispell’s Daily Interlake newspapers; an article announcing the scoping of the project was also published in the Daily Interlake. In addition, a letter that included maps and general information about the project and the project area was mailed to individuals, agencies, industry representatives, and other organizations that had expressed interest in Stillwater State Forest’s management activities. The mailing list developed for this project is in the project file.

The public-comment period for the initial project proposal was open for 30 days. As a result of the letters and notices in the newspapers, a total of 10 letters and phone calls were received. The issues and concerns identified through the public scoping were summarized and used to further refine the project.

The Interdisciplinary Team (ID Team), made up of DNRC's wildlife biologist, hydrologist, and several foresters, began compiling the issues and gathering information related to current conditions in May of 2001.

The priorities of the Stillwater Unit timber-sale program shifted from this timber sale to fire salvage during the remainder of 2001 and most of 2002 and 2003. In February 2002, a letter updating this project was sent to those on the mailing list; no responses were received. Another update letter was sent to the groups and individuals on the mailing list in February of 2004. This letter further described the status of the alternative-development process and provided notice that the SFLM Rules (*ARM 36.11.401* through *450*) would be followed on the project.

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)

A Draft Environmental Impact Statement (DEIS) was prepared in October 2004. Public comments related to the issues that could affect the project were incorporated into the document. Upon publication, the DEIS and Executive Summary were circulated to individuals, groups, and agencies requesting the documents. Notification that the documents were available on the DNRC web page or at Stillwater Unit was sent to the Whitefish Pilot and Daily InterLake newspapers, as well as to individuals who requested notification. Comments pertaining to the DEIS were accepted for 30 days. Three responses to the DEIS were received; those responses are included in APPENDIX H - COMMENTS AND RESPONSES.

FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS)

After public comments on the DEIS were received, compiled, and addressed, DNRC prepared this FEIS. The FEIS consists, primarily, of a revision of the DEIS that incorporates new information based on public and internal comments. A proposed decision was prepared by Robert L. Sandman, Stillwater Unit Manager, and is included at the end of CHAPTER II - ALTERNATIVES. As with the DEIS, this FEIS will also be published on the State web site at: **http://www.dnrc.mt.gov/eis_ea.html**

NOTIFICATION OF DECISION

Following publication of the FEIS, the Stillwater State Forest Unit Manager will review public comments, the FEIS, and information contained in the project file. No sooner than 15 days after publication of the FEIS, the Unit Manager will consider and determine the following:

- Do the alternatives presented in the FEIS meet the project's purpose?
- Is the proposed mitigation adequate and feasible?
- Which alternative or combination/modification of alternatives should be implemented and why?

These determinations will be published and all interested parties will be notified. The decisions presented in the published document would become recommendations from DNRC to the Land Board. Ultimately, the Land Board would make the final decisions regarding which actions to implement.

SCOPE OF THIS ENVIRONMENTAL ANALYSIS

OTHER ENVIRONMENTAL REVIEWS RELATED TO THE PROJECT

In order to address direct, indirect, and cumulative effects on many resources, the analysis must incorporate past, present, and future actions within a determined analysis area. The locations and sizes of the analysis areas vary by resource (watershed, soils, etc.) and species (grizzly bear, Canada lynx, etc.) and are further described by resource in Chapter III and the various resource appendices. The following timber sales are located within several of the West Fork environmental analysis areas.

- Ongoing timber sales where the environmental analysis has been completed:
  - Chicken/Werner Timber Sale Project Environmental Impact Statement (EIS) (1999)
  - Taylor South Timber Sale Project EIS (2001)
  - Good/Long/Boyle Timber Sale Project Environmental Analysis (EA) (2000)
  - Dog/Meadow Timber Sale Project EA (2003)
  - Ewing Middle Ridge EA (2004)
- The Point of Rocks Timber Sale Project was scoped in May/June of 2004 and the environmental review is now in progress.
- The Ewing/Fish Lake and Old Highway timber sale projects have been identified on DNRC's 3-year timber sale list as the next potential projects for Stillwater Unit. Currently, no proposal/proposed action has been initiated and the potential projects have not been scoped; therefore, DNRC has not initiated a preimpact study on these proposals.

OTHER AGENCIES OR ENTITIES WITH JURISDICTION RELATED TO THIS PROJECT

Montana Department of Fish, Wildlife and Parks (DFWP)

DFWP has jurisdiction over the management of fisheries and wildlife in the project area. A Stream Preservations Act Permit (124 Permit) is required from DFWP for activities that may affect the natural shape and form of any stream or its banks or tributaries.

Montana Department of Environmental Quality (DEQ)

A Short-term Exemption from Montana's Surface Water Quality Standards (3A Authorization) may be required if:

- temporary activities would introduce sediment above natural levels into streams, or
- DFWP feels a permit is necessary after reviewing the mitigation measures in the 124 Permit.

Montana Airshed Group

DNRC is a member of the Montana Airshed Group, which regulates slash burning done by DNRC. DNRC receives air-quality permits through participation in the Montana Airshed Group.

Plum Creek Timber Company

Cooperative road-maintenance activities by DNRC and Plum Creek Timber Company occur on "cost-share" roads to reduce sediment delivery from roads.

ISSUES AND CONCERNS

Through the scoping process, resource specialists of DNRC and other agencies and the public raised concerns about the project's potential impacts on the environment. These concerns were considered by DNRC in the development of project alternatives (see *CHAPTER II*). A summary of the comments that were incorporated in the alternatives is presented by resource in *TABLE I-1 – SUMMARY AND TRACKING OF ISSUES AND CONCERNS FROM PUBLIC COMMENTS*.

TABLE I-1 – SUMMARY AND TRACKING OF ISSUES AND CONCERNS FROM PUBLIC COMMENTS

RESOURCE AREA	**CONCERN OR ISSUE**	**WHERE ADDRESSED IN EIS PACKAGE**
Vegetation	The timber sale design should promote a healthy and vigorous forest, reduce the risks of wildfires, and improve the species composition to levels and types that were historically present.	*CHAPTER III – EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES* and *APPENDIX B – VEGETATION ANALYSIS*
	This timber harvest, in conjunction with other past timber sales, may have an affect on the anticipated historic conditions of the landscape.	
Water Quality and Water Yield	Proposed activities, such as road construction and timber harvesting, could negatively affect several watersheds tributary to Whitefish Lake. Increased waterflows into streams, which could also affect the water quality of the lake, may occur as a result of these activities.	*CHAPTER III –EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES* and *APPENDIX D – WATERSHED AND HYDROLOGY ANALYSIS*
	The West Fork of Swift Creek is listed as a water-quality-limited stream; a Total Maximum Daily Load (TMDL) calculation has not been prepared for this stream.	
Soils	Timber harvesting can affect long-term soil productivity by removing biomass, and, therefore, nutrients from the harvest areas.	*CHAPTER III –EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES* and *APPENDIX H – SOILS ANALYSIS*
	Long-term soil productivity can be affected by soil compaction and displacement.	
Fisheries	This project may further degrade fisheries habitat.	*CHAPTER III –EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES* and *APPENDIX E – FISHERIES ANALYSIS*
Wildlife	Logging activities and roads can cause loss or fragmentation of habitat, affect the quality of habitat, displace species with special habitat needs, and cause increases in open-road densities.	*CHAPTER III –EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES* and *APPENDIX F – WILDLIFE ANALYSIS*
Economics	If an action alternative of this project is implemented, direct costs and impacts to the local economy and selected socioeconomic institutions would occur.	*CHAPTER III –EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES* and *APPENDIX G – ECONOMICS ANALYSIS*
	Some individuals feel that tourism and recreation have economic value in the area.	
	Timber stand access, road improvements, and harvest methods can have an impact on the project’s feasibility.	
Road Management	Changes to public access on Stillwater State Forest as a result of this project are a concern.	*CHAPTER III –EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES*

CHAPTER II
ALTERNATIVES

INTRODUCTION

The purpose of Chapter II is to introduce 2 action alternatives for the West Fork Timber Sale Project, summarize the effects of each action alternative and the no-action alternative, ***and present the decisionmaker's proposed decision***. This chapter will focus on the development of the action alternatives, summarize the description of each alternative, and briefly outline the probable environmental consequences associated with each alternative. *TABLE II-2- SUMMARY OF ENVIRONMENTAL EFFECTS* summarizes the detailed environmental effects analysis in *CHAPTER III – EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES* or the various resource appendices.

DEVELOPMENT OF ALTERNATIVES

An ID Team was formed in the spring of 2001 to work on the West Fork Timber Sale Project. The role of an ID Team is to summarize issues and concerns, develop management options within the project area, and analyze the potential impacts of a proposal on the human and natural environments.

DNRC began reviewing resources in this area prior to 2000. Data was collected for resources within the project area to aid in the analyses of wildlife habitat, hydrology, fisheries, old-growth timber stands, timber-harvest feasibility, transportation systems, and economics. Data was also used to develop mitigation that could be applied to the proposal.

Foresters provided the ID Team with a harvest and road proposal to accomplish and meet the desired future forest conditions on Stillwater Unit and the objectives described in *CHAPTER I – PURPOSE AND NEED*. The proposal addresses some areas that were harvested around 1950 and currently have stand conditions that would likely not occur under natural processes (Harvest Area II). Another area, Harvest Area III, provides an opportunity to regenerate new stands of timber similar to the results of a wildfire. The ID Team further developed the proposal within the framework of the SFLMP and its administrative rules. The ID Team discussed how to address both public and internal issues, mitigations required by the SFLM Rules, and additional mitigations that may be implemented to reduce or minimize effects related to the project. This proposal developed into Action Alternative B.

During the initial evaluation of Action Alternative B, issues related to the harvesting activities in Harvest Area III, which do not occur when harvesting in Harvest Areas I and II, were noted by the ID Team. Harvest Area III includes harvesting in stands of old-growth timber; the costs of logging, road development, and site preparation are also higher in Harvest Area III than costs associated with Harvest Areas I and II. Issues with open-road density levels are also more complex when entering the locations in Harvest Area III. The open-road density levels can be met in the Upper Whitefish Lake Grizzly Bear Management Subunit, although existing open roads would be restricted while implementing the project.

Harvest Areas I and II would not include old-growth timber stands, but would require mitigation to meet the open-road density level. Those mitigation measures are in the form of road restrictions within the West Fork Timber Sale Project area.

Logging costs are minimized with the use of common skyline and ground-based logging equipment.

Based on discussions and reviews of the issues, the decisionmaker was comfortable with developing a second action alternative, Action Alternative C, which would harvest those areas in Harvest Areas I and II, but not the areas in Harvest Area III.

The decisionmaker also asked the ID Team to meet 2 additional objectives: replace the bridge on the West Fork and complete site improvements on existing roads to improve water quality. These objectives are listed in Chapter I.

To relieve economic concerns related to the removal of a wooden bridge and installation of a 75-foot steel bridge across the West Fork, Harvest Area II-P was added to both action alternatives. Expected returns from the harvest of Area II-P would cover the expenses of the bridge work. This bridge is instrumental in accessing the Stryker Basin area for fire protection, timber management, and recreation.

Inventory and assessment work was completed on existing roads within the project area in 2004. This information has identified sections of roads that should be improved to meet BMP standards prior to hauling logs. This information also helped identify several older stream crossings as potential sediment sources to the West Fork. These crossings in Section 25, T34N, R24W, and Section 29, T34N, R23W, were originally constructed with logs and covered with dirt and are beginning to collapse. Both action alternatives include upgrading roads to meet BMPs, removing the collapsing structures, and stabilizing the streambanks.

Rotting West Fork wooden bridge that would be replaced with a 75-foot steel bridge.

Collapsed native culvert that would be removed under either action alternative.

ALTERNATIVE DESCRIPTIONS

This section describes No-Action Alternative A and the developed Action Alternatives B and C.

- ***Description of No-Action Alternative A***

  No large-scale timber harvesting or roadwork would take place, although salvage logging and firewood gathering would likely continue. Road reconstruction beyond coordinated maintenance agreements would not be conducted. The bridge over the West Fork, currently restricted to 5 tons or less, would not be replaced at this time.

  Current road restrictions would remain the same. Recreational uses, such as hunting, fishing, berry picking, and snowmobiling, are expected to continue.

  Fire-suppression and weed-control efforts would continue.

  Natural events, including plant or forest succession, windthrow, insect and disease outbreaks, and wildfires, would continue to occur. Future actions, including timber harvesting, would be proposed and undergo environmental analysis before implementation.

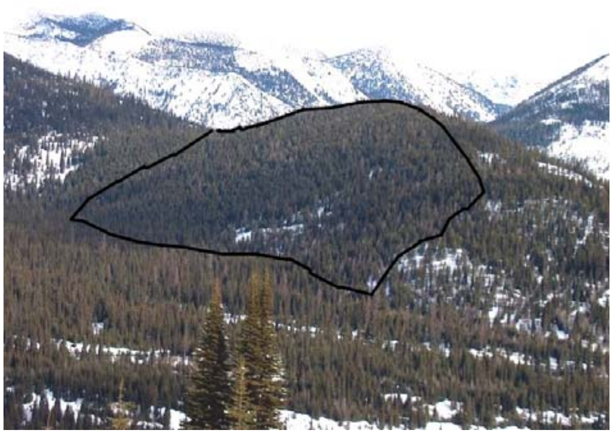
  No-Action Alternative A, which can be used as a baseline for comparing the environmental consequences of Action Alternatives B and C, is considered a viable alternative for selection.

- ***Description of Action Alternative B***

  Under this alternative, approximately 9.5 mmbf would be harvested from an estimated 1,270 acres. A description of the 3 harvest and silvicultural prescriptions proposed under this alternative will be explained under *Timber-Management Activities*. A more detailed description of silvicultural prescriptions, including photographs, is presented under SILVICULTURAL TREATMENTS and *TABLE II-1 – SILVICULTURAL TREATMENTS BY HARVEST AREA NUMBER FOR ACTION ALTERNATIVES B AND C.* A description of the proposed road plan and road-management options proposed to implement this alternative are provided under *Roadwork Activities*. The *WEST FORK TIMBER SALE ALTERNATIVE B* map is included for reference on *page II-5*.

  - **Timber-Management Activities**

    Within Harvest Area I, approximately 72 acres would be commercially thinned by utilizing a skyline cable system to harvest approximately 50 to 70 percent of the trees. A stand stocked with primarily Douglas-fir and western larch trees over 7 inches diameter at breast height (dbh) would remain.



Landscape view of proposed Harvest Area I. Approximately 72 acres would be commercially thinned.

    Within Harvest Areas II-A, II-C, II-G, II-H, and II-P, harvests of group selection and overstory removal are proposed on 866 acres. Due to timber-harvest treatments in the 1950s and the mosaic of age classes and tree sizes left in these areas, the amount of trees actually harvested per acre would vary from none to small clearcuts.

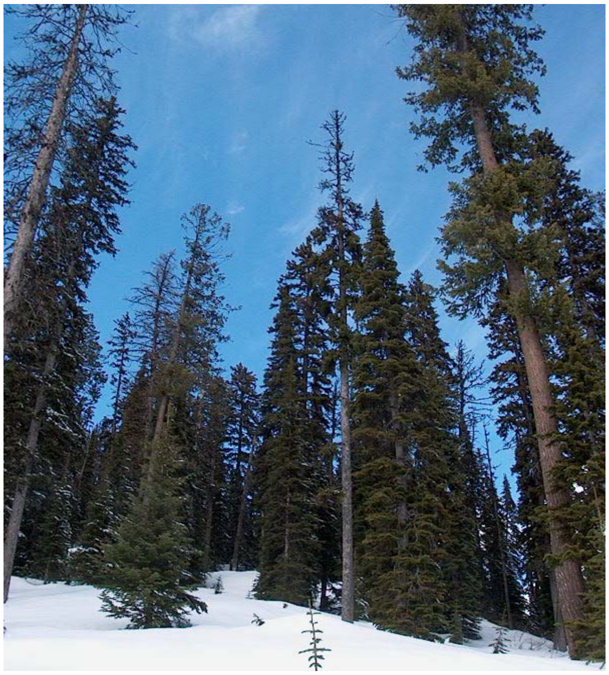
Although the majority of the area could be harvested with ground-based systems, skyline cable systems would be necessary in some locations. Associated with logging, a dozer or excavator would pile logging slash and prepare sites for the planting of western larch and western white pine seedlings.

A mid-ground view of Harvest Area II, where group-selection and overstory-removal harvest treatments would be done on approximately 866 acres.

A closer view of Harvest Area III.

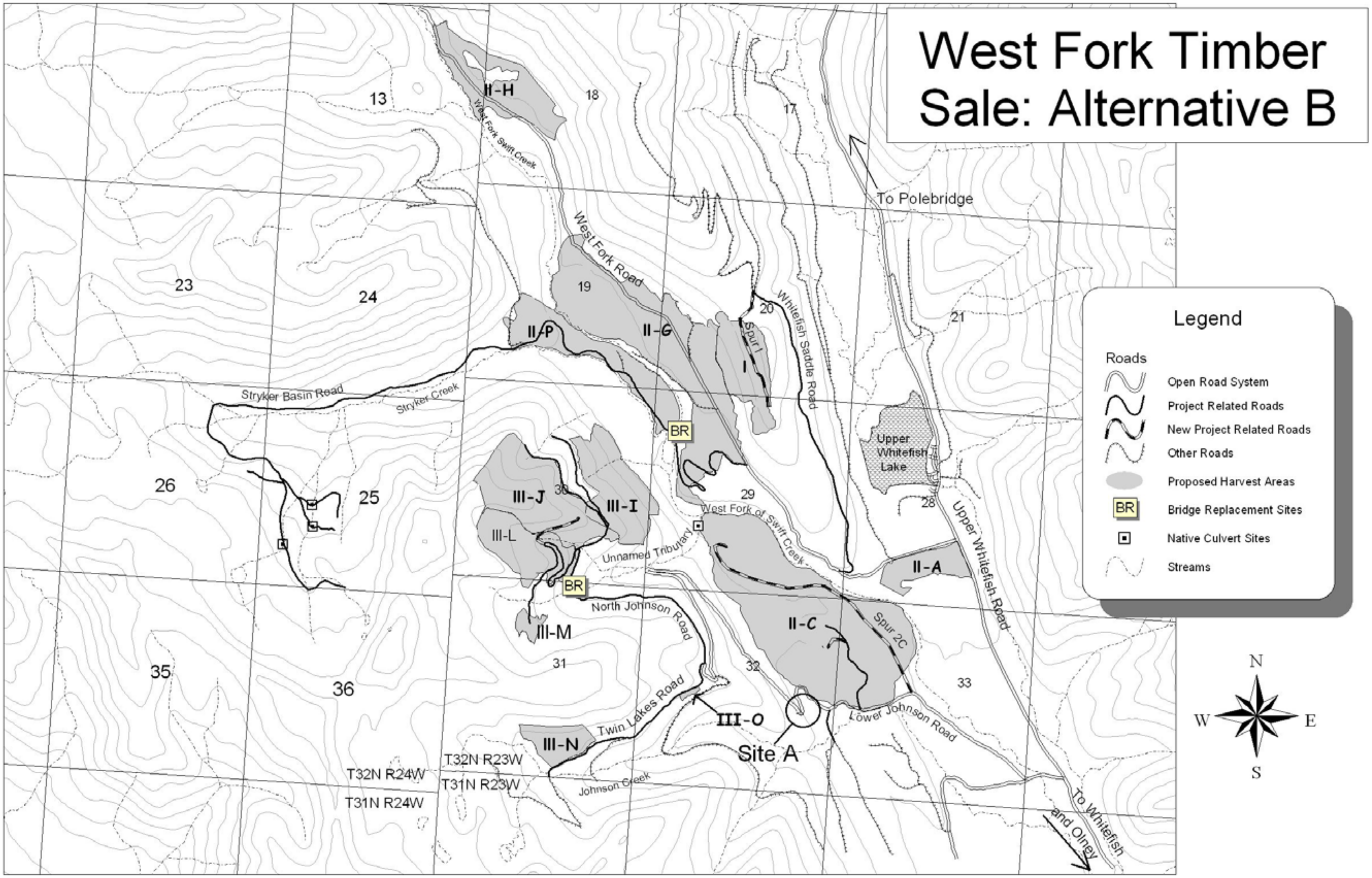
Within Harvest Areas III-I, III-J, III-L, III-M, III-N, and III-O, regeneration harvests are proposed on 308 acres and would utilize a combination of ground-based and skyline-cable systems. Groups of trees, ranging from a few trees to several acres, would be left standing in the harvest areas following

Landscape view of Harvest Area III. Regeneration harvests are proposed on approximately 308 acres would utilize a combination of ground-based and skyline-cable logging systems.



A foreground view of Harvest Area III.

FIGURE II-1



West Fork Timber Sale: Alternative B
Legend
Roads
Open Road System
Project Related Roads
New Project Related Roads
Other Roads
Proposed Harvest Areas
BR
Bridge Replacement Sites
Native Culvert Sites
Streams
N
S
E
W
II-H
II-P
II-G
I
III-J
III-I
III-L
III-M
III-N
III-O
II-C
II-A
Site A
Stryker Basin Road
Stryker Creek
West Fork Swift Creek
West Fork Road
Whitefish Saddle Road
Spur 1
Spur 2C
West Fork of Swift Creek
Unnamed Tributary
North Johnson Road
Twin Lakes Road
Johnson Creek
Lower Johnson Road
Upper Whitefish Road
Upper Whitefish Lake
To Polebridge
To Whitefish and Olney
T32N R24W
T31N R24W
T32N R23W
T31N R23W
13
18
17
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24
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harvesting. To reduce logging slash and prepare the area for new trees to regenerate, approximately 216 acres in Harvest Areas III-I and III-J would be broadcast burned, dependent upon such factors as funding, weather, site conditions, and personnel availability. Excavator site preparation and slash disposal would be conducted on the remaining acres. If burning could not be done, an excavator would pile slash and scarify the ground in Harvest Area III. A mixture of tree species would be planted in these areas.

- **Roadwork Activities**

Approximately 31.0 miles of existing roads accessing the harvest areas would require various levels of heavy maintenance; some minor reconstruction, including road widening and culvert installations, would be necessary to meet safe travel requirements and BMPs.

Approximately 1.0 mile of new road would be necessary to access Harvest Area I; approximately 2.1 miles of brushed-in roads and new road would be needed to access Harvest Area II-C, and approximately 0.3 miles of new road would be required for access to Harvest Area III-J. All these road segments would be used for administrative and logging purposes only. Following logging and site-preparation operations, slash, root wads, and grass seed would be distributed on the road to stabilize the roadbed and prevent use by motorized vehicles.

This proposal would replace 2 bridges. The bridge on Stryker Basin Road would be replaced with a 75-foot steel bridge, and a 30-foot wooden bridge on North Johnson Road would be replaced with a 30-foot temporary steel bridge.

Three older stream crossings in Section 25, T34N, R24W, and one crossing in Section 29, T34N, R23W, originally constructed with logs and covered with dirt, are in the early stages of collapse. One wooden bridge has failed and fallen into the unnamed tributary in Section 30, T34N, R23W. This alternative proposes to remove 5 structures and stabilize the streambanks to eliminate potential sediment sources in the future and upgrade roads to meet BMPs.

This broken native bridge is located on an unnamed tributary in Section 30. This bridge would be removed and the banks would be stabilized to prevent erosion of dirt into the stream.

This road slump would be repaired to meet BMPs before log hauling would take place.

- ***Description of Action Alternative C***

Under this action alternative, approximately 5.7 mmbf would be harvested from an estimated 938 acres. A description of the 2 harvest and silvicultural prescriptions proposed under this alternative will be explained under *Timber-Management Activities*. A more detailed description of silvicultural prescriptions, including photographs, is presented under SILVICULTURAL TREATMENTS and *TABLE II-1 – SILVICULTURAL TREATMENTS BY HARVEST AREA NUMBER FOR ACTION ALTERNATIVES B AND C.* The *Roadwork Activities* section describes the proposed road plan and road-management options needed to implement this alternative. The *WEST FORK TIMBER SALE ALTERNATIVE C* map is included for reference on *page III-9*.

- **Timber-Management Activities**

  This action alternative proposes timber-management activities within Harvest Areas I and II; the prescriptions for these areas are the same as those described under Action Alternative B. No timber-management activities would occur in Harvest Area III under this alternative. (Refer to *WEST FORK TIMBER SALE: ALTERNATIVE C* map and *TABLE II-1 – SILVICULTURAL TREATMENTS BY HARVEST AREA FOR ACTION ALTERNATIVES B AND C.*)

- **Roadwork Activities**

  On the road systems accessing the harvest areas, approximately 24.5 miles of existing road would require various levels of heavy maintenance. Some minor reconstruction, including road widening and culvert installations, would be required to meet safe travel requirements and BMPs.

Approximately 1.0 mile of new road would be necessary to access Harvest Area I; approximately 2.1 miles of brushed-in roads and new road would be needed to access Harvest Area II-C. Both of these road segments would be restricted to administrative and logging purposes only. Following tree-planting operations, slash, root wads, and grass seed would be distributed on the road to stabilize the roadbed and prevent use by motorized vehicles.

New road would be built to access some harvest areas. At the completion of tree-planting activities, slash, root wads, and grass seed would be placed on the road to stabilize the roadbed and prevent motorized vehicle use.

Action Alternative C proposes to replace the wooden bridge on Stryker Basin Road with a 75-foot steel bridge. This is the only bridge replacement under this alternative proposal.

Three older stream crossings in Section 25, T34N, R24W, and one crossing in Section 29, T34N, R23W, originally constructed with logs and covered with dirt, are in the early stages of collapse. This alternative proposes to remove 4 stream crossing structures, stabilize the streambanks to eliminate potential sediment sources in the future, and upgrade roads to meet BMPs.

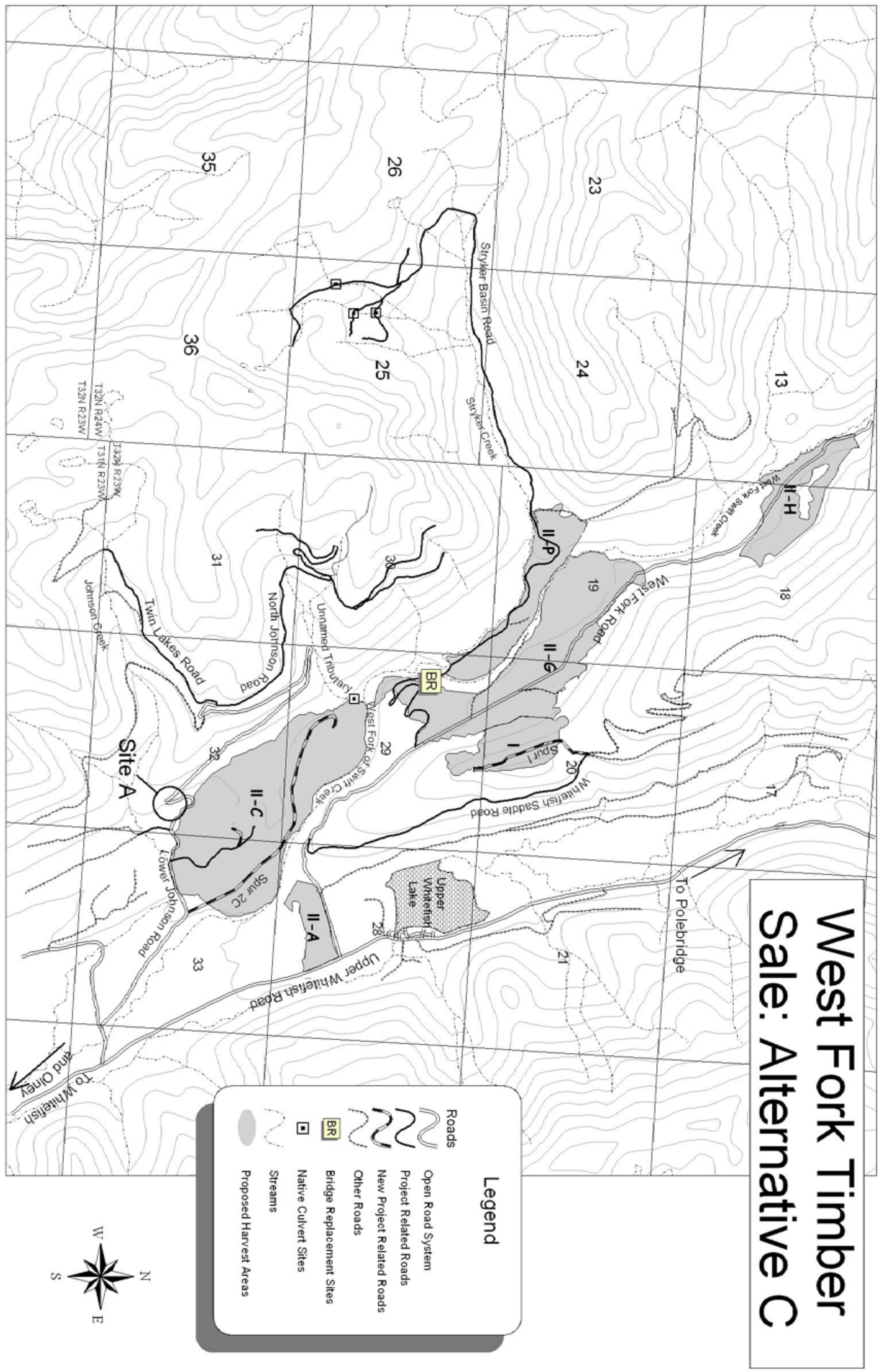


FIGURE II-2

West Fork Timber Sale: Alternative C

PROPOSED SILVICULTURAL TREATMENTS

Three different silvicultural prescriptions (harvest treatments) were chosen to meet the management objectives of this project. The photographs provide a visual representation of how these treated areas may appear following harvesting activities. Due to the variations in stand age, species components, and natural openings, the visualizations show what would be expected to occur on the ground.

- ***COMMERCIAL-THIN HARVEST***

  Fifty to seventy percent of the existing overstory would be harvested to reduce the stocking density, improve growth rates and vigor, and increase the representation of western larch in the stand. The stand would be fully stocked with trees, but would have an open-canopied appearance following harvesting.

Notice the open-canopied stand that has resulted from a commercial-thin harvest treatment.

Removal of 50 to 70 percent of the overstory reduces the stocking density, allowing tree growth rates and vigor to improve.

- ***GROUP-SELECTION/OVERSTORY-REMOVAL HARVEST***

  Due to the multistoried structure of the existing stands, this type of harvest treatment would result in several different stand conditions:

  – Small openings, up to 5 acres in size, would be created in the existing stand to promote new regeneration. Within these sites, most of the merchantable trees would be harvested, the excess logging slash piled, the ground scarified, and western larch and western white pine planted.

  – Trees that were too small for harvesting during the 1950s, and now over-top the sapling– and pole-sized trees, would be harvested to:

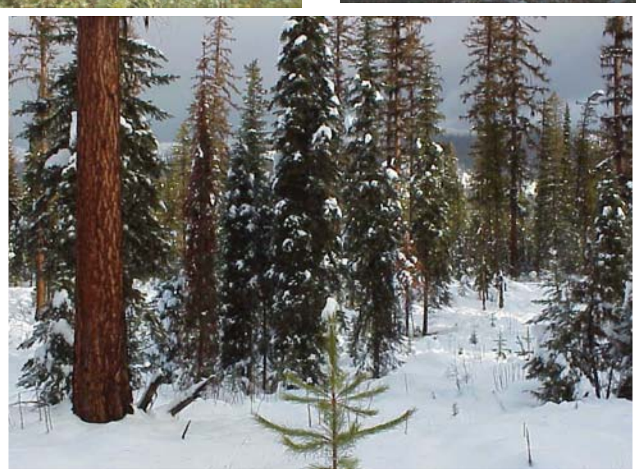
    * reduce value loss and mortality,
    * reduce the stocking density, and
    * increase the growth of the smaller diameter trees by allowing more penetration of sunlight and moisture.

  – An estimated 90 percent of the proposed harvest areas would receive some level of harvest treatment. Harvesting would not go through places that are currently without merchantable trees.

  – Existing snags and an average of 1 tree of large diameter per acre would be retained individually or in groups throughout the harvest area. Most western larch would be retained.

A landscape view of proposed Harvest Area II, where a combination of group-select and overstory-removal harvests would be implemented.

In this 23-acre group-select/ overstory-removal harvest unit, the 3-acre area in the picture has been prepared to grow new trees.



An overstory-removal harvest would remove most merchantable trees and leave sapling-sized trees room to grow.

- ***REGENERATION HARVEST***

  Most trees would be harvested, the excess logging slash piled or burned, and the site planted with a mix of tree species, including western larch, Douglas-fir, lodgepole pine, and whitebark pine. Areas near streams, inaccessible to logging systems, or designated by the Department would not be harvested; these are group-retention areas. Existing snags and an average of 1 large-diameter tree per acre would be retained individually or in groups throughout the harvest area. Due to safety and the difference in the way logs are skidded to the landings, less snags would be left in areas harvested by skyline logging equipment than those areas harvested with ground-based logging equipment.

Excess slash on a regeneration harvest area would be piled and burned. A mixture of tree species (such as western larch, Douglas-fir, lodgepole pine, and whitebark pine) would be planted in the harvest area. This is an example of Harvest Area III, posttreatment.

TABLE II-1 – SILVICULTURAL TREATMENTS BY HARVEST AREA FOR ACTION ALTERNATIVES B AND C

ACTION ALTERNATIVE	HARVEST AREA		ACRES	VOLUME	HARVEST TREATMENT	SITE PREPARATION TREATMENT METHOD
B and C	I	Section 20	71.8	340	Commercial thin with skyline system utilized	Site preparation is not required.
B and C	II-A	Section 28	39.3	190	Group select/ overstory removal with ground-based operations	Mechanical
B and C	II-C	Sections 29, 32, 33	363.5	2,250	Group select/ overstory removal with ground-based operations	Mechanical
B and C	II-G	Sections 19, 20, 29	271.9	1,750	Group select/ overstory removal with ground-based operations	Mechanical
B and C	II-H	Section 13, 18	93.5	665	Group select/ overstory removal with ground-based operations	Mechanical
B and C	II-P	Sections 19, 20, 29, 30	100.5	500	Group select/ overstory removal with ground-based operations	Mechanical
B	III-I	Section 29, 30 (east)	91.9	1,255	Seedtree with skyline system utilized	Combination broadcast burn and mechanical
B	III-J	Section 30 (mid-section)	123.9	1,350	Regeneration with groups of trees retained and skyline systems utilized	Combination broadcast burn and mechanical
B	III-L	Section 30	72.4	880	Regeneration with groups of trees retained and skyline and ground-based skidding systems utilized	Mechanical
B	III-M	Section 31 (north)	9.3	110	Regeneration with groups of trees retained and ground-based skidding system utilized	Mechanical
B	III-N	Section 31 (south)	33.0	185	Regeneration with groups of trees retained and ground-based skidding system utilized	Mechanical
B	III-O	Section 32	1.8	35	Seedtree with skyline system utilized	Site preparation is not required.

MITIGATIONS

To accomplish the various elements of the proposed project, certain methods or mitigation measures ***have been designed and would be applied***. Mitigation measures are designed to reduce impacts and protect resources during harvesting and road-improvement activities. Many are written into the SFLM Rules, but are substantial enough to the design of the project to mention here. Other mitigation measures pertinent to this project will be tracked in *APPENDIX A - STIPULATIONS AND SPECIFICATIONS*. Many mitigation measures are designed to be incorporated into the Timber Sale Contract or site-preparation contract clauses and are implemented through contract administration.

This section describes the mitigations and design components common to both action alternatives and describes those specific to each alternative.

MITIGATIONS COMMON TO BOTH ACTION ALTERNATIVES BY RESOURCE

- Water Quality and Fisheries
  - While removing and installing the bridge on Stryker Basin Road, construction work ***over*** the West Fork would be limited to July 15 through August 20 to avoid disturbance during bull trout spawning.
  - Timber-harvesting activities would not occur within 100 feet of the West Fork and Stryker and Johnson creeks; this would address fisher rules and exceed rules for the Riparian Management Zone (RMZ) and the Streamside Management Zone (SMZ) Law.
  - A segment of Lower Johnson Road is near the banks of Johnson Creek. Approximately 600 feet of road would be built farther from the creek; the original segment would be reclaimed with brush and grasses.
- Wildlife and Road Management
  - A gate would be installed at Site A (see project map) and remain closed for the entire year if road use to access Harvest Area 1 receives use exceeding 7 trips/week or 30 days of intensive use.
  - Log hauling from Harvest Area I on the Whitefish Saddle Road would be limited to August 15 through February 1 (eaglets have fledged by August 15).
  - The Whitefish Saddle, Stryker Basin, and Spur II-C roads would be restricted to administrative use and harvesting operations.
  - The earthen berm on Stryker Basin Road would be removed and replaced with a gate. Following harvesting, slash reduction, and site preparation, the earthen berms and waterbars would be replaced.
  - Gates would be installed on the roads needed to access Harvest Area II-C to restrict public motorized use. Following project completion, these roads would be reclaimed by seeding grass, distributing slash, and constructing water bars.
  - All timber-harvesting activities, including log hauling, from Harvest Area IIA, would be limited to August 15 through February 1 (after eaglets have fledged).
  - ***Several piles of cull logs in Harvest Area II would be retained to provide potential lynx denning habitat in the future.***
  - ***At a minimum, 1 snag and 1 snag recruitment tree over 21 inches dbh per acre, on average, would be retained in all harvest units. If these snags and trees are not available, the next largest***

available size would be substituted.

MITIGATION MEASURES TO BE APPLIED TO ACTION ALTERNATIVE B ONLY

– Harvesting activities within Harvest Areas I and III would not occur within the same year. If Area III is not active and the closure is moved to Site A, open-road density levels can be met during the harvesting of Area I.

– The temporary bridge accessing most of Harvest Area III would remain in place during the site-preparation and regeneration efforts.

– The earthen berm on North Johnson Road would be removed and a gate installed. This would facilitate harvesting and regeneration activities in Harvest Areas III-I through III-M. ***Following regeneration activities, the berm would be replaced and the gate removed.***

– The removal and stabilization of the native culvert sites in Stryker Basin would result in a temporary net decrease in grizzly bear security core from the levels calculated in 1996. The acting Forest Management Bureau Chief has authorized this temporary decrease in security core through an Alternative Practice process (*ARM 36.11.432.1.d.i and ARM 36.11.449*). As a part of the mitigations in the Alternative Practice:

  * The culvert project would be completed in a short time frame (approximately 7 continuous days).

  * The existing rock and gate road closure would be reinstalled. This closure is located at approximately 2.25 miles on Stryker Basin Road.

  * No motorized use would be allowed except those needed for culvert removal.

– In order to meet SFLM Rules for open-road densities ***while logging in Harvest Area III***, 3 road-management options have been developed. Either the Antice or Stryker Ridge road would be required to have year-round restrictions in place during the year(s) of harvesting Harvest Area III <u>or</u> the decisionmaker could choose to implement an authorized Alternative Practice to allow a temporary increase exceeding the 1996 road-density baseline levels for this project (*ARM 36.11.432.1.c.ii* and *ARM 36.11.449*). For more information, refer to *the ROAD MANAGEMENT section of CHAPTER III.*

MITIGATION MEASURES TO BE APPLIED TO ACTION ALTERNATIVE C ONLY

Other than those mitigations common to both alternatives, no additional mitigations have been proposed for Action Alternative C.

ALTERNATIVES CONSIDERED AND DROPPED FROM FURTHER DEVELOPMENT

Foresters and DNRC's engineer attempted to locate several routes into Stryker Basin to avoid installing a new bridge at the present bridge location over the West Fork of Swift Creek. Based on feasibility, resource protection, and expense, the existing location of the bridge appears to be the best location. No other alternatives related to accessing Stryker Basin will be considered in this project.

Harvest Areas III-I, III-J, and portions of III-L have a high level of tall brush. Following harvesting operations, the brush has the potential to impede the establishment of natural regeneration and the growth of planted regeneration. The ID Team has investigated the use of herbicides to treat brush within these areas. The ID Team feels that acceptable results can be met by both broadcast burning the harvest areas and supplementing the burning with mechanical site preparation. The successful regeneration and establishment of a new timber stand is a silvicultural priority. If brush competition impedes regeneration, the Department may consider the use of herbicides following a separate environmental review.

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS			
RESOURCE	**EXISTING CONDITION**	**DIRECT AND INDIRECT EFFECTS**	**CUMULATIVE EFFECTS**
Vegetation			
Covertype representation on Stillwater Unit	Mixed-conifer covertypes are currently overrepresented and the western larch/ Douglas-fir, western white pine, and lodgepole pine covertypes are underrepresented. The desired future condition for Stillwater State Forest would have more of the western larch/Douglas-fir and western white pine covertypes.	***No-Action Alternative A***	
		No change.	Since 1999, the western larch/Douglas-fir covertype has increased by ***6*** percent.
		Action Alternative B	
		Approximately 138 acres of mixed-conifer covertype would be converted to the western larch/Douglas-fir covertype. The current covertypes would not change on the 1,131 acres proposed for harvesting, although representation of the western larch and western white pine covertypes would increase.	Since 1999, the western larch/Douglas-fir covertype has increased by 6 percent.
		Action Alternative C	
		Approximately 46 acres of the mixed-conifer covertype would be converted to the western larch/Douglas-fir covertype. The current covertypes would not change on the 892 acres proposed for harvesting, although representation of the western larch and western white pine covertypes would increase.	Since 1999, the western larch/Douglas-fir covertype has increased by 6 percent.
Age-class representation on Stillwater Unit	The 150-year age class is overrepresented and the 0-to-39-year age class is underrepresented.	***No-Action Alternative A***	
		Older age-class representation would continue to increase over time.	The trend for managing age-class distributions has been increasing the amount of acres in the 0-to-39-year age class and reducing the amount of acres in the older age classes.

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	**EXISTING CONDITION**	**DIRECT AND INDIRECT EFFECTS**	**CUMULATIVE EFFECTS**
Vegetation (continued)			
Age class representation on Stillwater Unit (continued)		***Action Alternative B***	
		1,045 acres would be regenerated and added to the 0-to-39-year age class; 695 acres of the 150-year-plus age class would be reclassified in a younger age class.	The trend for managing age-class distributions has been increasing the amount of acres in the 0-to-39-year age class and reducing the amount of acres in the older age classes.
		Action Alternative C	
		713 acres would be regenerated and added to the 0-to-39-year age class; 393 acres of the 150-year-plus age class would be reclassified in a younger age class.	The trend for managing age-class distributions has been increasing the amount of acres in the 0-to-39-year age class and reducing the amount of acres in the older age classes.
Old-growth representation on Stillwater Unit	8,693 acres, or 8.7 percent of the Stillwater State Forest, meet the DNRC old-growth definition	***No-Action Alternative A***	
		No change in old-growth acres.	Due to recent and planned timber harvests, old-growth levels would be reduced 152 acres to 8,541 acres.
		Action Alternative B	
		Old-growth on Stillwater Unit would be reduced by 286 acres.	Due to recent and planned timber harvests, as well as this alternative, old-growth levels would be reduced by 438 acres, leaving 8,254 acres on Stillwater Unit.
		Action Alternative C	
		No change in old-growth acres.	Due to recent and planned timber harvests, old-growth levels would be reduced 152 acres, to 8,541 acres.

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	**EXISTING CONDITION**	**DIRECT AND INDIRECT EFFECTS**	**CUMULATIVE EFFECTS**
Vegetation (continued)			
Old-growth attributes	Old-growth attribute levels all rate 'medium' within the project area.	***No-Action Alternative A***	
		Old-growth attribute levels would not be affected in the short-term. Attributes, such as decadence, down woody debris, and snags, should increase.	Other Stillwater Unit timber sales that have been harvested or will likely be harvested include 152 acres of old-growth stands that have a medium level of attributes.
		Action Alternative B	
		Old-growth attributes, such as decadence, down woody debris, and snags, should decrease on 286 acres. The abrupt stand edges that may be created could contribute to blowdown.	In addition to the 286 acres of old growth with medium-level attributes proposed for harvesting, 152 acres of old-growth stands with medium-level attributes are in other Stillwater Unit timber sales that have been, or will likely be, harvested.
		Action Alternative C	
		Attribute levels would not be affected in the short term. Attributes such as decadence, down woody debris, and snags should increase.	152 acres of old-growth stands with medium-level attributes are in other Stillwater Unit timber sales that have been, or will likely be, harvested.
Watershed and Hydrology			
Sediment contributions to streams	Currently, 25.5 tons of sediment are delivered annually into the West Fork from roads and stream crossings; 5.2 tons are delivered annually into Johnson Creek.	***No-Action Alternative A***	
		No direct effect beyond those under current management.	Conditions would be similar to existing conditions.
		Action Alternative B	
		Road improvements would reduce approximately 4.2 tons of sediment per year to the West Fork and 2.7 tons per year to Johnson Creek.	Tons of sediment delivery would drop to 21.3 tons per year in the West Fork and to 2.5 tons per year in Johnson Creek.

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	**EXISTING CONDITION**	**DIRECT AND INDIRECT EFFECTS**	**CUMULATIVE EFFECTS**
Watershed and Hydrology (continued)			
Sediment contributions to streams (continued)		***Action Alternative C***	
		Road improvements would reduce approximately 2.6 tons of sediment per year to the West Fork.	Tons of sediment delivery would drop to 22.9 tons per year in the West Fork; no measurable change in sediment delivery would occur to Johnson Creek.
Water yield	The water yield in the West Fork watershed is presently about 3.4 percent over the naturally occurring level; ***the Antice/ Johnson watershed*** is 3.5 percent; the Swift Creek watershed is 3.4 percent.	***No-Action Alternative A***	
		No change in water yield is expected in the short term.	
		Action Alternative B	
		An increase in water yield of 2.6 percent over the current level would occur in the West Fork watershed; an increase of 0.2 percent would occur in *the Antice/Johnson watershed;* an increase of 0.8 percent would occur in the Swift Creek watershed.	The total increase in water yield above naturally occurring levels would be 6.0 percent in the West Fork watershed, 3.9 percent in the ***Antice/Johnson watershed,*** and 4.2 percent in the Swift Creek watershed.
		Action Alternative C	
		An increase in water yield of 1.7 percent over the current level would occur in the West Fork watershed; an increase of 0.2 percent would occur in *the Antice/Johnson watershed;* an increase of 0.5 percent would occur in the Swift Creek watershed.	The total increase in water yield above naturally occurring levels would be 5.1 percent in the West Fork watershed, 3.7 percent in the ***Antice/Johnson watershed,*** and 3.9 percent in the Swift Creek watershed.
Soils			
Soil Productivity	Past harvesting has caused some compaction and displacement of soils.	***No-Action Alternative A***	
		Soil productivity would not be directly affected.	No additional cumulative impacts would occur.

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	**EXISTING CONDITION**	**DIRECT AND INDIRECT EFFECTS**	**CUMULATIVE EFFECTS**
Soils (continued)			
Soil Productivity (continued)		***Action Alternative B***	
		Approximately 158 acres would be moderately impacted from skid trails and yarding corridors.	Long-term soil productivity would be maintained and adverse effects would be minimized with the application of mitigations.
		Action Alternative C	
		Approximately 131 acres would be moderately impacted from skid trails and yarding corridors.	Long-term soil productivity would be maintained and adverse effects would be minimized with the application of mitigations.
Fisheries			
Populations: – presence – genetics	Bull trout and westslope cutthroat trout both reside in the West Fork and Stryker and Johnson creeks.	***All Alternatives***	
		No impacts are expected beyond those described in *EXISTING CONDITION*.	
Habitat: – flow regime – sediment – channel form – large woody debris – riparian zone – stream temperature – connectivity	Existing conditions likely have had a low to moderate impact on habitat.	***No-Action Alternative A***	
		No impacts are expected beyond those described in *EXISTING CONDITION*.	
		Action Alternatives B and C	
		Increased streamflow may have negligible, if any, impact to habitat. Likely a net positive impact would occur to the sediment component of the habitat for bull trout and westslope cutthroat trout.	Impacts range from negligible to net positive.

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	**EXISTING CONDITION**	**DIRECT AND INDIRECT EFFECTS**	**CUMULATIVE EFFECTS**
Wildlife			
Coarse filter: – covertypes and age classes – patch size and interior habitats – connectivity – dead wood	Covertypes favor species that use closed-canopy forests. In many unharvested areas, snags range from 0 to ***64*** per acre.	***No-Action Alternative A***	
		No additional displacement or disturbance would be expected.	A decrease in habitat diversity would favor those animals associated with late-successional forest stages.
		Common to Action Alternatives B and C	
		Disturbance and displacement is expected. Negligible effects would occur to habitat connectivity. Mitigation would provide for species associated with large dead wood. Habitat for species that use forested and interior forests would decrease while habitat for species that use edge and young regenerating stands would increase.	The trend toward achieving appropriate forest covertypes or desired future conditions would benefit species using forests in early successional stages.
		Action Alternative B	
		This alternative is expected to have the most displacement due to the amount of area being disturbed. 138 acres would be converted to a western larch/Douglas-fir covertype. Western larch and western white pine would be regenerated and favored for leaving on ***more than*** 1,130 acres.	
		Action Alternative C	
		46 acres would be converted to a western larch/Douglas-fir covertype. Western larch and western white pine would be regenerated and favored for leaving on ***more than*** 892 acres.	

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	**EXISTING CONDITION**	**DIRECT AND INDIRECT EFFECTS**	**CUMULATIVE EFFECTS**
Wildlife (continued)			
Bald Eagle	A bald eagle nest is in the project area.	***No-Action Alternative A***	
		No effects are anticipated.	No additional effects would be expected.
		Action Alternatives B and C	
		No harvesting activities would take place in the nest or primary-use areas. With mitigations, no effects would be expected.	Habitat alterations are expected to be neutral to slightly positive. The reproductive success rate would not be expected to change.
➢ *Canada Lynx*	Although denning habitat was not noted in the proposed harvest areas, foraging habitat was found.	***No-Action Alternative A***	
		Denning habitat would be expected to increase while foraging habitat would decrease.	
		Action Alternative B	
		Some disturbance would occur to Canada lynx travel corridors. Habitat would be modified on 1,270 acres, but as stands regenerate, forage and denning habitats are expected to increase.	***Following harvests, approximately 14.1 percent of lynx habitat on DNRC lands within the Upper Whitefish Grizzly Bear Subunit would be temporarily unsuitable These lands are expected to develop into young foraging habitat in 10 to 20 years. Denning habitat would remain unchanged, but some piles of cull logs would be retained to provide denning structure in the future.***
		Action Alternative C	
		Some disturbance would occur to Canada lynx travel corridors. Habitat would be modified on 938 acres, but as stands regenerate, forage and denning habitats are expected to increase.	***Following harvests, approximately 13.1 percent of lynx habitat on DNRC lands within the Upper Whitefish Grizzly Bear Subunit would be temporarily unsuitable These lands are expected to develop into young foraging habitat in 10 to 20 years. Denning habitat would remain unchanged, but some piles of cull logs would be retained to provide denning structure in the future.***

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	**EXISTING CONDITION**	**DIRECT AND INDIRECT EFFECTS**	**CUMULATIVE EFFECTS**
Wildlife (continued)			
➢ *Grizzly Bear*	Year-round habitat is provided. Hiding cover is abundant throughout the project area and in the Upper Whitefish Grizzly Bear Subunit. Precise open-road densities are 31.8 percent and the 1996 baseline was 32.9 percent. Security core is currently 51.6 percent and the 1996 baseline was 43.8 percent.	***No-Action Alternative A***	
		No additional effects would be expected.	No additional effects would be expected.
		Action Alternative B	
		Decreased grizzly bear use of adjacent habitat is expected ***to be the most*** due to the amount ***and locations*** of disturbances. Hiding cover would be reduced, but would be short term and have minor effects. Forage could increase.	Without additional road restrictions, precise open-road densities would be 36.0 percent. With gate restrictions at Site A and additional restrictions placed on Antice Knob or Stryker Ridge Road, the precise open-road density would not exceed the 1996 baseline (31.4 to 32.7 percent). If the Alternative Practice is implemented, the precise open-road densities could be greater than the 1996 baseline (34 percent). The combined effect of both timber harvesting and native culvert removal would reduce the amount of security core below the baseline (42.7 percent).
		Action Alternative C	
		Decreased grizzly bear use of adjacent habitat is expected due to the amount of disturbance. Hiding cover would be reduced, but would be short term and have minor effects. Forage could increase.	Without additional road restrictions, precise open-road densities would be 34.0 percent. With gate restrictions at Site A, the precise open-road density would not exceed the 1996 baseline (32.7 percent). The combined effect of both activities would reduce the amount of security core, but remain above the baseline (45.5

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	**EXISTING CONDITION**	**DIRECT AND INDIRECT EFFECTS**	**CUMULATIVE EFFECTS**
Wildlife (continued)			
➢ *Fisher*	Habitat includes areas with dense canopies.	***No-Action Alternative A***	
		No additional effects would be expected.	Minor negative effects would be expected due to recent salvage logging and firewood cutting.
		Action Alternative B	
		1,270 acres of habitat would be modified, but ***existing forest cover in*** travel corridors would be retained. Minor displacement effects would be expected.	Minor negative effects would be expected due to recent salvage logging and firewood cutting.
		Action Alternative C	
		775 acres of habitat would be modified, but ***existing forest cover in*** travel corridors would be retained. Minor displacement effects would be expected.	Minor negative effects would be expected due to recent salvage logging and firewood cutting.
➢ *Pileated Woodpecker*	Habitat is limited by the amount of the harvest area at high elevation.	***No-Action Alternative A***	
		No additional effects would be expected.	Pileated woodpecker habitat would increase and, over time, begin to decline.
		Action Alternatives B and C	
		775 acres ***of potential habitat*** would be modified, but negligible effects would be expected. Disturbance is expected if harvesting is done during nesting season.	Potential habitat quality and quantity would be reduced. A long-term minor benefit would occur from the regeneration of western larch.
➢ *Big Game*	Habitat is limited to the nonwinter period.	***No-Action Alternative A***	
		No additional effects or increased vulnerability would occur.	
		Action Alternatives B and C	
		Forage would increase, while hiding cover would decrease. The overall effects are negligible.	

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	**EXISTING CONDITION**	**DIRECT AND INDIRECT EFFECTS**	**CUMULATIVE EFFECTS**
Economics			
	Economic benefits	*No-Action Alternative A*	
		No additional income would be provided for the school trust funds. Additional jobs would not be provided.	***Volume would come from sales elsewhere; however the sales would not necessarily benefit this region. Long-term deferral would have a minor impact on harvest patterns and scheduling across this State.***
		Action Alternative B	
		An estimated $677,900 would be generated to the school trust funds. This alternative would provide an estimated 100 jobs for the duration of the timber sale.	***Net revenue would add to the State-wide trust fund.***
		Action Alternative C	
		An estimated $359,000 would be generated to the school trust funds. This alternative would provide an estimated 60 jobs for the duration of the timber sale.	***Net revenue would add to the State-wide trust fund.***
Road Management			
	Currently, more miles of road in the Upper Whitefish Grizzly Bear Subunit are restricted from public motorized use than in the 1996 baseline year.	*No-Action Alternative A*	
		Current access and road restrictions would not change.	Open-road density levels would be met.
		Action Alternative B	
		2.0 miles of Johnson Road would be restricted from public motorized access for 3 years. Similar restrictions for a 2-year period may be applied to either 4.7 miles of Stryker Ridge Road or 5.4 miles of Antice Knob Road. The decisionmaker may select either of these 2 additional restrictions, which may temporarily reduce opportunities for recreational use. <u>Or</u> the decisionmaker may select an option to temporarily exceed open-road density levels (Alternative Practice).	Open-road density levels would be met with closure of Stryker Ridge or Antice Knob roads. With the implementation of the Alternative Practice, the open-road density level may be temporarily exceeded. Implementation of 1 of the 3 options would also contribute to displacement and disturbance to various wildlife species.

TABLE II-2 - SUMMARY OF ENVIRONMENTAL EFFECTS (continued)			
RESOURCE	**EXISTING CONDITION**	**DIRECT AND INDIRECT EFFECTS**	**CUMULATIVE EFFECTS**
Road Management (continued)			
		Action Alternative C	
		2.0 miles of Johnson Road would be restricted from public motorized access for 1 year. This additional road restriction may temporarily reduce opportunities for recreational use and contribute to displacement and disturbance of various wildlife species.	Open-road density levels would continue to be met.

PROPOSED DECISION

This portion of the FEIS presents the proposed decision by Robert L. Sandman, Area Manager, NWLO, DNRC.

The scope of this proposed decision is limited to actions associated with the West Fork Timber Sale Project proposal. The proposed decision is site-specific and is neither programmatic nor a general management plan for Stillwater State Forest.

The ID Team has completed the DEIS and prepared the FEIS for the West Fork Timber Sale Project proposal. Mr. Sandman proposes the following decision after a thorough review of the DEIS, project file, public correspondence, corrections and additions made by DNRC that were reflected in this FEIS, Department policies, the SFLMP, and the SFLM Rules.

1. PROPOSED ALTERNATIVE SELECTION: Action Alternative B

Three alternatives were developed and are presented in the FEIS:

- *No-Action Alternative A*

  No timber would be harvested, though existing activities would likely continue. The bridge over the West Fork, which is currently restricted to 5 tons or less, would not be replaced at this time unless alternate funding became available.

- *Action Alternative B*

  Approximately 9.5 mmbf of timber would be harvested from an estimated 1,270 acres. A combination of regeneration harvests, group select/overstory removal, and commercial-thin harvests would be implemented. Approximately 31 miles of existing roads would receive various levels of maintenance, minor reconstruction, and the installation of surface drainage, ditch relief features, and new stream-crossing structures. Approximately 3.4 miles of temporary access roads would be needed. Opening older brushed-in roads would provide a portion of this access; the other portion would be newly constructed roads that would be built to temporary road standards. Following postharvest operations, these roads would be partially reclaimed to stabilize the roadbed and prevent erosion and use by motor vehicles. This proposal would also replace the bridge on Stryker Basin Road with a 75-foot steel bridge and the bridge on North Johnson Road with a 30-foot temporary steel bridge. Five old wooden and earthen stream-crossing structures would be removed and the streambanks would be stabilized at the crossing sites. This alternative would earn approximately $677,900 for the school trust fund. Approximately 286 acres of old-growth timber stands would be harvested.

- ***Action Alternative C***

  Approximately 5.7 mmbf of timber would be harvested from an estimated 938 acres. A combination of group-select/overstory-removal and commercial-thin harvests would be implemented. Approximately 24.5 miles of existing road would receive various levels of maintenance, minor reconstruction, and the installation of surface drainage, ditch relief features, and new stream-crossing structures. Approximately 2.1 miles of temporary access roads would be needed. Opening older brushed-in roads would provide a portion of this access; the other portion would be newly constructed roads built to temporary road standards. Following postharvest operations, these roads would be partially reclaimed to stabilize the roadbed and prevent erosion and use by motor vehicles. Four old wooden and earthen stream-crossing structures would be removed and the streambanks would be stabilized at the crossing sites. This alternative would earn approximately $359,000 for the school trust fund. No old-growth stands would be entered for harvesting.

(A detailed description of Alternatives A through C are presented in the *FEIS*, *pages II-* through *II*-9).

The proposed decision is to select Action Alternative B, which would be implemented using an Alternative Practice. This Alternative Practice has been approved by Tom Schultz, DNRC Division Administrator, and allows DNRC to temporarily exceed the SFLM Rules for open-road density levels (see *4. RATIONALE FOR THE PROPOSED DECISION*). No roads, except the upper portion of Johnson Road, would have additional restrictions. This restriction is within the timber sale project area and would last for the life of the timber sale, approximately 4 years.

2. RELATIONSHIP OF THE OBJECTIVES TO THE PROPOSED DECISION

- The estimated revenue for appropriate school trusts generated from Action Alternative B is $677,900. In addition, $631,750 would be generated for forest improvements (FI); improvements to the transportation infrastructure are estimated to be valued at $250,000. This additional FI revenue helps maintain and, in some cases, increase the value of the trust lands through improvements. In the future, these improvements would help maintain the ability to generate revenue from these lands.
- Action Alternative B would harvest approximately 9.5 mmbf of sawtimber to contribute to DNRC's sustained yield as mandated by *State Statute 77-5-222, MCA.* The estimated timber volumes produced by each alterantive are based on stand volumes obtained from

SLI and other available data used in the analysis. Actual advertised volumes may vary from these values due to increased statistical accuracy of measured data obtained during sale layout. While the estimated log volume may be different, the environmental effects are based on acres treated and expected changes to stand conditions; these effects would remain similar to those shown in the FEIS.

- Action Alternative B is designed to improve the long-term productivity of timber stands being entered. Concepts being implemented are designed to promote biodiversity and trend timber stands toward the desired future conditions. This alternative is designed to implement the SFLM Rules (*ARM 36.11.401* to *450)*.
- Action Alternative B would replace 2 bridges, including the bridge over the West Fork. Replacement of the West Fork bridge would allow access to Stryker Basin for timber management, fire protection, and recreation. In addition, site improvements would be completed that improve drainage, water quality, and safety on the existing road system.

3. RELATIONSHIP OF THE ISSUES AND PUBLIC COMMENT TO THE PROPOSED DECISION

a. *VEGETATION (FEIS, pages III-2* through *III-11* and *APPENDIX B - VEGETATION ANALYSIS)*

Approximately 138 acres of mixed-conifer covertypes would be converted to the western larch/Douglas-fir covertype. The representation of western larch, western white pine, and whitebark pine is likely to increase in the harvest units after the establishment of regeneration. The representation of the 0-to-39-year age class on Stillwater Unit would be increased by 1 percent (1,045 acres), and the representation of the 150+-year-old stands would be reduced by 0.7 percent (695 acres). Approximately 286 acres of old growth would be harvested with Action Alternative B. The planned harvest and silviculture is designed to regenerate the majority of the area within these old-growth stands. The postharvest treatment includes both mechanical site preparation and burning, with a follow-up of planting various species, including western white pine and western larch.

b. *WATERSHED AND HYDROLOGY (FEIS, pages III-12* through *III-15 and APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS)*

With the implementation of Action Alternative B, several projects would occur that are designed to replace or remove old wooden or earthen stream-crossing structures. Implementing BMPs and erosion-control measures would minimize direct sediment delivery to streams while work is being done. Over the long term, these projects would reduce the annual sediment delivery to the creek in Stryker Basin, the West Fork, Johnson Creek, and other downstream waters. Water yield would increase by 2.6 percent in the West Fork watershed and 0.4 percent in the Antice/Johnson watershed. The cumulative water yield postharvest has a low risk of creating adverse effects to channel stability from increases in streamflow.

c. FISHERIES (FEIS, pages III-18 through III-24 and APPENDIX E - FISHERIES ANALYSIS)

Action Alternative B would have no effects on fish presence or genetics. Minimal effect to the flow-regime component of bull trout and westslope cutthroat trout habitat is expected. In the long term, this alternative would provide positive impacts to trout habitat in the project area by reducing sediment delivery. Effects to channel form are not expected. Action Alternative B is designed with a 100-foot no-cut buffer between the harvest units and 3 fisheries streams; therefore, no impacts to large-woody-debris recruitment, riparian-zone function, and stream temperature are expected.

d. SOILS (FEIS, pages III-16 through III-17 and APPENDIX D - SOILS ANALYSIS)

Following harvesting and postharvesting activities under Action Alternative B, approximately 12 percent of the area in the harvest units would be in an impacted condition from equipment operations. Skidding mitigation measures would include restricting the season of use, utilizing minimum skid-trail spacing, installing needed erosion-control devices; retaining woody debris; and following all applicable BMPs. Mitigation measures would be applied to minimize long-term effects to soil productivity.

e. WILDLIFE (FEIS, pages III-? through III-? and APPENDIX F - WILDLIFE ANALYSIS)

With Action Alternative B, some disturbance and displacement to wildlife in the project area would occur; however, the features of the project design would reduce widespread disturbances. Wildlife species that use the more open-canopied forests with shade-intolerant tree species would benefit, while wildife species that are primarily associated with the late successional timber stands that are dominated by shade-tolerant tree species would be more negatively affected. Substantial effects to connectivity are not expected. Habitat for species that use forested and interior habitat would decrease, while species that use edge and regeneration or unforested habitats would be favored.

Mitigation measures such as the timing of activities to reduce disturbance to nesting eagles; retaining large snags, cull trees, and down woody material; retaining cover and riparian habitat; and maintaining and implementing motorized-use restrictions are expected to reduce adverse effects and maintain habitat for most wildlife species that use the project area.

The proposed decision would implement the Alternative Practice, which authorizes the Department to temporarily exceed the baseline open-road densities and temporarily reduce grizzly bear security core. Grizzly bears may temporarily avoid 732 acres of available habitat as a result of increased road disturbance. The 1996 baseline for open-road density would be exceeded by 358 acres. The temporary displacement of bears from high quality habitats could affect grizzly survival and reproduction to some degree. Following completion of this project, all roads would revert to current management restrictions.

f. ECONOMICS (FEIS, PAGES III-34 THROUGH III-35 and APPENDIX G - ECONOMICS ANALYSIS)

A conservative estimate of the trust revenue from implementing Action Alternative B is $677,900. The sale would also bring in an estimated $631,750 in FI collections. Additional economic benefits of implementing the project are the generation of the equivalent of 100 local jobs for 1 year, with wages and salaries totaling $3,734,700. It is estimated that the revenue generated from this project could support 96 students for 1 year.

g. IRRETRIEVABLE AND IRREVERSIBLE COMMITMENTS (FEIS, page III-40)

Harvesting timber will cause live trees to be irretrievably lost. Harvested trees will no longer contribute to snag recruitment, stand structure and composition, diversity, aesthetics, wildlife habitat, nutrient cycling, and other important ecosystem functions. However, the loss of trees is not irreversible. Natural regeneration combined with site preparation and planting will promote the establishment of new trees that will eventually become equivalent in size and ecosystem function to those harvested. Action Alternative B includes temporary road construction; these roads would be reclaimed after harvesting. Only minor irreversible commitments to soil productivity would occur.

4. RATIONALE FOR THE PROPOSED DECISION

a. The lands involved in this project are held by the State of Montana in trust for the support of specific beneficiary institutions. DNRC is required by law to administer these trust lands to produce the largest reasonable and legitimate return over the long run (*Enabling Act of February 22, 1889; 1972 Montana constitution, Article X, Section 11; and, 77-1-202 MCA*). The SFLMP provides the management philosophy and framework to evaluate which alternative would maximize real income while sustaining the production of long-term income.

b. The proposed timber sale project contributes 9.5 mmbf to the statewide sustained yield mandated by State statute (*MCA 77-5-222)*

c. In regard to harvesting 286 acres of old growth with Action Alternative B, the following elements were considered at the project level:

- The project complies with DNRC’s Forest Management Rules (*ARM 36.11.401* to *450*) by considering a variety of factors at the project level, including timber stand age-class amounts and distributions, forest covertype amounts and distributions, connectivity, patch size, stand characteristics, etc. The old-growth stands proposed for harvesting with Action Alternative B were included in this consideration. The rules do not set an old-growth retention minimum, instead they state that the decision to treat specific stands of old growth will be made at the project level. Pursuant to *77-5-116 MCA*, DNRC is prohibited from temporarily or permanently setting aside “old growth” unless the full market value is obtained for the trust beneficiaries from such a deferral. *ARM 36.11.418* indicates that the “amounts and distribution of all age classes will shift and change over time” and that “no stands would be permanently deferred from management…”. This recognizes and provides for the inherent variability that occurs on the landscape over time and the fiduciary responsibilities of DNRC. The proposed stand-treatment concepts are designed to promote biodiversity and trend timber stands toward the desired future conditions.

- The timber stands being entered were accessed with roads for the purpose of timber management more than 20 years ago.
- Several old-growth stands proposed for harvesting have been entered previously with timber harvests and are adjacent to regenerating harvest units.
- The old-growth stands proposed for harvesting are in the subalpine fir (83 acres) and mixed-conifer (203 acres) covertypes. In regard to desired future conditions, both of these covertypes are considered overrepresented on the coarse-filter analysis level. Approximately 59 percent of the old-growth stands are represented by the subalpine fir and mixed-conifer covertypes. An estimated 8,406 acres of timber stands would remain in the coarse-filter analysis area following implementation of Action Alternative B. In combination with other timber sales that propose to harvest old growth or that have harvested old growth as identified in SLI, approximately 8,241 acres would remain in the analysis area.
- In the higher elevations where old growth is proposed for harvesting, whitebark pine was once a substantial component of the overstory. Over time, white pine blister rust and mountain pine beetles have killed a large percentage of the whitebark pine in this area and throughout northwestern Montana. Harvesting this area with the proposed follow-up treatments would provide an opportunity to regenerate whitebark pine.

5. Because of the condition, value, and cost associated with harvesting the additional 3.8 mmbf of timber from 332 acres in Action Alternative B, the timing of the project, in reference to market conditions, is a consideration. Currently, the market for timber stumpage is relatively strong and is expected to continue this same trend through 2005 (*personnel communication with Charles Keegan, UM Bureau of Business and Economic Research*). Stumpage prices for State timber sales over the last 6-month period have been relatively high with multiple bidders. Given the relatively ambitious objectives of replacing bridges and repairing existing roads over a large area, the additional timber and value being made available improves the overall project marketability, profitability, and potential revenue.

6. The Proposed Decision includes an approved Alternative Practice to:

a. Remove earthen fill over numerous logs used to form culverts in the road prism at the head of Stryker Basin. DNRC's hydrologist and fisheries biologist are concerned that these native culverts will fail and contribute high amounts of sediment to the West Fork, which could affect bull trout and westslope cutthroat trout. The objective is to remove the threat of failure and prevent undesirable sediment production. Using a backhoe and small crew, the operation would take approximately 1 week to complete.

b. Utilize the Johnson Basin road system for activities associated with the West Fork Timber Sale Project without restricting public access on roads outside of the project area that are currently open to public use. The objective is to use an existing road system without restricting public access on other open-road systems outside the project area.

The Johnson Basin road system would be used approximately 2 years for harvesting operations. The existing Johnson Basin gate restriction would be moved down to the base of the hill. This proposed road restriction would mitigate impacts to open-road density caused by the timber sale activities while using Whitefish Saddle Road. Motorized access to the general public would continue to be restricted on both of these roads. These road restrictions are within the immediate project area and would provide an additional level of mitigation.

Antice Knob Road would remain restricted during the spring season.

West Fork Road and Upper Whitefish Road are the only other open roads in the immediate project area; both are open to the public. Neither could be restricted during the sale because both are needed as part of the primary haul route. The level of hauling required for the sale exceeds the level of use associated with the restricted road status; even if the roads were gated, the level of use would exceed the restricted status allowance.

Contractors using the restricted roads for sale-related activities would be prohibited from carrying firearms.

In order to concentrate the timing of sale-related activities in a way that limits the magnitude of potential displacement, harvesting activities would not be authorized simultaneously on the Whitefish Saddle and Johnson Basin roads.

Spring activities would be extremely limited.

The culvert removal project would be limited to a period during the summer season when grizzly bears have the most available habitat (August 15 through September 15).

No other mitigation measures have been identified as being practicable within the sale area.

SUMMARY OF THE PROPOSED DECISION

Overall, Action Alternative B best complies with the Agency's legal requirement to manage these lands to produce the largest measure of reasonable and legitimate return over the long run for the beneficiary institutions. Action Alternative B strikes the best balance of revenue and development of the alternatives analyzed. The proposed project harvests timber in a manner that moves Stillwater State Forest toward desired future conditions while balancing the recovery of value and limiting high-risk effects to other valuable resources.

CHAPTER III
EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

This chapter contains information related to the Stillwater State Forest environment and the West Fork Timber Sale Project area. The information portrayed is related to the resource issues identified in *CHAPTER I - PURPOSE AND NEED*. Existing or current conditions discussed in this chapter include effects from current and past management and other known disturbances.

The *ALTERNATIVE EFFECTS* section will discuss the direct, indirect, and cumulative effects that No-Action Alternative A, Action Alternatives B and C would likely have on resources. Refer to the appropriate appendices of this EIS for more complete assessments and analyses related to the resources for both scientific and judicial reviews.

DNRC's Stillwater State Forest office at Olney

INTRODUCTION

This summary of *APPENDIX B – VEGETATION ANALYSIS* will provide a description of the present conditions of the forest. Also discussed are the effects the proposed alternatives would potentially have on the following issues:

- The distributions of covertypes and age classes at a landscape level (Stillwater State Forest and scattered sections north in Lincoln County).
- The distribution of old-growth timber at a landscape level and the characteristics (attributes) of the old-growth stands within the project area.
- The development of timber stands in the project area in relation to natural disturbances and timber management.

ANALYSIS METHODS

The current stand conditions will be compared to the stand conditions that DNRC believes to be the desired future conditions and appropriate for the site. A forest inventory from the 1930s was used to estimate the proportion of the various stages of stand structure by age classes and covertypes that were historically represented throughout the Inland Northwest (*Losensky 1993)*. From this, estimations have been made of the natural characteristics of forests in the period prior to fire suppression and extensive logging.

The procedure used to assign covertypes on State forested lands, including Stillwater State Forest, is explained in detail in the SFLM Rules (*ARM 36.11.405*).

The methods to identify old-growth timber stands are initiated from modeling based on the STW 2003 Stand Level Inventory (SLI) data. The model primarily sorts for stands that meet the age criteria and number of trees greater than a particular dbh, based on habitat-type groups. Field surveys were used to verify additional stands in the project area that meet the definition.

The analysis method for stand development is a discussion of the conditions of timber stands and how natural and man-caused disturbances may continue to affect the development of timber stands.

ANALYSIS AREA

The vegetation analysis includes 3 geographic scales:

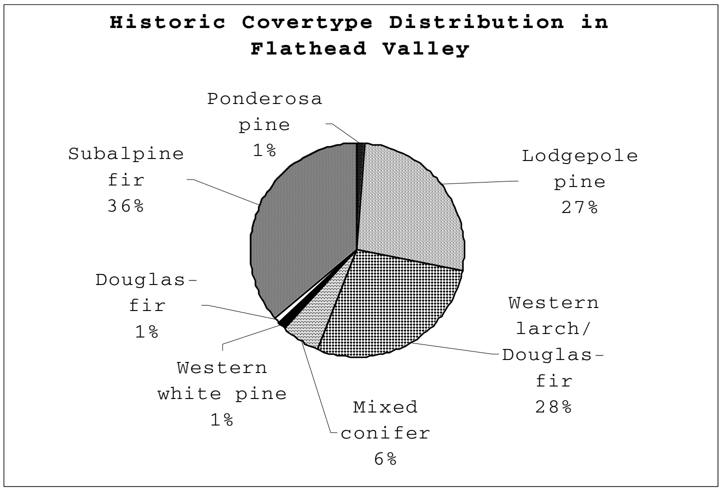
- Upper Flathead Valley - Historic conditions refer to those from Climatic Section 333C of the Upper Flathead Valley (*Losensky 1997*).
- Stillwater State Forest management block - Current and appropriate conditions for covertype, age, and old-growth distribution were analyzed. This analysis area is approximately 100,208 forested acres that includes the entire Stillwater State Forest and scattered outlying sections in northeastern Lincoln County.
- Project level - Stand attributes related to old growth, species composition, and structure will be analyzed by harvest area.

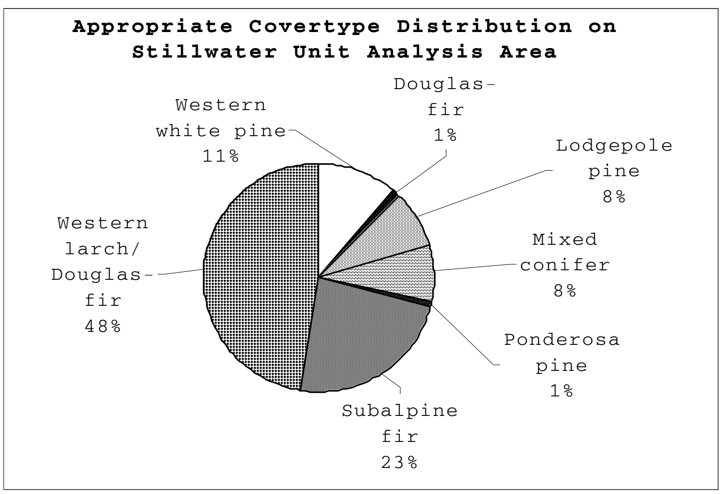
COVERTYPE

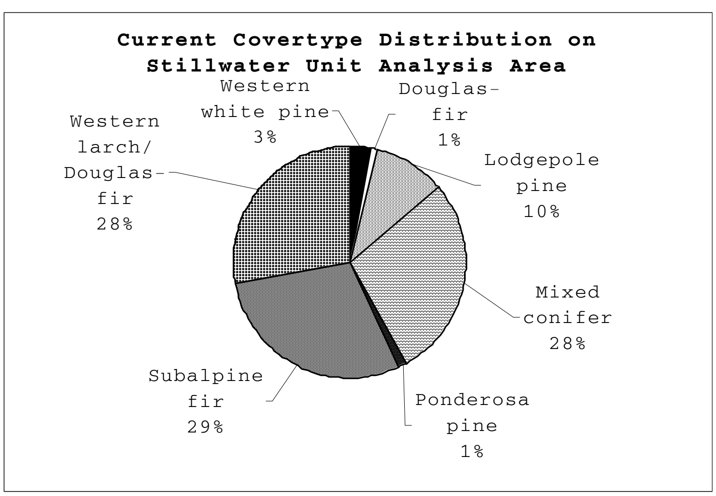
FIGURES III-1 through *III-3 - PERCENTAGE OF FORESTED ACRES BY COVERTYPE* illustrates the percentage of forested ground that is/was occupied by a particular covertype. These figures compare the historic covertype data of the Upper Flathead Valley to the current and appropriate covertype conditions in the analysis area. The chart displaying Historic conditions is from *Lozensky's* data and covers forested types at a much larger scale than do the Current and Appropriate conditions.

Historic data indicates that mixed-conifer stands are currently overrepresented and the western larch/Douglas-fir, western white pine, and lodgepole pine covertypes are underrepresented on the forest.

FIGURES III-1 THROUGH III-3 – PERCENTAGE OF FORESTED ACRES BY COVERTYPE ON STILLWATER UNIT







AGE-CLASS DISTRIBUTION

Comparing the entire Stillwater State Forest with the historical data from the Upper Flathead Valley, *TABLE III-1– DISTRIBUTION OF AGE CLASSES ON STILLWATER UNIT* shows that Stillwater State Forest is low in the seedling-sapling stands (0 to 39 years old) and high in stands 40 years and older.

TABLE III-1– DISTRIBUTION OF AGE CLASSES ON STILLWATER UNIT

AGE CLASS	HISTORIC PERCENT	CURRENT PERCENT
0 to 39 years	36	10
40 to 99 years	12	23
100 to 150 years	22	19
150+ years	29	48

OLD-GROWTH DISTRIBUTION AND ATTRIBUTES

Approximately 8,693 acres, (8.7 percent) of the coarse-filter analysis area can be classified as old-growth. On the opposite page, *FIGURE III-4 – OLD-GROWTH ON MAIN BLOCK OF STILLWATER STATE FOREST* displays the locations and distributions of old-growth stands on the main block of Stillwater State Forest.

TABLE III-2 – OLD-GROWTH ACRES BY COVERTYPE displays old growth by forest covertype. Covertype is related to habitat type, habitat-type groups, and successional stages. Covertype is used when presenting old growth because the amount can be correlated to *Lozensky's* historic information.

TABLE III-2 – OLD-GROWTH ACRES BY COVERTYPE

CURRENT COVERTYPE	GROSS ACRES BY SLI	OLD GROWTH FIELD-VERIFIED IN WEST FORK PROJECT	TOTALS
Douglas-fir	44		44
Lodgepole pine	398		398
Mixed conifer	1,802	182	1,984
Subalpine fir	3,139	215	3,354
Western larch/ Douglas-fir	2,432		2,432
Western white pine	481		481
Totals	8,296	397	8,693

OLD-GROWTH ATTRIBUTES

DNRC is in the process of developing a tool to assign levels of old-growth attributes to stands by sorting SLI data. The attributes considered are:

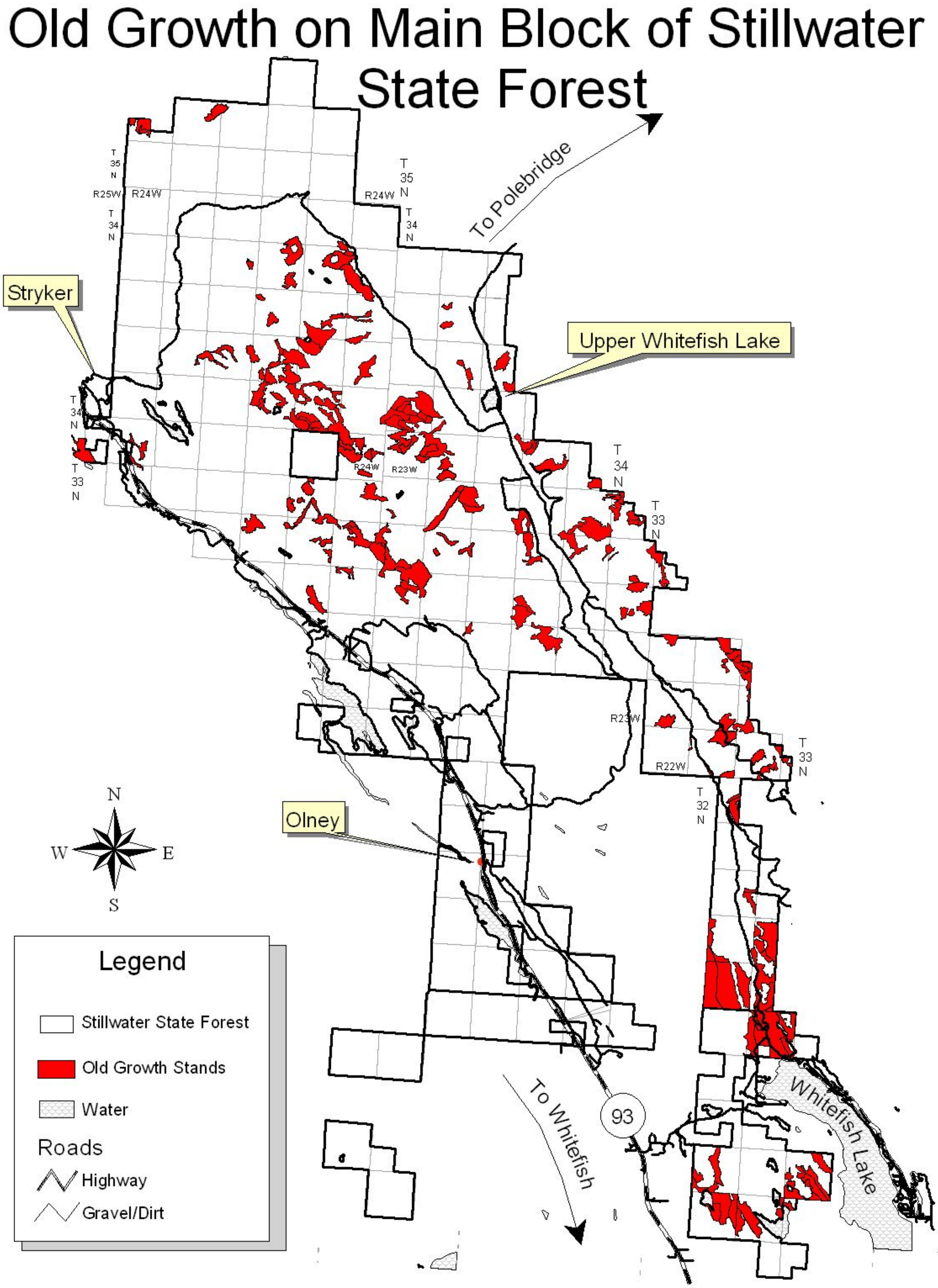
- number of large live trees,
- amount of coarse woody debris,
- number of snags,
- decadence,
- structure,
- gross volume, and
- crown density.

This data sort assigns a value or an index rating to those attributes in an old-growth stand that indicates its total score. These scores can be grouped into low, medium, and high categories to provide an indication of the stand condition in reference to attributes that are often associated with old-growth timber stands. Within the project area, the attribute index ratings are primarily medium.

Some old-growth characteristics in the project area:

C Engelmann spruce and subalpine fir are the dominant tree species in all of the old-growth stands, which total 777 acres.

FIGURE III-4


Old Growth on Main Block of Stillwater State Forest
To Polebridge
Stryker
Upper Whitefish Lake
Olney
To Whitefish
93
Whitefish Lake
T 35 N
R25W
R24W
T 34 N
R23W
T 33 N
R22W
T 32 N
N
W
E
S
Legend
Stillwater State Forest
Old Growth Stands
Water
Roads
Highway
Gravel/Dirt

- Whitebark pine is a component of the overstory and snag attributes in 7 stands, approximately 313 acres.
- Vigor is average to poor in all stands.
- Snag numbers are generally high (greater than 3 per acre).

STAND DEVELOPMENT

The natural processes of stand development and disturbance are influenced by environmental conditions and site characteristics, such as soil, stand covertype, forest health, elevation, and stand structure. The stand structures and species component can be greatly modified by natural disturbances, such as wildfire and wind events, as well as past management activities.

STAND COVERTYPE

Ninety-five percent of the project area is categorized in the “cool and moist” habitat group, and 99 percent of the project area is currently represented by the subalpine fir and mixed-conifer covertypes.

TIMBER-STAND HEALTH

Damage and mortality from insects and diseases are relatively minor in the project area. The incidence of western balsam bark beetles and mountain pine beetles have risen since the area was first scouted for this project. Minor levels of spruce beetles, Douglas-fir beetles, and fir engravers, as well as white pine blister rust in the western white pine and whitebark pine, also exist. Indian paint fungus is common in the subalpine fir throughout this area. Additionally, trees have been damaged by wind, snow, ice, and previous logging. This damage has allowed rot to develop in the boles of the trees, resulting in loss of value.

ELEVATION/ASPECT

Elevations in the project area range from 4,300 to 6,500 feet above sea level. The elevation of a stand is important in determining the tree and shrub species present and how fast or slow changes in the stand take place.

A large portion of the project area has a northeast aspect. This exposure, together with the high elevations, account for the high moisture availability and the long duration of snow on the ground. These 2 factors, elevation and aspect, are also the main reasons for the presence of whitebark pine.

STAND STRUCTURE

Approximately 93 percent of the project area is multistoried.

PAST MANAGEMENT ACTIVITIES

Stillwater State Forest has been harvesting timber in the project area since the late 1940s. Many of the stands in Harvest Area II were selectively logged in the late 1940s and early 1950s when Douglas-fir, Engelmann spruce, and western larch were harvested. According to inventory records, western larch, Douglas-fir, and western white pine were present in many of the stands in Harvest Area II in the past, as they are today, but Engelmann spruce and subalpine fir have always been the predominate species. In Harvest Area III, western larch, lodgepole pine, and whitebark pine are a minor component in the stand’s canopy composition.

In the early 1980s, infestations of spruce bark beetles occurred and those dead and dying trees were salvage harvested.

In some areas of past logging, desired tree species were able to regenerate with the help of ground scarification. Many areas that did not receive scarification and planting were taken over by shrub species. Regeneration has been slow and primarily limited to Engelmann spruce and subalpine fir.

FIRE REGIMES

The project area is primarily represented by Fire Group 9 Fire Regime (87 percent of gross acreage), as described by *Fisher/Bradley*. Fire Group 9 represents moist, lower subalpine habitat types where fires are infrequent, but severe, and the effects are long lasting. Stand-replacing fires have been estimated to occur at moderately long to long intervals, 150 to 300 years. The project area also has minor representation in Fire Groups 10 (8 percent), 8 (5 percent), and 7 (less than 1 percent).

The size of the fires in Fire Group 9 will vary from small (in the less severe fire conditions) to large and catastrophic (in the more severe fire conditions that have been experienced in the past few years). In the more severe fire conditions, thousands of acres burn in stand-replacement fires.

The incidence of bark beetle attacks is on the rise in the project area.

The next most common fire regime in the project area is Fire Group 10, which is characterized by the high-elevation forests near and at timberline. Some stands in Harvest Area III are in this regime. Stand-replacing fires, even in the more continuous forests, range in frequency to more than 300 years.

ALTERNATIVE EFFECTS

COVERTYPES AND AGE CLASSES

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Covertypes and Age Classes***

  Covertypes on Stillwater State Forest would not be affected. Older age classes would continue to increase.

- ***Direct and Indirect Effects of Action Alternative B to Covertypes and Age Classes***

  Approximately 138 acres of the mixed-conifer covertype would likely be converted to a western larch/Douglas-fir covertype by planting western larch in some areas and harvesting subalpine fir and Engelmann spruce in other areas. An additional 1,130 acres would be harvested, though the new stands created would still be classified mixed conifer (779 acres) and subalpine fir (351 acres). The representation of western larch and western white pine trees would likely increase in these covertypes due to site preparation and planting.

  Following site preparation and planting in Harvest Areas II and III, the representation of the 0-to-39-year age class on Stillwater Unit would increase by 1 percent (1,045 acres), and the representation of 150+-year-old stands would be reduced by 0.7 percent (695 acres).

- ***Direct and Indirect Effects of Action Alternative C to Covertypes and Age Classes***

  Approximately 46 acres of the mixed-conifer covertype would likely be converted to a western larch/Douglas-fir covertype by planting western larch and harvesting subalpine fir and Engelmann spruce. An additional 892 acres would be harvested, though the new stands created would still be classified mixed conifer (753 acres) and subalpine fir (139 acres). The representation of western larch and western white pine would likely increase in these covertypes due to site preparation and planting.

Following site preparation for Harvest Area II, the representation of the 0-to-39-year age class on Stillwater Unit would increase by 0.7 percent (713 acres) and the representation of 150+-year-old stands would be reduced by 0.4 percent (393 acres).

Cumulative Effects

C ***Cumulative Effects of All Alternatives to Covertypes and Age Classes***

The cumulative effects of timber-stand management on Stillwater State Forest is a trend toward increasing covertypes with western larch, lodgepole pine, and western white pine in areas where recent forest-management activities have taken place. Since the Chicken/Werner Timber Sale Project EIS in 1999, the western larch/Douglas-fir covertype has increased by 6 percent.

In addition to the changes in covertype distributions from these proposed alternatives, other timber sale projects have been started, but not completed. Thus, their effects are not represented in the Stillwater 2003 SLI. These current projects are expected to increase the amount of area in the 0-to-39-year age class by slightly decreasing the area in the older-stand age classes.

OLD-GROWTH DISTRIBUTION AND ATTRIBUTES

Direct Effects

- ***Direct Effects of No-Action Alternative A and Action Alternative C to Old-Growth Distribution and Attributes***

The distribution or attributes of old-growth stands would not be affected in the short term.

- ***Direct Effects of Action Alternative B to Old-Growth Distribution and Attributes***

Old-growth levels on Stillwater Unit would be decreased by approximately 286 acres; an estimated 8,406 acres of potential old growth would remain. This harvest would remove 203 acres from the mixed-conifer covertype and 83 acres from the subalpine fir covertype.

The locations where harvesting would affect the distribution of old-growth stands is shown on *FIGURE III-5 – WEST FORK OLD-GROWTH MAP*. Most of the attributes associated with the old-growth stands that would be harvested would be removed.

Indirect Effects

- ***Indirect Effects Common of All Alternatives to Old-Growth Distribution and Attributes***

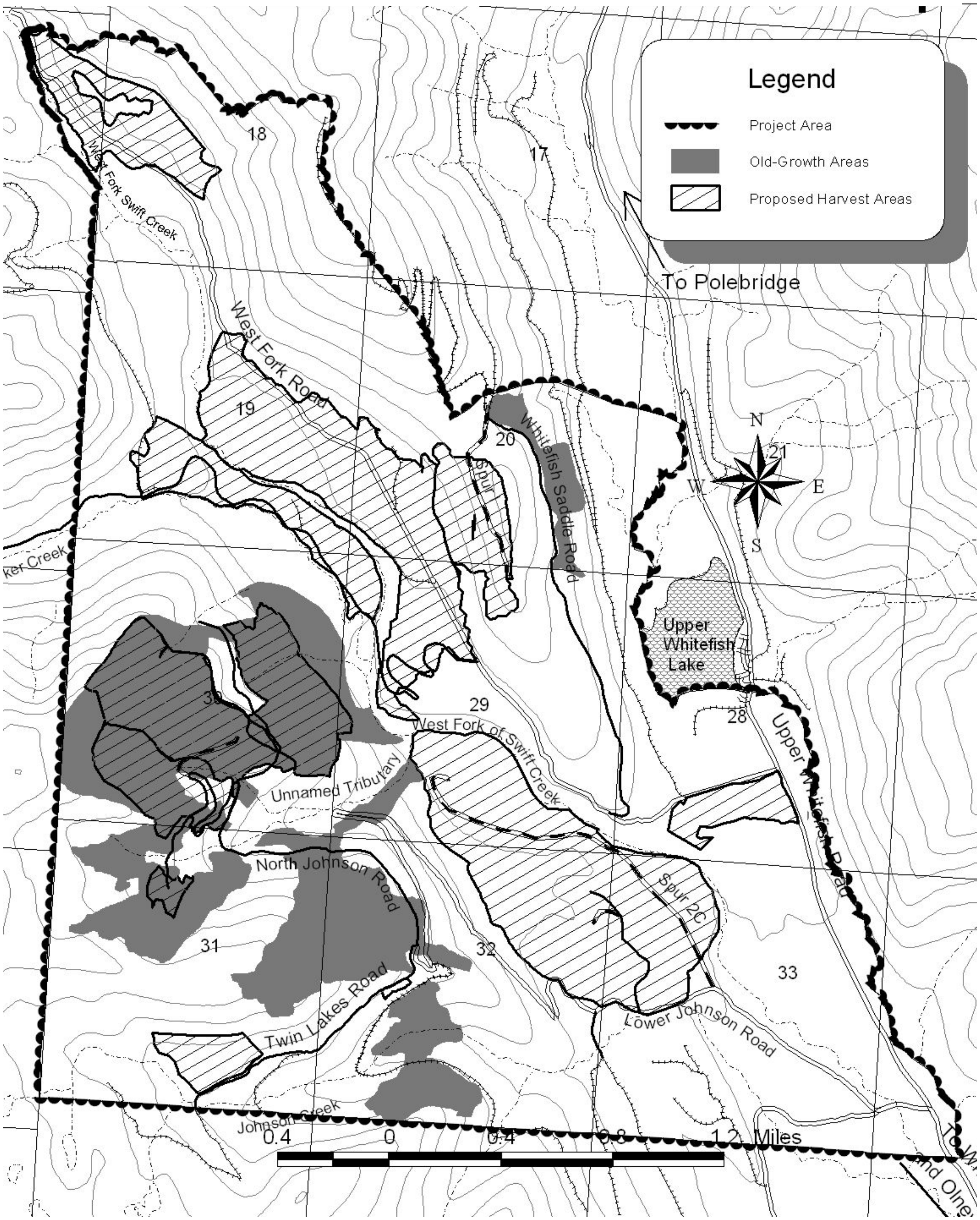
Many stands currently meeting DNRC's old-growth definition would become more decadent. Stocking levels and down woody debris would increase in some stands and covertypes, increasing wildfire hazards. Species that are shade tolerant would remain dominant in stands. Various factors, such as insect infestations, disease infections, and decreasing vigor, would eventually cause more snags in portions of the stands. White pine blister rust, mountain pine beetles, and weather-related damage would increase the amount of snags in old-growth stands.

- ***Indirect Effects of Action Alternative B to Old-Growth Distribution and Attributes***

Portions of old-growth stands would be harvested and create more abrupt stand edges structurally. The risk of blowdown along the proposed unit boundaries would increase. Harvest areas next to remaining old-growth stands could possibly act as fuel breaks that would

Figure III-5

WEST FORK OLD-GROWTH MAP



slow or stop wildfires before they reach the old-growth stands.

Cumulative Effects

- ***Cumulative Effects Common of All Alternatives to Old-Growth Distribution and Attributes***

  Approximately 48 acres of field-verified old growth are planned for harvesting in the Taylor South Timber Sale Project area. Approximately 104 acres of old growth, field verified or SLI identified, have been harvested with the Chicken/Werner Timber Sale. ***No additional old growth is proposed for harvesting in the Ewing Middle Ridge or Point of Rocks timber sales.*** In total, an estimated 59 acres of old growth would be removed from the mixed-conifer covertype, an estimated 81 acres from the western white pine covertype, and an estimated 12 acres from the Douglas-fir covertype.

  SLI originally classified these 152 acres as having medium attribute levels. These stands would no longer meet DNRC's old-growth definition following harvesting, and, at the most, would be rated as having low attributes levels.

- ***Cumulative Effects Common of No-Action Alternative A and Action Alternative C to Old-Growth Distribution and Attributes***

  Old-growth on Stillwater Unit would be reduced to an estimated 8,541 acres; approximately 8.6 percent. The percentage of old-growth acres by covertype would change very little.

- ***Cumulative Effects of Action Alternative B to Old-Growth Distribution and Attributes***

  Old-growth on Stillwater Unit would be reduced to an estimated 8,254 acres, approximately 8.3 percent. The representation of both the mixed-conifer and western white pine covertypes would be reduced by approximately 1 percent; the representation of the western larch/Douglas-fir covertype would increase by approximately 1 percent.

STAND DEVELOPMENT

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Stand Development***

  Stand development within the project area would not be directly affected. As stands age over time, natural forest succession and fire suppression would reduce the variability of covertypes both on the forest landscape and in the project area.

- ***Direct and Indirect Effects of Action Alternative B to Stand Development***

  Stand development would be directly affected by:

  - taking on the role of a stand-replacing fire in Harvest Area III by:
    - removing overstory trees, including those affected by insects and diseases;
    - reducing fuels; and
    - following subsequent site preparation to enhance western larch, Douglas-fir, western white pine, and whitebark pine regeneration.
  - taking on the role of a moderately-severe fire in Area II; this would create a vegetative mosaic by:
    - creating a vegetative mosaic by removing some overstory trees, including those affected by insects and diseases;
    - reducing fuels, and
    - following subsequent site preparation to enhance the regeneration of western larch, Douglas-fir, and western white pine.

  The resultant effect on stand development across the project area is that the forest would contain a mosaic of structures that include single-storied, two-storied, and multistoried conditions. Through harvesting, the structure changes would emulate the type of fire regime associated with the covertype. Fire regime simulations would range from stand-replacing to mixed-severity, depending on the type of site preparation and the extent that site preparation can actually be employed.

- ***Direct and Indirect Effects of Action Alternative C to Stand Development***

  Stand development would be directly affected by taking on the role of a moderately severe fire in Harvest Area II. This would create a vegetative mosaic by:

  - removing some overstory trees, including those affected by insects and diseases,
  - reducing fuels, and
  - following subsequent site preparation to enhance the western larch, Douglas-fir, and western white pine regeneration.

  The resultant effect on stand development across the project area is that the forest would contain a mosaic of structures that include single-storied, two-storied, and multistoried conditions. Through harvesting, the structure changes would emulate the type of fire regime associated with the covertype. Fire regime simulations would range from stand-replacing to mixed-severity, depending on the type of site preparation and the extent that site preparation can actually be employed.

Cumulative Effects

- ***Cumulative Effects of All Alternatives to Stand Development***

  Forest succession and stand development would continue as determined by site conditions, weather, timber management, and those factors discussed under *EXISTING CONDITIONS*.

WATERSHED AND HYDROLOGY ANALYSIS

INTRODUCTION

ANALYSIS AREA

The hydrologic environment affected by the proposed West Fork Timber Sale Project proposal includes the West Fork watershed and all of its tributaries.

ANALYSIS METHODS

Analysis methods used to evaluate the existing conditions and to assess the potential impacts to hydrology include an inventory of sediment sources, assessments of channel stability, and computer modeling of the annual water yield.

EXISTING CONDITIONS

- ***MONTANA SURFACE WATER QUALITY STANDARDS***

  According to *ARM 17.30.608 (1)(c)*, the Whitefish Lake drainage, including Swift Creek, is classified as A-1. For a description of criteria associated with A-1 waterbodies, refer to *APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS*. Designated beneficial water uses within the project area include cold-water fisheries and recreational use in the stream, wetlands, lake, and surrounding area.

- ***WATER-QUALITY-LIMITED WATERBODIES***

  Swift Creek and the West Fork are currently listed as water-quality-limited waterbodies in the 1996 and 2004 303(d) list. For a more detailed description of management implications in water-quality-limited waterbodies, refer to *APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS*. The current listed causes of impairment in Swift Creek are bank erosion, other habitat alterations, and nutrients. The probable source for Swift Creek is listed as silviculture. Current listed causes of impairment in the West Fork are flow alteration, other habitat alteration, and siltation. The probable sources for the West Fork are listed as *silviculture and highway maintenance and runoff*. A Total Maximum Daily Load (TMDL) assessment is scheduled to be completed in 2011 for the Swift Creek drainage.

- ***MONTANA STREAMSIDE MANAGEMENT ZONE (SMZ) LAW***

  By the definition in *ARM 36.11.312 (3)*, the majority of the West Fork and Johnson watersheds are class 1 streams. Some of the smaller first-order tributaries may be classified as class 2 or 3, based on conditions at specific sites. For a description of criteria for classification of streams, refer to *APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS*.

Surveys of channel stability show that stream channel conditions in the West Fork watershed are primarily good to fair; 6 reaches were rated in poor condition. An adequate supply of large woody debris was found. Little evidence of past streamside harvests was noted. Where past logging had taken place in the riparian area, a shortage of existing or potential down woody material in the streams was not evident.

The proposed project area was reviewed to see whether roads and stream crossings are sources of sediment. The road system in the West Fork watershed is contributing approximately 25.5 tons of sediment per year to streams. Roads in the Johnson Creek watershed are contributing about 5.2 tons of sediment per year to streams. Much of the existing road system in the proposed project area meet applicable BMPs. Surface drainage on the road systems in Stryker Basin, Herrig Basin, and on the main roads in the West Fork watershed have been installed with past projects.

At least 4 wooden crossing structures surfaced with road-fill material exist on perennial tributaries to the West Fork. Each is collapsing into the creek and is an existing sediment source to the West Fork.

An analysis of water yield in the West Fork watershed showed that past activities have produced a 3.4 percent water-yield increase over a fully forested condition. ***Past activities in the Antice/Johnson watershed have produced a 3.5 percent water-yield increase over a fully forested condition, and the current water-yield increase in the Swift Creek watershed is 3.4 percent over a fully forested condition as a result of past activity. These levels are*** much less than the 10 percent threshold of concern recommended for water-yield increases in the watershed.

This native bridge has collapsed into the creek, contributing sediment to the stream.

This dirt-covered old wooden bridge has been overgrown with vegetation and would eventually collapse and contribute sediment to the stream.

ALTERNATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS

- ***Direct and Indirect Effects of No-Action Alternative A***

  No direct effects to sediment delivery or water yield would occur beyond those under current management.

- ***Direct and Indirect Effects Common to Action Alternatives B and C***

  The wooden bridge spanning the West Fork on Stryker Basin Road would be replaced under either proposed action alternative. Also, 3 log crossings with earthen fill would be removed and the streambanks rehabilitated in the upper reaches of Stryker Basin. The proposed work on these sites would contribute sediment to the West Fork only while crews are operating. Sediment contribution would be minimized through BMPs and erosion-control measures. These projects would reduce the annual sediment delivery by approximately 2.33 tons of sediment per year and remove about 750 tons of bridge fill that would eventually fall into the creek if the sites are not repaired.

- ***Direct and Indirect Effects of Action Alternative B***

  Erosion control and BMPs would be improved in the West Fork and Johnson Creek watersheds along approximately 31 miles of existing road. This work would lower the annual sediment load to the West Fork by approximately 4.2 tons, and to Johnson Creek by approximately 2.7 tons.

  Ground-based yarding would increase the risk of sediment delivery by exposing soil in skid trails. Building approximately 3.4 miles of new and temporary road would also expose bare soil.

Water yield would increase by approximately 2.6 percent over the current level in the West Fork watershed, approximately 0.4 percent in the Antice/Johnson watershed, and approximately 0.8 percent in the Swift Creek watershed.

- ***Direct and Indirect Effects of Action Alternative C***

Erosion control and BMPs would be improved in the West Fork watershed along approximately 25 miles of existing road. This work would lower the annual sediment load to the West Fork by approximately 2.6 tons.

Ground-based yarding would increase the risk of sediment delivery by exposing soil in skid trails. Building approximately 2 miles of new and temporary road would also expose bare soil.

Though erosion-control measures would be taken, increases in sediment to the streams would occur temporarily during the installation of culverts or bridges. Once installed, the annual sediment delivery would be less than the current amount.

Annual water yield would increase by approximately 1.7 percent over the current level in the West Fork watershed, approximately 0.2 percent in the Antice/Johnson watershed, and approximately 0.5 percent in the Swift Creek watershed.

CUMULATIVE EFFECTS

- ***Cumulative Effects of No-Action Alternative A***

The cumulative effects would be similar to those described in the existing conditions for water yield and sediment delivery.

- ***Cumulative Effects of Action Alternative B***

Cumulatively, the total sediment load to the West Fork would increase over existing conditions. Road construction, culvert replacements, and bare soil from harvest areas would produce a higher risk of sediment delivery for a year or two. In the long term, sediment delivery would drop from approximately 25.5 tons per year to approximately 21.3 tons per year in the West Fork. Due to road repairs, the annual sediment delivery to Johnson Creek would drop from approximately 5.2 tons per year to approximately 2.5 tons.

Ground-based yarding would increase the risk of sediment delivery by exposing soil in skid trails. Harvesting activities would not occur within 100 feet of the West Fork or Stryker and Johnson creeks.

Water yield would rise from the current level of about 3.4 percent over fully forested conditions to about 6.0 percent in the West Fork watershed, from 3.5 percent to 3.9 percent in the Antice/Johnson watershed, and from about 3.4 percent to about 4.2 percent in the Swift Creek watershed. This water yield increase has a low risk of creating adverse cumulative effects to channel stability from increases in streamflow.

C *Cumulative Effects of Action Alternative C*

Cumulatively, the total sediment load to the West Fork would increase over existing conditions. Road construction, culvert replacements, and bare soil from harvest areas would produce a higher risk of sediment delivery for a year or two. In the long term, due to road repairs, sediment delivery to the West Fork would decrease from approximately 25.5 tons of sediment delivery per year to approximately 22.9 tons.

Water yield would rise from its current level of approximately 3.4 percent over fully forested conditions to approximately 5.1 percent in the West Fork watershed, from 3.5 percent to 3.7 percent in the Antice/Johnson watershed, and from approximately 3.4 percent to about 3.9 percent in the Swift Creek watershed. This water yield increase has a low risk of creating adverse cumulative effects to channel stability from increases in streamflow.

SOILS ANALYSIS

INTRODUCTION

The processes of glaciers and rivers have formed the valley of the Swift Creek watershed. Deep glacial tills are the dominant soil types found in the project area. The ridges and upper slopes are weathered bedrock scoured by glaciers.

ANALYSIS METHODS

The productivity of the soil will be analyzed by evaluating the current levels of disturbance to the soils in the project area. The risk factors of soil stability will be included in the analysis criteria.

ANALYSIS AREA

The project area is the analysis area for evaluating soil productivity. This analysis area is within both the West Fork and Antice/Johnson watersheds.

EXISTING CONDITIONS

DNRC has conducted timber harvesting in the West Fork watershed since the 1940s. Since the 1960s, 3,291 acres of State land have been harvested with a combination of ground-based and cable yarding equipment. Ground-based yarding equipment may displace and compact the surface layers of soil, mainly on heavily used trails, which affects soil productivity*.* ***Based on a review of 1964 aerial photos, approximately 10 to 15 percent of the previously harvested areas contained skid trails.*** Field reconnaissance shows that many of these trails are well vegetated, and frost action and vegetative growth are continuing to lessen the impacts. ***No erosion was observed on existing trails. Erosion-control status of the existing road system is addressed in the watershed analysis of this document.***

The soil types in the project area vary from nearly level wetland types along the West Fork to steep valley sideslopes on ridges. The Flathead National Forest Soil Survey identified one area of soils in the project area at high risk for mass movements. Though this soil type, landtype 74, is found in the northern portion of the project area, no slope failures were identified during reconnaissance.

ALTERNATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS

- ***Direct and Indirect Effects of No-Action Alternative A to Soils***

  Soil productivity would be neither directly nor indirectly affected.

- ***Direct and Indirect Effects of Action Alternatives B and C to Soils***

  Action Alternative B would have direct impacts on approximately 158 acres. Direct impacts would include compaction and displacement from skidding logs with ground-based equipment on approximately 937 acres and cable-yarding equipment on approximately 333 acres.

  Action Alternative C would have direct impacts on approximately 131 acres. Direct impacts would include compaction and displacement from skidding logs with ground-based equipment on approximately 866 acres and cable-yarding equipment on approximately 72 acres.

  For both action alternatives, site preparation and road construction with ground-based equipment would also generate direct impacts to the soil. *TABLE III-3 - SUMMARY OF DIRECT EFFECTS OF ALTERNATIVES ON SOILS WITH SUMMER HARVESTING* summarizes the expected impact to soils. These activities would leave up to 12 percent of the proposed harvest units in an impacted condition under Action Alternative B, and up to 14 percent under Action Alternative C. Mitigation measures would be implemented to maintain soil productivity in the long term and

TABLE III-3 - SUMMARY OF DIRECT EFFECTS OF ALTERNATIVES ON SOILS WITH SUMMER HARVESTING

DESCRIPTION OF PARAMETER	NO-ACTION ALTERNATIVE A	ACTION ALTERNATIVE B	ACTION ALTERNATIVE C
Acres of harvest	0	1,270	938
Acres of tractor yarding	0	937	866
Acres of skid trails and landings[1]	0	188	173
Acres of cable yarding	0	333	72
Acres of yarding corridor[2]	0	33	7
Acres of moderate impacts[3]	0	158	131
Percent of harvest area with impacts	0%	12.4%	14.0%

[1]20 percent of ground-based area
[2]5 to 10 percent of cable-yarding units
[3]75 percent of ground-based skid trails and 50 percent of cable corridors

control the area and degree of negative soil impacts to less than 15 percent of the proposed harvest area. Skidding mitigation measures would include:

- restricting the season of use;
- utilizing a minimum skid-trail spacing;
- installing erosion-control devices where needed;
- ***restricting ground skidding to slopes of less than 45 percent;*** and
- following all applicable BMPs.

DNRC would require retention of proportions of snags, coarse woody debris, and fine litter for nutrient cycling and wildlife needs. DNRC goals for coarse woody debris levels are based on research by Graham et al 1994.

CUMULATIVE EFFECTS

- ***Cumulative Effects of No-Action Alternative A to Soils***

No soil would be disturbed and no past harvest units would be reentered; therefore, this alternative would have no cumulative impacts on soil productivity and would be similar to the *EXISTING CONDITION* portion of this analysis.

- ***Cumulative Effects of Action Alternatives B and C to Soils***

Several stands where previous timber management has occurred would be entered. Cumulative effects may occur from repeated entries into a stand where additional ground is impacted by equipment operations. Long-term soil productivity would be maintained and adverse cumulative effects would be minimized by implementing one or more mitigations:

- Existing skid trails from past harvesting activities would be used if properly located and spaced.
- Additional skid trails would be used only where existing trails are unacceptable.
- Soil-moisture restrictions, season of operation, and methods of harvesting would mitigate the potential direct and indirect effects.
- A portion of coarse woody debris and fine litter would be retained for nutrient cycling.

In previously harvested stands, cumulative effects to soil productivity from multiple entries would be the same as those listed under *DIRECT AND INDIRECT EFFECTS*.

FISHERIES ANALYSIS

INTRODUCTION

This analysis describes the fisheries resources, displays the anticipated effects of each alternative of this proposal, and summarizes the detailed effects analysis in *APPENDIX E – FISHERIES ANALYSIS*.

Native cold-water fish species in the project area include bull trout, westslope cutthroat trout, slimy sculpin, largescale sucker, and longnose sucker. The eastern brook trout is the one nonnative species known to persist within the project area.

Bull trout and westslope cutthroat trout are the primary cold-water species that will be addressed. The bull trout is listed as "threatened" under the Endangered Species Act. Both bull trout and westslope cutthroat are listed as Class-A Montana Species of Concern, and DNRC has identified them as sensitive species.

ANALYSIS METHODS

The best available data for both fish populations and habitats will be presented for the 2 basins and 2 subbasins in the project area. The existing conditions and foreseeable alternative effects for each subbasin will be explored using the following outline of subissues:

- Populations
  - presence
  - genetics
- Habitat
  - flow Regime
  - sediment
  - channel form
  - large woody debris
  - riparian zone
  - stream temperature
  - connectivity
  - cumulative impacts (in *ALTERNATIVE EFFECTS* only)

ANALYSIS AREA

The project area includes the watersheds of 2 major tributaries of Swift Creek: West Fork of Swift Creek (West Fork) and East Fork of Swift Creek (East Fork). Also included in the project area are 2 specific subbasins of the West Fork: from north to south, the watersheds of Stryker Creek and Johnson Creek.

The East Fork will not be included in the fisheries analysis since no foreseeable direct, indirect, or cumulative impacts to bull trout or westslope cutthroat trout populations or habitats are expected as a result of any of the alternatives.

EXISTING CONDITIONS

POPULATIONS

- **Presence**

  The West Fork has been identified as providing important habitat for a disjunct bull trout population associated with Whitefish Lake. The annual number of bull trout redds found in the West Fork has ranged from 0 to 8 during the years of 1994 through 2003. No westslope cutthroat trout redds were found during surveys in 2000 through 2002.

  In Johnson and Stryker creeks, bull trout populations may utilize the lower reaches of the creeks as spawning and rearing habitat. Also, the possibility exists that the lower reaches of the streams could be utilized to some degree by juvenile and adult bull trout. Both Stryker and Johnson Creeks most certainly provide some level of spawning and rearing habitat to westslope cutthroat trout.

  Due to the lack of data on historic and comparable population presence, no apparent existing direct and indirect impacts to bull trout and westslope cutthroat trout population presence exist in the West Fork and Stryker and Johnson creeks.

- **Genetics**

Site-specific information regarding bull trout genetics in the West Fork is unavailable, but some level of hybridization has possibly occurred with eastern brook trout in the West Fork subbasin. The genetic purity of westslope cutthroat trout was determined to be 97.4 percent in a 1984 DFWP genetic survey.

Due to the possibility of bull trout and brook trout hybridization and the known occurrence of introgressed westslope cutthroat trout, low to moderate direct and indirect impacts to bull trout and westslope cutthroat trout population genetics exist in the West Fork.

Information regarding the existing conditions of bull trout genetics in Stryker Creek is the same as that for the West Fork. Regarding westslope cutthroat trout, a possibility exists that genetic introgression within the West Fork has spread upstream into Stryker Creek. Conversely, a remnant population of westslope cutthroat trout in the upstream reaches of Stryker Creek that may be genetically pure is also a possibility.

Information regarding the existing conditions of bull trout genetics in Johnson Creek is the same as that for the West Fork. Regarding westslope cutthroat trout, DFWP conducted a genetic survey in 1992 of 52 fish from lower Johnson Creek. The subspecies was found to be slightly introgressed (98.9 percent) with Yellowstone cutthroat trout. A DFWP genetic survey in 1998 of 3 fish from an upstream reach of Johnson Creek found samples to be genetically pure.

Due to the possibility of bull trout and brook trout hybridization and the potential occurrence of introgressed cutthroat trout, existing low to moderate direct and indirect impacts to bull trout and westslope cutthroat trout population genetics are possible in Stryker and Johnson creeks.

HABITAT

- **Flow Regime**

Changes in flow regime have been known to affect bull trout and westslope cutthroat trout spawning migrations, spawning habitat availability, and embryo survival.

The hydrology analysis for the West Fork basin indicates that the existing average flow regime for the stream is approximately 3.4 percent above the range of naturally occurring conditions (see *APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS*). Stryker Creek has an average flow regime of 3.3 percent above naturally occurring. Johnson Creek has an estimated flow regime of 3.5 percent over naturally occurring levels.

Due to the current flow-regime values, a very low potential for direct and indirect impacts related to the flow-regime component of bull trout and westslope cutthroat trout habitats exists in the West Fork and Stryker and Johnson creeks.

- **Sediment**

Existing stream-sediment processes that are described in *APPENDIX E - FISHERIES ANALYSIS* are *Rosgen* stream-morphological type, sediment budget, and streambank stability. The stream morphology (general shape of the stream) of the West Fork through the project area exhibits a B3/B4 streamtype; the proportion of fine (<6.35 mm) sediment is under the 35-percent threshold for ‘threatened’ status.

Substrate score samples show values that are considered not 'threatened'. Two *Wolman* pebble-count surveys from 2001 indicate that 8.5 percent of the streambed surface substrates are less than 8 millimeter. This is considerably lower than the results calculated for the similar size class in the *McNeil* core samples. A streambank-stability survey from 2001 indicates very high levels (99.19 percent) of streambank stability in the West Fork throughout the project area. Based on these observations, no direct and indirect impacts to the sediment component of bull trout and westslope cutthroat trout habitats exist in the West Fork.

Field surveys of Stryker Creek within the project area have found the *Rosgen* stream morphological type to be B3, with stream gradients ranging primarily from 4 to 6 percent. Field surveys of Johnson Creek within the project area have found the *Rosgen* stream morphological type to be B4 with a stream gradient of primarily 3 percent. Stream stability scores from reaches within the project area are considered fair for these stream types.

Based on these observations, no direct and indirect impacts to the sediment component of bull trout and westslope cutthroat trout habitats likely exist in the West Fork and Stryker and Johnson creeks.

- **Channel Forms**

Two descriptions of channel formation will be used to describe existing habitats for bull trout and westslope cutthroat trout in the West Fork:

- *Montgomery/Buffington* classification
- R1/R4 Fish Habitat Standard Inventory

The stream formations of the West Fork through the project area are broadly described as exhibiting both 'pool-riffle' and 'forced pool-riffle' (*Montgomery/Buffington* classifications). R1/R4 Fish Habitat Standard Inventory data indicates that the West Fork likely provides an average quantity of pool habitat within the project area.

Moving upstream through the project area, the stream formation of Stryker Creek is broadly described as a transitional zone between 'forced pool-riffle' and 'plane bed' (*Montgomery/Buffington* classifications) to 'forced step-pool' and 'step-pool' (*Montgomery/Buffington* classifications).

From the confluence with the West Fork and upstream to river mile 1.46, the stream formations of Johnson Creek, are broadly described as exhibiting both 'pool-riffle' and 'forced pool-riffle' (*Montgomery/Buffington* classifications). The stream formations from river mile 1.46 upstream through the project area to river mile 3.05 are broadly described as exhibiting 'step-pool', 'forced step-pool', and some 'cascade' (*Montgomery/Buffington* classifications).

Although insufficient historic data is available for describing existing trends in channel forms, no direct and indirect impacts to the channel-form component of bull trout and westslope cutthroat trout habitats likely exist in the West Fork or Stryker and Johnson creeks.

- **Large Woody Debris**

The average large woody-debris count in the West Fork is 50 pieces per 1,000 feet. This data suggests that existing amounts of large woody debris in the West Fork are below average. Based on these observations, low to moderate direct and indirect impacts to the large woody debris component of bull trout and westslope cutthroat trout habitats exist in the West Fork.

The large woody debris count in Stryker Creek averages 131 pieces per 1,000 feet. This data suggests that the existing amounts of large woody debris in Stryker Creek are average. Consequently, no direct and indirect impacts to the large woody component of bull trout and westslope cutthroat trout habitats exist in Stryker Creek.

Although specific historic data is not available to describe existing trends of large woody debris in Johnson Creek, low to moderate direct and indirect impacts to the large-woody-debris component of bull trout and westslope cutthroat trout habitats likely exist in Johnson Creek.

- **Riparian Zone**

  Existing impacts to the riparian zone from past timber harvests on the bull trout and westslope cutthroat trout habitats are low to moderate in the West Fork; no direct and indirect impacts exist in Stryker or Johnson creeks.

- **Stream Temperature**

  During the 2 seasons of record in the lower half of the project area, the weekly maximum stream temperature change in the West Fork ranged from 0.3 to 1.9 degrees Celcius.

  Although sufficient data is unavailable for describing existing trends in stream temperature in the West Fork or Stryker and Johnson creeks, no direct and indirect impacts to bull trout and westslope cutthroat trout habitats likely exist as a result of stream temperature.

- **Connectivity**

  No natural or manmade barriers to bull trout and westslope cutthroat trout migration occur in the project area on the West Fork or Stryker Creek. No direct and indirect impacts to bull trout and westslope cutthroat trout habitats as a result of disconnectivity exist on either stream.

  Currently, the 3 bridge crossings on Johnson Creek within the project area provide full passage of all life stages of bull trout and westslope cutthroat trout. One culvert is located within the project area on a lower reach of Johnson Creek with seasonal, discontinuous flow. This culvert is likely a migration barrier to all life stages of bull trout and westslope cutthroat trout, except for a portion of the strongest swimming adults. Due to a very limited potential for upstream migration through this culvert, moderate direct and indirect impacts to the connectivity component of bull trout and westslope cutthroat trout habitats exist in Johnson Creek.

SUMMARY OF EXISTING CONDITIONS

West Fork

* An estimated 3.4 percent increase in streamflow over naturally occurring conditions may have resulted in changes to channel formation, sediment levels, and streambank stability.
* Past individual-tree-selection harvest methods in riparian zones have likely reduced the amount of potentially recruitable large woody debris to the West Fork; this could be associated with the existing below-average amounts of large woody debris in the stream.
* Past canopy removal in riparian areas may have led to temporarily increased stream temperatures as a result of increased direct solar energy, but to accurately qualify

the extent of this potential past impact is not possible.

* In the project area, an estimated 25.5 tons of sediment from existing roads are contributed annually to streams in the West Fork watershed (see *APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS)*.

Overall, low to moderate collective past and present impacts to bull trout and westslope cutthroat trout are likely in the West Fork as a result of the existing conditions described above.

Stryker and Johnson Creeks

Stryker Creek

* An estimated 3.3 percent increase in the streamflow may have resulted in changes to channel formation, sediment levels, and streambank stability.
* In the project area, an estimated 2.8 tons of sediment from existing roads are contributed annually to streams in the Stryker Creek watershed (see *APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS)*.

Johnson Creek

* An estimated 3.5 percent increase in the streamflow regime may have resulted in changes to channel formation, sediment levels, and streambank stability.
* Past individual-tree-selection harvest methods in riparian zones along Johnson Creek may have reduced the amount of potentially recruitable large woody debris to the stream and increased incoming direct solar energy.
* In the project area, an estimated 5.2 tons of sediment from existing roads are contributed annually to streams in the Johnson Creek watershed (see *APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS)*.
* One existing culvert is likely a migration barrier to all life stages of bull trout and westslope cutthroat trout, except for a portion of the strongest swimming adults.

Overall, low to moderate collective past and present impacts to bull trout and westslope cutthroat trout are possible in Stryker and Johnson creeks as a result of the existing conditions described above.

ALTERNATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS

Populations

➢ ***Presence and Genetics***

- ***Direct and Indirect Effects of All Alternatives***

  No direct or indirect impacts would occur beyond those described under *EXISTING CONDITIONS*.

Habitat

➢ ***Flow Regime***

- ***Direct and Indirect Effects of No-Action Alternative A***

  No impacts would be expected beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternatives B and C***

  The approximate range of potential water-yield increases to streams in the project area is 0.4 to 2.6 percent under Action Alternative B and 0.2 to 1.6 percent with Action Alternative C. With respect to those existing conditions described in the *APPENDIX E - FISHERIES ANALYSIS*, these potential modifications of flow regimes are expected to have a negligible impact to the flow-regime component of bull trout and westslope cutthroat trout habitats beyond those described under *EXISTING CONDITIONS*.

- ***Sediment***
  - ***Direct and Indirect Effects of No-Action Alternative A***

    No impacts are expected beyond those described under *EXISTING CONDITIONS*.

  - ***Direct and Indirect Effects of Action Alternatives B and C***

    Data from *APPENDIX C – WATERSHED AND HYDROLOGY ANALYSIS* indicates the range of potential water-yield increases would be generally insufficient to facilitate the development of unstable stream channels, which could adversely affect the sediment component of bull trout and westslope cutthroat trout habitats. *APPENDIX C – WATERSHED AND HYDROLOGY ANALYSIS* also indicates that road improvements would reduce sediment. Timber-harvesting operations would comply with the SMZ laws. With respect to the earlier-described existing conditions, these alternatives would likely provide net positive impacts to the sediment component of bull trout and westslope cutthroat trout habitats.

- ***Channel Forms***
  - ***Direct and Indirect Effects of No-Action Alternative A***

    No impacts are expected beyond those described under *EXISTING CONDITIONS*.

  - ***Direct and Indirect Effects of Action Alternatives B and C***

    Potential changes to stream channel forms are primarily a function of modifications to flow regimes and consequent relationships with existing sediment size classes. As indicated earlier, modifications to the bull trout and westslope cutthroat trout habitat components of flow regime and sediment are expected to be negligible or not occur at all. With respect to *EXISTING CONDITIONS, Flow Regime* and *Sediment,* described earlier, no foreseeable direct and indirect impacts to the channel-form component of bull trout and westslope cutthroat trout habitats would be expected beyond those described under *EXISTING CONDITIONS.*

- ***Large Woody Debris***
  - ***Direct and Indirect Effects of No-Action Alternative A***

    No impacts would be expected beyond those described under *EXISTING CONDITIONS.*

  - ***Direct and Indirect Effects of Action Alternatives B and C***

    Since a 100-foot, no-harvest buffer would be established between the 3 streams and the associated proposed harvest areas, the rate of potential large-woody-debris recruitment would not likely be affected by any proposed harvest area. No direct or indirect impacts to the large-woody-debris component of bull trout and westslope cutthroat trout habitats would be expected beyond those described under *EXISTING CONDITIONS*.

- ***Riparian Zone***
  - ***Direct and Indirect Effects of No-Action Alternative A***

    No impacts would be expected beyond those described under *EXISTING CONDITIONS*.

  - ***Direct and Indirect Effects of Action Alternatives B and C***

    The capability of the riparian-zone function to provide potential large-woody-debris recruitment was evaluated. Since a no-harvest buffer of 100 feet would be established between the 3 streams and the associated proposed harvest areas, the riparian-zone function associated with these 3 stream channels would likely not be affected. No direct or indirect impacts to the riparian-zone component of bull trout and westslope cutthroat trout habitats would be expected beyond those described under *EXISTING CONDITIONS*.

- ***Stream Temperature***

  - ***Direct and Indirect Effects of No-Action Alternative A***

    No impacts would be expected beyond those described under *EXISTING CONDITIONS*.

  - ***Direct and Indirect Effects of Action Alternatives B and C***

    Direct solar radiation is the primary mechanism affecting changes in stream temperature throughout the project area. Consequently, increases in stream temperature can occur through the loss of riparian vegetation that intercepts solar radiation. Since a no-harvest buffer of 100 feet would be established between the 3 streams and the associated proposed harvest areas, stream temperatures would not likely be affected. No direct or indirect impacts to the stream-temperature component of bull trout and westslope cutthroat trout habitats would be expected beyond those described under *EXISTING CONDITIONS*.

- ***Connectivity***

  - ***Direct and Indirect Effects of All Alternatives***

    No impacts would be expected beyond those described under *EXISTING CONDITIONS*.

CUMULATIVE EFFECTS

- ***Cumulative Effects of No-Action Alternative A***

  Cumulative impacts to bull trout and westslope cutthroat trout would not be expected.

- ***Cumulative Effects of Action Alternatives B and C***

  As described in *EXISTING CONDITIONS* and *ALTERNATIVE EFFECTS* of *Action Alternatives B and C*, the direct, indirect, and collective impacts of past- and present-related actions associated with bull trout and westslope cutthroat populations and habitat range from low to moderate. No additional future activities related to the proposed actions by location or generic type are known at this time. As described throughout the direct and indirect effects of Action Alternatives B and C, the actions would have impacts to bull trout and westslope cutthroat trout that range from negligible to net positive. Consequently, the risk of foreseeable adverse cumulative impacts to bull trout and westslope cutthroat trout is low.

ANALYSIS AREA

This discussion occurs at 2 scales:

The project area includes lands that DNRC manages in Sections 18, 19, 20, 21, 28, 29, 30, 31, 32, 33, and 34, T34N, R23W, and Section 13 in T34N, R24W. Full descriptions of the project area and proposed harvest units are presented in *CHAPTER II – ALTERNATIVES* (*FIGURES II-1 - WEST FORK TIMBER SALE ALTERNATIVE B* and *II-2 - WEST FORK TIMBER SALE ALTERNATIVE C maps)*.

The second scale relates to the surrounding landscape for assessing cumulative effects. This scale varies according to the species being discussed, but generally approximates the size of the home range of the species in question.

ANALYSIS METHOD

COARSE-FILTER ASSESSMENT

DNRC recognizes that it is impossible and unnecessary to assess an affected environment or the effects of proposed actions on all wildlife species. We assume that if landscape patterns and processes similar to those that species adapted to are maintained, then the full complement of species will be maintained across the landscape (*DNRC 1996*).

Covertypes

Fire suppression probably had little effect in the project area, while past timber harvesting and diseases heavily influenced the decline in shade-intolerant tree species. The changes presumably reduce the abundance of species that use open, shade-intolerant forested habitat, while favoring species that use dense, closed-canopy habitats.

Patch Size and Interior Habitats

Species that are hesitant to cross broad expanses without forest cover, or that depend on interior-forest conditions, can be sensitive to the amount and spatial configuration of appropriate habitat.

Connectivity

The connectivity of forest cover between adjacent patches is important for promoting movements of species that are hesitant to cross broad, nonforested expanses. Key travel areas, such as saddles or near streams, are not included in the proposed harvest units.

Deadwood

Deadwood (downed trees and snags) is an important component of the forested ecosystems. Maintenance of habitats for birds and mammals that depend on insects for food is important for long-term health of the forest. In Harvest Area III, snag densities (greater than 14 inches dbh) ranged from 0 to 16 per acre, with an average of 3.1 snags for stands in the cool and moist habitat type and 3.4 snags for stands in the cold and moderately dry habitat type. The density of snags in the other harvest areas was assessed and appears to be relatively low. This can be expected in previously harvested stands and near open roads.

FINE-FILTER ASSESSMENT

In the fine-filter analysis, individual species of concern are evaluated. These include wildlife species listed under the Endangered Species Act, species listed as sensitive by DNRC (*ARM 36.11.436(6)*), and species managed as big game by DFWP. Included are the bald eagle, Canada lynx, Rocky Mountain gray wolf, grizzly bear, fisher, pileated woodpecker, and big game.

Threatened and Endangered Species

- *Bald Eagle*

  Bald eagles nest south of Upper Whitefish Lake. No proposed units occur within the nest or primary-use areas; however, routes for log hauling intersect the nest and primary-use area. The West Fork Road, an open road, borders the southern boundary of the nest and primary-use area, while the Whitefish Saddle Road, a restricted road, follows the primary-use area. To assess cumulative effects to bald eagles, the bald eagle territory home range was used.

- *Canada Lynx*

Based on field reconnaissance and SLI modeling, while all proposed harvest areas occur in general or foraging habitat, denning habitat is not expected to be affected. Cumulative effects were analyzed for lands in the Upper Whitefish Grizzly Bear Subunit.

- *Gray Wolf*

Use of the area by the gray wolf is expected to be transitory or sporadic. This project is not expected to affect gray wolves; therefore, this species was dropped from further analysis for this project.

- *Grizzly Bear*

The project area provides year-round habitat for grizzly bears. This project could affect grizzly bears directly through increased road traffic, noise, and human activity indicated by changes in road densities. This project could affect grizzly bears indirectly by altering the amount and location of hiding cover and forage. The cumulative-effects analysis was conducted using the Upper Whitefish Grizzly Bear Subunit. Managing motorized access reduces the potential for mortality, displacement from important habitats, and habituation to humans, and provides relatively secure habitat to reduce the energetic requirements. The road-management scenario in this subunit yields an open-road density of 31.8 percent, a total-road density of 33.8 percent, and a potential security-core area of 51.6 percent.

Sensitive Species

- *Fisher*

Fishers are generalist predators and use a variety of successional forest stages, but are most often found in stands with dense canopies. Timber harvesting and associated road construction could affect fishers by altering habitat and/or increasing their susceptibility to trapping. The Upper Whitefish Grizzly Bear Subunit was used to assess cumulative effects.

- *Pileated Woodpecker*

Due to the relatively high elevation of the project area, the pileated woodpecker is limited to the drainage bottoms in the project area. The analysis conducted for this large project area encompassed enough area to support several pairs of pileated woodpeckers; therefore, the analysis area for cumulative effects is the project area.

Big Game Species

The big game species that inhabit the project area are deer, elk, and moose. However, due to the high elevation and heavy snow accumulations, big game use of the project area is restricted to the nonwinter period.

ALTERNATIVE EFFECTS

DIRECT EFFECTS

C ***Direct Effects of No-Action Alternative A***

Coarse Filter: No additional displacement or disturbance of wildlife is expected in the area.

Bald Eagle: No additional direct effects to nesting or wintering bald eagles would be expected.

Canada Lynx: No additional activities would occur; therefore, no direct effects would be expected.

Grizzly Bears: No additional direct effects would occur under this alternative.

Fisher: No additional human disturbance or increased vulnerability to trapping would be expected.

Pileated Woodpecker: No disturbance of pileated woodpeckers would occur.

Big Game Species: No additional human disturbance or increased vulnerability to hunting would be expected.

- ***Direct Effects of Action Alternatives B and C***

Coarse Filter: Displacement and/or disturbance of wildlife species would be expected due to these alternatives. Due to the increased area and duration of Action Alternative B, it is expected to produce more disturbances to wildlife species than Action Alternative C. However, the features of the project design would reduce widespread disturbance of the area.

Bald Eagle: No harvesting would occur in the nest or primary-use areas. To limit disturbance to nesting eagles, Harvest Areas I and II-A would not be harvested during the eagle-nesting season (February 1 through August 15) unless the territory is determined to be unoccupied. With these mitigation measures in place, no additional disturbance effects are expected.

Canada Lynx: Some disturbance of lynx could occur in areas that have adequate cover for lynx to travel through. Lynx do not appear to avoid roads that have low traffic volumes, so increased logging traffic on open and gated roads is not expected to displace or increase the energetic cost of individual lynx. The risk of affecting lynx are higher under Action Alternative B than Action Alternative C, but both alternatives are expected to result in very minor risks of negative direct effects.

Grizzly Bears: Under these alternatives, disturbance would increase due to activities in the harvest units and on the associated access roads. To accomplish the harvests, some restricted roads would be used, but motorized use by the public would not be allowed over a period of several years. Disturbance associated with these roads are expected to result in decreased use of adjacent habitats by grizzly bears and will be discussed further in the cumulative effects analysis.

Fishers: Some displacement could occur under each action alternative; however, the effects of this displacement would be minor.

Pileated Woodpeckers: Under the action alternatives, pileated woodpeckers could be affected if harvesting occurred during the nesting period. Action Alternative C would result in a slighter risk of directly affecting pileated woodpeckers than Action Alternative B.

Big Game Species: Under each action alternative, some displacement could occur; however, the effects of this displacement would be minor.

Indirect Effects

- ***Indirect Effects of No-Action Alternatives A***

Covertypes: In the long-term, species that use the more-open stands and/or shade-intolerant tree species would be negatively affected due to the loss of habitat. Species that use late-successional forest structure would benefit by an increase in habitat.

Patch Size and Interior and Edge Habitats: Patch size, interior habitat, and edge habitats would not change in the near term.

Deadwood: No changes in deadwood resources would occur.

Bald Eagles: The density and proportion of shade-tolerant tree species would continue to increase in timber stands that presently provide bald eagle habitat, while growth rates in timber stands would decrease. The potential of these effects limiting nest success of this breeding pair is low.

Canada Lynx: In the short term, no effects to lynx are expected. In the longer-term without disturbance, denning habitat is expected to increase, but foraging opportunities are expected to decrease.

Grizzly Bears: No additional disturbance due to road use would occur; therefore, negligible effects are expected.

Fishers: Fisher habitat would remain relatively unchanged in the short-term.

Pileated Woodpeckers: The existing trees would continue to grow and die, thus providing potential nesting and foraging structure for pileated woodpeckers. Therefore, pileated woodpecker habitat would increase through time, then decline, resulting in a short- to mid-term moderate beneficial effect to pileated woodpeckers, but a long-term minor negative effect.

Big Game Species: No changes to big game habitat would occur in the short-term.

C ***Indirect Effects Common to Action Alternatives B and C***

Connectivity: Under both alternatives, substantial effects to connectivity are not expected; therefore, any effects are expected to be negligible.

Deadwood: Deadwood resources would be targeted for retention in the harvest units. Harvesting is expected to reduce the densities of small- to medium-sized snags; therefore, these alternatives are likely to affect cavity-nesting species that use snags of smaller diameter. However, retention of dominant trees, existing deadwood, and piles of cull logs is expected to provide habitat for species associated with large deadwood in the short and long terms. Action Alternative C would retain more deadwood habitat in the project area than Action Alternative B.

Age Class: Under both action alternatives, efforts would be made to convert stands to more closely reflect the historic conditions outlined in *Losensky (1997)*. Both alternatives would benefit early-successional species at the expense of mid– to later-successional species. Action Alternative B would create more early successional habitat than Action Alternative C.

Bald Eagle: Habitat in the nest-site or primary-use areas would not be modified under these action alternatives. Therefore, the effects discussed under No-Action Alternative A are expected to occur in these areas.

Grizzly Bears: Under Action Alternatives B and C, timber harvesting would reduce hiding cover. The loss of hiding cover is expected to result in negligible, short-term (5 to 10 years) negative effects to grizzly bears. Increased forage would be about proportional to canopy removal. The effects of both action alternatives would be minor.

Pileated Woodpeckers: Under Action Alternatives B and C, 775 acres of pileated woodpecker habitat in the project area would be modified. These alternatives are expected to result in negligible negative effects to pileated woodpeckers. Species such as western larch would be planted with these alternatives and could provide habitat for pileated woodpeckers in the distant future.

Big Game Species: Removal of the overstory canopy is expected to increase forage, but would also reduce hiding cover. Since Action Alternative B would remove overstory canopy from a larger area, the effects would be more pronounced in the project area under that alternative. However, in either case, effects are expected to be negligible.

- ***Indirect Effects of Action Alternatives B***

Covertypes: On 138 acres, harvesting would promote more historic covertype representation. On the remaining 1,130 acres, the covertype would not change; however, shade-intolerant species, such as western larch and western white pine, would be planted in regeneration units to reintroduce or increase their representation in the future stand. These changes would favor wildlife species that use more open-canopied, shade-intolerant tree species at the expense of wildlife species associated with closed-canopied, shade-tolerant tree species. If whitebark pine successfully regenerates, species such as Clarke’s nutcracker, grizzly bears, squirrels, etc., would benefit from an increase in key food sources.

Patch Size and Interior and Edge Habitats: Forested habitat would decrease by 1,187 acres and interior forested habitat would decrease by 1,526 acres, while edge habitat would increase by 339 acres in the Upper Whitefish Grizzly Bear Subunit. Habitat for species that use forested and interior habitat would decrease, while species that use edge and regeneration or unforested habitats would be favored.

Canada Lynx: Lynx habitat would be modified on 1,270 acres. In the short-term, available lynx habitat would decline. As stands regenerate, foraging and denning habitats are expected to increase over present.

Fishers: Under Action Alternative B, 1,270 acres of habitat would be modified. A 100-foot, no-harvest buffer along the West Fork and Stryker and Johnson creeks would be retained to protect potential high-quality resting habitat and travel corridors, since fishers travel along stream courses and prefer habitats in the proximity of water. This alternative is expected to remove fisher habitat, while retaining travel corridors along stream courses, which would result in minor negative effects to fishers.

- ***Indirect Effects of Action Alternatives C***

Covertypes: Harvesting would promote more historic covertype representation on 46 acres. On the remaining 892 acres, the covertype would not change; however, shade-intolerant species, such as western larch and western white pine, would be planted in regeneration units to reintroduce or increase their representation in the future stand. These changes would favor wildlife species that use more open-canopied, shade-intolerant tree species at the expense of wildlife species associated with closed-canopied, shade-tolerant tree species. Whitebark pine regeneration is not expected in any of these units.

Patch Size and Interior and Edge Habitats: Forested habitat would decrease by 855 acres and interior forested habitat would decrease by 1,136 acres, while edge habitat would increase by 281 acres in the Upper Whitefish Grizzly Bear Subunit.

Canada Lynx: This alternative is expected to result in the benefits discussed in Action Alternative B without the potential long-term loss of habitat on 332 acres in Harvest Area III.

Fishers: The effects discussed under Action Alternative B are expected; however, this alternative would not harvest in Harvest Area III (332 acres). Harvest Area III occurs in less desirable fisher habitat than the other areas in the flatter topography; therefore, this alternative would result in slightly less minor effects to fisher.

Cumulative Effects

- ***Cumulative Effects Common to All Alternatives***

Patch Size, Interior and Edge Habitats, and Connectivity: Adjacent USFS lands are not expected to be harvested, thereby forested habitat and patch size would be retained in those areas. The effects discussed under indirect effects would be cumulative to the conditions occurring on adjacent lands in the area.

Deadwood: Reductions in deadwood resources would be cumulative to past timber and salvage harvests.

Fishers: Salvage operations and firewood cutting on State trust lands has decreased habitat. Overall, Action Alternative B would combine with other activities on Stillwater Unit to produce minor negative effects to fishers. Slightly less minor effects are expected under Action Alternative C.

Big Game Species: Since no other projects are planned in the cumulative effects area, the effects discussed for the project area also hold true for the cumulative effects area.

- ***Cumulative Effects of the No Action Alternatives A***

Covertype and Age Class: This alternative would affect wildlife species using the area by decreasing habitat diversity in the area and favoring species associated with late-succession, shade-intolerant tree species.

Bald Eagles: Under this no-action alternative, no additional disturbance or habitat modification would occur in the analysis area.

Canada Lynx: No habitat would be modified. Under this alternative, barring any disturbance, forage availability would decrease while denning habitat would increase.

Grizzly Bears: Under this alternative, motorized access to the area would remain unchanged.

Pileated Woodpeckers: Pileated woodpecker habitat in and around the project area would increase on DNRC lands through time, then decline.

- ***Cumulative Effects Common to Action Alternatives B and C***

Covertype and Age Class: Under both action alternatives, efforts would be made to convert stands to more closely reflect the historic conditions outlined in *Losensky (1997)*. These alternatives would benefit early successional species at the expense of mid– to later-successional species.

Grizzly Bear: No reasonable mitigations were identified for avoiding the short-term impacts to security core while performing the culvert removals in Stryker basin. The Alternative Practice authorized by the Forest Management Bureau Chief would be implemented, allowing the Department to temporarily decrease the security core area below the 1996 baseline.

- ***Cumulative Effects of Action Alternatives B***

Canada Lynx: ***Following harvesting, approximately 14.1 percent of lynx habitat on DNRC lands within the Upper Whitefish Grizzly Bear Subunit would be temporarily unsuitable. These lands are expected to develop into young foraging habitat in 10 to 20 years. Denning habitat would remain unchanged, but some piles of cull logs would be retained to provide denning structure in the future.***

Grizzly Bears: Under this alternative, grizzly bears are expected to avoid an additional 1,368 acres of habitat due to the increased motorized use on roads associated with timber harvests. Additionally, 1,052 acres of potential security would be affected.

Dependent upon which road-management scenario is selected, the proposal could exceed open-road density levels over the 1996 baseline. If the decision is made to implement year-long restrictions on either the Stryker Ridge Road or Antice Knob Road, effects to the grizzly bear are expected to be negligible. If the decision is made to implement the Alternative Practice (authorizes the Department to temporarily exceed open-road densities), grizzly bears may avoid an additional 732 acres of habitat for 2 nondenning seasons as a result of increased road disturbance. This is 358 acres over the 1996 baseline level of open-road densities. Displacement of bears from quality habitats could affect grizzly bear survival and reproduction to an unknown degree. Following completion of this project, all roads would revert to current management.

- ***Cumulative Effects of Action Alternatives C***

Canada Lynx: ***Following harvests, approximately 13.1 percent of lynx habitat on DNRC lands within the Upper Whitefish Grizzly Bear Subunit would be temporarily unsuitable. These lands are expected to develop into young foraging habitat in 10 to 20 years. Denning habitat would remain unchanged, but some piles of cull logs would be retained to provide denning structure in the future.***

Grizzly Bears: Grizzly bears are expected to avoid 556 acres of habitat due to the increased motorized use on roads associated with the timber harvesting of this alternative. With the mitigation included in the project design, the amount of habitat disturbance is less then those experienced during the 1996 baseline conditions. Therefore, minor effects to bears are expected.

INTRODUCTION

The proposed timber sale is located in Stillwater State Forest north of Whitefish in Flathead County. This analysis analyzes the economic impacts of the proposed timber sale project. Market activities that directly or indirectly benefit the Montana education system, generate revenue for the school trust fund, and provide funding for public buildings will be emphasized in this section. The generation of income from trust forestlands for the school trust fund and public buildings is required under the Enabling Act of 1889 and the State of Montana Constitution.

EXISTING CONDITIONS

Enrollment in Montana schools for grades kindergarten through 12 was 149,995 in fiscal year 2003. The most recent information indicates that it costs an estimated $7,080 per year to educate one student, on average. The average expenditure per pupil in Montana is below the national average.

Most of the income from timber sales is allocated through the legislative process to various educational institutions. Local school districts also raise income through property taxes. The taxable value of property is an important factor that influences the ability of a local school district to generate tax revenue.

The Legislature allocates most of the income from timber sales to subsidize schools such as the West Valley and Bissell grade schools in Flathead County.

ALTERNATIVE EFFECTS

DIRECT EFFECTS

- ***Direct Effects of No-Action Alternative A on Economics***

  No income would be provided for schools. General fund revenues would be needed to replace money that would not be generated by one of the action alternatives.

- ***Direct Effects of Action Alternative B on Economics***

  An estimated $677,900 would be generated for the school trust fund. This revenue would be adequate to send 96 children through school for a year without other financial support.

- ***Direct Effects of Action Alternative C on Economics***

  An estimated $359,000 would be generated for the school trust fund. This revenue would be adequate to send 51 children through school for a year without other financial support.

INDIRECT EFFECTS

An indirect impact of timber sales is the employment generated and income provided to those workers who obtain jobs as a result of the timber harvest. The estimated employment in the forest industry in Montana is 10.58 jobs for every million board feet of timber harvested. The annual income associated with these jobs is $37,347 per year per job based on a weighted average of the incomes in the timber industry in Flathead and Lincoln Counties. Using this information, together with the timber harvest associated with each alternative, an estimate of the wage and salary income generated from each alternative is shown in *TABLE III-4 - EMPLOYMENT AND EARNINGS IMPACT*.

TABLE III-4 - EMPLOYMENT AND EARNINGS IMPACT

ALTERNATIVE	JOBS SUPPLIED	TOTAL INCOME ($)
A	0	0
B	100	3,734,700
C	60	2,240,800

CUMULATIVE EFFECTS

This sale would be part of the annual harvest of timber from the Montana forest trust lands. The net revenue from this sale would add to this year's contribution to the trust fund. Annual contributions to the trust fund have varied widely over the years because the actual contribution to the trust is more a function of ***annual*** harvest than of ***annual*** sales.

Harvest levels can vary substantially over time; sales tend to be more consistent. Annual revenue from harvests for the last 5 years is shown in *TABLE III-5 - ANNUAL REVENUE FROM TIMBER HARVESTED FROM MONTANA TRUST LANDS*. The net contribution to the trust fund is also affected by the annual costs experienced by the Department for program management, which varies year to year. The Department should continue to make net annual contributions to the trust from its forest management program.

TABLE III-5 - ANNUAL REVENUE FROM TIMBER HARVESTED FROM MONTANA TRUST LANDS

YEAR	HARVEST REVENUE ($)
2003	8,270,589
2002	9,699,034
2001	8,524,150
2000	12,710,311
1999	6,998,847

DNRC has a State-wide sustained-yield annual harvest goal of 50 mmbf. If timber from this project is not sold, this volume could come from sales elsewhere; however, the timber may be from other areas and not benefit this region of the State. This forest area would be available for harvesting consideration again.

ROAD MANAGEMENTASSESSMENT

INTRODUCTION

This section describes road use and road restrictions and the likely effects of the proposed actions.

METHODS

This section describes the locations, types of road restrictions, and periods of time the restrictions take effect.

ANALYSIS AREA

The Upper Whitefish Grizzly Bear Subunit is the analysis area; the project area is within this Subunit.

TABLE III-6 - EXISTING ROADS AND ROAD MANAGEMENT IN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT displays both open and restricted roads within the Upper Whitefish Grizzly Bear Subunit.

TABLE III-6 - SUMMARY OF ROADS WITHIN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT INVOLVED IN THE WEST FORK TIMBER SALE PROJECT

<table>
<tr><th>ROADS ASSOCIATED WITH ROAD MANAGEMENT</th><th>MILES</th><th>ROAD USE</th><th>REMARKS</th></tr>
<tr><td>Upper Whitefish Road</td><td>11.3</td><td rowspan="4">Open for public motorized use year-round.</td><td>Access from Whitefish and Olney to the North Fork of the Flathead River.</td></tr>
<tr><td>West Fork Road</td><td>6.1</td><td>Access from Upper Whitefish Road to Stryker.</td></tr>
<tr><td>Johnson Road</td><td>3.4</td><td>This dead-end road accesses the Johnson Basin area.</td></tr>
<tr><td>Stryker Ridge Road</td><td>4.7</td><td>Accesses Stryker Ridge; the open portion of the road ends at the gate and barricade.</td></tr>
<tr><td>Antice Knob Road</td><td>5.4</td><td>Open for public motorized use July 1 through April 1.</td><td>Provides access from Stryker Ridge Road to Johnson Road.</td></tr>
<tr><td>Whitefish Saddle Road</td><td>2.4</td><td rowspan="4">Public motorized use is restricted April 1 through November 15.</td><td>Dead-end road. Road use beyond 1.7 miles is restricted by brush.</td></tr>
<tr><td>Stryker Basin Road</td><td>5.4</td><td rowspan="4">The location of these dead-end roads can be found on the alternative maps in Chapter II.</td></tr>
<tr><td>North Johnson Road</td><td>1.8</td></tr>
<tr><td>Twin Lakes Road</td><td>1.2</td></tr>
<tr><td>Spur IIC Roads</td><td>1.4</td><td>Due to heavy brush, motorized use is restricted.</td></tr>
</table>

ALTERNATIVE EFFECTS

DIRECT EFFECTS

- ***Direct Effects of No-Action Alternative A to Road Management***

  Current access and road restriction would remain the same. Between April 1 and November 15, administrative use of restricted roads may continue at the current low level of use of 7 vehicle passes per week, or more than 7 vehicle passes per week, but less use than 30 continuous days per year.

- ***Direct Effects of Road Management Common to Action Alternatives B and C***

  The Upper Whitefish and West Fork roads would remain open to public motorized use, while the North Johnson, Stryker Basin, Spur II, and Twin Lakes roads would remain restricted from public motorized use. Whitefish Saddle Road would remain restricted from public motorized use, but would be open to harvest-related activities for 1 year.

  A gate would be installed at Site A (see *ALTERNATIVE MAPS* in *CHAPTER II*) on Johnson Road to restrict public access on approximately 2.0 miles. This would be a temporary restriction for the duration of the logging activity associated with this sale. This restriction is within the project area. With this restriction in place, logging operations would be able to exceed 30 days of use on Whitefish Saddle Road and still meet the baseline open-road-density levels of 1996.

- ***Direct Effects of Action Alternative B to Road Management***

  Several road-management scenarios are proposed with Action Alternative B. With an approved Alternative Practice available to temporarily exceed open-road densities and temporarily reduce the grizzly bear security core, 1 of the 3 following scenarios may be selected by the decisionmaker to implement. The details explain where changes are proposed, their purposes, and what direct effects would occur:

1) Scenario I would install a gate on Stryker Ridge Road near the junction of Antice Road. Approximately 4.4 miles of Stryker Ridge Road would be restricted from public motorized use from April 1 through November 15 for 2 consecutive years to allow harvesting activities to be completed in Harvest Area III.
2) Currently, public motorized use behind gates on Antice Road is restricted on 5.4 miles of road between April 1 and June 30; the second scenario would be to lengthen the length of time to November 15 for 2 years while harvesting activities proceed in Harvest Area III.
3) Scenario 3 would implement the Alternative Practice, which has been approved by the Acting Bureau Chief and allows DNRC to exceed the SFLM Rules for open-road density levels. No roads would have additional restrictions, except the upper portion of Johnson Road during log-hauling activities.

The gate restriction at Site A would also remain in place during active periods of harvesting in Harvest Area III. This upper portion of the Johnson road system is narrow with steep sideslopes; therefore, restriction of public vehicles is recommended for safety purposes. When timber sale activities are completed, the gate would be removed and closures at the North Johnson and Twin Lakes roads would be reinstalled.

- ***Direct Effects of Action Alternative C to Road Management***

  In addition to roads listed under *Direct Effects to Action Alternatives B and C*, the status of the Stryker Ridge and Antice Knob roads would remain unchanged.

INDIRECT EFFECTS

- ***Indirect Effects of All Alternatives on Road Management***

  Indirect effects of the changes to public access on Stillwater State Forest may be found under *Grizzly Bears* in *APPENDIX F - WILDLIFE ANALYSIS.*

- ***Indirect Effects of Action Alternatives B and C on Road Management***

  Restricted motorized access would temporarily reduce opportunities for recreational use.

CUMULATIVE EFFECTS

- ***Cumulative Effects of No-Action Alterantive A and Action Alternative C to Road Management***

  Stillwater Unit would continue to attempt to meet the open-road density levels within the grizzly bear subunits and restrict public motorized use of roads on new or temporary roads within the subunits.

- ***Cumulative Effects of Action Alternative B to Road Management***

  Stillwater Unit would continue to attempt to meet the SFLM Rules for open-road density levels within the grizzly bear subunits and restrict public motorized use of roads on new or temporary roads within the subunits. With the implementation of Action Alternative B and the Alternative Practice for open-road densities, the open-road-density level within the Upper Whitefish Grizzly Bear Subunit would be temporarily exceeded for approximately 2 years.

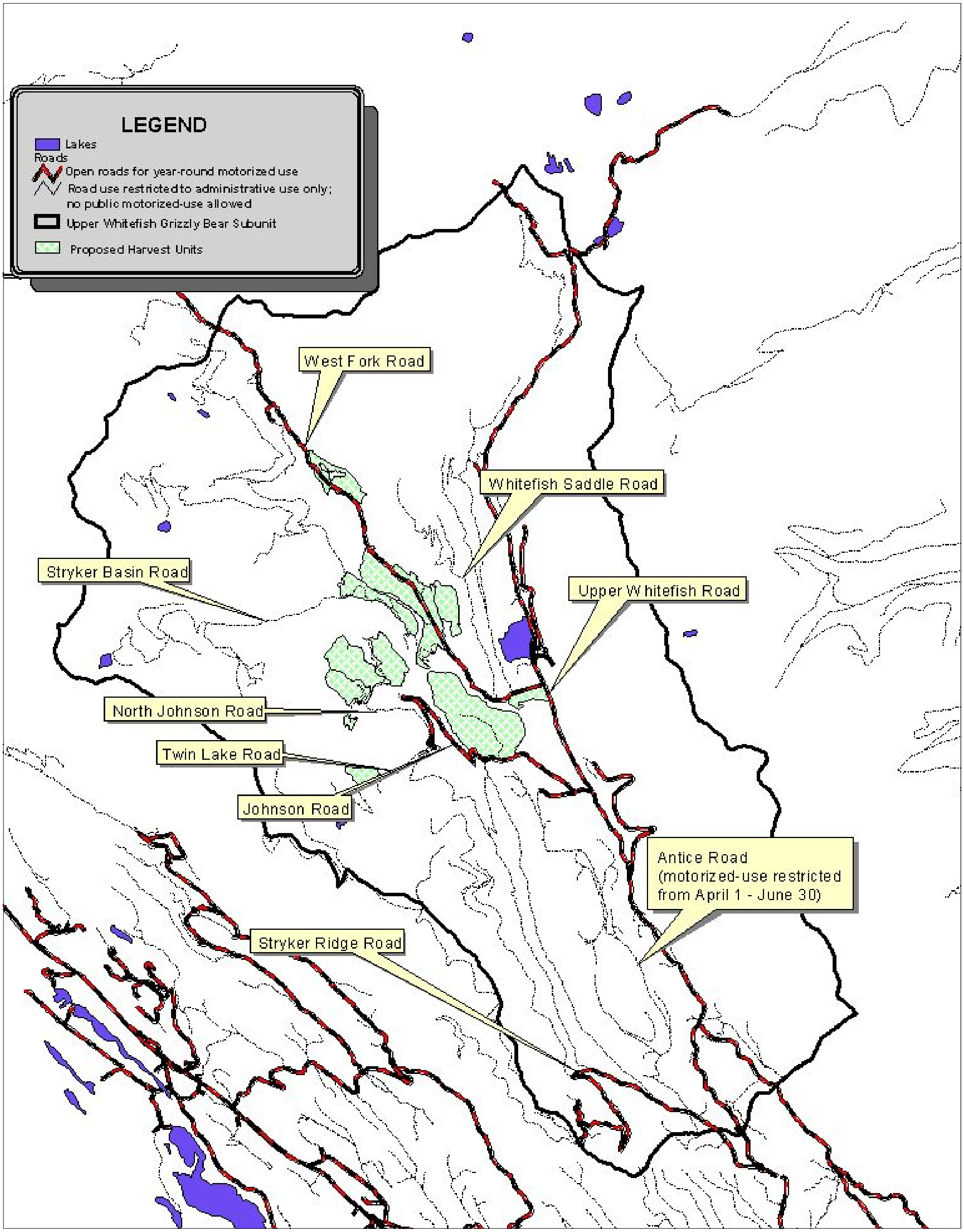


FIGURE III-6 - EXISTING ROADS AND ROAD MANAGEMENT IN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT

IRRETRIEVABLE AND IRREVERSIBLE COMMITMENTS OF NATURAL RESOURCES

IRRETRIEVABLE

A resource that has been irretrievably committed is lost for a period of time. Many timber stands in the project area are mature; some individual trees are more than 150 years old. Either timber-harvesting alternatives would cause live trees to be irretrievably lost; they would no longer contribute to future snag recruitment, stand structure and compositional diversity, aesthetics, wildlife habitat, the nutrient-recycling process, or any other important ecosystem functions.

Areas converted from timber production to permanent roads would be lost from timber production and would not function as forested lands for a period of time.

IRREVERSIBLE

An irreversible commitment of resources refers to the loss of production or use of a resource due to a land-use decision that, once executed, cannot be changed. A resource that has been irreversibly committed cannot be reversed or replaced. The initial loss of trees due to timber harvesting would not be irreversible. Natural regeneration combined with site preparation and artificial regeneration would promote the establishment of new trees. If management decisions allowed for the continued growth of established trees, they would ultimately become equivalent in size to the irretrievably harvested trees.

Timber harvesting would change plant succession, stand development, and species composition. The harvesting of old-growth timber would reduce the available old-growth habitat for an extended period of time (approximately 150 to 200 years) and would constitute an irreversible commitment of resources.

Areas that are initially lost to timber production through road construction could, over time, be reclaimed and once again produce timber and function as forested land. Temporary road construction, which is needed to access timber stands, is proposed under both action alternatives. Because these roads would be reclaimed after harvesting, only minor irreversible commitments of soil productivity would occur.

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REFERENCES

Ake, K. 1994. *Protocol paper: Moving window motorized access density analysis and security core area analysis for grizzly bear*. Unpubl. mimeo., 2/22/1995. Flathead National Forest, Kalispell, MT. 10pp.

Amaranthus, M. 1998. *The importance and conservation of ectomycorrhizal fungal diversity in forest ecosystems: Lessons from Europe and the Pacific Northwest*. USDA For. Serv. Gen. Tech. Rep. PNW-GTR-431. 15pp.

Aney, W. and R. McClelland. 1985. Pileated Woodpecker Habitat Relationships (revised). Pages 10-17 *in* Warren, N. eds. 1990. *Old Growth Habitats and Associated Wildlife Species in the Northern Rocky Mountains*. USFS, Northern Region, Wildlife Habitat Relationships Program R1-90-42. 47pp.

Bate, L and M. Wisdom. 200_. *Snag, Large Tree, and Log Resources in Relation to Roads and Other Indices of Human Access on the Flathead National Forest*.

Beschta, R., R. Bilby, G. Brown, L. Holtby and T. Hofstra. 1987. Stream temperature and aquatic habitat: fisheries and forestry interactions. *In*: Salo, E. and T. Cundy (eds.). Streamside management: forestry and fishery interactions. University of Washington, Institute of Forest Resources, Contribution No. 57. Seattle, WA.

Bilby, R.E. and P.A. Bisson. 1998. Function and distribution of large woody debris. *In* River Ecology and Management: Lessons from the Pacific Coastal Ecoregion. Springer, New York, NY.

Bower, J. 2004. Trends in Large Woody Debris (LWD) Recruitment to Stream Channels in Western Montana (Draft). Unpublished. Department of Natural Resources and Conservation, Missoula, MT.

Brown, G.W. and J.T Krygier. 1970. Effects of Clear-Cutting on Stream Temperature. Water Resources Research. 6(4):1133-1139.

Bull, E, T Torgersen, A Blumton, C McKenzie, and D Wyland. 1995. *Treatment of an old-growth stand and its effects on birds, ants, and large woody debris: a case study*. USDA For. Serv.. Gen. Tech. Rep. PNW-GTR-353. 12pp.

Castelle, A. and A. Johnson. 2000. Riparian Vegetation Effectiveness. National Council for Air and Stream Improvement, Technical Bulletin No. 799.

DNRC. 1996. State Forest Land Management Plan. Montana Department of Natural Resources and Conservation, Missoula, MT.

DNRC. 2000. Old Growth Management on Montana State Trust Lands. Montana Department of Natural Resources and Conservation, Missoula, MT.

Downs, C.C., R.G. White, B.B. Shepard. 1997. Age at Sexual Maturity, Sex Ratio, Fecundity, and Longevity of Isolated Headwater Populations of Westslope Cutthroat Trout. North American Journal of Fisheries Management. 17:85-92.

FBC (Flathead Basin Commission). 1991. Summary Report. Flathead Basin Forest Practices Water Quality and Fisheries Cooperative Program, Kalispell, MT.

Fisher, W.C., A.F. Bradley. 1987. Fire Ecology of Western Montana Forest Habitat Types. USFS Gen. Tech. Rept. INT-223

FishXing, ver 2.2. 1999. Six Rivers Watershed Interaction Team, USDA.

Fraley, J.J. and B.B. Shepard. 1989. Life History, Ecology and Population

Status of Migratory Bull Trout (*Salvelinus confluentus*) in the Flathead lake and River System, Montana. Northwest Science. 63(4):133-143.

Gamett, B. 2002. The Relationship Between Water Temperature and Bull Trout Distribution and Abundance. Master’s Thesis. Utah State University, Logan, UT.

Green, P., J. Joy, D Sirucek, W. Hann, A Zack, B. Naumann. 1992. Old-Growth Forest Types of the Northern Region. USDA Forest Service, Northern Region, Region 1, Missoula, Montana. 108pp.

Graham, Russell T.; Alan E. Harvey; Martin F. Jurgensen, Theresa B. Jain, Jonalea R. Tonn, and Deborah S. Page-Dumroese. 1994. Managing coarse woody debris in forests of the Rocky Mountains. Research Paper INT-RP-477. Moscow, ID: U.S. Department of Agriculture, Forest Service, Intermountain Research Station; 1994.

Hansen, P., R. Pfister, K. Boggs, B. Cook, J. Joy, D. Hinckley. 1995. Classification and Management of Montana’s Riparian and Wetland Sites. Miscellaneous Publication No. 54. The University of Montana, Montana Forest and Conservation Experiment Station, Missoula, MT.

Harrelson, C.C., C.L. Rawlins, J.P. Potyondy. 1994. Stream Channel Reference Sites: An Illustrated Guide to Field Technique. General Technical Report RM-245. U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.

Harris, R. 1999. *Abundance and characteristics of snags in western Montana Forests*. Gen. Tech. Rep. RMRS-GTR-31. Rocky Mountain Research Station, Missoula, MT. 19pp.

Heinemeyer, K.S. 1993. Temporal dynamics in the movements, habitat use, activity, and spacing of reintroduced fishers in northwest Montana. M.S. Thesis, Univ. Montana, Missoula, MT. 158pp.

Heinemeyer, unpubl. As cited *In* Heinemeyer, K and J. Jones. 1994. *Fisher biology and management in the western United States: A literature review and adaptive management strategy*. USDA For. Serv. Northern Region, Missoula, MT. 108pp.

Hillis, JM. 1993. *Lolo NF snag monitoring – Methodology, results, and longterm concerns with snag protection*. Presented at the Fish and Wildlife Congress.

IGBC. 1998. *Grizzly bear/motorized access management*. Interagency Grizzly Bear Committee. 6pp.

Johnson, S. 1984. Home range, movements, and habitat use of fishers in Wisconsin. M.S. Thesis, Univ. Wiscon, Stevens Point. 78pp.

Jones, J.L. 1991. Habitat use of fisher in northcentral Idaho. M.S. Thesis, Univ. Idaho, Moscow, ID. 147pp.

Kanda, N., R.F. Leary, F.W. Allendorf. 1997. Population Genetic Structure of Bull Trout in the Upper Flathead River Drainage. Friends of the Bull Trout Conference Proceedings, May 5-7, 1994, 299-308.

Keegan, Charles et al, 1995, Montana’s Forest Products Industry, A Descriptive Analysis, 1969-1994

Koehler, G.M. 1990. *Population and habitat characteristics of lynx and snowshoe hares in north central Washington*. Can. J. Zool. 68:845-851.

Koopal, M. 2001. West Fork Swift Creek R1/R4 Fish Habitat Inventory. Unpublished report prepared for Montana Department of Natural Resources and Conservation, Kalispell, MT.

Leary, R.F., F.W. Allendorf, K.L. Knudsen. 1983. Consistently High Meristic Counts in Natural Hybrids Between Brook Trout and Bull Trout.

Systematic Zoology. 32(4):369-376.

Losensky, J. 1997. Historical vegetation of Montana. Contract #970900. Montana DNRC. Missoula, MT. 109pp.

Mace, R., J. Waller, T. Manley, L. Lyon, H. Zuuring. 1997. *Relationships among grizzly bears, roads, and habitat in the Swan Mountains, Montana*. Pages 64-73 *In* Mace, R.D and J.S. Waller. 1997. Final Report: Grizzly bear ecology in the Swan Mountains. Montana Fish, Wildlife and Parks, 1920 6th Ave. East. P.O. Box 200701, Helena, MT 59620-0701.

Marten, P. 1979. Productivity and taxonomy of the *Vaccinium globulare, V. membranaceum* complex in Western Montana. M.S. Thesis. Univ. of Montana, Missoula. 136pp.

McNeil, W.J. and W.H. Ahnell. 1964. Success of Pink Salmon Spawning Relative to Size of Spawning Bed Materials. U.S. Fish and Wildlife Service. Special Scientific Report: Fisheries No. 469.

MFISH (Montana Fisheries Information System). 2004. Montana Fish, Wildlife and Parks, Montana Natural Resource Information System.

Montana Bald Eagle Working Group. 1991. Habitat management guide for bald eagles in Northwestern Montana.

Montana Bald Eagle Working Group. 1994. Montana Bald Eagle Management Plan. USDI Bureau of Land Management. Billings, MT. 61pp.

Montana Bull Trout Scientific Group. 1995. Flathead River drainage bull trout status report (including Flathead Lake, the North and Middle forks of the Flathead River, and the Stillwater and Whitefish Rivers.) Unpublished report prepared for the Montana Bull Trout Restoration Team. Montana Fish, Wildlife and Parks, Helena, MT.

Montana Bull Trout Scientific Group. 1998. The Relationship Between Land Management Activities and Habitat Requirements of Bull Trout. Unpublished report prepared for the Montana Bull Trout Restoration Team. Montana Fish, Wildlife and Parks, Helena, MT.

Montana Natural Heritage Program. 2003. Animal Species of Concern. Montana Natural Resource Information System.

Montgomery, D.R. and J.M. Buffington. 1997. Channel-Reach Morphology in Mountain Drainage Basins. GSA Bulletin. 109(5):596-611.

Mowat, G, K.G. Poole, and M. O'Donoghue. 2000. *Ecology of lynx in northern Canada and Alaska*. Chapter 9 in Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, et al., tech eds. Ecology and conservation of lynx in the United States. Univ. Press of Colorado. Boulder, CO. 480pp.

Murphy, M.L. and K.V. Koski. 1989. Input and Depletion of Woody Debris in Alaska Streams and Implications for Streamside Management. North American Journal of Fisheries Management. 9:427-636.

Nakano, S., K. Fausch, T. Furukawa-Tanaka, K. Maekawa, H. Kawanabe. 1992. Resource Utilization by Bull Trout and Cutthroat Trout in a Mountain Stream in Montana, U.S.A. Japanese Journal of Ichthyology. 39(3):211-217.

Paige, C. 1997. Upper Whitefish Lake Bald Eagle Territory site-specific management guidelines. Montana Department of Natural Resources and Conservation. Kalispell, MT. 58pp.

Parks, CG and DC Shaw. 1996. *Death and decay: A vital part of living canopies*. Northwest science. Vol 70, special issue: 46-53.

Pearson, D. 1999. *Small mammals of the Bitterroot National Forest: A literature review and annotated bibliography*. USDA For. Serv. Gen. Tech. Rep. RMRS-GTR-25.

Pfister, R., B. Kovalchik, S. Arno, and R. Presby. 1977. *Forest* *habitat types of Montana*. USDA For. Serv. Gen. Tech. Rep. INT-34. Intermountain For. and Range Exp. Sta. Ogden, UT. 174pp.

Powell, R. 1982. The fisher: National history, ecology, and behavoiur. Univ. Minn. Press, Minneapolis. 217pp.

Pratt, K. 1984. Habitat Use and Species Interactions of Juvenile Cutthroat (*Salmo clarki lewisi*) and Bull Trout (*Salvelinus confluentus*) in the Upper Flathead River Basin. Master's Thesis, University of Idaho, Moscow, ID.

Overton, C.K., S.P. Wollrab, B.C. Roberts, M.A. Radko. 1997. R1/R4 (Northern/Intermountain Regions) Fish and Fish Habitat Standard Inventory Procedures Handbook. General Technical Report INT-GTR-346. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, UT.

Rieman, B.E. and G.L. Chandler. 1999. Empirical Evaluation of Temperature Effects on Bull Trout Distribution in the Northwest. Final Report to U.S. Environmental Protection Agency, Boise, ID.

Rieman, B.E. and J.D. McIntyre. 1993. Demographic and Habitat Requirements for Conservation of Bull Trout. General Technical Report INT-302. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, UT.

Rieman, B.E. and D.L. Myers. 1997. Use of Redd Counts to Detect Trends in Bull Trout (*Salvelinus confluentus*) Populations. Conservation Biology. 11(4):1015-1018.

Robinson, E.G. and R.L. Beschta. 1990. Identifying Trees in Riparian Areas That Can Provide Coarse Woody Debris to Streams. Forest Science. 36(3):790-800.

Rosgen, D. 1996. *Applied River Morphology.* Printed Media Companies. Minneapolis, MN.

Roy, K. 1991. Ecology of reintroduced fishers in the Cabinet Mountains of Northwest Montana. M.S. Thesis, Univ. Mont., Missoula. 94pp.

Ruediger, B, J Claar, Sl Mighton, B. Nanaey, T. Tinaldi, F. Wahl, N. Warren, D. Wenger, A. Williamson, L. Lewis, B. Holt, G. Patton, J. Trick, A. Vandehey, S. Gniadek. 2000. Canada lynx conservation assessment and strategy (2nd edition). USDA For. Serv., USDI Fish and Wildlife Serv., USDI Bureau of Land Management, and USDI National Park Serv. Missoula, MT. 122pp.

Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, et al (Tech. Eds). 2000. Ecology and conservation of lynx in the United States. Univ. Press of CO, Boulder, CO. 480pp.

Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, et al. 2000a. *The scientific basis for lynx conservation: Qualified insights*. Chapter 16 *In* Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, et al (Tech. Eds). 2000. Ecology and conservation of lynx in the United States. Univ. Press of CO, Boulder, CO. 480pp.

Shepard, B.B., K.L. Pratt, P.J. Graham. 1984. Life Histories of Westslope Cutthroat and Bull Trout in the Upper Flathead River Basin, Montana. Montana Fish, Wildlife and Parks, Kalispell, MT.

Streamside Management Rules. 1996. Montana Code Annotated 36.11.311 – 36.11.312

Sugden, B.D. and R.L. Steiner. 2003. Effects of Current and Historic Forest Practices on Stream Temperature. *In* Proceedings of the 8-12 November 2003 Conference on Total Maximum Daily Load (TMDL) Environmental Regulations – II. *Ed.* A Saleh. ASAE Publication Number 701P1503:198-203.

Sylte, T. and C. Fishenich. 2002. Techniques for Measuring Substrate Embeddedness. EMRRP Technical Note:

ERDC TN-EMRRP-SR-36, U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Thomas, J., K. Sutherland, B. Kuntz, S. Potts. 1990. Montana Nonpoint Source Management Plan. Montana Department of Health and Environmental Sciences, Water Quality Bureau, Helena, MT.

Torgersen, T. 1994. *Natural enemies in forest insect regulation*. Pages 108-111 *in* Pilarski, M (ed). Restoration Forestry: An international guide to sustainable forestry practices. Kivaki Press.

USFWS 1987. Northern Rocky Mountain wolf recovery plan. USFWS, Denver, CO. 119pp.

USFWS. 1986. Recovery plan for the Pacific bald eagle. USFWS. Portland, OR. 160pp.

USFWS. 1993. Grizzly bear recovery plan. Missoula, MT. 181pp.

USFWS. 1999. Rocky Mountain wolf recovery: 1999 annual report. USFWS. Helena, MT. 22pp

USFWS (U.S. Fish and Wildlife Service). 2002a. Endangered and Threatened Wildlife and Plants; Proposed Designation of Critical Habitat for the Klamath River and Columbia River Distinct Population Segments of Bull Trout. U.S. Fish and Wildlife Service, Portland, OR.

USFWS (U.S. Fish and Wildlife Service). 2002b. Bull Trout (*Salvelinus confluentus*) Draft Recovery Plan, Chapter 3, Clark Fork River Recovery Unit, Montana, Idaho, and Washington. U.S. Fish and Wildlife Service, Portland, OR.

Weaver, T. and J. Fraley. 1991. Fisheries Habitat and Fish Populations. Flathead Basin Commission, Flathead Basin Forest Practices Water Quality and Fisheries Cooperative Program, Kalispell, MT.

Weaver, T.M. and J.J. Fraley. 1993. A Method to Measure Emergence Success of Westslope Cutthroat Trout Fry from Varying Substrate Compositions in a Natural Stream Channel. North American Journal of Fisheries Management. 13:817-822.

Wolman, M.G. 1954. A Method of Sampling Coarse River-Bed Material. Transaction American Geophysical Union. 35(6):951-956.

Wright, M. and R.Escano. 1986. Montana bald eagle nesting habitat: a macro-habitat description. USDA For. Serv. Wildlife and Fish Habitat Relationships Program. Missoula, MT. 24pp.

Zager, P. 1980. The influence of logging and wildfire on grizzly bear habitat in Northwestern. PhD. Thesis. Univ. of Montana, Missoula. 130pp.

GLOSSARY

Administrative road use
Road use that is restricted to DNRC personnel and contractors or for purposes such as monitoring, forest improvement, fire control, hazard reduction, etc.

Airshed
An area defined by a certain set of air conditions; typically, a mountain valley in which air movement is constrained by natural conditions such as topography.

Alevins
Juvenile fish in the developmental stage, where the egg yolk sac is still attached.

Appropriate conditions
Describes the set of forest conditions determined by DNRC to best meet the SFLMP objectives. The 4 main components useful for describing an appropriate mix of conditions are covertype proportions, age-class distributions, stand-structural characteristics, and the spatial relationships of stands (size, shape, location, etc.), all assessed across the landscape.

Bald eagle primary-use area
An area where it is assumed that 75 percent of the foraging, resting, and associated behaviors occur.

Basal area
A measure of the number of square feet of space occupied by the stem of a tree.

Bedload aggredation
Stream sediment consisting of sand, gravel, cobbles, and small boulders is termed bedload. Bedload aggredation is the accumulation of bedload sediment in a particular location.

Benthic
Bottom dwelling.

Best Management Practices (BMPs)
Guidelines to direct forest activities, such as logging and road construction, for the protection of soils and water quality.

Biodiversity
The variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.

Board foot
144 cubic inches of wood that is equivalent to a piece of lumber 1 inch thick by 1 foot wide by 1 foot long.

Canopy
The upper level of a forest consisting of branches and leaves of the taller trees.

Canopy closure
The percentage of a given area covered by the crowns, or canopies, of trees.

Cavity
A hollow excavated in trees by birds or other animals. Cavities are used for roosting and reproduction by many birds and mammals.

Coarse down woody material
Dead trees within a forest stand that have fallen and begun decomposing on the forest floor.

Compaction
Increased soil density caused by force exerted at the soil surface, modifying aeration and nutrient availability.

Connectivity
The quality, extent, or state of being joined; unity; the opposite of fragmentation.

Cover
See *Hiding cover* and/or *Thermal cover.*

Co-dominant tree
A tree that extends its crown into the canopy, receiving direct sunlight from above and limited sunlight on its sides. One or more sides are crowded by the crowns of other trees.

Crown cover or crown closure
The percentage of a given area covered by the crowns of trees.

Cull
A tree of such poor quality that it has no merchantable value in terms of the product being cut.

Cutting units
Areas of timber proposed for harvesting.

Cumulative effect
The impact on the environment that results from the incremental impact of the action when added to other actions. Cumulative impacts can also result from individually minor actions, but collectively they may compound the effect of the actions.

Desired future conditions
See 'Appropriate conditions'.

Direct effect
Effects on the environment that occur at the same time and place as the initial cause or action.

Ditch relief
A method of draining water from roads using ditches and corrugated metal pipe. The pipe is placed just under the surface of the road.

Dominant tree
Those trees within a forest stand that extend their crowns above surrounding trees and capture sunlight from above and around the crown.

Drain dip
A graded depression built into a road to divert water and prevent soil erosion.

Ecosystem
An interacting system of living organisms and the land and water that make up their environment; the home place of all living things, including humans.

Environmental effects
The impacts or effects of a project on the natural and human environment.

Equivalent clearcut acres (ECA)
This method equates the area harvested and the percent of crown removed with an equivalent amount of clearcut area.

Allowable ECA - The estimated number of acres that can be clearcut before stream channel stability is affected.

Existing ECA - The number of acres that have been previously harvested, taking into account the degree of hydrologic recovery that has occurred due to revegetation.

Remaining ECA - The calculated amount of harvesting that may occur without substantially increasing the risk of causing detrimental effects to the stability of the stream channel.

Excavator piling
The piling of logging residue using an excavator.

Fire regimes
Describes the frequency, type, and severity of wildfires. Examples include: frequent nonlethal underburns; mixed-severity fires; and stand-replacement or lethal burns.

Fledge
To rear until ready for flight or independent activity.

Forage
All browse and nonwoody plants available to wildlife for grazing.

Forest improvement
The establishment and growing of trees after a site has been harvested. Associated activities include:
– site preparation,
– planting,
– survival checks,
– regeneration surveys, and
– stand thinnings.

Fragmentation (forest)
A reduction of connectivity and an increase in sharp stand edges resulting when large contiguous areas of forest with similar age and structural character are interrupted through disturbance (stand-replacement fire, timber harvesting, etc.)

Geomorphical
A term referring to the shape of the earth or its topography.

Habitat
The place where a plant or animal naturally or normally lives and grows.

Habitat type
The place or type of site where a plant or animal naturally or normally lives and grows.

Hazard reduction
The reduction of fire hazard by processing logging residue with methods such as separation, removal, scattering, lopping, crushing, piling and burning, broadcast burning, burying, and chipping.

HEX-RAS
A computer software package used to model stream flows.

Hiding cover
Vegetation capable of hiding some specified portion of a standing adult mammal from human view at a distance of 200 feet.

Historical forest condition
The condition of the forest prior to settlement by Europeans.

Indirect Effects
Secondary effects that occur in locations other than the initial action or significantly later in time.

Interdisciplinary team (ID Team)
A team of resource specialists brought together to analyze the effects of a project on the environment.

Intermediate trees
A characteristic of certain tree species that allows them to survive in relatively low light conditions, although they may not thrive.

Interstitial
The spaces between the rocks that make up a stream’s substrate.

Introgression
The successive gene transfer/flow between hybridized individuals of a population and those individuals that are ‘genetically pure’ (or of some other level of genetic purity).

Landscape
An area of land with interacting ecosystems.

Macroinvertebrates
Aquatic insects.

Meter
A measurement equaling 39.37 inches.

Mitigation measure
An action or policy designed to reduce or prevent detrimental effects.

Morphology
The general shape of the stream.

Multistoried stands
Timber stands with 3 or more distinct stories.

Nest-site area (bald eagle)
The area in which human activity or development may stimulate abandonment of the breeding area, affect successful completion of the nesting cycle, or reduce productivity. This area is either mapped for a specific nest based on field data, or, if that is impossible, is defined as the area within a quarter-mile radius of all nest sites in the breeding area that have been active within 5 years.

No-action alternative
The option of maintaining the status quo and continuing present management activities; the proposed project would not be implemented.

Nonforested area
A naturally occurring area where trees do not establish over the long term, such as bogs, natural meadows, avalanche chutes, and alpine areas.

Old growth
For this analysis, old growth is defined as stands that meet the minimum criteria (number of trees per acre that have a minimum dbh and a minimum age) for a given site (old-growth group from habitat type). These minimums can be found in the *Green et al Old Growth Forest Types of the Northern Region* (see *REFERENCES).*

Overstory
The level of the forest canopy including the crowns of dominant, codominant, and intermediate trees.

Patch
A discrete area of forest connected to other discrete forest areas by relatively narrow corridors; an ecosystem element (such as vegetation) that is relatively homogeneous internally, but differs from what surrounds it.

Periphyton
Single-celled algae.

Permeability
The ease or rate that water passes through a layer or object.

Porosity
The quality or state of having holes through which fluid or air may pass.

Potential nesting habitat (bald eagle)
Sometimes referred to as 'suitable nesting habitat,' areas that have no history of occupancy by breeding bald eagles, but contain the potential to do so.

Project file
A public record of the analysis process, including all documents that form the basis for the project analysis. The project file for the West Fork of Swift Creek Timber Sale EIS is located at the Stillwater State Forest office near Olney, Montana.

Redds
The spawning ground or nest of various fish species.

Regeneration
The replacement of one forest stand by another as a result of natural seeding, sprouting, planting, or other methods.

Residual stand
Trees that remain standing following any harvesting operation.

Road-construction activities
In general, the term 'road construction activities' refers to all the activities conducted while building new roads, reconstructing existing roads, and obliterating roads. The activities may include any or all of the following:

- road construction;
- right-of-way clearing;
- excavation of cut/fill material;
- installation of road surface and ditch drainage features;
- installation of culverts at stream crossings;
- burning right-of-way slash;
- hauling and installation of borrow material; and
- blading and shaping road surfaces.

Road improvements
Construction projects on an existing road to improve ease of travel, safety, drainage, and water quality.

Salmonids
Member of the trout family.

Saplings
Trees 1 to 4 inches in diameter at breast height.

Sawtimber trees
Trees with a minimum dbh of 9 inches.

Scarification
The mechanized gouging and ripping of surface vegetation and litter to expose mineral soil and enhance the establishment of natural regeneration.

Scoping
The process of determining the extent of the environmental assessment task. Scoping includes public involvement to learn which issues and concerns should be addressed and the depth of assessment that will be required. It also includes a review of other factors, such as laws, policies, actions by other landowners, and jurisdictions of other agencies that may affect the extent of assessment needed.

Security
For wild animals, the freedom from the likelihood of displacement or mortality due to human disturbance or confrontation.

Seedlings
Live trees less that 1 inch dbh.

Sediment
In bodies of water, solid material, mineral or organic, that is suspended and transported or deposited.

Sediment yield
The amount of sediment that is carried to streams.

Seral
Refers to a biotic community that is in a developmental, transitional stage in ecological succession.

Shade intolerant
Describes the tree species that generally can only reproduce and grow in the open or where the overstory is broken and allows sufficient sunlight to penetrate. Often these are seral species that get replaced by more shade-tolerant species during succession. In Stillwater State Forest, shade-intolerant species generally include ponderosa pine, western larch, Douglas-fir, western white pine, and lodgepole pine.

Shade tolerant
Describes tree species that can reproduce and grow under the canopy in poor sunlight conditions. These species replace less shade-tolerant species during succession. In Stillwater State Forest, shade-tolerant species generally include subalpine fir, grand fir, Engelmann spruce, and western red cedar.

Siltation
The process of very fine particles of soil (silt) settling. This may occur in streams or from runoff. An example would be the silt build-up left after a puddle evaporates.

Silviculture
The art and science of managing the establishment, composition, and growth of forests to accomplish specific objectives.

Sinuosity
A measure of meander within a stream.

Site preparation
A hand or mechanized manipulation of a harvested site to enhance the success of regeneration. Treatments are intended to modify the soil, litter, and vegetation to create microclimate conditions conducive to the establishment and growth of desired species.

Slash
Branches, tree tops, and cull trees left on the ground following a harvest.

Snag
A standing dead tree or the portion of a broken-off tree. Snags may provide feeding and/or nesting sites for wildlife.

Snow intercept
The action of trees and other plants in catching falling snow and preventing it from reaching the ground.

Spur roads
Low-standard roads constructed to meet minimum requirements for harvest-related traffic.

Stand
An aggregation of trees occupying a specific area and sufficiently uniform in composition, age arrangement, and condition so as to

be distinguishable from the adjoining forest.

Stand density
Number of trees per acre.

Stocking
The degree of occupancy of land by trees as measured by basal area or number of trees, and as compared to a stocking standard, which is an estimate of either the basal area or the number of trees per acre required to fully use the growth potential of the land.

Stream gradient
The slope of a stream along its course, usually expressed in percentage indicating the amount of drop per 100 feet.

Stumpage
The value of standing trees in the forest; sometimes used to mean the commercial value of standing trees.

Substrate scoring
Rating of streambed particle sizes.

Succession
The natural series of replacement of one plant (and animal) community by another over time in the absence of disturbance.

Suppressed
The condition of a tree characterized by a low growth rate and low vigor due to competition.

Temporary road
Roads built to the minimal standards necessary to prevent impacts to water quality and provide a safe and efficient route to remove logs from the timber sale area. Following logging operations or site preparations, reclamation would incorporate the following concepts to discourage future motorized use of the roads:

– Segments near the beginning of the new temporary road systems would be reshaped to their natural contours and reclaimed for approximately 200 feet by grass seeding and strewing slash and debris.
– The reclamation of the remaining road would include a combination of ripping or mechanically loosening the surface soils on the road, removing culverts or bridges that were installed, spreading forest debris along portions of the road, and allowing the surface to revegetate naturally.

Territoriality
The behavioral pattern exhibited by an animal defending its territory.

Texture
A term used in visual assessments indicating distinctive or identifying features of the landscape depending on distance.

Thermal cover
For white-tailed deer, thermal cover has 70 percent or more coniferous canopy closure at least 20 feet above the ground, generally requiring trees to be 40 feet or taller.

For elk and mule deer, thermal cover has 50 percent or more coniferous canopy closure at least 20 feet above the ground, generally requiring trees to be 40 feet or taller.

Timber-harvesting activities
In general, the term timber-harvesting activities refers to all the activities conducted to facilitate timber removal before, during, and after the timber is removed. These activities may include any or all of the following:

– felling and bucking standing trees into logs;
– skidding logs to a landing;
– processing, sorting, and loading logs onto trucks at the landing;
– hauling logs by truck to a mill;
– slashing and sanitizing residual vegetation damaged during logging;
– machine piling logging slash;
– burning logging slash;
– scarifying and preparing the site for planting; and
– planting trees.

Understory
The trees and other woody species growing under a, more or less, continuous cover of branches and foliage formed collectively by the overstory of adjacent trees and other woody growth.

Uneven-aged stand
Various ages and sizes of trees growing together on a uniform site.

Ungulates
Hoofed animals, such as mule deer, white-tailed deer, elk, and moose, that are mostly herbivorous; many are horned or antlered.

Vigor
The degree of health and growth of a tree or stand of trees.

Watershed
The region or area drained by a river or other body of water.

Water yield
The average annual runoff for a particular watershed expressed in acre-feet.

Water-yield increase
Due to forest canopy removal, an increase in the average annual runoff over natural conditions.

Windthrow
A tree pushed over by wind. Windthrows (blowdowns) are common among shallow-rooted species and in areas where cutting or natural disturbances have reduced the density of a stand so individual trees remain unprotected from the force of the wind.

Win XSPRO
A computer software package used to model stream flows.

ACRONYMS

ARM	Administrative Rules of Montana
BMP	Best Management Practices
cmp	corrugated metal pipe
CS	Common Schools (trust)
dbh	diameter at breast height
DEQ	Department of Environmental Quality
DFWP	Department of Fish, Wildlife and Parks
DNRC	Department of Natural Resources and Conservation
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
ECA	Equivalent Clearcut Acres
EIS	Environmental Impact Statement
EPA	Environmental Protection Act
FEIS	Final Environmental Impact Statement
FI	Forest Improvement
FNF	Flathead National Forest
IGBC	Interagency Grizzly Bear Committee
mbf	thousand board feet
MCA	Montana Codes Annotated
MEPA	Montana Environmental Protection Agency
mmbf	million board feet
MNHP	Montana Natural Heritage Program
NCDE	Northern Continental Divide Ecosystem
NWLO	Northwestern Land Office
RMZ	Riparian Management Zone
SFLMP	State Forest Land Management Plan
SLI	Stand Level Inventory
SMZ	Streamside Management Zone
TLMS	Trust Land Management System
TMDL	Total Maximum Daily Load
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service

ID Team	Interdisciplinary Team
Land Board	Montana Board of Land Commissioners
124 Permit	Stream protection Act Permit
3A Permit	Authorization A — Short-term Exemption from Montana’s Surface Water-Quality Standards
SFLM Rules	State Forest Land Management Rules

Copies of this document with its appendices were published at an approximate cost of $11.21 per copy for printing and $3.95 per copy for mailing.

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West Fork of Swift Creek Timber Sale Project

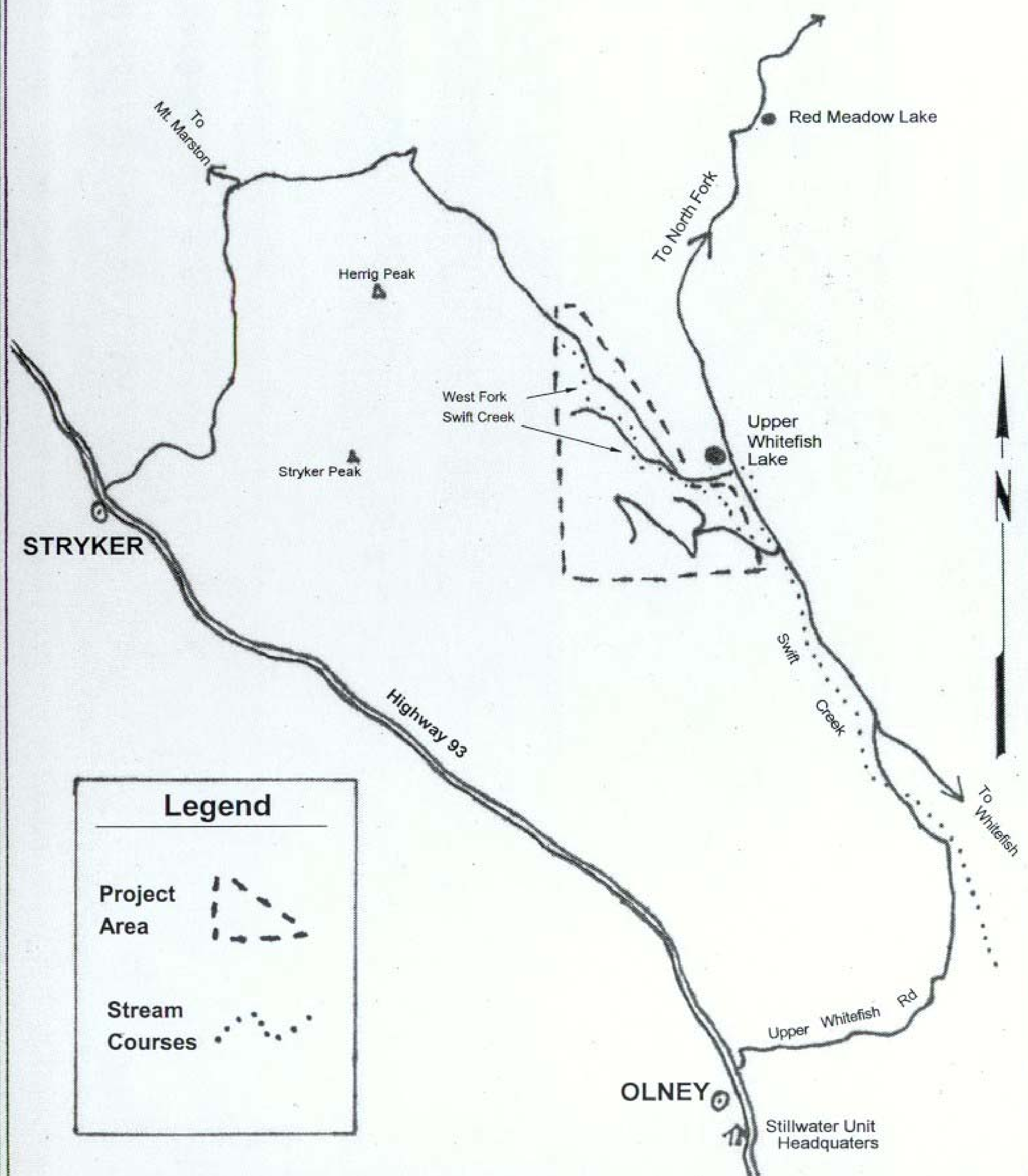
Final Environmental Impact Statement

Resource Appendices

January 2005

Department of Natural Resources and Conservation

Vicinity Map for the West Fork Timber Sale Proposal



APPENDIX RESOURCES

TABLE OF CONTENTS

APPENDIX A
STIPULATIONS AND SPECIFICATIONS

Stipulations and specifications for the action alternatives were identified or designed to prevent or reduce potential effects to resources considered in this analysis. In part, stipulations and specifications are a direct result of issue identification and resource concerns. This section is organized by resource.

Stipulations and specifications that apply to operations required by and occurring during the contract period would be contained within the timber sale contract; as such, they are binding and enforceable. Stipulations and specifications relating to activities that may occur during or after the contract period (hazard reduction, site preparation, planting) would be enforced by project administrators.

The following stipulations and specifications are incorporated to mitigate effects on resources involved with action alternatives considered in this proposal.

WATERSHED AND FISHERIES

- Planned erosion-control measures and BMPs include:
  - installing grade breaks on roads,
  - installing water-diverting mechanisms on roads,
  - installing slash-filter windrows, and
  - grass seeding.

  Details for these control measures would be included in *APPENDIX B* of the *TIMBER SALE AGREEMENT.*
- SMZs and RMZs would be defined along those streams that are within or adjacent to timber-harvesting areas. Harvesting operations would be a minimum of 100 feet from the West Fork and Stryker Creek to protect areas adjacent to streams and maintain water quality.
- Culvert sizing for all road projects would be as recommended by the DNRC hydrologist for a 50-year flood period.
- Stream crossings, where culvert or bridge removals and installations are planned, would have the following requirements, as needed, to meet the intent of water-quality permits and BMPs and protect water quality:
  - Slash-filter windrows would be constructed on the base of the fill slopes.
  - Silt fences would be installed along the streambanks prior to and following excavation at crossing sites.
  - Filter-fabric fences would be in place downstream prior to and during culvert installation.
  - Bridge work within the stream area of the West Fork stream crossing would be limited to the period of July 15 through August 20 in order to avoid the bull trout spawning period.
- Water-quality monitoring would continue in the Swift Creek and Fitzsimmons drainages to assess and track water quality and resource values associated with water quality. In addition, the monitoring would provide data for water-quality studies being conducted in the Flathead Basin.
- Brush would be removed from existing road prisms to allow effective maintenance. Improved road maintenance would reduce sediment delivery.

- The contractor would be responsible for the immediate cleanup of any spills (fuel, oil, dirt, etc.) that may affect water quality.
- Leaking equipment would not be permitted to operate in stream-crossing construction sites.
- Included in the project proposal are the following pertinent recommendations of the *Flathead Basin Forest Practices, Water Quality, Fisheries Cooperative Program Final Report (June 1991)*.
- The following numbers correspond to the numbering of recommendation items contained within the aforementioned document, included in pages 154 through 162 of the final report:

1. BMPs are incorporated into the project design and operations of the proposed project.
2. Riparian indicators would be considered in the harvest unit layout.
3. Management standards of the SMZ Law (*75-5-301 MCA*) are used in conjunction with the recommendations of the study.
4. The BMP audit process will continue. This sale would likely be reviewed in an internal audit and may be picked at random as a State-wide audit site.
7. SMZs will be evaluated as a part of the audit process.
11. Swift Creek monitoring is part of the Flathead Basin monitoring effort.
12. Watershed-level planning and analysis are complete. Logging plans of Plum Creek Timber Company, USFS, and Stoltze Land and Lumber Company, as reported to the Cumulative Watershed Effects Cooperative, are used.
14. DNRC is cooperating with DFWP on a further study of the fish habitat and population for Swift Creek and its tributaries.
15. DNRC would use the best methods available for logging and road building for this proposal.

16A. Existing roads are fully utilized for this proposal.

17. DNRC requested inventory information from DFWP. DNRC’s mitigation plan for roads fits all recommendations for “impaired streams”. Using “worst-case scenario” criteria provides for conservative operations in this proposal.
18. Provisions in the Timber Sale Agreement address BMPs that are rigidly enforced.
20. Planning for long-term monitoring of Swift Creek is in place.

29-34. DNRC has cooperated with DFWP to continue fisheries work. DNRC will continue to monitor fisheries in the future as funding allows.

WILDLIFE

GRIZZLY BEARS

The following items are incorporated into this proposal:

- The grass seeding plans to revegetate roads include a combination of seed mixtures that have different palatability in relation to grizzly bears. The less palatable species are planned for areas where bear use is to be discouraged to minimize the potential for bear/human conflicts.
- No logging camps would be allowed in the sale area.
- Garbage hauling would be required daily.

- The Forest Officer would, if necessary, immediately suspend any or all activities directly related to the proposed action to prevent imminent confrontation or conflict between grizzly bears (or other threatened or endangered species) and humans.
- Vigorous patches of Vaccinium sp. (huckleberry) would be avoided during scarification when possible.
- Contractors would be prohibited from carrying firearms while working under contract.
- All gates would be closed after each entry during the general big game hunting season.
- Road management would vary by alternative and includes proposals given in *CHAPTER II – ALTERNATIVES*.
- A vegetative screen would be retained along open roads.

WOLVES

A contract provision would be included to protect any wolf den or rendezvous site within the gross sale area that may be discovered during implementation of this proposal.

CANADA LYNX

During site preparation, available cull logs would be piled to provide future habitat.

SNAG RETENTION

- Wildlife trees of high quality, such as large broken-topped western larch, would be designated for retention and given special consideration during yarding operations to prevent loss.
- Snag retention and recruitment: All cull snags that are safe to operate near and a minimum of 1 to 2 of the larger trees per acre, preferably greater than 21 inches dbh, would be retained. The number of trees and snags larger than 21 inches dbh is dependent on habitat group.

BALD EAGLE

- Timing restrictions would be implemented on the Whitefish Saddle Road; log hauling is restricted to August 15 through February 1.
- Timing restrictions would be implemented for logging operations in Harvest Area II-A, with logging restricted to the period between August 15 through February 1.

ROADS

- Road reconstruction activities and road use associated with road construction activities would be relayed to the general public.
- BMPs would be incorporated in all planned road construction.

AESTHETICS

- Damaged residual vegetation would be slashed.
- Landings would be limited in size and number and located away from main roads when possible.
- Disturbed sites along road rights-of-way would be grass seeded.

AIR QUALITY

The first item is designed to prevent individual or cumulative effects during burning operations. The next 3 items are designed to reduce effects from burning operations.

- Burning operations would be in compliance with the Montana Airshed Group reporting regulations and any burning restrictions imposed in Airshed 2. This would provide for burning during acceptable ventilation and dispersion conditions.
- Excavator, landing, and roadwork debris would be piled clean to allow ignition to occur during fall and spring when ventilation is good and surrounding fuels are wet. The Forest Officer may

require that piles be covered to reduce dispersed (unentrained) smoke. Covered piles are drier, ignite easier, burn hotter, and extinguish sooner.

- In order to reduce smoke production, the number of burn piles would be minimized by leaving large woody debris on site.
- Dust abatement may be applied on some of the segments of Upper Whitefish Road that would be used during hauling; whether dust abatement would be applied depends on the season of harvest and level of public traffic.

SOILS

COMPACTION

- Logging equipment would not operate off forest roads unless:
  - soil moisture is less than 20 percent,
  - soil is frozen to a depth that would support machine operations, or
  - soil is snow covered to a depth that would prevent compaction, rutting, or displacement.
- Existing skid trails and landings would be used where their design is consistent with prescribed treatments and meets current BMP guidelines.
- Designated skid trails would be required where moist soils or short steep pitches (less than 300 feet) would not be accessed by other logging systems. This would reduce the number of skid trails and the potential for erosion.
- Skid-trail density in a harvest area would not exceed 20 percent of the total area in a cutting unit.

SOIL DISPLACEMENT

- Conventional ground-based skidding equipment would not be operated on sustained steep slopes (greater than 40 percent). Soft-tracked yarders are suitable on slopes up to 55 percent with less impact than conventional tractor skidding. Cable yarding would be used on sustained steeper slopes.
- Piling and scarification would be completed with a dozer where slopes are gentle enough to permit. Steeper slopes would have slash treatment and site preparation done by using an excavator or broadcast burning.

EROSION

- Ground skidding machinery would be required to be equipped with a winchline to limit equipment operation on steeper slopes.
- Roads used by the purchaser would be reshaped and the ditches redefined prior to and following use to reduce surface erosion.
- Drain dips, open-topped culverts, and gravel would be installed on roads as needed to improve road drainage and reduce maintenance needs and erosion.
- Some road sections would be repaired to upgrade the roads to design standards that reduce erosion potential and maintenance needs.
- The prompt and timely application of certified weed-free grass seed and fertilizer would be applied to newly constructed road surfaces and cut-and-fill slopes. These applications would also be applied to any existing disturbed cut-and-fill slopes and landings immediately adjacent to open roads. These would be done to stabilize soils and reduce or prevent noxious weed establishment and would include:
  - seeding all road cuts and fills concurrent with construction,
  - applying “quick-cover” seed mix within 1 day of work completion at culvert installation sites, and
  - seeding all road surfaces and reseeding culvert installation

sites when the final blading is completed for each specified road segment.

- Water bars, logging-slash barriers, and, in some cases, temporary culverts would be installed on skid trails where erosion is anticipated, based on ground and weather conditions and as directed by the forest officer. These erosion-control features would be periodically inspected and maintained throughout the contract period or extensions thereof.

NOXIOUS WEED MANAGEMENT

- Surface blading on roads affected by the proposal may be required to remove weeds before the seed-set stage.
- All tracked and wheeled equipment would be cleaned of noxious weeds prior to beginning project operations. The contract administrating officer would inspect equipment periodically during project implementation.
- Prompt revegetation of disturbed roadside sites would be required.
- Roads used and closed as part of this proposal would be reshaped and grass seeded.

ARCHAEOLOGY

A review of the project was conducted by a DNRC archaeologist. A contract clause provides for suspending operations if cultural resources were discovered and operations would only resume as directed by the Forest Officer.

APPENDIX B
VEGETATION ANALYSIS

INTRODUCTION

This section will provide a description of the present vegetative conditions of the forest and address the potential effects of the proposed alternatives related to the following issues:

- Covertype and age-class distributions through a landscape-level analysis of timber stands.
- Old-growth-stand distribution at a landscape level and old-growth-stand attributes.
- Stand development in relation to natural disturbances and management activities.

ANALYSIS METHOD

The SFLM Rules direct DNRC to take a landscape-level or coarse-filter approach to biodiversity. To promote biodiversity, an appropriate mix of stand structures and compositions on State land should be favored (*Montana DNRC 1996*). To implement a coarse-filter approach, landscape analysis techniques were used to determine an appropriate mix of stand structures and compositions based on ecological characteristics, such as landtypes, climatic sections, habitat types, disturbance regimes, and other unique characteristics, on Stillwater State Forest. Covertype representations and age-class distributions are general characteristics shown in the landscape-level analysis.

This analysis will compare the desired stand conditions that DNRC believes to be appropriate for the site with current stand conditions. A forest inventory from the 1930s was used in *Losensky's 1993* data to estimate the proportion of various stand-structure stages by covertype and age class as they were historically represented throughout the Inland Northwest. This provides an estimate of the natural characteristics of forests prior to fire suppression and extensive logging. *Losensky (1997)* worked with DNRC to complete an analysis for the entire State; some vegetation types specific to that work are included in this analysis.

The protocol used to assign covertypes on DNRC forested lands, including Stillwater Unit, is explained in detail in the SFLM Rules (*ARM 36.11.405*). The SLI database used for this analysis is the September 15, 2003 version of "main block and scattered north.dbf" (*STW 2003 SLI data*). This data is available at the Stillwater Unit office at Olney. The methodology used to analyze current and appropriate stand conditions follows:

Two filters were developed and applied to Stillwater State Forest's SLI data (*STW 2003 SLI*). The filters were assigned covertypes similar to those used in the inventory of the 1930s. The first filter followed the 1930s criteria exactly, or as closely as possible, representing current conditions. The other filter for appropriate conditions assigns covertypes using criteria primarily designed to help address the situation where succession from one covertype to another was occurring. The successional filter was developed to indicate that those areas in the absence of fire suppression, introduced pathogens, and timber harvesting would likely have been assigned to a different covertype than the current covertype filter would suggest. The appropriate filter then estimates, from the current condition of the stand, what the stand would have looked like in

1900.

The methods to identify old-growth timber stands are initiated from modeling based on the STW 2003 SLI data. The query primarily sorts for stands that meet the age criteria and number of trees greater than a certain dbh based on habitat-type groups; refer to the *GLOSSARY* for DNRC's old-growth definition. Field surveys were used to verify those modeled old-growth stands and determine if additional stands meet the definition within the project area.

The analysis on stand development will be a qualitative discussion of the conditions of timber stands, including how various natural and man-caused disturbances and site factors have affected, and may continue to affect, timber-stand development.

ANALYSIS AREA

The vegetation analysis includes 3 geographic scales:

- Upper Flathead Valley - Historic conditions refer to those from Climatic Section 333C of the Upper Flathead Valley (*Losensky 1997*). For this analysis, the historic conditions for Climatic Section 333C relate to forest covertypes and age-class distributions only.
- Stillwater State Forest management block - Current and appropriate conditions were analyzed on the scale of the entire Stillwater State Forest and scattered outlying sections in northeastern Lincoln County (approximately 100,208 forested acres). Current and appropriate conditions for covertype, age, and old-growth distribution were analyzed at this scale.
- Project level - Stand attributes related to old growth, species composition, and stand development will be analyzed by harvest area.

COVERTYPE

FIGURES B-1 through *B-3 - PERCENTAGE OF FORESTED ACRES BY COVERTYPE* illustrate the percentage of forested ground that is/was occupied by a particular covertype. The comparison shown includes the Upper Flathead Valley historic covertype data and current and appropriate covertype conditions on the scale of the analysis area (Stillwater Unit). The chart displaying historic conditions is from *Lozensky's* data and covers forested types of a much larger scale than do the current and appropriate conditions.

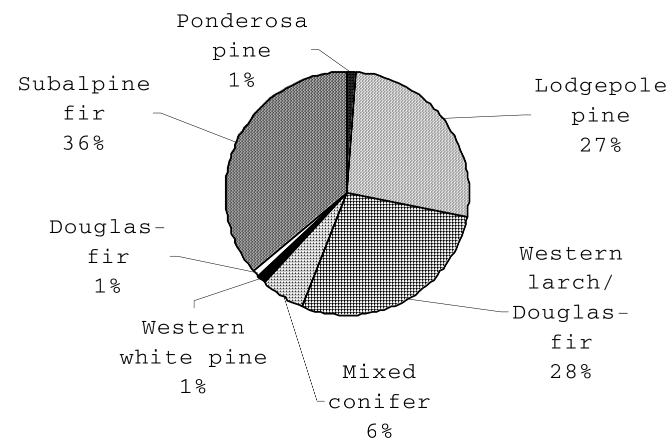
Data indicates, as illustrated by *FIGURES B-2 and B-3*, that mixed-conifer stands are currently overrepresented in reference to both historic conditions and conditions that DNRC feels appropriate by using historic data (desired future covertype conditions). Many of the species that make up the mixed-conifer covertype are shade tolerant and their representation increases as the intervals between disturbances, such as wildfires, lengthens.

The western larch/Douglas-fir and lodgepole pine covertypes are currently underrepresented on the forest in reference to ***appropriate conditions***; western larch and lodgepole pine are not shade tolerant and, historically, the species have been perpetuated through fairly intensive disturbances, such as wildfires.

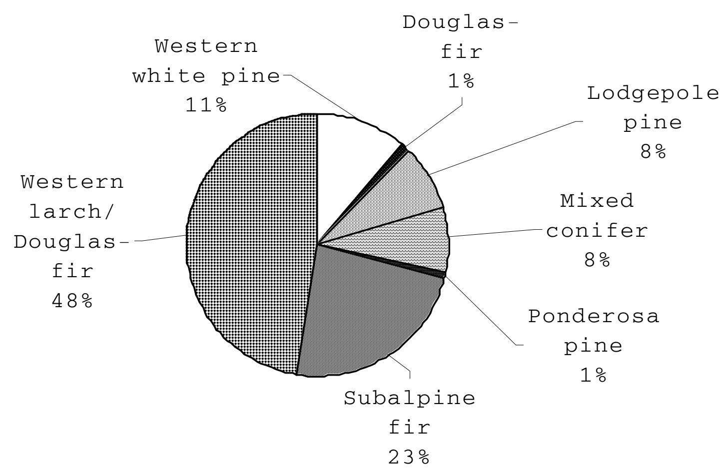
The data sort indicates the amount of western white pine covertype is slightly lower than what occurred historically. The white pine blister rust infection has drastically affected the western white pine. In reality, the number of healthy western white pine that occupy the canopy as overstory dominants has been on the decline

FIGURES B-1 THROUGH B-3 – PERCENTAGE OF FORESTED ACRES BY COVERTYPE ON STILLWATER UNIT

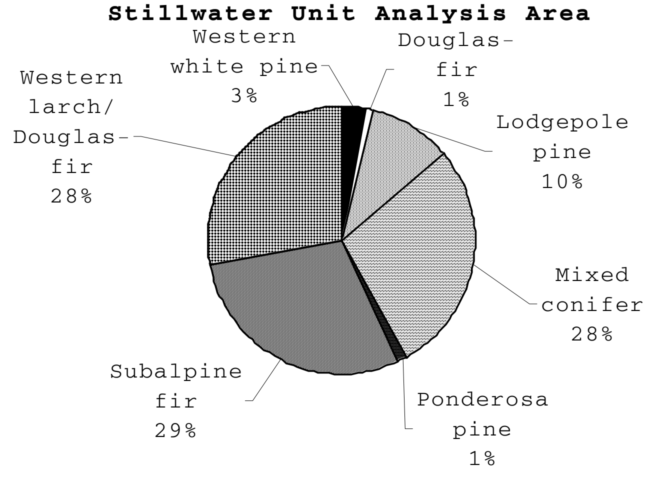
Historic Covertype Distribution in Flathead Valley



Appropriate Covertype Distribution on Stillwater Unit Analysis Area



Current Covertype Distribution on Stillwater Unit Analysis Area



across most of the Pacific Northwest for several decades.

AGE-CLASS DISTRIBUTION

Age-class distributions delineate another characteristic important for determining trends on a landscape level.

Inventories of the 1930s quantified the ages of the forest stands. To arrive at age estimates, *Losensky* examined the data and projected the stands back in time to the early 1900s. This data is useful in setting baseline conditions for determining the extent that current forest age-class distribution deviates from average historical conditions.

Comparing the entire Stillwater State Forest with historical data from the Upper Flathead Valley, *TABLE B-1 – DISTRIBUTION OF AGE CLASSES ON THE CONTIGUOUS STILLWATER STATE FOREST* shows that Stillwater State Forest is low in stands of the seedling-sapling age class and higher is stands that are in the 40-years-and-older age classes.

TABLE B-1 – DISTRIBUTION OF AGE CLASSES ON THE CONTIGUOUS STILLWATER STATE FOREST

AGE CLASS	HISTORIC PERCENT	CURRENT PERCENT
0 to 39 years	36	10
40 to 99 years	12	23
100 to 150 years	22	19
150+ years	29	48

OLD GROWTH

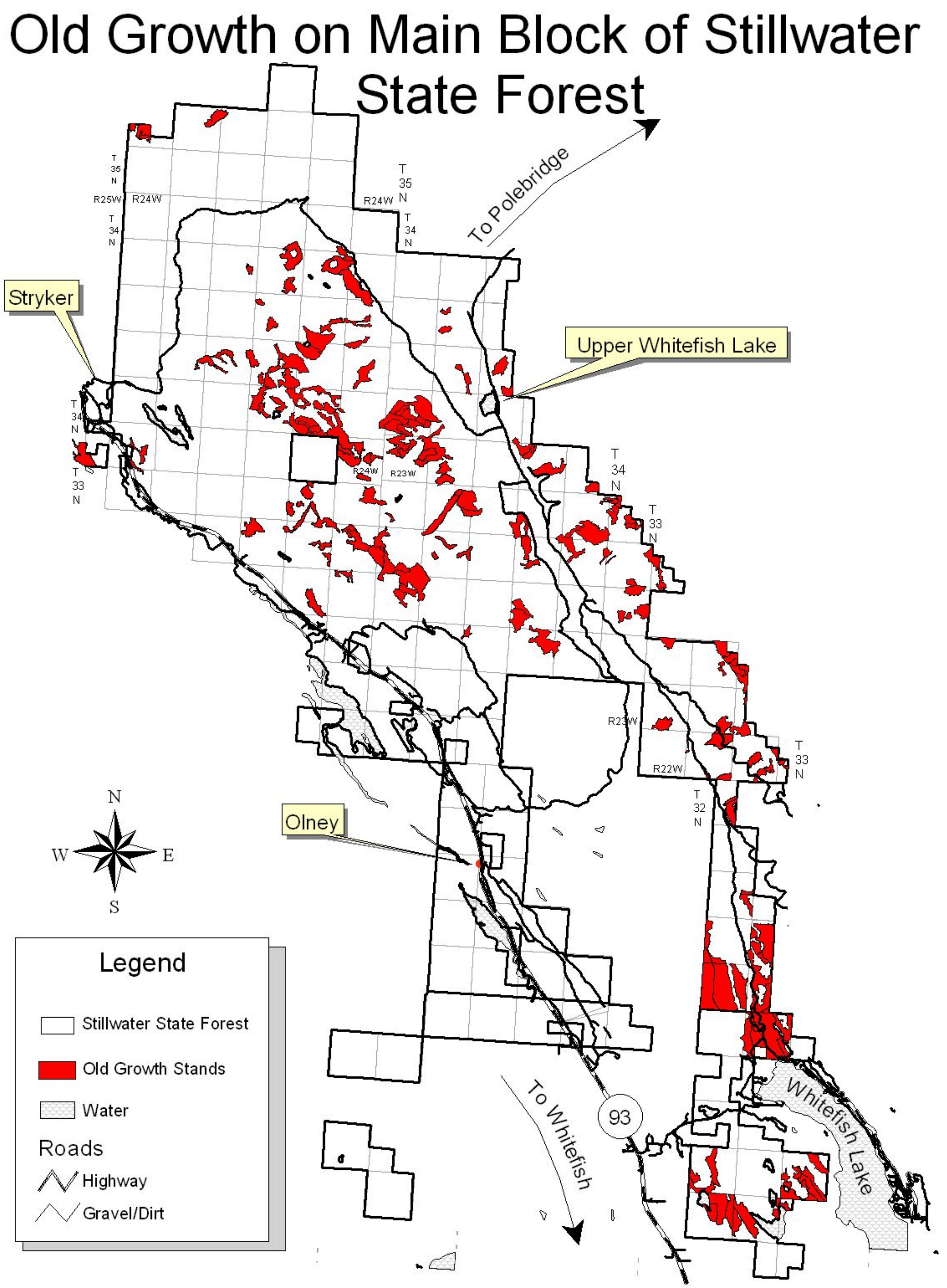
OLD-GROWTH DISTRIBUTION

Old growth, for this analysis, is defined as stands that meet the minimum criteria (number of trees per acre that have a minimum dbh and a minimum age) for a given site, ***which is based on habitat-type grouping***. The criteria can be found in *Green et al (Old Growth Forest Types of the Northern Region).* Based on SLI data, field surveys within the project area, and the effects of other timber sales on SLI old-growth data, approximately 8,679 acres, or 8.7 percent, of the coarse-filter analysis area can be classified as old-growth. ***The amount of old growth present in the Stillwater analysis area is within an expected range of natural variation of old-growth levels based on previous DNRC analysis. Similar to the restrictive definition DNRC currently uses, the analysis using Option 2 was based on a narrower range of old-growth conditions emphasizing stands with higher old-growth attribute levels (DNRC 2000).*** No field-verified old growth or SLI potential old growth has been identified in the northern scattered sections; therefore, those areas are not displayed in *FIGURE B-4 - OLD-GROWTH ON MAIN BLOCK OF STILLWATER STATE FOREST*.

TABLE B-2 - OLD-GROWTH ACRES BY COVERTYPE

CURRENT COVERTYPE	DOUGLAS-FIR	LODGEPOLE PINE	MIXED CONIFER	SUBALPINE FIR	WESTERN LARCH/ DOUGLAS-FIR	WESTERN WHITE PINE	TOTALS
Gross acres by SLI	44	398	1,802	3,139	2,432	481	8,296
Additional old growth confirmed by West Fork Project			183	200			383
Totals	44	398	1,985	3,339	2,432	481	8,679

FIGURE B-4



Old Growth on Main Block of Stillwater State Forest
To Polebridge
Stryker
Upper Whitefish Lake
Olney
To Whitefish
93
Whitefish Lake
N
S
E
W
Legend
Stillwater State Forest
Old Growth Stands
Water
Roads
Highway
Gravel/Dirt

TABLE B-2 – OLD-GROWTH ACRES BY COVERTYPE displays old growth by forest covertype. Covertype is related to habitat type, habitat-type groups, and successional stages. Covertype is used when presenting old growth because the amount can be correlated to Lozensky's historic information. Subalpine fir and western larch/Douglas-fir (as displayed below in *TABLE B-2 — OLD-GROWTH ACRES BY COVERTYPE*) are the 2 dominant old-growth covertypes on Stillwater State Forest.

Old growth within the project area can be viewed in *FIGURE B-5 – WEST FORK OLD-GROWTH MAP* under *ALTERNATIVE EFFECTS (page B-12).* In addition to old-growth stands identified by SLI in the project area, approximately 383 field-verified acres of old growth have been identified.

OLD-GROWTH ATTRIBUTES

DNRC is in the process of developing a tool to assign old-growth attribute levels to stands by sorting SLI data. The attributes considered are:

- number of large live trees,
- amount of coarse woody debris,
- number of snags,
- amount of decadence,
- multistoried structures,
- gross volume, and
- crown density.

This data sort assigns a value or an index rating to an old-growth stand that indicates its total score. These scores can be grouped into low, medium, and high categories. This provides an indication of the condition of the stand in reference to attributes that are often associated with old-growth timber stands. These attribute levels are not necessarily an indication of quality, but are tools to compare and classify a collection of older stands over the landscape. The expected variation of levels are based on numerous factors, including habitat groups, tree species, covertype, altitude, past management activities, and proximity to roads. Many of these attributes will relate to wildlife and be discussed within *APPENDIX E – WILDLIFE ANALYSIS.*

Within the project area, the attribute index ratings are primarily medium. The SLI category for most of the field-verified, old-growth stands was low, but based on data collected on these areas (number of larger diameter trees per acre and gross volume per acre), those stands should be within the medium attribute levels.

Some of the old-growth characteristics within the project area:

- Engelmann spruce and subalpine fir are the dominant tree species in all of the old-growth stands, which total 777 acres.
- Whitebark pine is a component of the overstory and snag attributes in 7 old-growth stands, which amounts to approximately 313 acres.
- The stand structures are all multistoried, with seedlings to large sawtimber-sized trees.
- Vigor is average to poor in all stands.
- Snag levels are generally high, with greater than 3 snags per acre.

STAND DEVELOPMENT

Natural processes of stand development and disturbance are influenced by environmental conditions and site characteristics, such as soils, stand covertype, forest health, elevation, and stand structure. The stand structures and species component can be greatly modified by natural disturbances, such as wildfire and blowdown events, as well as past management activities.

STAND COVERTYPE

Site factors, such as soil type, aspect, elevation, growing season, and moisture availability, are combined to develop habitat-type classifications, which are then used to describe successional development and timber productivity, among other things *(Pfister et al, 1977).* For the project area, 95 percent of the acreage is categorized in the "cool and moist" habitat group, and 99 percent of the area is currently represented by the subalpine fir and mixed-conifer covertypes.

TIMBER-STAND HEALTH

Damage and mortality from insects and diseases are relatively minor in forest types that exist in this area. A rise has occurred in the incidence of western balsam bark beetles, mountain pine beetles, and white pine blister rust, as well as minor levels of infestations of spruce bark beetles, Douglas-fir beetles, and fir engravers. Indian paint fungus is common in subalpine fir throughout this area. In addition to the insects and pathogens listed above, trees throughout the project area have mechanical damage caused by previous logging, as well as damage caused by wind, snow, and ice, which has allowed rot to develop in the boles of the trees and value to be lost. Also, stands where tree crowns appear sparse and ratty reflect poor vigor and slow growth.

ELEVATION/ASPECT

The elevation of a stand has great importance in determining not only what tree and shrub species are present, but also how fast or slow changes take place. Elevations in the project area range from 4,300 feet to 6,500 feet above sea level. Based on measurements taken over the last 27 years, the average snow depth for the Herrig snow-course survey, which is located in Harvest Area II-P, is 65 inches. A large portion of the project area has a northeast aspect. This exposure, together with high elevations, account for the high moisture availability, as well as the long duration snow is on the ground. These 2 factors, elevation and aspect, are also the main reason for the presence of whitebark pine. Within the project area are a total of 882 acres in 18 stands that have whitebark pine older than 150 years in the upper level canopy.

STAND STRUCTURE

Stand structure indicates a characteristic of stand development and how the stand will continue to develop.

Single-storied stands are most often associated with stand-replacement events, such as severe fires or clearcut harvesting.

Two-storied stands are often associated with areas of less severe fire and usually have more fire-resistant trees, such as western larch or Douglas-fir, left in the overstory. Regeneration harvests that retain approximately 10 percent crown cover in the overstory and have seedling/sapling understory are also classified as 2-storied stands.

The multistoried condition arises when a stand has progressed through time and succession to the point that shade-tolerant species are replacing a shade-intolerant overstory. Often a long interval of time occurs between major disturbances.

TABLE B-3 – PERCENT OF STAND STUCTURES IN THE PROJECT AREA AND ENTIRE STILLWATER STATE FOREST

TABLE B-3 – PERCENT OF STAND STUCTURES IN THE PROJECT AREA AND ENTIRE STILLWATER STATE FOREST

STAND STRUCTURE	STILLWATER UNIT	PROJECT AREA
Single-storied	18%	6%
Two-storied	6%	Trace
Multistoried	76%	93%

displays the percent of stands in the single-storied, two-storied, and multistoried levels on Stillwater Unit and within the project area.

PAST MANAGEMENT ACTIVITIES

Engelmann spruce and subalpine fir have always been the predominate species in the project area. According to past inventory records, western larch, Douglas-fir, and western white pine were present in many of the stands in Harvest Area II, as they are today, but Engelmann spruce and subalpine fir have always been the predominate species. In Harvest Area III, the seral species are a minor component with less than 15 percent canopy composition.

Major timber harvesting has been ongoing in the project area since the late 1940s. Many of the stands in Harvest Area II were selectively logged in the late 1940s and early 1950s, targeting Douglas-fir, Engelmann spruce, and western larch, where available, for use as railroad ties. Minimal site preparation was completed following harvesting; therefore, the progression of these stands leans toward the shade-tolerant species of Engelmann spruce and subalpine fir.

Over time, salvage logging has occurred in many of the stands in order to remove blowdown or beetle-infested trees, mainly Engelmann spruce.

Overall, there are approximately 1,600 acres in the project area that have more than 30-percent crown removal. Most (76 percent) of the acres were harvested in the 1950s and 24 percent was salvaged and clearcut. Where the ground was scarified, desired tree species were able to regenerate. However, without scarification and planting, many of these areas were taken over by shrub species, causing regeneration to be slow and limited.

FIRE REGIMES

The fire regimes across Stillwater State Forest are variable. The forest, as a whole, has a mosaic pattern that developed from different fire frequencies and intensities. Areas of frequent fire have produced Douglas-fir, western larch, and ponderosa pine covertypes. As the intervals between fires become longer, the more shade-tolerant species (Engelmann spruce, subalpine fir, grand fir, western hemlock, and western red cedar) begin to develop. The higher elevations within the forest have longer fire intervals and the stands tend to be multistoried with a dominant shade-tolerant covertype. Where fire frequencies were short, the stands are open, single-storied, and, occasionally, 2-storied. With the arrival of aggressive fire-suppression efforts, covertypes and fire frequencies were altered. Stands of ponderosa pine, western larch, and/or Douglas-fir have become multistoried with shade-tolerant species. Stands that were once open, now have a thick understory of predominantly Douglas-fir, grand fir, Engelmann spruce, and subalpine fir. Fires are generally kept small, limiting natural fire effects. If a large-scale fire were to occur, many acres could be affected due to ladder fuels, heavy fuel accumulation, and other environmental factors.

The West Fork Timber Sale Project area is primarily represented by Fire Group 9 Fire Regime (87 percent of the project area gross acreage), with minor representation in Fire Groups 10 (8 percent), 8 (5 percent), and 7 (less than 1 percent) (*Fischer and Bradley, 1987)*. All stands in Harvest Area II and most stands in Harvest Area III fall into Fire Group 9. Fire Group 9 represents moist, lower subalpine habitat types where fires are infrequent, but severe, and the effects are long lasting. Fire-free intervals range from 117 years in valleys to more than 146 years on lower alpine slopes. Within the project area, stand-replacing fires have been estimated to occur at moderately long to long intervals, 150 to 300 years. Fire history information for subalpine fir habitat types is limited, particularly for moist Fire Group 9 sites. Available evidence indicates that fires on such sites are infrequent and are mostly either low severity or stand replacing. Moderately severe fires are apparently less frequent, although they do occur. Therefore, the size of the fires in this fire regime will vary from small in the less severe fire conditions to large in the more severe fire conditions that have been experienced lately where thousands of acres in the later successional stages are burned in a stand-replacement fire.

The next most common fire regime in the project area is Fire Group 10, which is characterized by high-elevation forests near and at timberline. Some stands in Harvest Area III are in this regime. Stand-replacing fires even in the more continuous forests range in frequency to more than 300 years.

Fire Group 8 consists of dry, lower subalpine habitat types where Engelmann spruce, subalpine fir, or mountain hemlock are the indicated climax species. This group experiences more frequent fires that are generally less severe than Fire Group 9. Intervals range from 50 years in lodgepole pine stands to 130 years for the more moist, lower subalpine types.

No harvest areas are proposed in Fire Group 7; this group is less than 1 percent of the project area; therefore, this group will not be discussed further.

ALTERNATIVE EFFECTS

COVERTYPES AND AGE CLASSES

Direct Effects

- ***Direct Effects of No-Action Alternative A to Covertypes and Age Classes***

  Covertypes and age classes on Stillwater State Forest would not be directly affected.

- ***Direct Effects of Action Alternative B to Covertypes and Age Classes***

  This alternative proposes:

  - a commercial-thin harvest on 73 acres in Harvest Area I.
  - regeneration harvests, including group-selection and overstory-removal treatments, on approximately 1,174 acres in Harvest Areas II and III.

  Approximately 138 acres of the mixed-conifer covertype would likely be converted to a western larch/Douglas-fir covertype through the planting of western larch or the harvesting of subalpine fir and Engelmann spruce. An additional 351 acres of the subalpine fir covertype and 779 acres of the mixed-conifer covertype would be harvested, but no change in covertype is expected. The representation of western larch and western white pine would likely increase due to planting; Douglas-fir and whitebark pine representation should remain similar to current numbers.

  With the group-selection/overstory-removal treatments planned for Harvest Area II, approximately 713 acres would be regenerated and 153 acres would be retained in a stocked stand of saplings and pole-sized trees in the 40-to-99-year age class. Approximately 190 acres would change from the 40-to-99-

year age class to 0 years, 160 acres would change from the 100-to-150-year age class to 0 years, and 695 acres would change from the old-stand age class to 0 years.

Following site preparation and planting of Harvest Areas II and III, representation of the 0-to-39-year age class on Stillwater Unit would increase by 1 percent, or 1,045 acres, and representation of 150+-year-old stands would be reduced by 0.7 percent.

- ***Direct Effects of Action Alternative C to Covertypes and Age Classes***

Action Alternative C proposes a commercial-thin harvest on 73 acres and group-selection and overstory-removal treatments on approximately 866 acres.

Through the planting or removal of subalpine fir and Engelmann spruce during the thinning harvest, approximately 46 acres of the mixed-conifer covertype would likely be converted to the western larch/Douglas-fir covertype. Approximately 139 acres of the subalpine fir and 753 acres of the mixed-conifer covertypes would be harvested, but no covertype change is expected. The representation of western larch and western white pine would likely increase due to planting; Douglas-fir and whitebark pine representation should remain similar to the current numbers.

With the group-selection/overstory-removal treatments planned for Harvest Area II, approximately 713 acres would be regenerated and 153 acres would be retained in a stocked stand of saplings and pole-sized trees in the 40-to-99-year age class. Approximately 190 acres would change from the 40-to-99-year age class to 0 years, 160 acres would change from the 100-to-150-year age class to 0 years, and 695 acres would change from the ***150-year-plus*** age class to 0 years.

Following the site preparation for Harvest Area II, the representation of the 0-to-39-year age class on Stillwater Unit would increase by 0.7 percent or 713 acres and the representation of 150+-year-old stands would be reduced by 0.4 percent.

Indirect Effects

- ***Indirect Effects of No-Action Alternative A to Covertypes and Age Classes***

Overtime, natural forest succession and fire suppression would reduce the variability of covertypes and age classes, thus, reducing biodiversity.

- ***Indirect Effects of Action Alternative B to Covertypes and Age Classes***

Harvesting trees would move the representation of age classes and covertypes would move representation toward historical distribution. In total, representation of the 0-to-39-year age class on Stillwater State Forest would increase by 1 percent, or 1,045 acres, and the old-stand representation would be reduced by 0.7 percent.

- ***Indirect Effects of Action Alternative C to Covertypes and Age Classes***

The representation of age classes and covertypes would move representation toward historical distribution. In total, representation of the 0-to-39-year age class on Stillwater State Forest would increase by 0.7 percent, or 713 acres, and the 150-year-age-class representation would be reduced by 0.4 percent.

Cumulative Effects

- ***Cumulative Effects of All Alternatives to Covertypes and Age Classes***

The cumulative effects of timber-stand management on Stillwater State Forest is a trend toward increasing seral covertypes in areas where recent forest-management activities have taken place. Since the Chicken/Werner Timber Sale Project EIS in 1999, the western larch/Douglas-fir covertype has increased by 6 percent.

In addition to the changes in covertype distributions from the proposed alternatives, other timber sale projects have been initiated, but have not been completed; therefore, their effects are not represented in the STW 2003 SLI. Scheduled updates of the SLI will begin to capture the trend toward more western larch/Douglas-fir, lodgepole pine, and western white pine covertypes on Stillwater State Forest, as well as the trend toward increasing the amount of acres in the 0-to-39-year age class.

OLD-GROWTH DISTRIBUTION AND ATTRIBUTES

Direct Effects

- ***Direct Effects of No-Action Alternative A to Old-Growth Distribution and Attributes***

  The distribution or attributes of old-growth stands would not be affected.

- ***Direct Effects of Action Alternative B to Old-Growth Distribution and Attributes***

  Approximately 286 acres of old-growth would be harvested with regeneration treatments on areas typically suited to stand-replacement fire regimes. The posttreatment timber stand would no longer meet DNRC's criteria for old growth. Those portions of the original stand that are not harvested would likely continue to meet DNRC's old-growth definition. ***Future SLI updates would be made on the remaining portions of the timber stands.*** Implementation of Action Alternative B would decrease Stillwater Unit's old-growth levels by 286 acres and retain an estimated 8,393 acres of potential old growth. ***Recognizing that the amounts and distributions of all age classes will shift and change over time, the amount of old growth remaining is within an expected range of natural variation.*** This harvest would remove 118 acres from the mixed-conifer covertype and 168 acres from the subalpine fir covertype.

  FIGURE III-6 – WEST FORK OLD-GROWTH MAP (next page) shows the locations where harvesting would affect the distribution of old-growth stands.

  Most attributes associated with old-growth stands would be removed. Structure would be retained in small areas where existing trees would not be harvested, such as near springs, areas that are not feasible to skid or yard, or areas that are marked with leave trees. A minimum of 1 large (greater than 21-inches dbh) snag and 1 large-diameter snag-recruitment tree per acre would be retained within the harvest areas. If no snags this size are available, the next largest size would be retained. In addition to live recruitment trees, up to 10 western larch, Douglas-fir, and whitebark pine trees per acre that are suitable for seed dispersal would be retained.

- ***Direct Effects of Action Alternative C to Old-Growth Distribution and Attributes***

  The distribution or attributes of old-growth stands would not be affected.

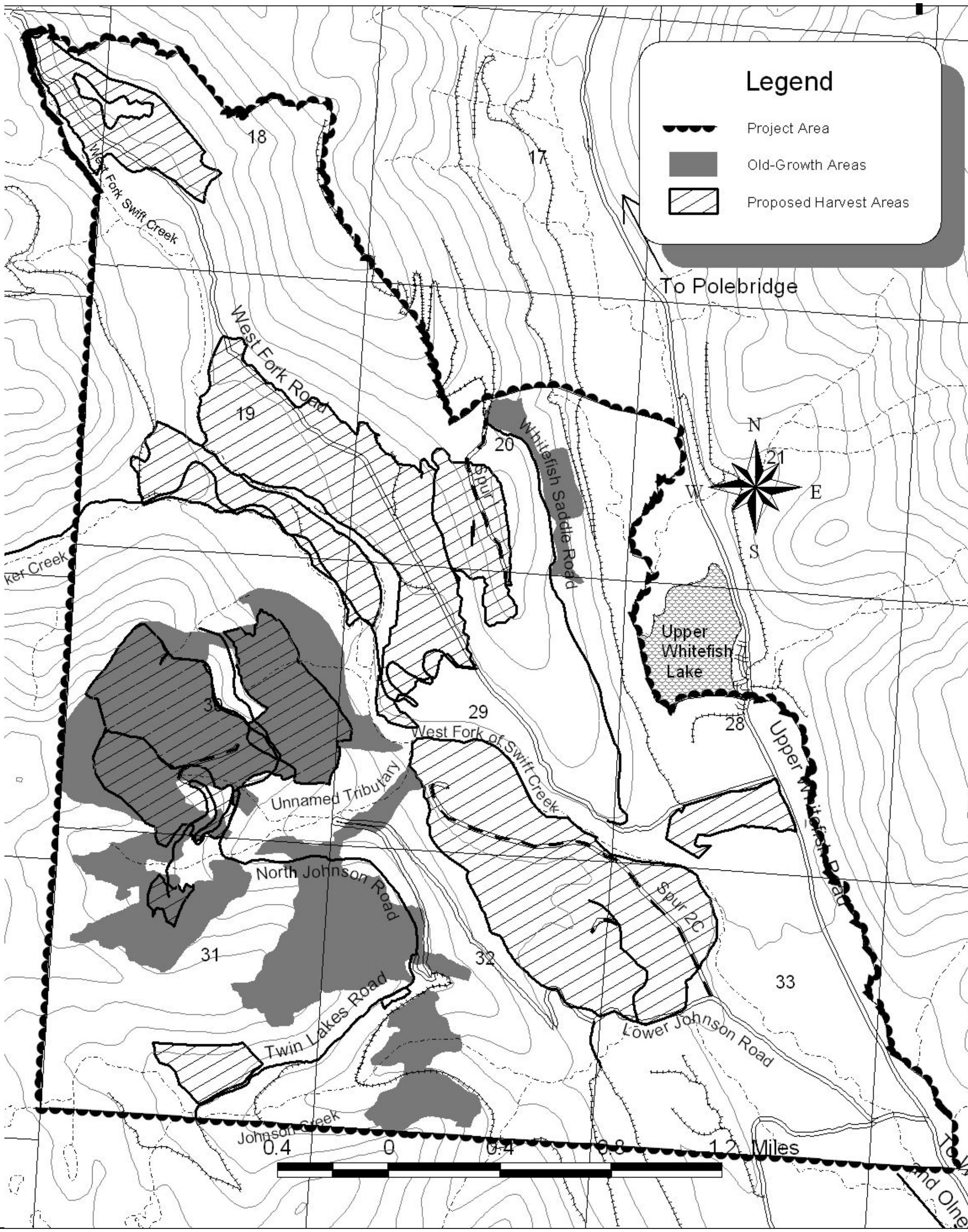
Indirect Effects

- ***Indirect Effects Common of All Alternatives to Old-Growth Distribution and Attributes***

  Stands currently meeting DNRC's old-growth definition ***and not***

Figure B-5

WEST FORK OLD-GROWTH MAP



proposed for harvesting would become more decadent. Stocking levels and the loading of down woody debris would increase in some stands and covertypes, increasing wildfire hazards. Shade-tolerant species would remain dominant in stands. Various factors, such as insects, diseases, and decreasing vigor, would eventually cause more snags to occupy portions of the stands. Within the project area, white pine blister rust, mountain pine beetles, and weather-related damage has increased the amount of snags in old-growth stands.

- ***Indirect Effects of Action Alternative B to Old-Growth Distribution and Attributes***

  Action Alternative B would harvest timber near old-growth stands and structurally create more abrupt stand edges. ***If the proposed units in Harvest Area III are harvested, an increase in sunlight would occur along the edges of harvested and unharvested areas. This additional sunlight would increase the growth of small trees established in that zone. Regeneration may also occur, but due to site preparation not occurring, the species regenerating would likely be subalpine fir or Engelmann spruce.*** Potentially, the risk of blowdown along the proposed unit boundaries would increase and likely ***add to the down fuel loading***. Harvest areas next to old-growth stands could possibly act as fuel breaks, which could slow or stop wildfires before they could burn the old-growth.

Cumulative Effects

- ***Cumulative Effects Common to All Alternatives to Old-Growth Distribution and Attributes***

  Approximately 48 acres of field-verified old growth ***of the Taylor South Timber Sale Project area*** are planned for harvesting in Sections 20, 29, and 32, Township 32 north, Range 22 west; the EIS ***for this project*** covered the harvesting of these acres. Approximately 104 acres of old growth, both field verified and SLI identified, have been harvested in the Chicken/Werner Timber Sale Project area. ***No additional old growth is proposed for harvesting in the Ewing Middle Ridge or Point of Rocks timber sale projects.*** In total, an estimated 59 acres of old growth would be removed from the mixed-conifer covertype, 81 acres from the western white pine covertype, and 12 acres from the Douglas-fir covertype.

  SLI originally classified these 152 acres as having medium attribute levels. These stands would no longer meet DNRC's old-growth definition following harvesting, and, at the most, they would have low attributes.

- ***Cumulative Effects Common of No-Action Alternative A and Action Alternative C to Old-Growth Distribution and Attributes***

  The estimated acres of old-growth on Stillwater Unit would be reduced to 8,527 acres; approximately 8.5 percent of the analysis area. The percentage of old-growth acres by covertype would change very little.

- ***Cumulative Effects of Action Alternative B to Old-Growth Distribution and Attributes***

  Old-growth on Stillwater Unit would be reduced to an estimated 8,241 acres; approximately 8.2 percent of the analysis area. ***Recognizing that the amounts and distributions of all age classes will shift and change over time, the amount of old growth remaining is within an expected range of natural variation.*** The representation of the mixed-conifer old-growth area would be reduced by about 2 percent; the representation of both the western larch/Douglas-fir and subalpine fir covertypes would increase by approximately 1 percent.

STAND DEVELOPMENT

Direct Effects

- ***Direct Effects of No-Action Alternative A to Stand Development***

  Stand development within the project area would not be directly affected.

- ***Direct Effects of Action Alternative B to Stand Development***

  This alternative would directly affect stand development by taking on the role of a stand-replacing fire in Area III, and a moderately-severe fire in Area II; a vegetative mosaic would be created by removing some overstory trees and reducing fuels. The climax species of Engelmann spruce and subalpine fir, which are easily killed by fire, would be removed, thereby allowing the regeneration of those species that require more sunlight. This alternative would likely convert approximately 138 acres of the mixed-conifer covertype to the western larch/Douglas-fir covertype (see *Direct Effects to Covertypes and Age Classes*). By removing trees that are affected by insects and diseases, the vigor and health of the residual trees, adjacent stands, and future forest would all be directly affected.

  In stands with whitebark pine, the desired future condition is a healthy, virile stand of trees with some degree of rust resistance. The cones and seeds from these trees are beneficial to wildlife. The regeneration harvests and subsequent site preparation in Areas II and III would enhance the regeneration of the seral species. The seral species are western larch, Douglas-fir, and western white pine in the stands of lower elevation and whitebark pine in the stands of higher elevations. Broadcast burning would be a benefit for reestablishing whitebark pine in these stands.

- ***Direct Effects of Action Alternative C to Stand Development***

  This alternative would directly affect stand development by taking on the role of a moderately severe fire in Area II, creating a vegetative mosaic by removing some overstory trees, and reducing fuels. The climax species of Engelmann spruce and subalpine fir, easily killed by fire, would be removed, thereby allowing the regeneration of those species that require more sunlight. Action Alternative C would likely convert approximately 46 acres of the mixed-conifer covertype to the western larch/Douglas-fir covertype (see *Direct Effects to Covertypes and Age Classes*). By removing trees that have been affected by insects and diseases, the vigor and health of the residual trees, present adjacent stands, and future forest would all be directly affected.

  The regeneration harvests and subsequent site preparation in Area II would enhance the regeneration of the seral species. The seral species are western larch, Douglas-fir, and western white pine.

Indirect Effects

- ***Indirect Effects of No-action Alternative A to Stand Development***

  As stands age over time, natural forest succession and fire suppression would reduce the variability of covertypes both on the forest landscape and in the project area. Coupled with the effects of mountain pine beetles and white pine blister rust, the representation of whitebark pine would diminish over the landscape, and the benefits to wildlife would diminish as well. Engelmann spruce and subalpine fir would continue to replace the seral species until a stand-replacing fire develops some day and allows the process of succession to begin again. Hundreds of years may pass before this happens. With current fire-suppression efforts, surface fires that act as underburns would more likely occur, reducing fuels and killing some overstory trees. Less frequent, more severe fires could occur over small areas, but their effect would usually be limited to the creation of vegetative mosaics.

- ***Indirect Effects of Action Alternative B to Stand Development***

In Harvest Area III, logging takes on the role of a stand-replacing fire that probably would not naturally occur except at 150- to 300-year intervals. The shade-tolerant climax species (Engelmann spruce and subalpine fir) are removed, shrub competition is reduced, and some soil is exposed to allow the seeds from the more shade-intolerant species of whitebark pine, western larch, and Douglas-fir to germinate.

All proposed harvest units in Area II are in the Fire Group 9 fire regime, where logging imitates more of a moderately severe fire. A fire in this regime is less intense, but still effective in removing the shade-tolerant and ***least fire-resistant species of Engelmann spruce and subalpine fir.***

The resultant indirect effect on stand development across the project area is that the forest would contain a mosaic of structures to include single-storied, two-storied, and multistoried conditions. The structure changes through harvesting would emulate the type of fire regime associated with the covertype. Fire regime simulations would range from stand-replacing to mixed-severity, depending on the site preparation used and the extent that it could be employed.

- ***Indirect Effects of Action Alternative C to Stand Development***

All of the proposed harvest units in Area II are in the Fire Group 9 fire regime, where logging would imitate more of a mixed-severity fire. A mixed-severity fire is less intense, but still effective in removing the shade-tolerant and least fire-resistant species of Engelmann spruce and subalpine fir.

The resultant indirect effect on stand development across the project area is that the forest would contain a mosaic of structures to include single-storied, two-storied, and multistoried conditions. The changes in structure through harvesting would emulate the type of fire regime associated with the habitat type. Fire regime simulations would range from stand-replacing to mixed-severity, depending on the type of site preparation used and the extent that it could be employed.

Cumulative Effects

- ***Cumulative Effects of No-action Alternative A to Stand Development***

Forest succession and fire suppression would continue; whitebark pine representation would continue to diminish from the landscape. Even if a fire were allowed to burn in the higher elevations, a stand-replacing fire would not likely

develop. The conditions required for this type of fire are extensive drought and a severe wind-driven crown fire. The political, social, and environmental consequences are much too great for any land manager to allow this kind of "let-burn" action to happen. This type of fire only occurs naturally, and the likelihood for this is small, even with the climatic conditions experienced in the recent past.

- ***Cumulative Effects of Action Alternative B to Stand Development***

  Natural stand development, past timber sales, and wildfires have created the current vegetative mosaic in this area. Future timber sale projects would likely continue to be planned with the potential to modify the distribution of stand development within stands. Seedling/sapling stands would continue to develop.

  Action Alternative B is an opportunity to reestablish whitebark pine seedlings on the landscape. Recent fires on higher elevation sites have also provided opportunities to reestablish whitebark pine.

- ***Cumulative Effects of Action Alternative C to Stand Development***

  Natural stand development, past timber sales, and wildfires have created the current vegetative mosaic in this area. Future timber sales would likely continue to be planned with the potential to modify the distribution of stand development within stands. Seedling/sapling stands would continue to develop.

  Recent fires on higher elevation sites have provided opportunities to reestablish whitebark pine.

APPENDIX C
WATERSHED AND HYDROLOGY ANALYSIS

INTRODUCTION

SEDIMENT DELIVERY

Timber harvesting and related activities, such as road construction, can lead to water-quality impacts by increasing the production and delivery of fine sediment to streams. The construction of roads, skid trails, and landings can generate and transfer substantial amounts of sediment through the removal of vegetation and exposure of bare soil. In addition, removal of vegetation near stream channels reduces the sediment-filtering capacity and may reduce channel stability and the amounts of large woody material. Large woody debris, which creates natural sediment traps and energy dissipaters to reduce the velocity and erosiveness of stream flows, is a very important component of stream dynamics.

WATER YIELD

Timber harvesting and associated activities can affect the timing, distribution, and amount of water yield in a harvested watershed. Water yields increase proportionately to the percentage of canopy removal, because removal of live trees reduces the amount of water transpired, leaving more water available for soil saturation and runoff. Canopy removal also decreases interception of rain and snow and alters snowpack distribution and snowmelt, which lead to further water-yield increases. Higher water yields may lead to increases in peak flows and peak-flow duration, which can result in accelerated streambank erosion and sediment deposition.

ANALYSIS METHODS

SEDIMENT DELIVERY

Methodology for analyzing sediment delivery was completed using a sediment-source inventory. Roads and stream crossings within the project area were evaluated to determine sources of introduced sediment. In addition, in-channel sources of sediment were identified using channel-stability rating methods developed by *Pfankuch* and through the conversion of stability rating to reach condition by stream type developed by *Rosgen (1990)*. These analyses were conducted in 1999 by a contracted firm and verified by a DNRC hydrologist. In addition, data was collected in 2003 to quantify sediment delivery using procedures adapted from the *Washington Forest Practices Board (Callahan, 2000)*.

WATER YIELD

The water-yield increase for the watershed in the project area was determined using the equivalent clearcut area (ECA) method as outlined in *Forest Hydrology Part II (1976)*. ECA is a function of total area roaded and harvested, percent of crown removal in harvesting, and amount of vegetative recovery that has occurred in harvested areas. This method equates area harvested and percent of crown removed with an equivalent amount of clearcut area. For example, if 100 acres had 60 percent crown removed, ECA would be approximately 60, or equivalent to a 60-acre clearcut. The relationship between crown removal and ECA is not a 1-to-1 ratio, so the percent ECA is not always the same as the percent of canopy removal. As live trees are removed, the water they would have evaporated and transpired either saturates the soil or is translated to runoff. This method also calculates the recovery of these increases as new trees vegetate the site and move toward preharvest water use.

In order to evaluate the watershed risk of potential water-yield increase effectively, a threshold of concern must be established. Acceptable risk level, resource value, and watershed sensitivity are evaluated according to *Young (1989)* in order to determine a threshold of concern. The watershed sensitivity is evaluated using qualitative assessments, as well as procedures outlined in *Forest Hydrology Part II (1976)*. The stability of a stream channel is an important indicator of where a threshold of concern should be set. As water yields increase as a result of canopy removal, the amount of water flowing in a creek gradually increases. When these increases reach a certain level, the bed and banks may begin to erode. The more stable streams will be able to handle larger increases in water yield before they begin to erode, while less stable streams will experience erosion at more moderate water-yield increases.

ANALYSIS AREA

SEDIMENT DELIVERY

The analysis area for sediment delivery is the West Fork Timber Sale project area and the proposed haul routes. The West Fork watershed is a 10,669-acre, perennial, third-order tributary to Swift Creek and Whitefish Lake and includes Stryker Creek. The Antice/Johnson watershed is a 7,289-acre tributary to Swift Creek. Analysis will cover stream segments within these watersheds that may be affected by the proposed project and all roads and upland sites that may contribute sediment to the West Fork or Johnson Creek.

WATER YIELD

The analysis area for water yield is the West Fork and Antice/Johnson Creek watersheds. Precipitation in both watersheds range from 30 inches in the Antice/Johnson watershed in the lower elevations to 80 inches at the ridgetops. In addition, the water yield of the entire Swift Creek watershed will be analyzed to determine the effects of the proposed project on the receiving waters.

EXISTING CONDITIONS

REGULATORY FRAMEWORK

Montana Surface Water-Quality Standards

According to *ARM 17.30.608 (1)(c)*, the Whitefish Lake drainage, including Swift Creek, is classified as A-1. Among other criteria for A-1 waters, no increases are allowed above naturally occurring levels of sediment or turbidity. "Naturally occurring," as defined by *ARM 17.30.602 (17)*, includes conditions or materials present during runoff from developed land where all reasonable land, soil, and water conservation practices (commonly called BMPs) have been applied. Reasonable practices include methods, measures, or practices that protect present and reasonably anticipated beneficial uses. These practices include, but are not limited to, structural and nonstructural controls and operation and maintenance procedures. Appropriate practices may be applied before, during, or after completion of potentially impactive activities.

Designated beneficial water uses within the project area include cold-water fisheries and recreational use in the streams, wetlands, lake, and surrounding area.

Water-Quality-Limited Waterbodies

Swift Creek and the West Fork of Swift Creek are currently listed as a water-quality-limited waterbodies in the 1996 and 2004 303(d) list. The 303(d) list is compiled by DEQ as required by Section 303(d) of the Federal Clean Water Act and the Environmental Protection Agency (EPA) Water Quality Planning and Management Regulations (*40 CFR, Part 130*). Under these laws, DEQ is required to identify waterbodies that do not fully meet water-quality standards, or where beneficial uses are threatened or impaired. These waterbodies are then characterized as "water-quality limited" and thus targeted for TMDL development. The TMDL process is used to determine the total allowable amount of particulates in a waterbody of the watershed. Each contributing source is allocated a portion of the allowable limit. These allocations are designed to achieve water-quality standards.

The Montana Water Quality Act (*MCA 75-5-701-705*) also directs the DEQ to assess the quality of State waters, ensure that sufficient and credible data exists to support a 303(d) listing, and develop TMDL for those waters identified as threatened or impaired. Under the Montana TMDL Law, new or expanded nonpoint-source activities affecting a listed waterbody may commence and continue provided they are conducted in accordance with all reasonable land, soil, and water conservation practices and BMPs. TMDLs have not been completed for the Swift Creek or West Fork drainages. DNRC will comply with the Law and interim guidance developed by DEQ through implementation of all reasonable soil and water conservation practices, including BMPs and Forest Management Rules.

The current listed causes of impairment in Swift Creek are bank erosion, other habitat alterations, and nutrients. The probable source for Swift Creek is listed as silviculture. Current listed causes of impairment in the West Fork are flow alteration, other habitat alteration, and siltation. The probable sources for the West Fork are listed as silviculture, highway maintenance, and runoff.

Montana SMZ Law

By the definition in *ARM 36.11.312 (3)*, the majority of the West Fork and Johnson Creek watersheds are Class 1 streams. Johnson Creek, the West Fork, and many of their tributaries have flow for more than 6 months each year. Many of these stream reaches also support fish. Some of the smaller first-order tributaries may be classified as Class 2 or 3 based on site-specific conditions.

SEDIMENT DELIVERY

According to field reconnaissance in the summers of 1999, 2000, and 2003, stream channels in the West Fork watershed are primarily in good to fair condition. Six reaches were rated in poor condition. These 6 reaches represent approximately 7 percent of the identified reaches in the West Fork, and approximately 16 percent of the total length of streams in the watershed. The primary reason for poor reach ratings is movement of channel-bed material. Most reaches were rated as B3 and B4 channels by a classification system developed by *Rosgen (1990)*. Channel types rated as "B" are typically in the 2- to 4-percent gradient range and have a moderate degree of meander (sinuosity). Channel-bed materials in B3 and B4 types are mainly cobble and gravel. Given the cobble and gravel beds, and the gradient of these stream types, bed materials commonly move. Gravel bars have formed on point bars in these reaches. No areas of down-cut channels were identified during field reconnaissance. Large woody debris was found in adequate supply to allow proper hydrologic function.

For further analysis of large woody debris, see *APPENDIX E -FISHERIES ANALYSIS*. Little evidence of past streamside harvesting was found, and, where past logging had taken place in the riparian area, the streams did not appear to be deficient in existing or potential downed woody material.

The existing road system leading to and in the proposed project area was reviewed for potential sources of sediment. The road system in the West Fork watershed is contributing an estimated 25.5 tons per year of sediment to streams. Roads proposed for hauling in the project area in the Johnson Creek watershed are contributing an estimated 5.2 tons of sediment per year to streams. These sediment-delivery values are estimates based on procedures outlined above and are not measured values.

Estimated sediment delivery occurs primarily at stream crossings and comes from a variety of sources. In the upper reaches of the West Fork in Stryker Basin, 3 existing crossings are constructed of wood and earth that are in various stages of decay; another structure is located on an unnamed tributary of the West Fork. Combined, these structures are contributing an estimated 2.8 tons of sediment per year. In addition, each site is at high risk for failure due to decaying wood. In total, these 3 structures are comprised of approximately 760 tons of sediment, most of which, upon failure, would be delivered to the West Fork and Stryker Creek. Other sources of sediment delivery found during the inventory were a result of sites needing erosion-control devices installed on old roads that had been used before the adoption of forest management BMPs.

Much of the existing road system in the proposed project area meets applicable BMPs. Past project work has installed surface drainage on the road systems in Stryker and Herrig basins, as well as on the major routes in the West Fork watershed.

WATER YIELD

The allowable water-yield increase for the West Fork watershed has been set at 10 percent based on channel-stability evaluations, watershed sensitivity, and acceptable risk. This water-yield increase would be reached when the ECA level in the West Fork reaches the allowable level of 2,667. Timber harvesting and associated road construction activities have taken place in the West Fork watershed since the 1930s. These activities, combined with vegetative recovery, have led to an estimated 3.4 percent water-yield increase over an unharvested condition in the West Fork watershed. ***Currently, the water yield increases in the Antice/Johnson and Swift Creek watersheds are 3.5 percent and 3.4 percent, respectively.*** *TABLE C-1 – CURRENT WATER-YIELD AND ECA INCREASES* ***BY WATERSHED*** summarizes the existing conditions for water yield in the ***3*** watershed***s***.

TABLE C-1 – CURRENT WATER-YIELD AND ECA INCREASES BY WATERSHED

	WEST FORK	***ANTICE/JOHNSON***	***SWIFT CREEK***
Percent WYI	3.4	***3.5***	***3.4***
Allowable WYI	10	***10***	***10***
Existing ECA	876	***641***	***4,833***
Allowable ECA	2,667	***1,822***	***12,362***
Remaining ECA	1,791	***1,181***	***7,529***

ALTERNATIVE EFFECTS

SEDIMENT DELIVERY

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Sediment Delivery***

  No-Action Alternative A would have no direct effects to sediment delivery beyond those currently occurring. Existing sources of sediment, both in-channel and out of channel, would continue to recover or degrade based on natural or preexisting conditions.

  The indirect effects would be an increased risk of sediment delivery to streams from crossings that do not meet applicable BMPs. These sites would continue to pose a risk of sediment delivery to streams until other funding became available to repair them.

- ***Direct and Indirect Effects Common to Both Action Alternatives***

  Each of the proposed action alternatives would replace the wooden West Fork bridge on Stryker Basin Road. Each of the action alternatives would also remove and rehabilitate 3 log and earth-fill crossings in the upper reaches of Stryker Basin.

  Replacement of the existing bridge over the West Fork would involve removal of log-crib walls and the fill material that they are currently retaining. The existing structure is beginning to decay and, over time, would become an increasing risk of failure due to decay in the wood. A potential failure of the wood cribbing could allow several tons of sediment to enter the stream. The proposed new bridge would be designed to allow the stream to flow freely with no constriction of the bank-full channel. This would reduce the potential for bank erosion and channel down-cutting that may occur with vertical bridge abutments. The new crossing would also divert overland flow from the road surface away from the crossing site in both directions. This would lead to a decrease in delivery of approximately 0.11 tons of sediment per year at this site.

  Removal and rehabilitation of the 3 log/earth crossings in upper Stryker Basin would remove potential sources of sediment, as well as reduce current sediment delivery by approximately 2.22 tons per year for all 3 sites. As stated above, these 3 sites contain an estimated 750 tons of fill material. Removal and disposal of this material outside of the SMZ would remove the risk of this material being delivered to the West Fork and Swift Creek.

- ***Direct and Indirect Effects of Action Alternative B to Sediment Delivery***

  Several stream crossings would be replaced in the West Fork and Johnson Creek watersheds and along the proposed haul route. Erosion control and BMPs would be improved on approximately 31 miles of existing road. This work would decrease the estimated sediment load to the West Fork by approximately 4.2 tons of sediment per year, and reduce the estimated sediment load to Johnson Creek by approximately 2.7 tons per year. See *TABLE C-2 – SEDIMENT-DELIVERY ESTIMATES IN THE WEST* FORK for a

TABLE C-2 – SEDIMENT-DELIVERY ESTIMATES IN THE WEST FORK

	West Fork			**Johnson Creek**		
	Alternative			**Alternative**		
	A	**B**	**C**	**A**	**B**	**C**
Postproject delivery (tons per year)	25.5	21.3	22.9	5.2	2.5	5.2
Reduction (tons per year)	0	4.2	2.6	0	2.7	0
Reduction percent	0	16%	10%	0	52%	0

summary of sediment-delivery estimates.

Crossings proposed for replacement do not currently meet all applicable BMPs and require a new culvert or bridge in order to meet applicable standards. The replacement of existing stream crossings would contribute sediment directly to the West Fork. This sediment would be minimized through the application of standard erosion-control measures. The sediment delivery anticipated from this project would be short term and comply with all applicable permits and State water-quality laws. In addition, several sites would have additional erosion-control measures added to lower the risk of sediment delivery to a stream or draw. In some cases, the addition of erosion-control measures may increase the risk of sediment delivery in the short term by creating bare soil. However, as these sites revegetate, the long-term risk of sedimentation to a stream would be reduced to levels lower than the existing condition.

This alternative would also construct approximately 1.0 mile of new road to access proposed Harvest Area I, approximately 2.1 miles of temporary road in proposed Harvest Areas II-C, and 0.3 mile of new road to Harvest Area III-J. Reclamation of the temporary roads would occur immediately following completion of activities in the proposed harvest areas. The reclaimed road would present an increased risk of sediment delivery until bare soil revegetated.

Action Alternative B would have a very low risk of sediment delivery to streams as a result of the proposed timber-harvesting activities. Some harvesting activities may occur within designated SMZs. This harvesting activity would follow all requirements of the SMZ Law and have a low risk of affecting recruitment of large woody material to the West Fork, Johnson Creek, or their tributaries. The SMZ law, rules, and all applicable BMPs would be applied to all harvesting activities, which would minimize the risk of sediment delivery to draws and streams.

- ***Direct and Indirect Effects of Action Alternative C to Sediment Delivery***

Several stream crossings would be replaced in the West Fork watershed and along the proposed haul route, and erosion control and BMPs would be improved on approximately 25 miles of existing road. This work would decrease the estimated sediment load to the West Fork by approximately 2.6 tons of sediment per year.

Crossings proposed for replacement do not currently meet all applicable BMPs; to meet applicable standards, a new culvert or bridge is required. The replacement of existing stream crossings would contribute sediment directly to the West Fork. This sediment would be minimized through application of standard erosion-control measures. The sediment delivery anticipated from this project would be short term and comply with all applicable permits and State water-quality laws. Also, additional erosion control would be added to several sites to lower the risk of sediment delivery to a stream or draw. In some cases, the addition of erosion-control measures may increase the risk of sediment delivery in the short term by creating bare soil. However, as these sites revegetate, the long-term risk of sedimentation to a stream would be reduced to levels lower than the existing condition.

This alternative would also construct approximately 1.0 mile of new road to access proposed Harvest Area I and approximately 2.1 miles of temporary road in Harvest Area II-C of the proposed project area. Reclamation of the temporary road would occur immediately following completion of activities in the proposed harvest areas. The reclaimed road would present an increased risk of sediment delivery until bare soil revegetated.

Action Alternative C would have a very low risk of sediment delivery to streams as a result of proposed timber-harvesting activities. Some harvesting activities may occur within designated SMZs; these harvesting activities would follow all requirements of the SMZ Law, and would have a low risk of affecting recruitment of large woody material to the West Fork, Johnson Creek, or their tributaries. The SMZ law, rules, and all applicable BMPs would be applied to all harvesting activities, which would minimize the risk of sediment delivery to draws and streams. (See *TABLE C-2 – SEDIMENT-DELIVERY ESTIMATES IN THE WEST* FORK for a summary of sediment-delivery estimates.)

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Sediment Delivery***

The cumulative effects of sediment delivery would be very similar to those described in the existing conditions portion of this analysis. All existing sources of sediment would continue to recover or degrade as dictated by natural and preexisting conditions until a source of funding became available to repair them. Sediment loads would remain at or near present levels.

- ***Cumulative Effects of Action Alternative B to Sediment Delivery***

Cumulative effects to sediment delivery would be primarily related to roadwork, stream-crossing replacements, and rehabilitations. The sediment generated from the replacement of existing culverts would increase the total sediment load in the West Fork for the duration of activity. These increases would not exceed any State water-quality laws and would follow all applicable recommendations given in 124 and 318 permit applications. In the long term, the cumulative effects to sediment delivery would be a reduction from approximately 25.5 tons of sediment per year to 21.3 tons of sediment per year in the West Fork, and a reduction from approximately 5.2 tons per year to 2.5 tons per year in Johnson Creek. A summary of sediment-delivery estimates is found in *TABLE C-2 – SEDIMENT-DELIVERY ESTIMATES IN THE WEST FORK*. As the sites stabilize and revegetate, sediment levels resulting from culvert replacements would decrease further from projected levels as work sites, and closed and reclaimed roads revegetate and stabilize. Over the long term, cumulative sediment loads would be reduced due to better designed crossings. Improved design would reduce the risk of structure failure, which would reduce the risk of sediment delivery to Swift Creek and other downstream waters.

The installation and improvement of erosion-control and surface-drainage features on existing roads would also affect the cumulative sediment delivery to the West Fork and Johnson Creek, as described above. In the short term, the installation and improvement of surface-drainage features would expose bare soil. This would increase the risk of sediment delivery to the streams in and around the proposed project area. The application of all applicable BMPs during this work would make increased sediment loads unlikely. Over the long term, with the installation of more effective surface-drainage and erosion-control features on the existing road system, cumulative sediment delivery to the West Fork and Johnson Creek is projected to be lower than existing conditions.

Harvesting trees within an SMZ would have a low risk of adverse cumulative effects to downed woody material in the West Fork watershed. The tree-retention requirements of the SMZ Law and the application of Forest Management Rules would ensure a future supply of woody material to the creeks.

None of the cumulative impacts described above are expected to adversely affect downstream beneficial uses. All activities would comply with applicable laws, rules, and regulations.

- ***Cumulative Effects of Action Alternative C to Sediment Delivery***

Cumulative effects to sediment delivery would be primarily related to roadwork and stream-crossing replacements. The sediment generated from replacing existing culverts would increase the total sediment load in the West Fork for the duration of the activity. These increases would not exceed any State water-quality laws, and would follow all applicable recommendations given in the 124 and 318 permit applications. In the long term, the cumulative effects to sediment delivery would be a reduction from approximately 25.5 tons of sediment per year to approximately 22.9 tons of sediment per year in the West Fork. *TABLE C-2 – SEDIMENT-DELIVERY ESTIMATES IN THE WEST FORK* summarizes sediment-delivery estimates. As the sites stabilize and revegetate, sediment levels resulting from culvert replacements would decrease further from projected levels as work sites and closed and reclaimed roads revegetate and stabilize. Over the long term, cumulative sediment loads would be reduced due to a better crossing design. Improved design would reduce the risk of structure failure, which would reduce the risk of sediment delivery to Swift Creek and other downstream waters.

The installation and improvement of erosion-control and surface-drainage features on existing roads would also affect the cumulative sediment delivery to the West Fork as described above. In the short term, the installation and improvement of surface drainage features would expose bare soil, which would increase the risk of sediment delivery to the streams in and around the proposed project area. The application of all applicable BMPs during this work would make increased sediment loads unlikely. Over the long term, with the installation of more effective surface drainage and erosion control features on the existing road system, cumulative sediment delivery to the West Fork is projected to be lower than existing conditions.

Harvesting trees within an SMZ would have a low risk of adverse cumulative effects to downed woody material in the West Fork or its tributaries. The tree-retention requirements of the SMZ Law would ensure a future supply of woody material to the creeks.

None of the cumulative impacts described above are expected to adversely affect downstream beneficial uses. All activities would comply with applicable laws, rules, and regulations.

WATER YIELD

Direct and Indirect Effects

- ***Direct and Indirect Effects of No-Action Alternative A to Water Yield***

  This alternative would have no direct or indirect effects on water yield. Water quantity would not be changed from present levels.

- ***Direct and Indirect Effects of Action Alternative B to Water Yield***

  The annual water yield in the West Fork watershed would increase by an estimated 2.6 percent over the current level, ***Antice/***Johnson ***watershed*** would increase by 0.4 percent, ***and the entire Swift Creek watershed would increase by 0.8 percent.*** These levels of water-yield increases would not be sufficient to create unstable channels.

- ***Direct and Indirect Effects of Action Alternative C to Water Yield***

  The annual water yield in the West Fork watershed would increase by an estimated 1.7 percent over the current level***, Antice/***Johnson ***watershed would*** increase by 0.2 percent***, and the entire Swift Creek watershed would increase by 0.5 percent.*** These levels of water-yield increases would not be sufficient to create unstable channels.

CUMULATIVE EFFECTS

- ***Cumulative Effects of No-Action Alternative A to Water Yield***

  This alternative would have no cumulative effects on water yield. Existing timber harvest units would continue to revegetate and move closer to premanagement levels of water use and snowpack distribution.

- ***Cumulative Effects of Action Alternative B to Water Yield***

  The removal of trees proposed in Action Alternative B would increase the water yield in the West Fork watershed from its current level of approximately 3.4 percent over unharvested to an estimated 6.0 percent. This water-yield increase and its associated ECA level includes the impacts of all past-management activity, existing and proposed roads, proposed timber harvesting, and vegetative hydrologic recovery in the West Fork watershed. The water-yield increase expected from Action Alternative B leaves the watershed well below the established threshold of concern. No impacts to water quality are expected as a result of this alternative. A summary of the anticipated water-yield impacts of Action Alternative B to the West Fork, Antice/Johnson watershed, and the entire Swift Creek drainage is found in *TABLE C-3 – WATER YIELD AND ECA INCREASES IN THE WEST FORK; TABLE C-4 – WATER YIELD AND ECA INCREASES IN ANTICE/JOHNSON WATERSHED;* and *TABLE C-5 – WATER YIELD AND ECA INCREASES IN THE SWIFT CREEK WATERSHED (INCLUDING WEST FORK AND ANTICE/JOHNSON)*.

- ***Cumulative Effects of Action Alternative C to Water Yield***

  The removal of trees would increase the water yield in the West Fork watershed from its current level of approximately 3.4 percent over unharvested to an estimated 5.1 percent. This water-yield increase and its associated ECA level includes the impacts of all past management activity, existing and proposed roads, proposed timber harvesting, and vegetative hydrologic recovery in the West Fork watershed. The water-yield increase expected from Action Alternative C leaves the watershed well below the established threshold of concern. No impacts to water quality are expected as a result of this alternative. A summary of the anticipated water-yield impacts of Action Alternative C to the West

Fork, Antice/Johnson watershed, and the entire Swift Creek drainage is found in *TABLE C-3 – WATER-YIELD AND ECA INCREASES IN THE WEST FORK; TABLE C-4 – WATER-YIELD AND ECA INCREASES IN ANTICE/JOHNSON WATERSHED;* and *TABLE C-5 – WATER-YIELD AND ECA INCREASES IN THE SWIFT CREEK WATERSHED (INCLUDING WEST FORK AND ANTICE/JOHNSON)*.

TABLE C-3 – WATER-YIELD AND ECA INCREASES IN THE WEST FORK

	ALTERNATIVE		
	A	**B**	**C**
Allowable WYI (percent)	10	10	10
Percent of WYI	3.4	6.0	5.1
Acres harvested	0	1,180	883
Miles of new road	0	1.0	0.7
ECA generated	0	1,114	822
Total ECA	876	1,992	1,700
Remaining ECA	1,791	675	967
Allowable ECA	2,667	2,667	2,667

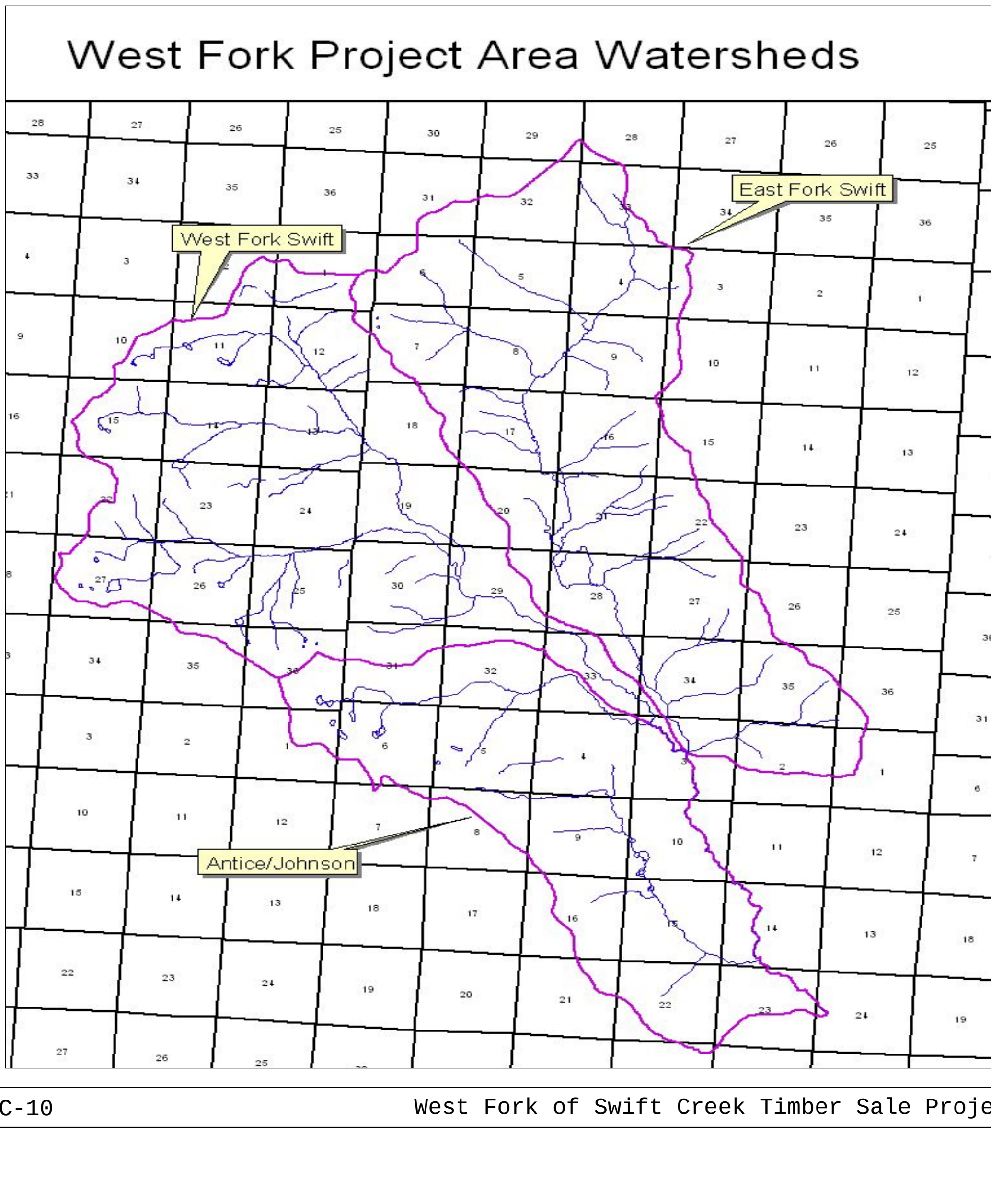
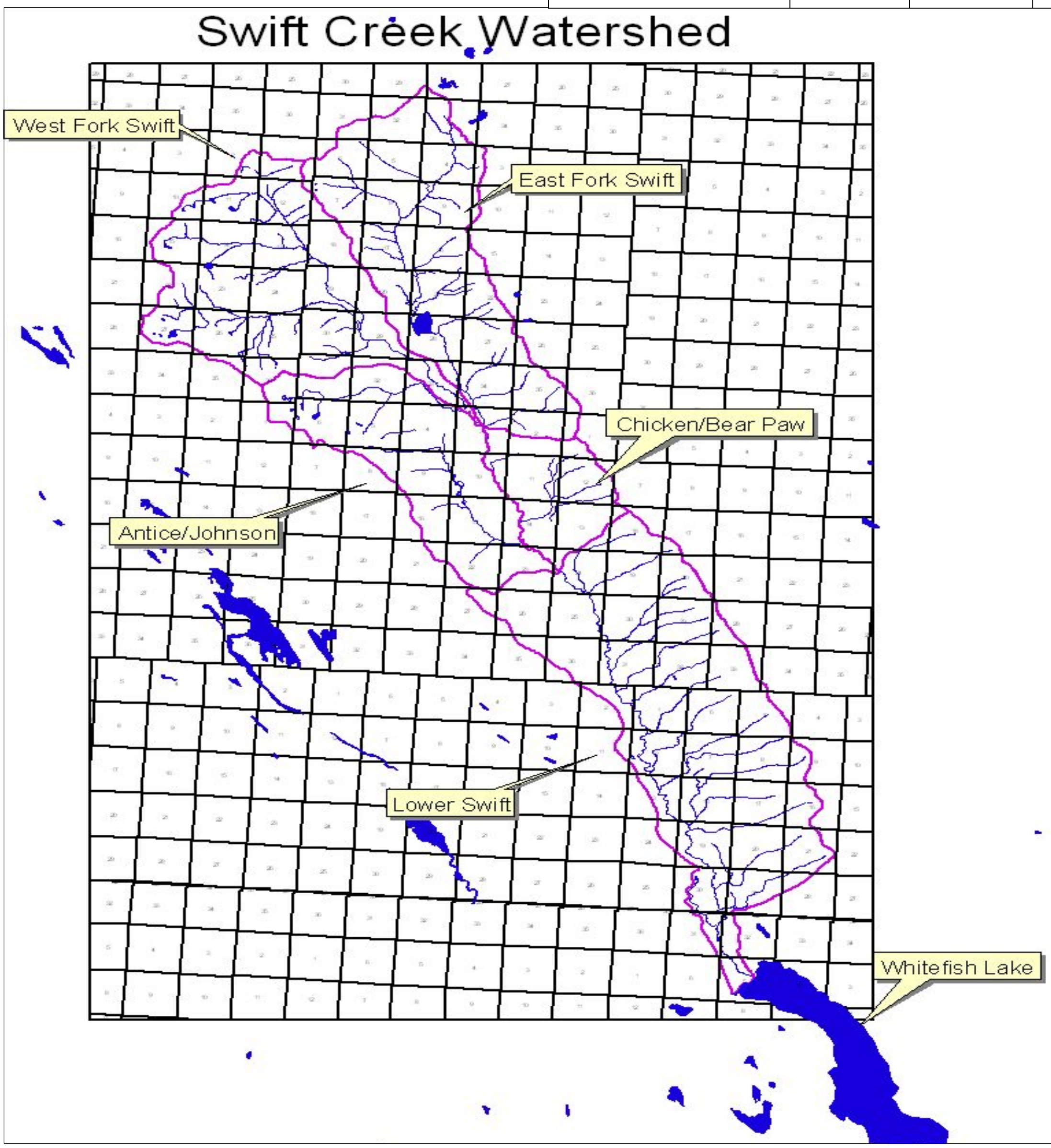


TABLE C-4 – WATER-YIELD AND ECA INCREASES IN THE ANTICE/JOHNSON WATERSHED

	ALTERNATIVE		
	A	**B**	**C**
Allowable WYI (percent)	10	10	10
Percent WYI	3.5	3.9	3.7
Acres harvested	0	94	60
Miles of new road	0	0	0
ECA generated	0	91	57
Total ECA	641	732	698
Remaining ECA	1,181	1,090	1,124
Allowable ECA	1,822	1,822	1,822

TABLE C-5 – WATER-YIELD AND ECA INCREASES IN THE SWIFT CREEK WATERSHED (INCLUDING THE WEST FORK AND ANTICE/JOHNSON)

	ALTERNATIVE		
	A	**B**	**C**
Allowable WYI (percent)	10	10	10
Percent WYI	3.4	4.2	3.9
Acres harvested	0	1,275	943
Miles of new road	0	1.0	0.7
ECA generated	0	1,204	879
Total ECA	4,833	6,040	5,714
Remaining ECA	7,529	6,322	6,648
Allowable ECA	12,362	12,362	12,362



APPENDIX D
SOILS ANALYSIS

INTRODUCTION

The Swift Creek watershed is a valley formed by glaciers and river processes. The dominant soil types found in the project area are deep glacial tills derived from argillite, siltite, and limestone from the Belt Supergroup. Upper slopes and ridges are weathered bedrock scoured by glaciers.

ANALYSIS METHODS

Soil productivity will be analyzed ***through aerial photo interpretation of past harvesting activities, field verification of aerial photo interpretation, and*** by evaluating the current levels of soil disturbance in the proposed project area. Analysis criteria will also include soil stability risk factors.

ANALYSIS AREA

The analysis area for evaluating soil productivity will include State-owned land within the West Fork Timber Sale Project area. The proposed project area is within both the West Fork and Antice/Johnson watersheds.

EXISTING CONDITION

In the West Fork watershed, DNRC has conducted timber harvesting since the 1940s. Since timber sale records dating back to the 1960s, 3,291 acres of State land have been harvested ***(approximately 775 acres are within within the proposed project area)***, using a combination of ground-based and cable-yarding harvest methods. Ground-based yarding can affect soil productivity through displacement and compaction of productive surface layers of soil, mainly on heavily used trails. Field review and aerial photos of the proposed project area show that ***approximately 775 acres*** of the proposed project area has been harvested in the past. ***Based on a review of 1964 aerial photos, 10 to 15 percent of the previously harvested areas contained skid trails.*** Field reconnaissance shows that many of the existing trails from past management are well vegetated and past impacts are ameliorating from frost and vegetation. ***No erosion was observed on existing trails. The erosion-control status of the existing road system is addressed in the watershed analysis of this document.***

Soil types in the project area vary from nearly level wetland types along the West Fork to steep valley sideslopes on ridges. The Flathead National Forest Soil Survey identified one area of soils at high risk for mass movements in the project area. This soil type is landtype 74 and is found in the northern portion of the proposed project area. ***No unique geology is known to exist and*** *n*o slope failures were identified in the proposed project area during reconnaissance. A list of soil types found in the West Fork Timber Sale Project area and their associated management implications are found in *TABLE D-1—SUMMARY OF DIRECT EFFECTS OF ALTERNATIVES ON SOILS WITH SUMMER HARVESTING*.

ALTERNATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS

- ***Direct and Indirect Effects of No-Action Alternative A on Soils***

  Soil productivity would not be directly or indirectly affected. No ground-based activity would take place, which would leave the soil in the project area unchanged from the description in the *EXISTING CONDITION* portion of this analysis.

- ***Direct and Indirect Effects of Action Alternative B on Soils***

  This alternative would have direct impacts on approximately 158 acres. Direct impacts would include compaction and displacement resulting from use of ground-based equipment to skid logs on approximately 937 acres, and use of cable-yarding equipment on approximately 333 acres. Ground-based site preparation and road construction would also generate direct impacts to the soil resource. *TABLE D-1—SUMMARY OF DIRECT EFFECTS OF ALTERNATIVES ON SOILS WITH SUMMER HARVESTING* summarizes the expected impacts to the soil resource as a result of Action Alternative B. These activities would leave up to 12 percent of the proposed harvest units in an impacted condition.

DNRC expects to maintain long-term soil productivity based on the implementation of mitigation measures to control the area and degree of detrimental soil impacts to less than 15 percent of the proposed harvest area. ***This range of soil effects is achievable based on past monitoring.*** A combination of skidding mitigation measures would include:

- restricting the season of use,
- utilizing a minimum skid-trail spacing,
- installing erosion control where needed,
- ***restricting ground skidding to slopes of less than 45 percent***, and
- following all applicable BMPs.

DNRC would require that proportions of snags, coarse woody debris, and fine litter for nutrient cycling and wildlife needs be retained. DNRC's goals for coarse-woody-debris levels are based on research by Graham et al 1994.

- ***Direct and Indirect Effects of Action Alternative C on Soils***

  Approximately 131 acres would be directly impacted. Direct impacts would include compaction and

TABLE D-1 – SUMMARY OF DIRECT EFFECTS OF ALTERNATIVES ON SOILS WITH SUMMER HARVESTING

DESCRIPTION OF PARAMETER	**NO-ACTION ALTERNATIVE A**	**ACTION ALTERNATIVE B**	**ACTION ALTERNATIVE C**
Acres of harvest	0	1,270	938
Acres of tractor yarding	0	937	866
Acres of skid trails and landings[1]	0	188	173
Acres of cable yarding	0	333	72
Acres of yarding corridors[2]	0	33	7
Acres of moderate impacts[3]	0	158	131
Percent of harvest area with impacts	0%	12.4%	14.0%

[1] 20 percent of ground based area
[2] 5 to 10 percent of cable yarding units
[3] 75 percent of ground-based skid trails and 50 percent of cable corridors

displacement resulting from use of ground-based equipment to skid logs on approximately 866 acres and cable-yarding equipment on approximately 72 acres. Ground-based site preparation and road construction would also generate direct impacts to the soil resource. *TABLE D-1—SUMMARY OF DIRECT EFFECTS OF ALTERNATIVES ON SOILS WITH SUMMER HARVESTING* summarizes the expected impacts to the soil resource as a result of Action Alternative C. These activities would leave up to 14 percent of the proposed harvest units in an impacted condition. DNRC expects to maintain long-term soil productivity based on the implementation of mitigation measures to control the area and degree of detrimental soil impacts to less than 15 percent of the proposed harvest area. ***The range of soils effects is achievable based on past monitoring.*** A combination of skidding mitigation measures would include:

– restricting the season-of-use,
– utilizing a minimum skid-trail spacing,
– installing erosion control where needed,
– ***restricting ground skidding to slopes of less than 45 percent***, and
– following all applicable BMPs.

DNRC would require that proportions of snags, coarse woody debris, and fine litter for nutrient cycling and wildlife needs be retained. DNRC's goals for coarse-woody-debris levels are based on research by Graham et al 1994.

CUMULATIVE EFFECTS

- ***Cumulative Effects of No-Action Alternative A to Soils***

This alternative would have no cumulative impacts on soil productivity. No soil would be disturbed and no past harvest units would be reentered. Cumulative effects of this alternative would be similar to those described under the *EXISTING CONDITION* portion of this analysis.

- ***Cumulative Effects Common to Action Alternatives B and C to Soils***

Both action alternatives would enter several stands where previous timber management has occurred. Cumulative effects to soils may occur from repeated entries into a forest stand where additional ground is impacted by equipment operations. DNRC would maintain long-term soil productivity and minimize adverse cumulative effects by implementing any or all of the following ***mitigations specific to harvest units***:

– If properly located and spaced, existing skid trails from past harvesting activities would be used.
– Additional skid trails would be used only where existing trails are unacceptable.
– The potential direct and indirect effects would be mitigated with soil moisture restrictions, season of operation, ***limiting ground skidding to slopes of less than 45 percent, and use of equipment suited to slopes and soil types.***
– A portion of coarse woody debris and fine litter would be retained for nutrient cycling.

In previously unharvested stands, cumulative effects to soil productivity from multiple entries would be the same as those listed in the direct and indirect effects sections.

West Fork Soil Types

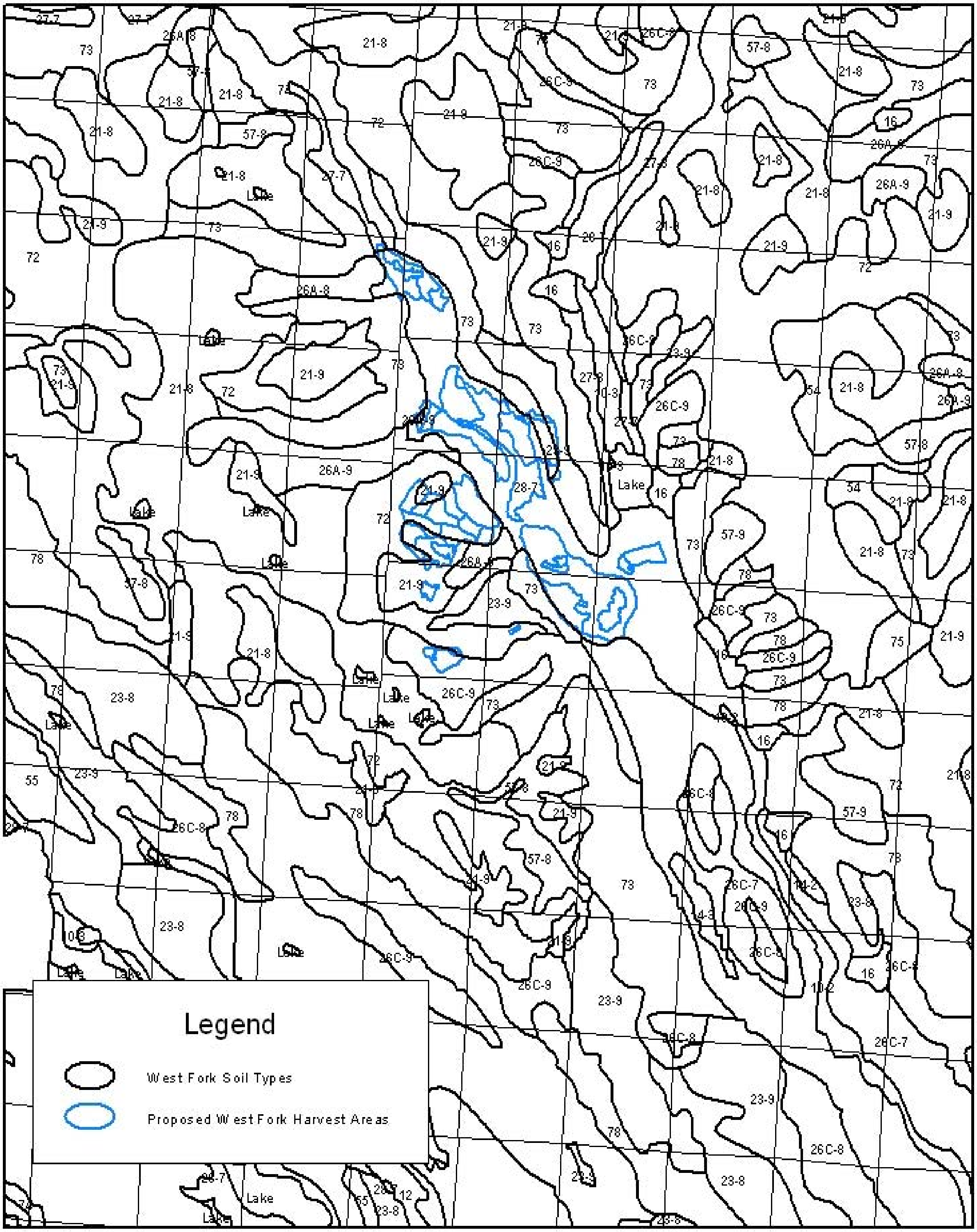


TABLE D-2 - SOIL MAP UNIT DESCRIPTIONS FOR THE WEST FORK TIMBER SALE PROJECT AREA

MAP UNIT	DESCRIPTION	SOIL DRAINAGE	ROAD LIMITATIONS	TOPSOIL DISPLACEMENT AND COMPACTION	SEEDLING ESTABLISHMENT	EROSION (BARE SURFACE)	NOTES
10-2	Alluvial soils	Poor to well drained	Moderate to severe	Severe	Good	Low	Streamside management guides will be applied.
14-3	Silty lacustrine terraces, 0-20% slopes	Somewhat poor	Poor bearing strength	Severe if wet	Good	High	Soil has very limited season of use; consider winter harvesting, designated skid trails. Roads may require turnpiking, special design, gravel. Lop and scatter, excavator pile, or broadcast burn slash.
21-8	Cirque basins, 20-40% slopes	Somewhat excessive	Moderate rock on ridges	Moderate	Fair, droughty	Moderate	Moderately deep coarse soils reduce water and nutrients. South slopes droughty. On slopes over 35%, lop and scatter, excavator pile, or broadcast burn slash.
21-9	Rock outcrops, shallow glacial till, 40-60% slopes	Moderate to well drained	Low/moderate	Moderate/ **high**	Poor	Moderate	Unsurfaced roads are very bumpy due to shallow bedrock. ***Displacement risk increases with slope. Avoid ground-based skidding on slopes over 45 percent.***
23-8	Glaciated mountain slopes, 20-40% slopes	Well drained	Low	Moderate/ high	Moderate competition	Moderate	Moderately deep coarse soils reduce water and nutrients. South slopes droughty. On slopes over 35%, lop and scatter, excavator pile, or broadcast burn slash.
23-9	Glaciated mountain slopes 40-60% slopes	Well drained	Low	Moderate/ high	Moderate competition	Moderate	Moderately deep coarse soils reduce water and nutrients. South slopes very droughty. Cable yard on slopes over 45% or soft-track up to 55% slopes.

MAP UNIT	DESCRIPTION	SOIL DRAINAGE	ROAD LIMITATIONS	TOPSOIL DISPLACEMENT AND COMPACTION	SEEDLLNG ESTABLISHMENT	EROSION (BARE SURFACE)	NOTES
26A-8	Glacial till, 20-40% slopes	Well drained	Moderate	Moderate	Good	Moderate	Deep productive soil. Fine-textured soil remains moist; check soil moisture. Topsoil depth is important.
26A-9	Glacial till, 20-40% slopes	Well drained	Moderate	Moderate	Good	Moderate	Deep productive soil. Fine-textured soil remains moist; check soil moisture. Topsoil depth is important.
26C-7	Glacial moraines, 0-20% slopes	Well drained	Low	Moderate (severe if wet)	Good	Low	Deep productive soil. Topsoil depth is important.
26C-8	Glacial moraines, 20-40% slopes	Well drained	Moderate/ high	Moderate/ high	Good	Moderate	Deep productive soil. Topsoil depth is important.
26C-9	Glacial moraines, 40-60% slopes	Well drained	Moderate/ high	Moderate/ high	Good	Moderate /high	Deep productive soil; average season of use. Limit soft-track skidder to slopes less than 45%.
27-7	Glacial dames and kettles, 10-20% slopes	Well drained	Low	Low	Fair	Moderate	Deep soil, low fertility. Topsoil depth is very important.
28-7	Glacial moraines, 0-20% slopes	Well drained	Low	Moderate	Moderate-droughty	Low	Topsoil depth is very important.
57-8	Residual soils, 20-40% slopes	Well drained	Low	Moderate	Fair, droughty	Moderate	Shallow and moderately deep very gravelly/rocky soils. Cable yarding on slopes over 45%, broadcast burn.

MAP UNIT	DESCRIPTION	SOIL DRAINAGE	ROAD LIMITATIONS	TOPSOIL DISPLACEMENT AND COMPACTION	SEEDLLNG ESTABLISHMENT	EROSION (BARE SURFACE)	NOTES
72	Glacial cirque wall, 60-90% slopes	Well drained	Rocky, steep	Low	Very poor	Low	Very shallow soils with excessively steep sideslopes. Cutslopes are difficult to revegetate.
73	Glacial trough wall, 60-90%	Well drained	Rocky, steep	Cable - moderate	Fair	High	Steep slopes, rocky soils with common rock outcrops. Cable logging recommended for slopes over 45%. Lop and scatter or excavator pile slash.
74	Stream breaklands, slopes over 60%	Fair to good, droughty on south slopes	Moderate to severe (steep)	High displacement	Fair, competition	High	Steep slopes require cable operation.

APPENDIX E
FISHERIES ANALYSIS

ISSUE

The purpose of this analysis is to assess potential impacts to cold-water fisheries within the West Fork Timber Sale Project area as a result of any one of the project alternatives.

INTRODUCTION

The West Fork Timber Sale Project area includes State trust lands within Sections 18, 19, 20, 28, 29, 30, 31, 32, 33, and 34, T34N, R23W, and Section 13, T34N, R24W, which lie entirely within the Swift Creek drainage (*5th code HUC 17010210050*). Up to 1,270 acres of total harvest area is proposed within the project area.

The project area includes the watersheds of 2 major tributaries of Swift Creek: West Fork of Swift Creek (West Fork) and East Fork of Swift Creek (East Fork). Additionally, 2 specific subbasins of the West Fork will be included in the analysis; from north to south, Stryker Creek and Johnson Creek. The downstream, main-stem reach of Swift Creek between Section 3, T33N, R23W, and Whitefish Lake is not within the project area and will not be included in this analysis. None of the project alternatives are expected to have any direct, indirect, or cumulative impacts with respect to downstream fisheries in the main-stem reach of Swift Creek.

The West Fork is identified on the Montana 303(d) list as an impaired stream, and a TMDL is scheduled for development in 2011. The portion of the West Fork within the project area has been identified as “not supporting” of cold-water fisheries and other aquatic life according to the 2002 and Draft 2004 303(d) lists developed by the DEQ. Probable causes of this listing include flow alteration, other habitat alterations, and siltation; the probable sources include silviculture, highway maintenance, and runoff.

The East Fork is identified on the Montana 303(d) list, but is not scheduled for TMDL development as an impaired stream. The portion of the East Fork within the project area has been identified as “partially supporting” cold-water fisheries and other aquatic life according to the 2002 and draft 2004 303(d) lists developed by DEQ. Probable causes of this listing include flow alteration and other habitat alterations; the probable sources include silviculture, habitat modification (other than hydromodification), and modification/destablilization of banks or shoreline.

The Swift Creek drainage, including the West Fork, East Fork, and any contributing subbasins, is classified as A-1 in the Montana Surface Water Quality Standards. The A-1 classification is for multiple beneficial-use waters, including the growth and propagation of cold-water fisheries and associated aquatic life. Among other criteria for A-1 waters, a 1 degree Fahrenheit maximum increase above naturally occurring water temperature is allowed within the range of 32 to 66 degrees Fahrenheit (0 to 18.9 degrees Celsius) and no increases are allowed above naturally occurring concentrations of sediment, which will harm or prove detrimental to fish or wildlife. In regard to sediment, naturally occurring includes conditions or materials present from runoff on developed land where all reasonable land, soil, and water conservation practices have been applied. Reasonable practices include methods, measures, or practices that protect present and reasonably anticipated beneficial uses. The State has adopted Forestry BMPs through its Nonpoint-Source Management Plan as the principle means of controlling nonpoint-source pollution from silvicultural activities (*Thomas et al 1990*).

SPECIES

Native cold-water fish species within the project area include bull trout (*Salvelinus confluentus*), westslope cutthroat trout (*Oncorhynchus clarki lewisi*), slimy sculpin (*Cottus cognatus*), largescale sucker (*Catostomus macrocheilus*), and longnose sucker (*Catostomus catostomus*). The 1 nonnative species known to persist within the specific project area is eastern brook trout (*Salvelinus fontinalis*).

Neither slimy sculpin, largescale sucker, nor longnose sucker are identified as endangered, threatened, or sensitive species (*Montana Natural Heritage Program [MNHP] 2003*). Although all 3 species are an integral component of the aquatic ecosystem within the project area, any foreseeable issues or concerns regarding these species' populations or habitats can be addressed through an effects analysis for bull trout and westslope cutthroat trout. Eastern brook trout is an invasive species that is not a component of the region's historical biodiversity, but any foreseeable issues or concerns regarding this species' populations or habitats can also be addressed through an effects analysis for bull trout and westslope cutthroat trout.

Bull trout and westslope cutthroat trout are the primary cold-water species that will be addressed in this analysis. The U.S. Fish and Wildlife Service (USFWS) has listed bull trout as "threatened" under the Endangered Species Act. Both bull trout and westslope cutthroat trout are listed as Class-A Montana Animal Species of Concern. A Class-A designation is defined as a species or subspecies that has limited numbers and/or habitats both in Montana and elsewhere in North America and elimination from Montana would be a significant loss to the gene pool of the species or subspecies (*DFWP, MNHP, and Montana Chapter American Fisheries Society Rankings*). DNRC has also identified bull trout and westslope cutthroat trout as sensitive species (*ARM 36.11.436*).

Both bull trout and westslope cutthroat trout exhibit resident, fluvial, and adfluvial life forms. Resident life forms spend their juvenile and adult life in natal or nearby low-order tributaries. Fluvial and adfluvial life forms generally leave their natal streams within 1 to 3 years of emergence (*Shepard et al 1984, Fraley and Shepard 1989*) to mature in downstream river and lake systems, respectively, and then return again to headwater or upstream reaches to spawn. Fluvial and adfluvial life forms of bull trout and westslope cutthroat trout are typically larger than resident fish, and bull trout have been observed returning to upstream reaches during successive or alternating years to spawn (*Fraley and Shepard 1989*). The life forms and stages of bull trout and westslope cutthroat trout have evolved to coexist in overlapping geographic areas (*Nakano et al 1992, Pratt 1984, Shepard et al 1984*).

Fluvial and adfluvial bull trout generally mature between ages 5 to 6, begin upstream spawning migrations in April, and spawn between September and October in response to a temperature regime decline below 9 to 10 degrees Celsius (*Fraley and Shepard 1989*). Spawning adult bull trout are known to construct redds in close association with upwelling groundwater and proximity to overhanging or instream cover (*Fraley and Shepard 1989*). Naturally occurring stream temperature regimes and substrate compositions having low levels of fine material are closely related to bull trout embryo and juvenile survival (*MBTSG 1998, Weaver and Fraley 1991, Pratt 1984*).

Resident westslope cutthroat trout have been observed maturing at ages 3 to 5 (*Downs et al 1997*), and all life forms are known to spawn during May through June (*Shepard et al 1984*). Naturally occurring stream-temperature regimes and substrate compositions having low levels of fine material are closely related to westslope cutthroat trout embryo and juvenile survival (*Pratt 1984*).

ISSUES RAISED DURING SCOPING

Four concerns were received by DNRC during the scoping process that pertain specifically to fisheries:

1) The project should protect the genetic diversity of existing bull trout populations.
2) The project should help protect bull trout and westslope cutthroat trout in Johnson and Swift creeks.
3) The project will not address existing areas of degraded habitat.
4) The project may further degrade bull trout habitat.

Concerns 1 and 2 are stated as conservation goals and are not considered ‘issues’ to be described in the *EXISTING CONDITIONS* and *ENVIRONMENTAL EFFECTS* sections. Concern 3 is an ‘issue’ that will be addressed under the *EXISTING CONDITIONS* habitat subissues for each basin and subbasin. Concern 4 is an ‘issue’ that will be addressed under the *ALTERNATIVE EFFECTS* habitat subissues for each basin and subbasin.

ANALYSIS METHODS AND SUBISSUES

The existing conditions of bull trout and westslope cutthroat trout populations and habitat will be described in the *EXISTING CONDITIONS* portion of this analysis. In *ALTERNATIVE EFFECTS,* those existing conditions will then be compared to the anticipated effects of the project alternatives to determine foreseeable impacts to bull trout and westslope cutthroat trout.

Analysis methods are a function of the types and quality of data available for analysis, which varies among the different basins and subbasins in the project area. The analyses may either be quantitative or qualitative. The best available data for both populations and habitats will be presented separately for Stryker and Johnson creeks and the West Fork. Existing conditions and foreseeable environmental effects for each subbasin will be explored using the following outline of subissues:

- Populations
  - presence
  - genetics
- Habitat
  - flow regime
  - sediment
  - channel form
  - large woody debris
  - riparian zone
  - stream temperature
  - connectivity

The East Fork will not be analyzed for existing conditions under the *EXISTING CONDITIONS* or *ALTERNATIVE EFFECTS* sections since a portion of Harvest Area II-A (see *Action Alternatives B* and *C*) is the only area within the East Fork watershed that is proposed for harvesting. This specific proposed harvest area includes approximately 31.5 acres within the East Fork watershed and lies on a very low slope, 1 to 2 percent gradient terrain. The boundary of the proposed harvest unit parallels the East Fork for approximately 1,025 feet, but the boundary is at least 285 feet from the stream at all points. The very low relative amount of potential timber harvesting in the East Fork watershed and the associated risk of cumulative effects due to a potential water-yield increase is inconsequential (see *APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS*). Consequently, this stream will not be included in the fisheries analysis since no foreseeable direct, indirect, and/or cumulative impacts to bull trout or westslope cutthroat trout populations (presence, genetics) or habitat (flow regime, sediment, channel form, large woody debris, riparian zone, stream temperature, connectivity) are expected as a result of No-Action Alternative A or Action Alternatives B or C.

SUMMARY OF ALTERNATIVES

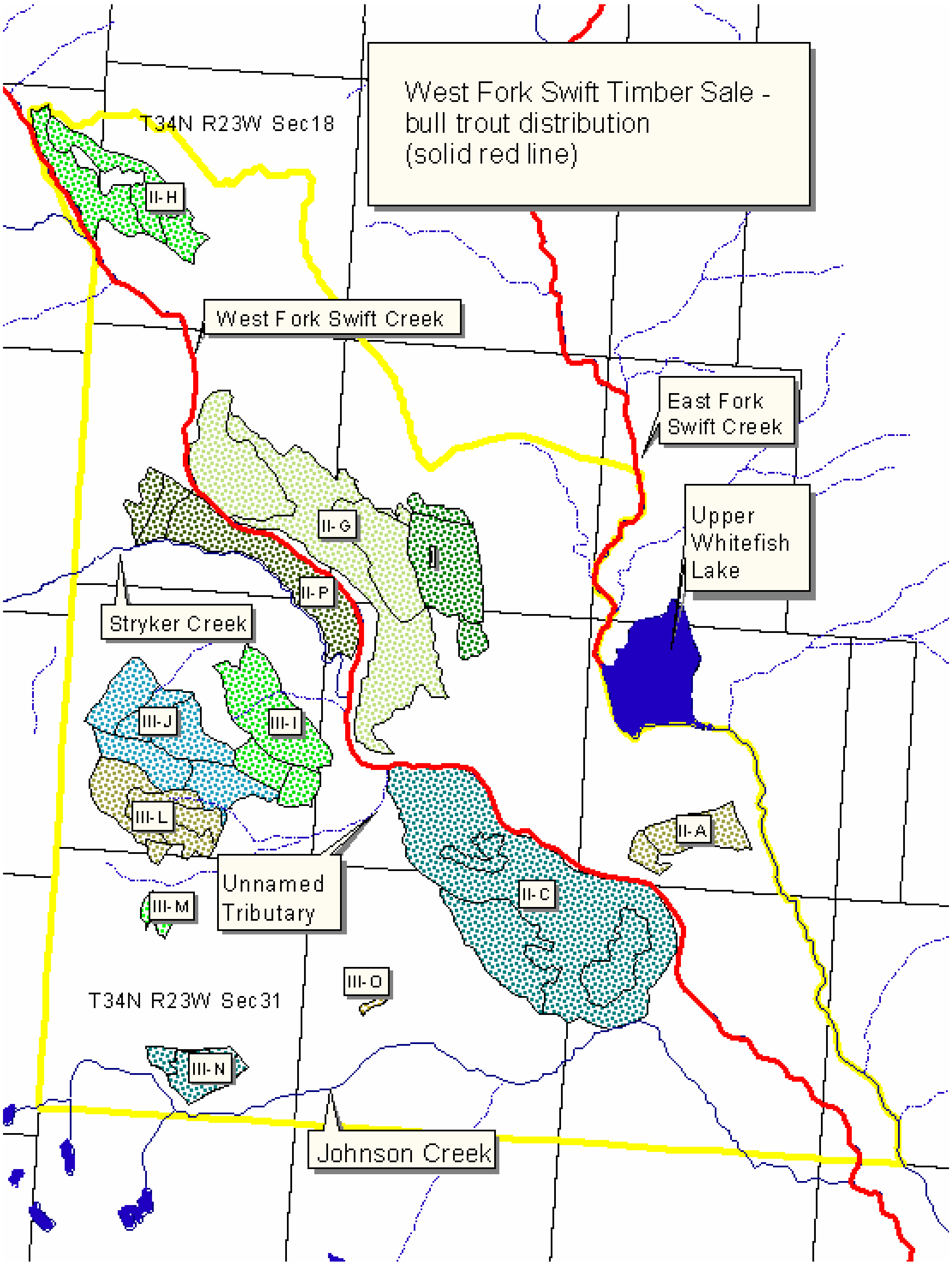
See *CHAPTER II—ALTERNATIVES* for detailed information, specific mitigations, and road management plans pertaining to No-Action Alternative A and Action Alternatives B and C.

Under No-Action Alternative A, existing conditions relative to bull trout and westslope cutthroat trout in the project area would remain unchanged as a result of the selection of this alternative.

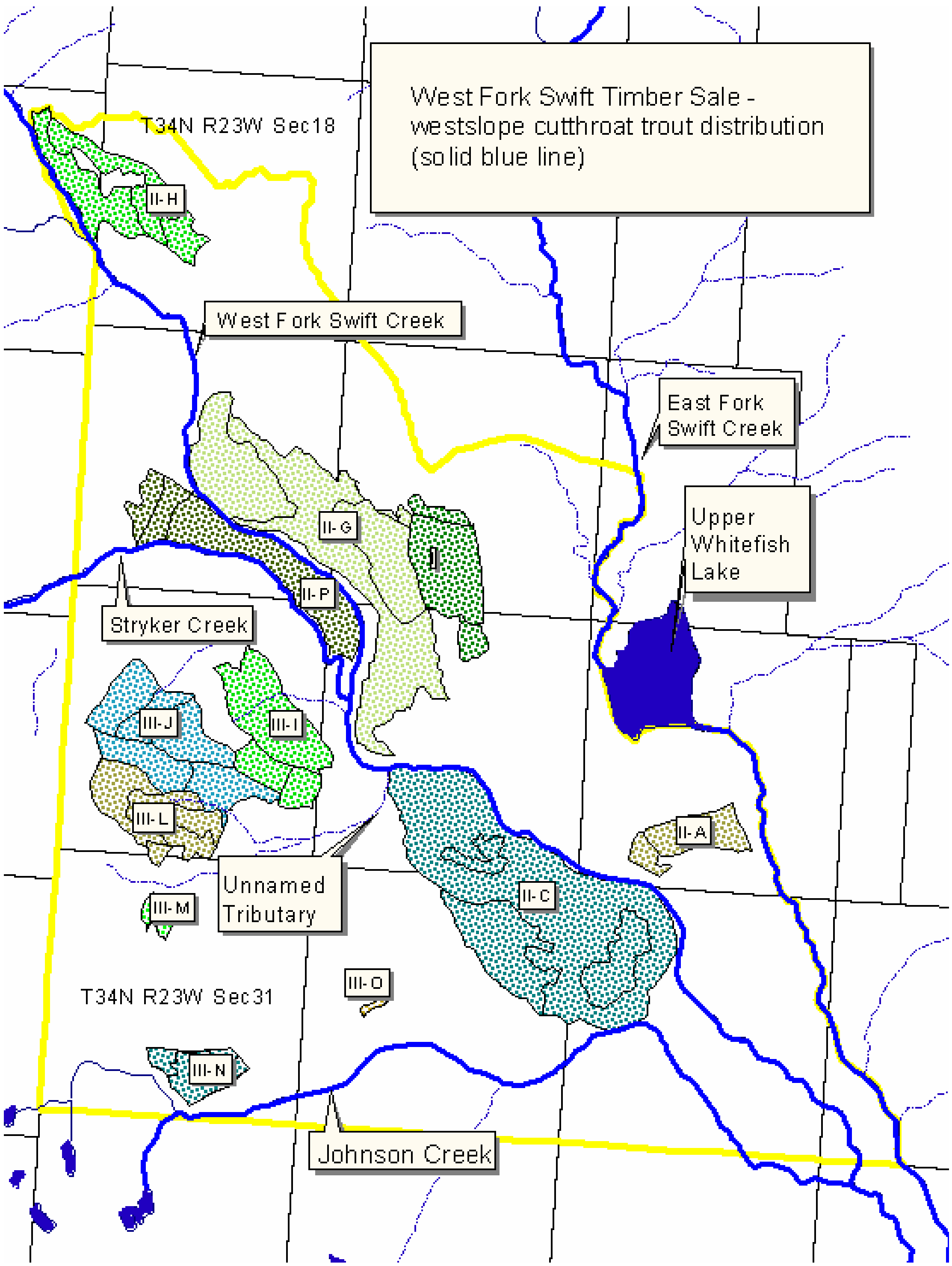
Action Alternative B involves 12 proposed timber harvest subareas in 3 areas; approximately 1,270 acres would be harvested using various silviculture plans. Actions associated with Action Alternative B would occur in the West Fork basin and the subbasins of Stryker Creek, and Johnson Creek, all of which provide varying degrees of bull trout and westslope cutthroat trout habitat.

Action Alternative C involves 6 proposed timber harvest subareas in 2 areas. Approximately 938 acres would be harvested using various silviculture plans. Actions associated with this alternative would occur in the West Fork basin and the subbasins of Stryker Creek, and Johnson Creek, all of which provide varying degrees of bull trout and westslope cutthroat trout habitat.

MAP 1 – KNOWN BULL TROUT DISTRIBUTION WITHIN THE PROJECT AREA (MFISH)



MAP 2 – *KNOWN WESTSLOPE CUTTHROAT TROUT DISTRIBUTION WITHIN THE PROJECT AREA (MFISH)*



EXISTING CONDITIONS

➢ *WEST FORK*

The West Fork is a fourth-order stream; the entire reach within the project area is considered fish bearing.

West Fork Bull Trout and Westslope Cutthroat Trout Populations

- ***Presence***

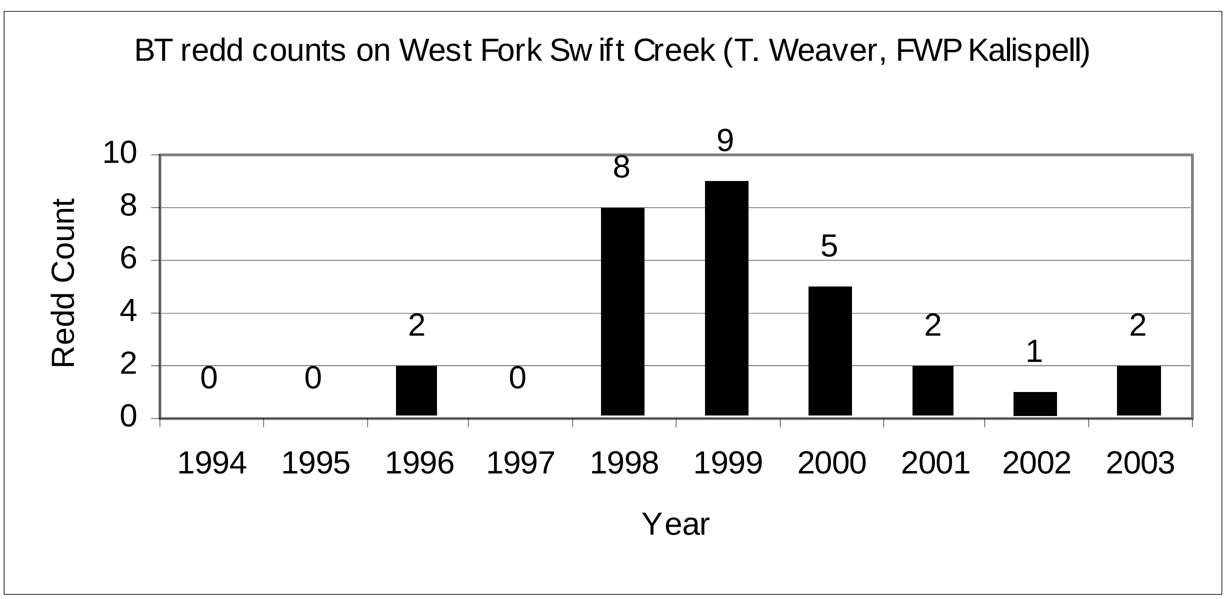
The West Fork has been identified as ***providing important habitat for a disjunct bull trout population associated with Whitefish Lake.***

Although bull trout may exhibit the resident life form in the West Fork, this subbasin is likely used by bull trout primarily as spawning and rearing habitat for disjunct populations associated with Whitefish and Upper Whitefish lakes. Genetic data suggests that migratory adults in the upper Flathead River system have been found to frequently return to their natal or near-natal streams (*Kanda et al 1997*), and populations of migratory spawning adult fish in the Flathead River system have been observed returning to the same stream reaches during subsequent spawning runs (*Fraley and Shepard 1989*). This propensity for habitual adult migration to natal or near-natal streams and the consequent selection of unique spawning locations would make the use of redd counts in the West Fork a valid measure of the trends of the species' overall success in occupying a specific subbasin.

The protocol for collecting redd count and estimated population data in the West Fork is described in *Weaver and Fraley (1991)*. Experienced crews and fixed survey boundaries are used for result consistency.

The data in *FIGURE E-1 – BULL TROUT REDD COUNTS IN WEST FORK OF SWIFT CREEK, 1994 THROUGH 2003* shows the number of bull trout redds constructed in the West Fork has ranged from 0 to 8 during the years 1994 to 2003. The data may also appear to describe a positive trend in bull trout success in the West

FIGURE E-1 – BULL TROUT REDD COUNTS IN WEST FORK OF SWIFT CREEK, 1994 THROUGH 2003



Fork, but the statistical significance of the simple linear regression is very low ($r^2 = 0.0515$), and studies suggest that a larger data set is needed in order to begin identifying long-term trends in bull trout populations through redd counts (*Rieman and Myers 1997*). The data in *TABLE E-1 - BULL TROUT POPULATION ESTIMATES IN THE WEST FORK, 1995 THROUGH 2003* shows the population estimates of bull trout age 1 and older in the West Fork has ranged from 0.22 to 5.10 individuals per 100 square meters during the years 1995 to 2003. The statistical significance of the simple linear regression for this data set is also very low ($r^2 = 0.0022$). For these reasons, it is determined that insufficient data is available to infer existing bull trout population trends or long-term success in the West Fork.

The West Fork is used primarily as habitat for resident westslope cutthroat trout, although resident adults typically spawn in several of the stream's lower-order tributaries such as Herrig, Stryker, and Johnson creeks. The West Fork may also be utilized to some degree as spawning and rearing habitat for adfluvial life forms that have matured in Whitefish or Upper Whitefish lakes. DFWP has conducted surveys of westslope cutthroat trout redd counts during the 2000, 2001, and 2002 early summer seasons utilizing the same protocols as described above for bull trout. No westslope cutthroat trout redds were counted during those survey years.

Due to lack of historic and comparable population presence data, there are no apparent existing direct and indirect impacts to bull trout and westslope cutthroat trout population presence in the West Fork.

- ***Genetics***

Site-specific information from DFWP regarding bull trout genetics is unavailable. However, some level of hybridization has possibly occurred with resident or migratory eastern brook trout in the West Fork subbasin, as data suggests that this hybridization has occurred widely throughout the Flathead River basin (*Kanda et al 1997*). Any existing impact to bull trout populations in the subbasin as a result of hybridization with eastern brook

TABLE E-1 – BULL TROUT POPULATION ESTIMATES IN WEST FORK SWIFT CREEK, 1995 THROUGH 2003

DATE	POPULATION ESTIMATES	95-PERCENT CONFIDENCE INTERVAL	PROBABILITY OF FIRST-PASS CAPTURE	DENSITY (NUMBER PER 100 SQUARE METERS)
8/24/1995	9	no estimate		1.04
9/16/1996	7	no estimate		0.81
8/26/1997	8	no estimate		0.92
8/26/1998	44	+/-20	0.52	5.10
8/25/1999	14	+/-1	0.92	1.44
9/07/2000	9	+/-1	0.88	1.52
8/31/2001	29	+/-3	0.83	2.80
9/19/2002	12	+/-2	0.80	1.38
8/29/2003	2	no estimate		0.22

Data adapted from T. Weaver (fisheries biologist), DFWP, Kalispell: population estimates, 95-percent confidence intervals, probability of first-pass capture and densities for age 1 and older bull trout calculated from electrofishing in a 150-meter section of the West Fork.

trout most likely is low. Migratory bull trout tend to have a reproductive size advantage over resident eastern brook trout (*Reiman and McIntyre 1993*), and offspring can have a considerable chance of being sterile or exhibiting other progressive growth problems (*Leary et al 1983).*

A DFWP genetic survey in 1984 of 26 westslope cutthroat trout collected from the West Fork found the subspecies slightly introgressed with rainbow trout. The genetic purity of westslope cutthroat trout was determined at that time to be 97.4 percent (*MFISH 2004*).

Due to the possibility of bull trout and brook trout hybridization and the known occurrence of introgressed westslope cutthroat trout, there are existing low to moderate direct and indirect impacts to bull trout and westslope cutthroat trout population genetics in the West Fork.

West Fork Bull Trout and Westslope Cutthroat Trout Habitat

- ***Flow Regime***

  Flow regime is the range of discharge frequencies and intensities in a specific watershed that occur throughout the year. The analysis of hydrologic data for the West Fork basin indicates that the existing average flow regime for the stream is approximately 3.4 percent above the range of naturally occurring conditions (see *APPENDIX C – WATERSHED AND HYDROLOGY ANALYSIS*), which is primarily a result of past forest crown removal. The range of naturally occurring conditions is considered representative of those flow regimes in a fully forested, mature (20 to 30 years old) watershed.

  Changes in flow regime can affect bull trout and westslope cutthroat trout through modifications of stream morphology, sediment budget, streambank stability, and channel formations. There is likely no detectable existing impact on these specific habitat characteristics as a result of the estimated 3.4 percent increase in flow regime.

  Changes in flow regime have been known to affect bull trout and westslope cutthroat trout spawning migration, habitat available for spawning, and embryo survival; for this reason, there is a very low potential for direct and indirect impacts to bull trout and westslope cutthroat trout as a result of flow-regime modifications in the West Fork.

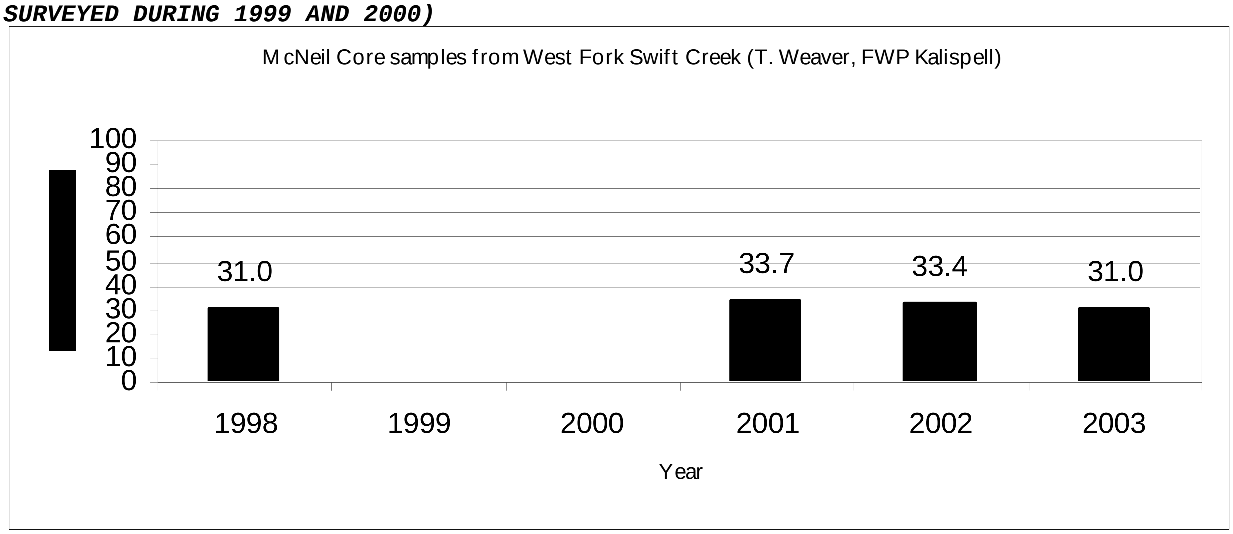
- ***Sediment***

  Existing stream-sediment processes that are described in this analysis are *Rosgen* stream-morphological type, sediment budget, and streambank stability. The stream morphology of the West Fork, from the confluence with the East Fork (river mile 0.00) in Section 3, T33N, R23W, upstream through the project area and to a point (river mile 7.13) in Section 12, T34N, R24W, is generally described as exhibiting a B3/B4 *Rosgen* morphological type with gradients ranging from 2 to 4 percent (*Koopal 2001*). The B morphological type broadly includes riffle-dominated streams in narrow, gently sloping valleys, which typically exhibit infrequently spaced pools (*Rosgen 1996*). Furthermore, the B3/B4 morphological type is characteristic of channel compositions dominated by cobbles and codominated by gravels, with lesser amounts of boulder, gravel, and sand (*Rosgen 1996*).

Several surveys have been conducted to describe the sediment budget of the West Fork, including McNeil core, substrate score, and Wolman pebble count. The McNeil core sampling methodology (*McNeil and Ahnell 1964*) has been demonstrated to be an effective technique for measuring temporal changes in the streambed permeability of spawning gravels. McNeil core data has been collected at known bull trout spawning reaches in the West Fork between 1998 and 2003 (*FIGURE E-2 – MCNEIL CORE SAMPLES FROM THE WEST FORK, 1998 THROUGH 2003 [NOT SURVEYED DURING 1999 AND 2000]*). *Weaver and Fraley (1991)* found that the percentage of substrates less than 6.35 millimeter in spawning beds was inversely proportional to bull trout and westslope cutthroat trout embryo survival in the Flathead River basin. The Flathead Basin Commission, a cooperative program involving private, State, and Federal landowners in the river basin, subsequently determined that streams with spawning gravels having 35 or 40 percent of substrates less than 6.35 millimeter in any given year were “threatened” or “impaired”, respectively, in regards to bull trout and western cutthroat trout embryo survival (*Flathead Basin Commission 1991*). The McNeil core sample results from the West Fork are collected using *Weaver and Fraley (1991)* and are displayed in *FIGURE E-2 – MCNEIL CORE SAMPLES FROM THE WEST FORK, 1998 THROUGH 2003 [NOT SURVEYED DURING 1999 AND 2000]*) to show the proportion of substrates in the less than 6.35 millimeter size class. All of the sample sets show that the proportion of substrates less than 6.35 millimeters is under the 35 percent threshold for “threatened” status.

Embeddedness is generally described as the degree to which fine sediments surround coarse substrates on the streambed surface (*Sylte and Fischenich 2002*). The substrate score is one technique for measuring embeddedness, where higher scores indicate lower embeddedness and typically better juvenile bull trout habitat (*Shepard et al 1984*). A modified substrate score

FIGURE E-2 – MCNEIL CORE SAMPLES FROM THE WEST FORK, 1998 THROUGH 2003 (NOT SURVEYED DURING 1999 AND 2000)



methodology has been employed on the West Fork (*Weaver and Fraley 1991 citing others*) from 1994 through 2003 (see *FIGURE E-3 – SUBSTRATE SCORE SAMPLES FROM THE WEST FORK, 1994 THROUGH 2003 [NOT SURVEYED DURING 1995 AND 1998]*). The Flathead Basin Commission has subsequently determined that streams with substrate scores of 10 or 9 in any given year were "threatened" or "impaired", respectively, in regards to bull trout and westslope cutthroat trout embryo survival and juvenile rearing habitat (*Flathead Basin Commission 1991*). All of the sample sets in *FIGURE E-3 – SUBSTRATE SCORE SAMPLES FROM WEST FORK SWIFT CREEK, 1994 THROUGH 2003 (NOT SURVEYED DURING 1995 AND 1998)* show substrate scores higher than 10, and data also suggests that overall habitat quality as it relates to substrate embeddedness is likely improving over time.

The Wolman pebble count (*Wolman 1954*) is another method that can be used to describe temporal changes in substrate size classes on the streambed surface. Sample data from 2 collection sites on the West Fork is only available for the year 2001 (*FIGURE E-4 – WOLMAN PEBBLE COUNT RESULTS FROM THE WEST FORK, 2001*). The combined

FIGURE E-3 – SUBSTRATE SCORE SAMPLES FROM WEST FORK SWIFT CREEK, 1994 THROUGH 2003 (NOT SURVEYED DURING 1995 AND 1998)

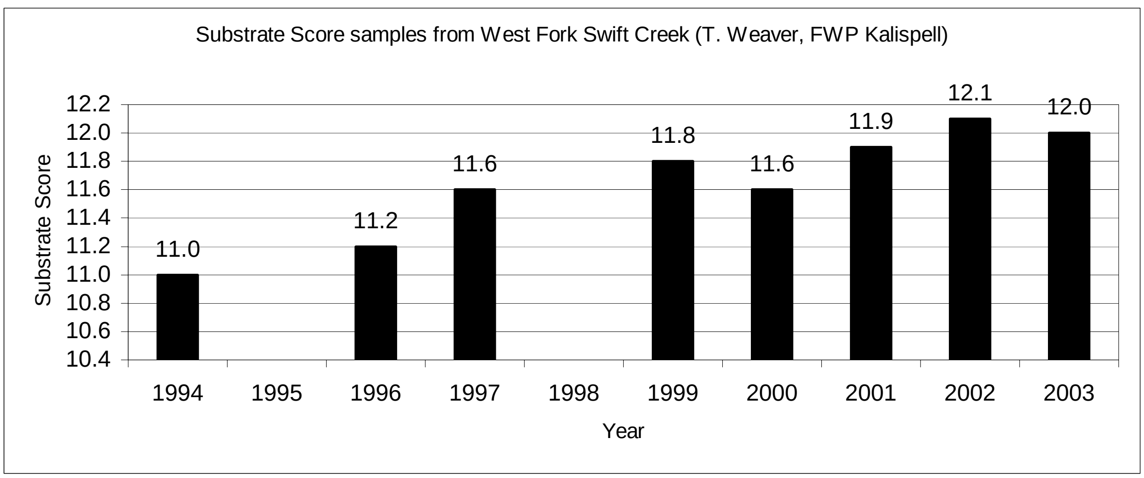
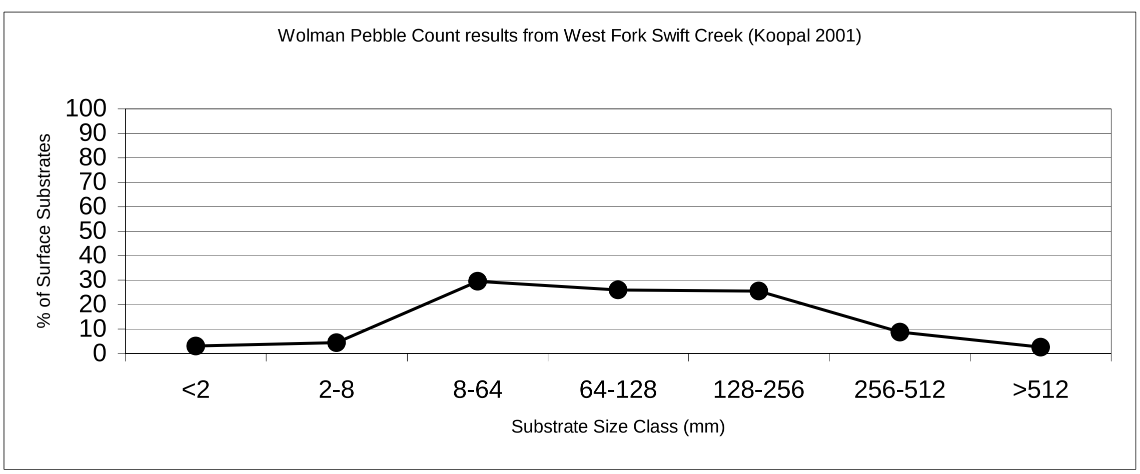


FIGURE E-4 – WOLMAN PEBBLE COUNT RESULTS FROM THE WEST FORK, 2001



percentage of substrates less than 8 millimeter is 7.5 percent, which is considerably lower than the results calculated for the similar size class in the McNeil core samples (percentage of substrate less than 6.35 millimeters ranges from 31.0 to 33.7 percent). This difference suggests that there could be a greater level of interstitial spaces in the streambed surface gravel and cobble substrates than may be indicated by the McNeil core data.

The final assessment of stream sediment processes includes a description of existing streambank stability. Streambank stability is a measure of bank erosion rates per stream length; temporal changes in the rates can be used as one indicator of potential existing impacts to fish habitats. Streambank stability data for the West Fork is only available for the year 2001 (*TABLE E-2 – STREAMBANK STABILITY RESULTS FROM THE WEST FORK (KOOPAL 2001*) and includes all stream habitats from the confluence with the East Fork (river mile 0.00) in Section 3, T33N, R23W, upstream through the project area and to a point

TABLE E-2 – STREAMBANK STABILITY RESULTS FROM THE WEST FORK (KOOPAL 2001)

HABITAT TYPE*	TOTAL NUMBER OF UNITS	TOTAL LEFT BANK LENGTH (FEET)	TOTAL RIGHT BANK LENGTH (FEET)	MEAN PERCENT STABLE BANK	MEAN PERCENT UNSTABLE BANK	MEAN PERCENT UNDERCUT BANK
DMV	1	49.0	49.0	100.00	0.00	15.00
DMW	5	215.0	214.0	86.60	13.40	0.70
GLD	2	220.0	220.0	100.00	0.00	0.00
HGR	7	831.0	832.0	100.00	0.00	0.26
LGR	140	29,135.0	29,303.0	99.26	0.74	1.09
RUN	27	2,714.0	2,704.0	100.00	0.00	2.09
SLB	6	178.0	178.0	100.00	0.00	2.30
SLM	27	999.0	1,003.0	100.00	0.00	7.09
SLW	22	595.0	591.0	94.18	5.82	2.76
SMB	12	476.0	486.0	100.00	0.00	2.35
SMW	10	324.0	329.0	99.17	0.83	6.26
SPB	2	71.0	75.0	100.00	0.00	3.08
SPW	38	1,016.0	1,011.0	97.83	2.17	5.01
STP	4	315.0	304.0	100.00	0.00	0.00
SUW	12	402.0	408.0	99.36	0.64	10.80
Totals	315	37,540.0	37,707.0			
Mean				99.19	0.81	1.61

**DMV = main channel dammed pool caused by beaver*
DMW = main channel dammed pool caused by large woody debris
GLD = glide, "HGR" = high gradient riffle
LGR = low gradient riffle
RUN = run
SLB = lateral scour pool formed by boulder
SLM = lateral scour pool formed by meander
SLW = lateral scour pool formed by large woody debris
SMB = mid-channel scour pool formed by boulder
SMW = mid-channel scour pool formed by large woody debris
SPB = plunge pool formed by boulder
SPW = plunge pool formed by large woody debris
STP = step-pool
SUW = underscour pool formed by large woody debris

(river mile 7.13) in Section 12, T34N, R24W. The protocol used for collecting the streambank stability data is outlined in *Overton et al (1997)*. Overall, the results of this data set show very high levels (99.19 percent) of streambank stability throughout the project area.

McNeil core data indicates that the substrates of known spawning reaches are not “threatened”; substrate scores describing streambed substrate embeddedness also indicate that known spawning reaches are not “threatened”, and Wolman pebble counts suggest that there are high levels of streambed substrates in the gravel, cobble, and boulder classes. Additionally, a recent streambank-stability assessment shows very low levels of potential streambank erosion. Based on these observations, there are no existing direct and indirect impacts to bull trout and westslope cutthroat trout habitat as a result of sediment in the West Fork.

- ***Channel Forms***

  Two descriptions of channel formation will also be used to describe existing bull trout and westslope cutthroat trout habitat in the West Fork: *Montgomery/Buffington* classification (*Montgomery and Buffington 1997*) and *R1/R4 Fish Habitat Standard Inventory* (*Overton et al 1997*). The stream formations of the West Fork, from the confluence with the East Fork (river mile 0.00) in Section 3, T33N, R23W, upstream through the project area and to a point (river mile 7.13) in Section 12, T34N, R24W, are broadly described as exhibiting both ‘pool-riffle’ and ‘forced pool-riffle’ Montgomery/Buffington classifications. The ‘forced pool-riffle’ channel form is generally a function of large-woody-debris recruitment to the bankfull area of the stream, and both channel forms typically have pool frequencies of 1:5 to 1:7, where the later ratio is channel width (*Montgomery and Buffington 1997*).

  The *R1/R4 Fish Habitat Standard Inventory* is a useful protocol for describing existing conditions and tracking temporal changes in the relative proportions of different stream microhabitats used by bull trout, westslope cutthroat trout, and other native fisheries. Inventory data for the West Fork is only available for the year 2001 (*TABLE E-3 – R1/R4 FISH HABITAT STANDARD INVENTORY RESULTS FROM THE WEST FORK [KOOPAL 2001*]) and includes all stream habitats from the confluence with the East Fork (river mile 0.00) in Section 3, T33N, R23W, upstream through the project area and to a point (river mile 7.13) in Section 12, T34N, R24W.

  The *R1/R4 Fish Habitat Standard Inventory* data from 2001 indicates that 56 percent of all channel forms are nonpool features (GLD, HGR, LGR, RUN), and the remaining 44 percent of all channel forms are pool features. The relative numbers of nonpool and pool channel forms are roughly equivalent to the mean quantity of habitat area, which is 53 and 47 percent, respectively. On the contrary, the mean quantity of habitat volume in the West Fork is 43 percent for nonpool features and 57 percent for pool features. Increasing amounts of different pool habitats are typically proportional to increasing levels of bull trout and westslope cutthroat trout stream-habitat quality. As B morphological type streams are

TABLE E-3 – R1/R4 FISH HABITAT STANDARD INVENTORY RESULTS FROM THE WEST FORK SWIFT CREEK (KOOPAL 2001)

HABITAT TYPE*	TOTAL NUMBER OF UNITS	MEAN HABITAT LENGTH (FEET)	MEAN WIDTH (FEET)	MEAN HABITAT DEPTH (FEET)	MEAN WIDTH/DEPTH RATIO	MEAN HABITAT AREA (SQUARE FEET)	MEAN HABITAT VOLUME (CUBIC FEET)
DMV	1	49.0	19.5	0.68	28.68	955.5	649.7
DMW	5	41.4	18.7	0.76	24.90	772.2	586.0
GLD	2	110.0	13.7	0.52	32.55	1,509.0	777.6
HGR	7	118.4	14.1	0.54	27.91	1,669.2	894.5
LGR	140	208.0	17.2	0.52	35.94	3,568.7	1,873.5
RUN	27	107.5	17.1	0.65	29.37	1,838.0	1,194.2
SLB	6	29.3	16.4	0.79	20.91	479.7	377.8
SLM	27	36.5	16.0	0.83	21.07	584.7	483.6
SLW	22	26.0	17.9	0.84	24.45	465.6	393.3
SMB	12	39.6	17.8	0.77	24.17	702.6	539.0
SMW	10	31.8	19.5	0.72	29.70	620.6	447.4
SPB	2	35.5	12.6	0.76	16.62	446.8	340.2
SPW	38	26.1	18.1	0.89	22.56	471.8	418.6
STP	4	75.3	19.2	1.01	19.71	1,446.1	1,455.7
SUW	12	33.1	20.3	0.86	25.26	671.0	575.1
Total	315						
Mean		119.4	17.1	0.57	33.70	2,047.5	1,175.1

**DMV = main channel dammed pool caused by beaver*
DMW = main channel dammed pool caused by large woody debris
GLD = glide
HGR = high gradient riffle
LGR = low gradient riffle
RUN = run
SLB = lateral scour pool formed by boulder
SLM = lateral scour pool formed by meander
SLW = lateral scour pool formed by large woody debris
SMB = mid-channel scour pool formed by boulder
SMW = mid-channel scour pool formed by large woody debris
SPB = plunge pool formed by boulder
SPW = plunge pool formed by large woody debris
STP = step-pool
SUW = underscour pool formed by large woody debris

generally riffle dominated (*Rosgen 1996*), this data indicates that the West Fork likely provides an average quantity of pool habitat within the project area.

No specific conclusions regarding trends in channel form can be drawn from these current observations, but this data will be indispensable in future habitat assessment and monitoring efforts. Although insufficient data is available for describing existing trends in channel forms, likely there are no existing direct and indirect impacts to bull trout and westslope cutthroat trout habitat as a result of channel formations in the West Fork.

- ***Large Woody Debris***

Large woody debris is recruited to the stream channel from adjacent and upstream riparian vegetation, and the material is a critical component in the formation of complex bull trout and westslope cutthroat trout habitat. All life stages of bull trout and westslope cutthroat trout have been observed closely associated with

TABLE E-4 – LARGE-WOODY-DEBRIS COUNT RESULTS FROM THE WEST FORK (KOOPAL 2001)

HABITAT TYPE*	TOTAL NUMBER OF UNITS	SINGLE PIECES			AGGREGATES				ROOT WADS		
		TOTAL NUMBER	MEAN NUMBER	NUMBER PER 100 FEET	TOTAL NUMBER	MEAN NUMBER	NUMBER PER 100 FEET	NUMBER OF PIECES	TOTAL NUMBER	MEAN NUMBER	NUMBER PER 100 FEET
DMV	1	1	1.0	2.0	0	0.0	0.0	0	0	0.0	0.0
DMW	5	1	0.2	0.5	6	1.2	2.9	47	0	0.0	0.0
GLD	2	2	1.0	0.9	0	0.0	0.0	0	0	0.0	0.0
HGR	7	12	1.7	1.4	6	0.9	0.7	16	0	0.0	0.0
LGR	140	368	2.6	1.3	223	1.6	0.8	707	14	0.1	0.0
RUN	27	33	1.2	1.1	25	0.9	0.9	77	1	0.0	0.0
SLB	6	5	0.8	2.8	2	0.3	1.1	10	0	0.0	0.0
SLM	27	24	0.9	2.4	10	0.4	1.0	41	6	0.2	0.6
SLW	22	3	0.1	0.5	20	0.9	3.5	94	2	0.1	0.3
SMB	12	11	0.9	2.3	8	0.7	1.7	32	1	0.1	0.2
SMW	10	2	0.2	0.6	10	1.0	3.1	59	1	0.1	0.3
SPB	2	2	1.0	2.8	2	1.0	2.8	7	0	0.0	0.0
SPW	38	23	0.6	2.3	29	0.8	2.9	161	0	0.0	0.0
STP	4	3	0.8	1.0	5	1.3	1.7	58	0	0.0	0.0
SUW	12	6	0.5	1.5	13	1.1	3.3	51	1	0.1	0.3
Totals	315	496			359			1,360	26		
Mean			1.6	1.3		1.1	1.0			0.1	0.1

**DM = main channel dammed pool caused by beaver*
DMW = main channel dammed pool caused by large woody debris
GLD = glide
HGR = high gradient riffle
LGR = low gradient riffle
RUN = run
SLB = lateral scour pool formed by boulder
SLM = lateral scour pool formed by meander
SLW = lateral scour pool formed by large woody debris
SMB = mid-channel scour pool formed by boulder
SMW = mid-channel scour pool formed by large woody debris
SPB = plunge pool formed by boulder
SPW = plunge pool formed by large woody debris
STP = step-pool
SUW = underscour pool formed by large woody debris

large woody debris in the Flathead River basin (*Platt 1984, Shepard et al 1984*). Large woody debris recruitment rates to the West Fork throughout the project area can be described using large-woody-debris counts per stream length; this data was collected during 2001 as part a *R1/R4 Fish Habitat Standard Inventory* (*Overton et al 1997*). (See *TABLE E-4 – LARGE-WOODY-DEBRIS COUNT RESULTS FROM THE WEST FORK [KOOPAL 2001]*). Large-woody-debris counts for the West Fork include all stream habitats from the confluence with the East Fork (river mile 0.00) in Section 3, T33N, R23W, upstream through the project area and to a point (river mile 7.13) in Section 12, T34N, R24W.

The mean large-woody-debris count per 1,000 feet is calculated by dividing the sum of the total number of single pieces, the number of pieces in each aggregate, and the total number of root wads by the total length of all main-channel habitat units (37,612.0 feet) surveyed during the inventory. The mean large-woody-debris count per 1,000 feet in the West Fork is 50 pieces per 1,000 feet.

Data from reference reaches (*Harrelson et al 1994*) in the Flathead River Basin region indicate that the average amount of large woody debris in undisturbed ‘B’ channel types (*Rosgen* morphological stream type) is 123 pieces per 1,000 feet plus or minus 57 percent (*Bower 2004*). This data suggests that existing amounts of large woody debris in the West Fork are below average when compared to reference reaches in the region with similar morphological characteristics.

Moderate levels of riparian harvests have occurred on the West Fork during the 1950s. These riparian harvests primarily involved the individual selection of larger diameter trees in the riparian zone throughout the existing project area and did not include clearcut methods in the riparian zone. This past individual-tree-selection harvest method likely reduced the amount of potentially recruitable large woody debris to the West Fork and could be associated with existing below-average amounts of large woody debris in the stream. Consequently, there is a low to moderate existing direct and indirect impact to bull trout and westslope cutthroat trout habitat as a result of low levels of large-woody-debris recruitment in the West Fork.

- ***Riparian Zone***

The stream riparian area is broadly defined as the interface or linkage between the terrestrial and aquatic zones, and this area is critical for regulating large-woody-debris recruitment, thermal regimes, stream nutrient inputs, and water quality among other variables (*Hansen et al 1995*). This section will consider how riparian-zone function, in particular, is related to the potential for large-woody-debris recruitment. Studies of large-woody-debris recruitment to the stream channel suggest that the primary zone of recruitment is approximately equal to the height of the tallest trees growing in the riparian zone (*Robinson and Beschta 1990, Bilby and Bisson 1998*). The site-potential tree height at 100 years is used to estimate the extent of the primary zone of large-woody-debris recruitment for riparian areas adjacent to proposed harvest areas. Calculations of the site-potential tree height for riparian zones adjacent to various proposed harvest areas are displayed in *TABLE E-5 – CALCULATIONS OF SITE POTENTIAL TREE HEIGHT AT 100 YEARS**.

As described in the previous section*, Large Woody Debris*, past individual-selection harvesting has likely reduced the amount of potentially recruitable large woody debris to the West Fork. This selective harvest is known to have occurred within those riparian zones delineated by the mean site-potential tree height at 100 years in *TABLE E-5 – CALCULATIONS OF SITE-POTENTIAL TREE HEIGHT AT 100 YEARS**. Consequently, there are low to moderate existing direct and indirect impacts to bull trout and westslope cutthroat trout habitat as a result of riparian-zone function in the West Fork.

TABLE E-5 – CALCULATIONS OF SITE POTENTIAL TREE HEIGHT AT 100 YEARS*

AREA	ADJACENT STREAM	SAMPLE	SPECIES	HEIGHT (FEET)	AGE (YEARS)	SITE INDEX	SITE-POTENTIAL TREE HEIGHT AT 100 YEARS (FEET)	MEAN SITE-POTENTIAL TREE HEIGHT AT 100 YEARS (FEET)	REFERENCE
II-H	West Fork	1A-1	Englemann spruce	68	75	50	75		USFS INT-42
II-H	West Fork	1B-1	Englemann spruce	115	158	70	103		USFS INT-42
II-H	West Fork	1B-2	Englemann spruce	98	138	60	88		USFS INT-42
II-H	West Fork	2A-1	Subalpine fir	84	70	40	110		USFS RN-71
II-H	West Fork	2A-2	Englemann spruce	98	126	60	88		USFS INT-42
II-H	West Fork							**93**	
II-G	West Fork	3A-1	Subalpine fir	48	65	30	91		USFS RN-71
II-G	West Fork	3B-1	Englemann spruce	65	100	40	63		USFS INT-42
II-G	West Fork	3C-1	Englemann spruce	49	40	60	88		USFS INT-42
II-G	West Fork	3D-1	Subalpine fir	71	105	30	91		USFS RN-71
II-G	West Fork							**83**	
II-P	West Fork	5A-1	Subalpine fir	57	58	30	91		USFS RN-71
II-P	West Fork	5A-2	Englemann spruce	80	154	50	75		USFS INT-42
II-P	West Fork	5B-1	Subalpine fir	38	33	40	110		USFS RN-71
II-P	West Fork	5C-1	Englemann spruce	57	44	60	88		USFS INT-42
II-P	West Fork	5C-2	Subalpine fir	75	112	30	91		USFS RN-71
II-P	West Fork							**91**	
II-C	West Fork	7A-1	Subalpine fir	61	85	30	91		USFS RN-71
II-C	West Fork	7A-2	Englemann spruce	58	60	50	75		USFS INT-42
II-C	West Fork	7B-1	Englemann spruce	58	63	50	75		USFS INT-42
II-C	West Fork	7B-2	Englemann spruce	80	105	50	75		USFS INT-42
II-C	West Fork	7C-1	Subalpine fir	37	50	30	91		USFS RN-71
II-C	West Fork							**81**	

**Samples were taken by DNRC personnel on 3/3/2004 and 3/4/2004. Samples were taken from random trees with unimpeded growth at a distance of 50 feet from the bank-full slope break.*

- ***Stream Temperature***

  Stream temperature data for the West Fork, available for only 2001 and 2003, is displayed in *TABLE E-6 – STREAM TEMPERATURE DATA (CELCIUS) FOR THE WEST FORK**. The 'upper' recording station is located in the northwest quarter of Section 29, T34N, R23W, and the 'lower' recording station is located in the southwest quarter of Section 34, T34N, R23W. Data indicates that the annual mean weekly maximum temperature at the upper recording station is relatively stable (11.3 degrees Celsius during 2001 and 2003.) Data also indicates that the mean weekly maximum temperature at the lower recording station is more variable than the upper station (11.6 to 13.2 degrees Celsius during 2001 and 2003). During the 2 seasons of record, the average change in stream temperature through the lower half of the project area ranged from 0.3 to 1.9 degrees Celsius.

  In respect to bull trout, the temperature ranges described in *TABLE D-6 – STREAM TEMPERATURE DATA (CELCIUS) FOR THE WEST FORK** are at the upper end of the species' tolerances as observed in various studies. *Fraley and Shepard (1989)* rarely observed juvenile bull trout in streams exceeding 15 degrees Celsius. *Gamett (2002)* did not find bull trout where maximum stream temperatures exceeded 20 degrees Celsius. *Reiman and Chandler (1999)* found that bull trout are most frequently observed in streams having summer maximum temperatures of approximately 13 to 14 degrees Celsius.

  No specific conclusions regarding stream temperature trends in the West Fork can be drawn from these current observations, but this data will be indispensable in future habitat assessment and monitoring efforts. Although insufficient data is available for describing existing trends in stream temperature, no existing direct and indirect impacts to bull trout and westslope cutthroat trout habitat are likely as a result of stream temperature in the West Fork.

- ***Connectivity***

  Currently, 2 bridge crossings of the West Fork are in the project area in Sections 29 and 34, T34N, R23W. These crossings provide full passage of all life stages of bull trout and westslope cutthroat trout. No naturally occurring or manmade barriers to either trout exist on the West Fork in the project area.

TABLE E-6 – STREAM TEMPERATURE DATA (CELCIUS) FOR THE WEST FORK*

SITE NAME	SEASONAL MAXIMUM		SEASONAL MAXIMUM CHANGE IN TEMPERATURE		7-DAY AVERAGES		DAYS GREATER THAN 10.0 CELSIUS	DAYS GREATER THAN 15.0 CELSIUS
	DATE	VALUE	DATE	VALUE	DATE	MAXIMUM		
West Fork 2001 - Upper	08/07/01	11.8	07/07/01	6.4	08/09/01	11.3	36	0
West Fork 2001 - Lower	08/07/01	14.1	08/06/01	8.2	08/09/01	13.2	61	0
West Fork 2003 - Upper	07/23/03	11.7	07/18/03	5.9	07/22/03	11.3	35	0
West Fork 2003 - Lower	07/23/03	12.1	07/18/03	6.0	07/21/03	11.6	40	0

**Samples obtained by DNRC hydrologists using Stowaway (Onset Corporation) data loggers.*

There are no existing direct and indirect impacts to bull trout and westslope cutthroat trout habitat as a result of disconnectivity on the West Fork.

Summary of West Fork Existing Conditions

The entire West Fork watershed, including subbasins, has undergone extensive, but irregular timber harvesting through much of the past century, up to approximately 20 years ago. Existing, nonspecific pressures on bull trout and westslope cutthroat trout may include past upland or riparian timber harvesting and secondary road construction. The potential existing impacts from these past events may include increased sedimentation, increased peak flows, modifications of the hydrograph, and reduced large-woody-debris recruitment and channel stability (*Montana Bull Trout Scientific Group 1995, USFWS 2002b*). In the West Fork, an estimated 3 percent increase in the flow regime may be resulting in a modified hydrograph, and reduced large-woody-debris recruitment has been observed.

Moderate levels of riparian harvests have occurred on the West Fork during the 1950s. This riparian harvest primarily involved the individual selection of larger diameter trees in the riparian zone throughout the existing project area and did not include clearcut methods in the riparian zone. This past individual-selection harvest method likely reduced the amount of potentially recruitable large woody debris to the West Fork and could be associated with the existing below-average amounts of large woody debris in the stream (see *West Fork Bull Trout and Westslope Cutthroat Trout Habitat – Large Woody Debris*). This riparian canopy removal may also have led to temporarily increased stream temperatures as a result of increased incoming direct solar energy, but to accurately qualify the extent of this potential past impact is not possible. Nonetheless, this specific pattern of past riparian management collectively constitutes low past and present impacts to bull trout and westslope cutthroat trout in the West Fork.

No data is available regarding recreational fishing pressure on bull trout and westslope cutthroat trout in the West Fork (*MFISH 2004*); therefore, these potential past and present impacts are likely very low.

The existing road system in the project area has been assessed for specific sources of sedimentation to streams in the West Fork watershed. Estimates indicate that approximately 25.5 tons per year of road material (sediment) are contributed to streams in the West Fork watershed by the existing road system *(*see *APPENDIX C – WATERSHED AND HYDROLOGY ANALYSIS*).

Overall, low to moderate collective past and present impacts to bull trout and westslope cutthroat trout are likely in the West Fork as a result of the existing conditions described above.

- *STRYKER CREEK*

Stryker Creek is a third-order stream and the entire reach within the project area is considered fish bearing.

Stryker Creek Bull Trout and Westslope Cutthroat Trout Populations

- **Presence**

  Very little fisheries data is available for Stryker Creek and no known fisheries surveys have been conducted on the creek. Although this subbasin is not typically utilized by bull trout as spawning habitat for disjunct populations associated with Whitefish and Upper Whitefish lakes, a possibility exists that the lower reaches of the stream are utilized as short-term rearing habitat by juvenile bull trout that later become adfluvial or fluvial life forms. Also, the lower reaches of the stream could possibly be utilized to some degree by resident bull trout.

Westslope cutthroat trout are known to exist in Stryker Creek; however, the degree to which westslope cutthroat trout utilize the stream is not well studied. Stryker Creek most certainly provides some level of spawning and rearing habitat to resident westslope cutthroat trout and, possibly, adfluvial and fluvial life forms associated with Whitefish and Upper Whitefish lakes.

Due to the lack of historic and comparable population-presence data, there are no apparent existing direct and indirect impacts to bull trout and westslope cutthroat trout population presence in Stryker Creek.

- **Genetics**

  Information regarding the existing conditions of bull trout genetics in Stryker Creek is the same as that for the West Fork – see *West Fork Bull Trout and Western Cutthroat Trout Populations – Genetics)*.

  Site-specific information from DFWP regarding westslope cutthroat trout genetics in Stryker Creek is unavailable. A DFWP genetic survey in 1984 of 26 westslope cutthroat trout from the West Fork found the subspecies slightly introgressed with rainbow trout. The genetic purity of westslope cutthroat trout was determined at that time to be 97.4 percent (*MFISH 2004*). A possibility exists that genetic introgression among individual westslope cutthroat trout from the West Fork has spread upstream into Stryker Creek. Conversely, there is the possibility of a remnant population of westslope cutthroat trout in the upstream reaches of Stryker Creek that may be genetically pure.

  Due to the possibility of bull trout and brook trout hybridization and the occurrence of introgressed westslope cutthroat trout, existing low to moderate direct and indirect impacts to bull trout and westslope cutthroat trout population genetics in Stryker Creek are possible.

Stryker Creek Bull Trout and Westslope Cutthroat Trout Habitat

- **Flow Regime**

  Flow regime is the range of discharge frequencies and intensities in a specific watershed that occur throughout the year. The analysis of hydrologic data for the Stryker Creek subbasin indicates that the existing average flow regime for the stream is approximately 3.3 percent above the range of naturally occurring conditions, which is primarily a result of past forest crown removal. The range of naturally occurring conditions is considered representative of those flow regimes in a fully forested, mature (20 to 30 years old) watershed.

  Changes in flow regime can affect bull trout and westslope cutthroat trout through modifications of stream morphology, sediment budget, streambank stability, stream temperature ranges, and channel formations. There is likely no detectable existing impact on these specific habitat characteristics as a result of the estimated 3.3 percent increase in flow regime.

Changes in flow regime have been know to affect bull trout and westslope cutthroat trout spawning migration, habitat available for spawning, and embryo survival; for this reason there is a very low potential for direct and indirect impacts to bull trout and westslope cutthroat trout as a result of flow-regime modifications in Stryker Creek.

- **Sediment**

  Field surveys of Stryker Creek within the project area have found the *Rosgen* stream morphological type to be B3; this is characteristic of cobble-dominated channels with lesser amounts of gravels, boulders, and sands (*Rosgen 1996*). Stream gradients range primarily from 4 to 6 percent. *Pfankuch (1978)* stream-stability scores from reaches within the project area range from 73 to 76, which is considered fair for B3 stream types.

  Based on these observations, existing direct and indirect impacts to bull trout and westslope cutthroat trout habitat are not likely as a result of sediment in Stryker Creek.

- **Channel Forms**

  Descriptions of channel formation that can be used to describe existing bull trout and westslope cutthroat trout habitat in Stryker Creek are the *Montgomery/Buffington* classification (*Montgomery and Buffington 1997*) and *R1/R4 Fish Habitat Standard Inventory* (*Overton et al 1997*). The stream formations of Stryker Creek, from the confluence with the West Fork (river mile 0.00) in Section 29, T34N, R23W, upstream through the project area and to a point (river mile 1.45) in Section 19, T34N, R24W, is broadly described as a transitional zone between 'forced pool-riffle' and 'plane-bed' classifications to 'forced step-pool' and 'step-pool' classifications, respectively. The 'forced pool-riffle' and 'forced step-pool' channel forms are generally a function of large-woody-debris recruitment to the bankfull area of the stream. The 'forced pool-riffle' channel form typically has pool frequencies of 1:5 to 1:7, where the later ratio is channel width, and gradients less than 3 percent (*Montgomery and Buffington 1997*). Both 'step-pool' channel forms typically have pool frequencies of 1:1 to 1:4, where the later ratio is channel width, and gradients of 3 to 8 percent (*Montgomery and Buffington 1997*). The 'plane bed' channel form typically does not have pools and generally occurs in gradients of 1 to 4 percent (*Montgomery and Buffington 1997*).

  R1/R4 Fish Habitat Standard Inventory (*Overton et al 1997*) is not available for Stryker Creek within the project area.

  Although insufficient data is available for describing existing trends in channel forms, no existing direct and indirect impacts to bull trout and westslope cutthroat trout habitat are likely as a result of channel formations in Stryker Creek.

- **Large Woody Debris**

  Large woody debris is recruited to the stream channel from adjacent and upstream riparian vegetation; this material is a critical component in the formation of complex bull trout and westslope cutthroat trout habitat. All life stages of bull trout and westslope cutthroat trout have been observed closely associating with large woody debris in the Flathead River basin (*Platt 1984, Shepard et al 1984*). Large-woody-debris recruitment rates to Stryker Creek throughout the project area can be described using large-woody-debris counts per stream length; this data was collected during a survey in June 2004 using the protocol described in *Overton et al 1997*. Two separate 1,000-foot, large-woody-debris survey sections were located on Stryker Creek adjacent to proposed Harvest Area II-P; the mean large-woody-debris count per 1,000 feet in Stryker Creek was determined to be 131 pieces.

Data from reference reaches (*Harrelson et al 1994*) in the Flathead River basin region indicate that the average amount of large woody debris in undisturbed 'B' channel types (*Rosgen* morphological stream type) is 123 pieces per 1,000 feet, plus or minus 57 percent (*Bower 2004*). This data suggests that existing amounts of large woody debris in Stryker Creek are average when compared to reference reaches in the region with similar morphological characteristics.

Consequently, there are no direct and indirect impacts to bull trout and westslope cutthroat trout habitat as a result of large-woody-debris recruitment in Stryker Creek.

- **Riparian Zone**

  Proposed Harvest Area II-P is the only area immediately adjacent to Stryker Creek. The site-potential tree height in the riparian zone of this proposed harvest area was calculated for the West Fork. The watershed proximity and the similarity of stand types and growth conditions is sufficient enough that the site-potential tree-height values for the West Fork can be applied to Stryker Creek within proposed Harvest Area II-P. Therefore, the site-potential tree height at 100 years for this riparian zone is determined to be 91 feet (*TABLE E-5 – CALCULATIONS OF SITE-POTENTIAL TREE HEIGHT AT 100 YEARS*).*

  There are no existing direct and indirect impacts to bull trout and westslope cutthroat trout habitat as a result of riparian-zone function adjacent to Stryker Creek.

- **Stream Temperature**

  Stream-temperature data is not available for Stryker Creek within the project area. Although Stryker Creek is quite similar to the West Fork in respect to many environmental conditions, stream temperature conditions and data generally can be moderately variable between subbasins.

  Although sufficient data is unavailable for describing existing trends in stream temperature, no existing direct and indirect impacts to bull trout and westslope cutthroat trout habitat are likely as a result of stream temperature in Stryker Creek.

- **Connectivity**

  Currently, 1 bridge crosses Stryker Creek in the northeast quarter of Section 30, T34N, R23W, of the project area. Although this bridge is a failing native-material structure, this crossing provides full passage of all life stages of bull trout and westslope cutthroat trout. No naturally occurring or manmade barriers to bull trout or westslope cutthroat trout are on

Stryker Creek in the project area.

There are no existing direct and indirect impacts to bull trout and westslope cutthroat trout habitat as a result of disconnectivity on Stryker Creek.

Summary of Stryker Creek Existing Conditions

The entire Stryker Creek watershed has undergone extensive, but irregular timber harvesting through much of the past century, up to approximately 20 years ago. Existing, nonspecific pressures on bull trout and westslope cutthroat trout may include past upland or riparian timber harvesting and secondary road construction. The potential existing impacts from these past events may include increased sedimentation, increased peak flows, modifications of the hydrograph, and reduced large-woody-debris recruitment and channel stability (*Montana Bull Trout Scientific Group 1995, USFWS 2002b*). In Stryker Creek, an estimated 3.3 percent increase in the flow regime may be resulting in a modified hydrograph.

No data is available regarding recreational fishing pressure on bull trout and westslope cutthroat trout in Stryker Creek (*MFISH 2004*); therefore, these potential past and present impacts are likely very low.

The existing road system in the project area has been assessed for specific sources of sedimentation to streams in the Stryker Creek watershed. Estimates indicate that approximately 2.8 tons per year of road material (sediment) are contributed to streams in the Stryker Creek watershed by the existing road system (see *APPENDIX C – WATERSHED AND HYDROLOGY ANALYSIS*).

Overall, low collective past and present impacts to bull trout and westslope cutthroat trout are likely in Stryker Creek as a result of the existing conditions described above.

- *JOHNSON CREEK*

Johnson Creek is a third-order stream and the entire reach within the project area is considered fish bearing. A variable portion of the lower reach immediately above the confluence with the West Fork exhibits discontinuous, subterrain flows during low-flow periods of the year.

Johnson Creek Bull Trout and Westslope Cutthroat Trout Populations

- **Presence**

  Limited fisheries data is available for Johnson Creek, and no known fisheries population surveys have been conducted on the stream. Although this subbasin is not likely utilized by bull trout as spawning habitat for disjunct populations associated with Whitefish and Upper Whitefish lakes, the lower perennial reaches of the stream are possibly utilized as short-term rearing habitat by juvenile bull trout that later become adfluvial or fluvial life forms. Also, the lower perennial reaches of the stream could possibly be utilized to some degree by resident bull trout.

  Westslope cutthroat trout are known to exist in Johnson Creek; however, the degree to which westslope cutthroat trout utilize the stream is not well studied. Johnson Creek most certainly provides some level of spawning and rearing habitat to resident westslope cutthroat trout and possibly adfluvial and fluvial life forms associated with Whitefish and Upper Whitefish lakes.

  Due to the lack of historic and comparable population-presence data, there are no apparent existing direct and indirect impacts to bull trout and westslope cutthroat trout population presence in Johnson Creek.

- **Genetics**

  Information regarding the existing conditions of bull trout genetics in Johnson Creek is the same as that for the West Fork (see *West Fork Bull Trout and Westslope Cutthroat Trout Populations - Genetics*).

  A 1992 DFWP genetic survey of 52 westslope cutthroat trout from Johnson Creek (river mile 1.2 to 1.3) found the subspecies slightly introgressed with Yellowstone cutthroat trout. The genetic purity of westslope cutthroat trout was determined at that time to be 98.9 percent (*MFISH 2004*). A later (1998) DFWP genetic survey of 3 westslope cutthroat trout from an upstream reach of Johnson Creek (river mile 2.0 to 2.1) found samples to be genetically pure. The possibility exists that the genetic introgression that has occurred among the westslope cutthroat trout population within the reach of river mile 1.2 to 1.3 has since spread further upstream into Johnson Creek. Conversely, the possibility also exists that the population representing genetically pure specimens of westslope cutthroat trout in upstream reaches of Johnson Creek may remain genetically isolated.

  Due to the possibility of bull trout and brook trout hybridization and the known occurrence of introgressed westslope cutthroat trout, there are possible existing low to moderate direct and indirect impacts to bull trout and westslope cutthroat trout population genetics in Johnson Creek.

Johnson Creek Bull Trout and Westslope Cutthroat Trout Habitat

- **Flow Regime**

  Flow regime is the range of discharge frequencies and intensities in a specific watershed that occur throughout the year. The analysis of hydrologic data for the Johnson Creek subbasin indicates that the existing average flow regime for the stream is approximately 3.5 percent above the range of naturally occurring conditions (see *APPENDIX C – WATERSHED AND HYDROLOGY ANALYSIS*), which is primarily a result of past forest crown removal. The range of naturally occurring conditions is considered representative of those flow regimes in a fully forested, mature (20 to 30 years old) watershed.

  Changes in flow regime can affect bull trout and westslope cutthroat trout through modifications of stream morphology, sediment budget, streambank stability, stream temperature ranges, and channel formations. There is likely no detectable existing impact on these specific habitat characteristics as a result of the estimated 3.5 percent increase in flow regime.

  Changes in flow regime have been known to affect bull trout and westslope cutthroat spawning migration, habitat available for spawning, and embryo survival; for this reason, there is a very low potential for direct and indirect impacts to bull trout and westslope cutthroat trout as a result of flow regime modifications in Johnson Creek.

- **Sediment**

  Field surveys of the reach of Johnson Creek adjacent to proposed Harvest Area II-C and within the project area have found the overall *Rosgen* stream morphological type to be B4; this is characteristic of gravel-dominated channels, with lesser amounts of cobbles, boulders, and sands (*Rosgen 1996*). The stream gradient in this reach is approximately 3 percent. The *Pfankuch* (*1978*) stream stability score for this reach is 79, which is considered fair for B4 stream types.

Based on these observations, no existing direct and indirect impacts to bull trout and westslope cutthroat trout habitat are likely as a result of sediment in Johnson Creek.

- **Channel Forms**

  Descriptions of channel formation that can be used to describe existing bull trout and westslope cutthroat trout habitat in Johnson Creek are the *Montgomery/Buffington* classification (*Montgomery and Buffington 1997*) and *R1/R4 Fish Habitat Standard Inventory* (*Overton et al 1997*). The stream formations of Johnson Creek, from the confluence with the West Fork (river mile 0.00) in Section 3, T33N, R23W, upstream through the project area and to a point (river mile 1.46) in the southwest quarter of Section 32, T34N, R23W, is broadly described as exhibiting both 'pool-riffle' and 'forced pool-riffle' *Montgomery/Buffington* classifications. The 'forced pool-riffle' channel form is generally a function of large-woody-debris recruitment to the bankfull area of the stream, and both channel forms typically have pool frequencies of 1:5 to 1:7, where the later ratio is channel width (*Montgomery and Buffington 1997*). The stream formations of Johnson Creek, from river mile 1.46 upstream through the project area and to a point (river mile 3.05) in Section 31, T34N, R23W, is broadly described as exhibiting 'step-pool', 'forced step-pool', and some 'cascade' *Montgomery/Buffington* classifications. Both 'step-pool' and 'forced step-pool' channel forms typically have pool frequencies of 1:1 to 1:4, where the later ratio is channel width, and gradients of 3 to 8 percent (*Montgomery and Buffington 1997*). The 'cascade' channel form typically has pool frequencies of 1:<1, where the later ratio is channel width, and gradients of 4 to 20 percent (*Montgomery and Buffington 1997*).

  R1/R4 Fish Habitat Standard Inventory (*Overton et al 1997*) is not available for Johnson Creek within the project area.

  Although sufficient data is unavailable for describing existing trends in channel forms, no existing direct and indirect impacts to bull trout and westslope cutthroat trout habitat are likely as a result of channel formations in Johnson Creek.

- **Large Woody Debris**

  Large-woody-debris count data is not available for Johnson Creek within the project area. Although Johnson Creek is a lower-order tributary to the West Fork, existing large-woody-debris counts within the project area are likely quite similar to those in the West Fork. This is probably attributed to watershed proximity, similar stand types and growth conditions, and similar soil and geologic conditions.

  Therefore, although sufficient data is unavailable to specifically describe existing conditions of large woody debris in Johnson Creek, low to moderate existing direct and indirect impacts to bull trout and westslope cutthroat trout habitat are likely as a result of the low levels of large-woody-debris recruitment.

- **Riparian Zone**

  Proposed Harvest Area II-C is the only area immediately adjacent to Johnson Creek. Specific calculations of the site-potential tree height in the riparian zone adjacent to this proposed harvest area are not available. However, the site-potential tree height in the riparian zone of this proposed harvest area was calculated for the West Fork. There is sufficient watershed proximity and similarity of stand types and growth conditions that the site-potential tree-height values for the West Fork can be applied to Johnson Creek within proposed Harvest Area II-C. Therefore, the site-potential tree height at 100 years for this riparian zone is determined to be 81 feet (*TABLE E-5 – CALCULATIONS OF SITE-POTENTIAL TREE HEIGHT AT 100 YEARS*)*.

  There are likely no existing direct and indirect impacts to bull trout and westslope cutthroat trout habitat as a result of riparian-zone function adjacent to Johnson Creek.

- **Stream Temperature**

  Stream-temperature data is not available for Johnson Creek within the project area. Although Johnson Creek is quite similar to the West Fork in respect to many environmental conditions, stream temperature conditions and data generally can be moderately variable between subbasins.

  Although insufficient data is available for describing existing trends in stream temperature, no existing direct and indirect impacts to bull trout and westslope cutthroat trout habitat are likely as a result of stream temperature in Johnson Creek.

- **Connectivity**

  Currently 1 culvert crossing and 3 bridge crossings exist on Johnson Creek in the project area. The culvert is located in the southeast quarter of Section 33, T34N, R23W, and the bridges are located in the southeast quarter of Section 32, the southwest quarter of Section 32, and the southeast quarter of Section 31, all in T32N, R23W. The 3 bridge crossings provide full passage of all life stages of bull trout and westslope cutthroat trout.

  A variable portion of the lower reach immediately above the confluence with the West Fork exhibits discontinuous, subterrain flows during low-flow periods of the year. With discontinuous flow, this reach acts as a naturally occurring seasonal barrier to bull trout and westslope cutthroat trout migration. Bull trout and westslope cutthroat trout passage through this reach is most likely possible only during runoff or other bankfull flow events.

  The culvert on Johnson Creek within the project area is located on the lower reach with discontinuous flow. This culvert was surveyed during 2003 as part of the *DNRC Fish Passage Assessment Project*; information collected during that survey was used to model seasonal low and high flows, along with juvenile and adult cutthroat trout passage through the structure using *FishXing* software (*1999*). The results of those modeling efforts indicate that the culvert is an upstream migration barrier to juveniles and most adult westslope cutthroat trout. Only those adults capable of attaining burst swim speeds of 9.75 feet per second for 7.5 seconds are likely able to migrate upstream through the culvert during low to bankfull flows. These results are likely representative of bull trout and westslope cutthroat trout swim performances and suggest that only a portion of the strongest swimming adults are able to migrate upstream through the structure.

Due to very limited upstream migration potential through the culvert located in the lower reach with seasonal, discontinuous flow, there is a moderate existing direct and indirect impact to bull trout and westslope cutthroat trout habitat as a result of disconnectivity on Johnson Creek.

Johnson Creek Existing Cumulative Impacts

The entire Johnson Creek watershed has undergone extensive, but irregular, timber harvesting through much of the past century, up to approximately 20 years ago. Existing, nonspecific pressures on bull trout and westslope cutthroat trout may include past upland or riparian timber harvesting and secondary road construction. The potential existing impacts from these past events may include increased sedimentation, increased peak flows, modifications of the hydrograph, and reduced large-woody-debris recruitment and channel stability (*Montana Bull Trout Scientific Group 1995, USFWS 2002b*).

Moderate levels of riparian harvesting have occurred on Johnson Creek during the previous harvest period described above. This riparian harvest primarily involved the individual selection of larger-diameter trees in the riparian zone throughout the existing project area and did not include clearcut methods in the riparian zone. This past individual-tree-selection harvest method likely reduced the amount of potentially recruitable large woody debris to Johnson Creek and could be associated with possible below-average amounts of large woody debris in the stream (see *West Fork Bull Trout and Westslope Cutthroat Trout Habitat – Large Woody Debris* under *Stryker Creek*). This riparian canopy removal may also have led to temporarily increased stream temperatures as a result of increased incoming direct solar energy, but to accurately qualify the extent of this potential past impact is not possible. Nonetheless, this specific pattern of past riparian management collectively constitutes low past and present impacts to bull trout and westslope cutthroat trout in Johnson Creek.

No data is available regarding recreational fishing pressure on bull trout and westslope cutthroat trout in Johnson Creek (*MFISH 2004*); therefore, potential past and present impacts are likely very low.

The existing road system in the project area has been assessed for specific sources of sedimentation to streams in the Johnson Creek watershed. Estimates indicate that approximately 5.2 tons per year of road material (sediment) are contributed to streams in the Johnson Creek watershed by the existing road system (see *APPENDIX C – WATERSHED AND HYDROLOGY ANALYSIS*).

Overall, low to moderate collective past and present impacts to bull trout and westslope cutthroat trout are likely in Johnson Creek as a result of the existing conditions described above.

ALTERNATIVE EFFECTS

DIRECT AND INDIRECT EFFECTS FOR THE WEST FORK, STRYKER CREEK, AND JOHNSON CREEK

Bull Trout and Westslope Cutthroat Trout Populations

~ ***Presence***

- ***Direct and Indirect Effects of No-Action Alternative A***

  This no-action alternative would not be expected to have any direct or indirect impacts to bull trout and westslope cutthroat trout population presence in the West Fork or Stryker or Johnson creeks beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternative B***

  The existing conditions describe confirmed bull trout and westslope cutthroat trout presence in the West Fork and Johnson Creek and the likely presence of one or both species in Stryker Creek. Redd count and estimated population data from the West Fork indicate that habitat utilization specific to this stream is variable for both bull trout and westslope cutthroat trout. It is reasonable to assume that relatively proportionate levels of variability in habitat utilization also occur in Stryker and Johnson creeks.

  Action Alternative B would not involve direct or indirect impacts to any specific bull trout or westslope cutthroat trout populations in the project area. Therefore, Action Alternative B would have no direct or indirect impact to bull trout and westslope cutthroat trout population presence in the West Fork or Stryker and Johnson creeks beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternative C***

  Direct and indirect impacts to bull trout and westslope cutthroat trout population presence as a result of Action Alternative C are expected to be the same as those described for Action Alternative B.

~ ***Genetics***

- ***Direct and Indirect Effects of No-Action Alternative A***

  No-Action Alternative A would not be expected to have any direct or indirect impacts to bull trout and westslope cutthroat trout population genetics in the West Fork or Stryker and Johnson creeks beyond those described under *Existing Conditions*.

- ***Direct and Indirect Effects of Action Alternative B***

  The eastern brook trout may negatively affect bull trout population genetics in the West Fork and Stryker and Johnson creeks through hybridization, as described in the *EXISTING CONDITIONS*. However, the introduction, migration, and spawning behavior of nonnative eastern brook trout and the consequent population biological interactions with bull trout are beyond the control and regulatory jurisdiction of DNRC land-management activities.

  Different strains of nonnative and historic hatchery rainbow trout may hybridize with westslope cutthroat trout, which can introduce long-term genetic introgression to pure westslope cutthroat trout populations in the West Fork and Stryker and Johnson creeks. The genetic introgression of westslope cutthroat trout may also arise from hybridization with Yellowstone cutthroat trout, through either local introduction of the subspecies or residual introgression introduced by westslope cutthroat trout that may have originally come from historic cutthroat trout hatcheries. Introgression, in general, negatively affects genetically pure westslope cutthroat trout, and, as described in *EXISTING CONDITIONS*, this is known to have occurred at a minimum in the West Fork and Johnson Creek (*MFISH 2004*). However, the introduction, migration, and spawning behavior of nonnative rainbow trout and the consequent population biological interactions with westslope cutthroat trout are beyond the control and regulatory jurisdiction of DNRC land-management activities. Additionally, the genetic pathway within westslope cutthroat trout populations of genes specific to Yellowstone cutthroat trout is also beyond the control of DNRC land-management activities.

Therefore, Action Alternative B would not be expected to have any direct or indirect impacts to bull trout and westslope cutthroat trout population genetics in the West Fork or Stryker and Johnson creeks beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternative C***

Direct and indirect environmental effects of Action Alternative C to bull trout and westslope cutthroat trout population genetics would be expected to be the same as those described for Action Alternative B.

~ **Flow Regime**

- ***Direct and Indirect Effects of No-Action Alternative A***

No-Action Alternative A would not be expected to have any direct or indirect impacts to the flow-regime component of bull trout and westslope cutthroat trout habitat in the West Fork or Stryker and Johnson creeks beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternative B***

Changes in flow regime can affect bull trout and westslope cutthroat trout spawning migration, spawning behavior, potential spawning habitat, and embryo survival through modifications of stream morphology, sediment budget, streambank stability, stream temperature ranges, and channel formations. An analysis of potential actions related to Action Alternative B indicates that water yields would increase from approximately 3.4 percent (existing conditions) to approximately 6.0 percent in the West Fork, approximately 3.3 percent (existing conditions) to approximately 4.1 percent in Stryker Creek, and approximately 3.5 percent (existing conditions) to approximately 3.9 percent in Johnson Creek (see *APPENDIX C – WATERSHED AND HYDROLOGY ANALYSIS*).

The range of potential water-yield increases to streams with bull trout and westslope cutthroat trout habitat in the project area is approximately from 0.4 percent to 2.6 percent. With respect to those existing conditions described earlier, these potential modifications of flow regimes as a result of Action Alternative B are expected to have negligible, if any, direct and indirect impacts to bull trout and westslope cutthroat trout in the West Fork and Stryker and Johnson creeks.

- ***Direct and Indirect Effects of Action Alternative C***

Changes in flow regime can affect bull trout and westslope cutthroat trout spawning migration, spawning behavior, potential spawning habitat, and embryo survival through modifications of stream morphology, sediment budget, streambank stability, stream temperature ranges, and channel formations. An analysis of potential actions related to Action Alternative C indicate that water yields would increase from approximately 3.4 percent (existing conditions) to approximately 5.0 percent in the West Fork, approximately 3.3 percent (existing conditions) to approximately 3.5 percent in Stryker Creek, and approximately 3.5 percent (existing conditions) to approximately 3.7 percent in Johnson Creek (see *APPENDIX C – WATERSHED AND HYDROLOGY ANALYSIS*).

The range of potential water yield increases to streams with bull trout and westslope cutthroat trout habitat in the project area is approximately 0.2 percent to approximately 1.6 percent. With respect to those existing conditions described earlier, these potential modifications of flow regimes as a result of Action Alternative C are expected to have negligible, if any, direct and indirect impacts to bull trout and westslope cutthroat trout in the West Fork and Stryker and Johnson creeks.

Bull Trout and Westslope Cutthroat Trout Habitat

~ **Sediment**

- ***Direct and Indirect Effects of No-Action Alternative A***

No-Action Alternative A would not be expected to have any direct or indirect impacts to the sediment component of bull trout and westslope cutthroat trout habitat in the West Fork or Stryker and Johnson creeks beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternative B***

Modifications of stream sediment size classes, especially with trends toward fine size classes, could adversely affect bull trout and westslope cutthroat trout in the project area by reducing the quality of spawning habitat, in-stream cover, rearing habitat, and wintering habitat. Increased levels of fine sediments can be introduced to the stream system from various sources, including bank erosion due to stream channel instability, road features, and adjacent timber-harvesting operations.

Data from *APPENDIX C – WATERSHED AND HYDROLOGY ANALYSIS* in this EIS indicates that the range of potential water-yield increases as a result of Action Alternative B is generally insufficient to facilitate the development of unstable stream channels.

APPENDIX C – WATERSHED AND HYDROLOGY ANALYSIS also indicates that road improvements associated with Action Alternative B would reduce sedimentation to the West Fork and Stryker Creek by approximately 4.2 tons per year and by approximately 2.7 tons per year to Johnson Creek. Road improvement activities that remove or mitigate potential sediment sources may have temporary, unavoidable, and short-term impacts to the sediment component of streams (see *APPENDIX C – WATERSHED AND HYDROLOGY ANALYSIS*), which may correspond to a minor, short-term impact to bull trout or westslope cutthroat trout. However, these road improvements would provide a long-term, net-positive impact to bull trout and westslope cutthroat trout habitat in respect to sediment.

Timber harvesting operations adjacent to the West Fork and Stryker and Johnson creeks would comply with SMZ laws. The SMZ laws are designed to provide adequate mitigations for the prevention of sedimentation to streams from adjacent timber-harvest-related activities.

With respect to those existing conditions described earlier, the selection of Action Alternative B would likely provide net-positive direct and indirect impacts to the sediment component of bull trout and westslope cutthroat trout habitat in the West Fork and Stryker and Johnson creeks.

- ***Direct and Indirect Effects of Action Alternative C***

Modifications of stream-sediment size classes, especially with trends toward fine size classes, could adversely affect bull trout and westslope cutthroat trout in the project area by reducing the quality of spawning habitat, in-stream cover, rearing habitat, and wintering habitat. Increased levels of fine sediments can be introduced to the stream system from various sources, including bank erosion due to stream channel instability, road features, and adjacent timber-harvesting operations.

Data from *APPENDIX C – WATERSHED AND HYDROLOGY ANALYSIS* indicates that the range of potential water-yield increases as a result of Action Alternative C is generally insufficient to facilitate the development of unstable stream channels.

The *APPENDIX C – WATERSHED AND HYDROLOGY ANALYSIS* also indicates that road improvements associated with Action Alternative C would reduce sedimentation to the West Fork and Stryker Creek by approximately 2.6 tons per year and by approximately 0.0 tons per year to Johnson Creek. Road-improvement activities that remove or mitigate potential sediment sources may have temporary, unavoidable, and short-term impacts to the sediment component of streams (see *APPENDIX C – WATERSHED AND HYDROLOGY ANALYSIS*), which may correspond to a minor, short-term impact to bull trout or westslope cutthroat trout. However, these road improvements would provide a long-term, net-positive impact to bull trout and westslope cutthroat trout habitat in respect to sediment.

Timber-harvesting operations adjacent to the West Fork and Stryker and Johnson creeks would comply with SMZ laws. The SMZ laws are designed to provide adequate mitigations for the prevention of sedimentation to streams from adjacent activities related to timber harvesting.

With respect to those existing conditions described earlier, the selection of Action Alternative C would likely provide net-positive direct and indirect impacts to the sediment component of bull trout and westslope cutthroat trout habitat in the West Fork and Stryker and Johnson creeks.

~ **Channel Forms**

- ***Direct and Indirect Effects of No-Action Alternative A***

  No-Action Alternative A would not be expected to have any direct or indirect impacts to the channel-form component of bull trout and westslope cutthroat trout habitat in the West Fork and Stryker and Johnson creeks beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternative B***

  Potential changes to stream channel forms are primarily a function of modifications to flow regimes and consequent relationships with existing sediment size classes. As indicated earlier, modifications to the bull trout and westslope cutthroat trout habitat features of flow regime and sediment as a result of Action Alternative B are expected to be negligible or not occur at all.

  Therefore, with respect to those existing conditions described earlier, there are no foreseeable direct and indirect impacts to the channel form component of bull trout and westslope cutthroat trout habitat in the West Fork and Stryker and Johnson creeks.

- ***Direct and Indirect Effects of Action Alternative C***

  Potential changes to stream channel forms are primarily a function of modifications to flow regimes and consequent relationships with existing sediment size classes. As indicated earlier, modifications to the bull trout and westslope cutthroat trout habitat features of flow regime and sediment as a result of Action Alternative C are expected to be negligible or not occur at all.

  Therefore, with respect to those existing conditions described earlier, there are no foreseeable direct and indirect impacts to the channel form component of bull trout and westslope cutthroat trout habitat in the West Fork and Stryker and Johnson creeks.

~ **Large Woody Debris**

- ***Direct and Indirect Effects of No-Action Alternative A***

  No-Action Alternative A would not be expected to have any direct or indirect impacts to the large-woody-debris component of bull trout and westslope cutthroat trout habitat in the West Fork or Stryker and Johnson creeks beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternative B***

  Action Alternative B proposes varying levels of timber harvesting up to, but not within, 100 feet of the nearest stream bankfull edges of the West Fork (proposed Harvest Areas II-H, II-G, II-P, and II-C), Stryker Creek (proposed Harvest Area II-P), and Johnson Creek (proposed Harvest Area II-C). Potential large-woody-debris recruitment to the channels of these and other streams is a function of the distance from the stream channel that riparian trees may fall in order to contribute large woody debris. This distance from the stream channel is generally equal to the mean height of dominant and co-dominant trees (*Robinson and Beschta 1990, Bilby and Bisson 1998*), which is usually expressed as the site-potential tree height.

  As described in *EXISTING CONDITIONS*, the site-potential tree height at 100 years from sample sites in the riparian zone along both sides of the

West Fork throughout the project area ranges from 81 to 93 feet. The riparian zones along Stryker and Johnson creeks are likely sufficiently similar to those in the West Fork that site-potential tree heights of 81 to 93 feet can also be applied to these areas. Since a no-harvest buffer of 100 feet would be established between the 3 streams and associated proposed harvest areas described above, rates of potential large-woody-debris recruitment to any of these 3 stream channels is not expected to be affected by any of the proposed harvest areas. Correspondingly, a study of large-woody-debris recruitment to stream channels in Alaska found that 99 percent of in-stream large woody debris was recruited from trees within 30 meters (96 feet) of the stream channel (*Murphy and Koski 1989*).

In-stream large woody debris may also be recruited to 1 of the 3 stream channels from upstream channel reaches. Proposed Harvest Area III-I intersects 1 intermittent stream channel that eventually delivers seasonal flow to the West Fork, and proposed Harvest Areas III-J and III-L are jointly bordered by 1 intermittent stream channel that eventually delivers seasonal flow to the West Fork. The very low discharge of these 2 intermittent streams is unlikely to provide sufficient energy for transportation of large woody debris to downstream reaches. The intersecting reaches of these 2 first-order, intermittent tributaries, which would also have established buffers for Class I streams according to *Streamside Management Rules (1996)*, are not expected to affect sources of upstream large-woody-debris recruitment to the West Fork in any measurable or detectable way.

Therefore, Action Alternative B would not be expected to have any direct or indirect impacts to the large-woody-debris component of bull trout and westslope cutthroat trout habitat in the West Fork or Stryker and Johnson creeks beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternative C***

Although Action Alternative C does not propose any harvesting in Harvest Area III, the consequences, in respect to large woody debris, would be identical to those of Action Alternative B. Therefore, the direct and indirect effects of Action Alternative C to the large-woody-debris component of bull trout and westslope cutthroat trout habitat would be expected to be the same as those described for Action Alternative B.

~ **Riparian Zone**

- ***Direct and Indirect Effects of No-Action Alternative A***

No-Action Alternative A would not be expected to have any direct or indirect impacts to the riparian-zone component of bull trout and westslope cutthroat trout habitat in the West Fork or Stryker or Johnson creeks beyond those described under *Existing Conditions*.

- ***Direct and Indirect Effects of Action Alternative B***

The manner in which the riparian zone affects bull trout and westslope cutthroat trout habitat through large-woody-debris recruitment to the stream channel is described under *Large Woody Debris* (previous heading). In that section, the effective riparian zone is described as varying between 81 and 93 feet along the West Fork and Stryker and Johnson creeks. Since a 100-foot no-harvest buffer would be established between these 3 streams and the associated proposed harvest areas in Action Alternative B, the riparian-zone function associated with these 3 stream channels is not expected to be affected by any of the proposed harvest areas.

Therefore, Action Alternative B would not be expected to have any direct or indirect impacts to the riparian-zone component of bull trout and westslope cutthroat trout habitat in the West Fork or Stryker or Johnson creeks beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternative C***

The direct and indirect environmental effects to the riparian-zone component of bull trout and westslope cutthroat trout habitat for Action Alternative C would be expected to be the same as those described for Action Alternative B.

~ **Stream Temperature**

- ***Direct and Indirect Effects of No-Action Alternative A***

No-Action Alternative A would not be expected to have any direct or indirect impacts to the stream-temperature component of bull trout and westslope cutthroat trout habitat in the West Fork or Stryker or Johnson creeks beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternative B***

Direct solar radiation is the primary mechanism affecting positive changes in stream temperature throughout the project area. Increases in stream temperature can then, consequently, occur through the loss of riparian vegetation, which intercepts solar radiation. The amount of riparian vegetation intercepting solar radiation, or stream shading, depends on many factors, such as width of the stream channel, site-potential tree height of dominant and co-dominant riparian tree species, riparian tree density, and stream azimuth. Nonetheless, studies with no-harvest riparian buffers of 30 meters (96 feet) in managed, forested watersheds have demonstrated levels of stream shading equivalent to unlogged, forested watersheds (*Beschta et al 1987, Castelle and Johnson 2000 citing others*.) A similar study has found the same results with a 100-foot no-harvest buffer (*Brown and Krygier 1970*). Since a no-harvest buffer of 100 feet would be established between the West Fork and Stryker and Johnson creeks and the associated proposed harvest areas in Action Alternative B, stream temperatures associated with these 3 stream channels are not expected to be affected by any of the proposed harvest areas.

Tributaries to streams can have an affect on (downstream) stream temperatures that is proportional to the discharge of the tributary. Proposed Harvest Area III-I intersects an intermittent stream channel that eventually delivers seasonal flow to the West Fork, and proposed Harvest Areas III-J and III-L are jointly bordered by an intermittent stream channel that eventually delivers seasonal flow to the West Fork. The intersecting reaches of these 2 first-order, intermittent tributaries would have established buffers for Class I streams according to *Streamside Management Rules (1996)*, which have been shown to have a statistically insignificant effect on stream temperatures in preliminary studies (*Sugden and Steiner 2003*). As these streams also provide only low, seasonally intermittent discharges to higher-order streams, no measurable or detectable changes in stream temperature would be expected in the West Fork due to Action Alternative B.

Therefore, Action Alternative B would not be expected to have any direct or indirect impacts to the stream-temperature component of bull trout and westslope cutthroat trout habitat in the West Fork or Stryker and Johnson creeks beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternative C***

Although Action Alternative C does not propose any harvesting in Harvest Area III, the consequences in respect to stream temperature would be identical to those of Action Alternative B. Therefore, direct and indirect environmental effects to the stream-temperature component of bull trout and westslope cutthroat trout habitat as a result of the selection of Action Alternative C are expected to be the same as those described for Action Alternative B.

~ **Connectivity**

- ***Direct and Indirect Effects of No-Action Alternative A***

No-Action Alternative A would not be expected to have any direct or indirect impacts to the connectivity component of bull trout and westslope cutthroat trout habitat in the West Fork or Stryker or Johnson creeks beyond those described under *EXISTING CONDITIONS.*

- ***Direct and Indirect Effects of Action Alternative B***

As part of Action Alternative B, the bridge crossing the West Fork in Section 29, T34N, R23W, would be replaced with a new 70-foot steel bridge. The new structure would be expected to provide naturally occurring levels of connectivity to all life stages of bull trout and westslope cutthroat trout.

Therefore, Action Alternative B would not be expected to have any direct or indirect impacts to the connectivity component of bull trout and westslope cutthroat trout habitat in the West Fork or Stryker and Johnson creeks beyond those described under *EXISTING CONDITIONS*.

- ***Direct and Indirect Effects of Action Alternative C***

Direct and indirect effects to the connectivity component of bull trout and westslope cutthroat trout habitat as a result of the selection of Action Alternative C are expected to be the same as those described for Action Alternative B.

CUMULATIVE EFFECTS FOR THE WEST FORK, STRYKER CREEK, AND JOHNSON CREEK

- ***Cumulative Effects of No-Action Alternative A***

Action Alternative A would not be expected to have any cumulative impacts to bull trout and westslope cutthroat trout in the West Fork and Stryker and Johnson creeks.

- ***Cumulative Effects of Action Alternative B***

Cumulative impacts are those collective impacts on the human environment of the proposed action when considered in conjunction with other past, present, and future actions related to the proposed action by location or generic type (*75-1-220, MCA*).

The direct, indirect, and collective impacts of past- and present-related actions associated with bull trout and westslope cutthroat trout populations and habitat in the project area for all 3 specific streams are described throughout the *EXISTING CONDITIONS* section. These existing impacts to bull trout and westslope cutthroat trout described earlier range from low to moderate in the West Fork and Johnson Creek and low in Stryker Creek.

There are no known future activities related to the proposed action by location or generic type.

As described in the *Direct and Indirect Effects of Action Alternative B*, the actions associated with proposed Action Alternative B would have impacts to bull trout and westslope cutthroat trout that range from negligible to net positive. The assessment of the proposed actions on bull trout and westslope cutthroat trout populations (presence and genetics) and bull trout and westslope cutthroat trout habitat variables (flow regime, sediment, channel form, large woody debris, riparian-zone function, stream temperature, and connectivity) summarily indicate that no adverse negative impacts would likely be associated with Action Alternative B. Consequently, as a result of the selection of Action Alternative B, the risk of foreseeable, adverse cumulative impacts to bull trout and westslope cutthroat trout is low in the West Fork and Stryker and Johnson creeks.

- ***Cumulative Effects of Action Alternative C***

Cumulative impacts are those collective impacts on the human environment of the proposed action when considered in conjunction with other past, present, and future actions related to the proposed action by location or generic type (*75-1-220, MCA*).

The direct, indirect, and collective impacts of past- and present-related actions associated with bull trout and westslope cutthroat trout populations and habitat in the project area are described throughout the *EXISTING CONDITIONS* section for all 3 specific streams. Those existing impacts to bull trout and westslope cutthroat trout, described earlier, range from low to moderate in the West Fork and Johnson Creek and low in Stryker Creek.

There are no known future-related activities associated to the proposed action by location or generic type.

As described in *Direct and Indirect Effects of Action Alternative C*, the actions associated with proposed Action Alternative C would have impacts to bull trout and westslope cutthroat trout that range from negligible to net positive. The assessment of the proposed actions on bull trout and westslope cutthroat trout populations (presence and genetics) and bull trout and westslope cutthroat trout habitat variables (flow regime, sediment, channel form, large woody debris, riparian-zone function, stream temperature, and connectivity) summarily indicate no adverse negative impacts would likely be associated with Action Alternative C. Consequently, as a result of the selection of Action Alternative C, the risk of foreseeable, adverse cumulative impacts to bull trout and westslope cutthroat trout is low in the West Fork or Stryker or Johnson creeks.

APPENDIX F
WILDLIFE ANALYSIS

INTRODUCTION

The discussion in this section pertains to wildlife species and their habitats in the existing environment and changes to that environment due to each alternative.

During the initial scoping, the following issues were expressed regarding the effects of the proposed project:

- Timber harvesting and road use could reduce habitat security of areas for large mammals.
- Timber harvesting and road use could cause fragmentation.

In addition to the above issues, the analyses below discuss other environmental effects of the alternatives to the wildlife resource.

This discussion occurs at 2 scales. The project area includes DNRC-managed lands within Sections 18 through 21 and 28 through 34 in T34N, R23W, and Section 13 in T34N, R24W. Full descriptions of the project area and proposed harvest areas are presented in *CHAPTER II – ALTERNATIVES* (*TABLE II-1 – SILVICULTURAL TREATMENTS BY HARVEST AREA NUMBER FOR ACTION ALTERNATIVES B AND C)*. The second scale relates to the surrounding landscape for assessing cumulative effects. This scale varies according to the species being discussed, but generally approximates the size of the home range of the species in question. Under each grouping or species heading, the description for the cumulative-effects analysis area will be discussed. In the cumulative-effects analysis area, the project area and the effects are placed in a landscape context. If habitat does not exist in the project area or would not be modified by any alternative, species that use that habitat were dismissed from further analysis.

METHODS

To assess the existing condition of the project area and the surrounding landscape, a variety of techniques were used. Field visits, scientific literature, data from the SLI and Montana Natural Heritage Program, aerial photography, consultations with other professionals, and professional judgment provided information for the following discussion and effects analysis. In the effects analysis, changes in the habitat quality and quantity from the existing conditions were evaluated and explained. Specialized methodologies are discussed under the species in which they apply.

COARSE-FILTER ASSESSMENT

DNRC recognizes that it is an impossible and unnecessary task to assess an affected environment or the effects of proposed actions on all wildlife species. We assume that if landscape patterns and processes similar to those that species adapted to are maintained, then the full complement of species will be maintained across the landscape (*DNRC 1996*). This “coarse filter” approach supports diverse wildlife populations by managing for a variety of forest structures and compositions that approximate “historic conditions” across a landscape. To compare present and historical conditions across the landscape, the analysis was conducted for Stillwater State Forest using SLI data (refer to *APPENDIX B - VEGETATION ANALYSIS*) and was compared to the historical assessment compiled for the Lower Flathead Climatic Section (*Losensky 1997*).

Covertypes

The vegetation analysis indicates that covertypes changed over the past century due to the influence of fire suppression, insects, diseases, and timber harvesting. Generally, Stillwater State Forest should support more western white pine and western larch/Douglas-fir covertypes and less subalpine fir and lodgepole pine covertypes than found on average for the climatic type. All other covertypes occur near historical proportions found in the climatic section (*Losensky 1997*). Therefore, species using western white pine and western larch/Douglas-fir covertypes are presumably more likely to be found and/or be more abundant on Stillwater State Forest than on average in the climatic section. Conversely, species using subalpine fir and lodgepole pine covertypes are presumably less likely to occur or occur in lower densities on Stillwater State Forest due to the amount of habitat present, while species that use other covertypes are expected to occur near the average densities expected throughout the climatic section. However, primarily due to fire suppression, timber management, and introduced diseases, many of the stands have increased in the proportion of shade-tolerant tree species (*TABLE F-1 - PERCENTAGE OF COVERTYPES FOUND ON STILLWATER STATE FOREST AND THE CLIMATIC SECTION*). Fire suppression probably had little effect in the project area, while past timber harvesting and diseases heavily influenced the decline in shade-intolerant tree species. The changes presumably reduce the abundance of species that use open, shade-intolerant forested habitat, while favoring species using dense, closed-canopy habitats.

Patch Size and Interior Habitats

Species that are hesitant to cross broad expanses without forest cover, or those that depend upon interior forest conditions, can be sensitive to the amount and spatial configuration of appropriate habitat. Therefore, patch size and juxtaposition can influence habitat quality and population dynamics for some species. Some species are adapted to thrive near patch edges, while others are adversely affected by the presence of edge or by the presence of other animals that prosper in edge habitats.

TABLE F-1 - PERCENTAGE OF COVERTYPES FOUND ON STILLWATER STATE FOREST AND THE 333C CLIMATIC SECTION

COVERTYPE	PERCENT CLIMATIC SECTION (LOSENSKY 1997)	PERCENT OF COVERTYPES ON THE STILLWATER STATE FOREST EXPECTED UNDER HISTORIC CONDITIONS	PERCENT OF COVERTYPES ON THE STILLWATER STATE FOREST EXISTING COVERTYPES CURRENTLY
Douglas-fir	<1	2	2
Lodgepole pine	27	11	11
Mixed conifer[1] (spruce-fir)[2]	6	8	27
Nonforest[1] (wheat-fescue)[2]	Trace	2	2
Other types	Trace	Trace	Trace
Ponderosa pine	1	1	1
Subalpine fir	36	20	26
Western larch/ Douglas-fir	28	45	26
Western white pine	1	11	3

[1] *DNRC classification*
[2] *Losensky (1997) classification*

A "patch" is defined as a unit of habitat with broadly similar age and structural characteristics (primarily associated with forest or nonforest cover). For this analysis, forested habitats provided the basis for patch, interior-habitat, and edge-habitat analyses. Forested habitats were defined as stands greater than 40 years old (pole- to sawtimber-sized stands) with a canopy cover of 40 percent or more. Interior forested habitat is defined as an area that is not affected by the adjacent stand and retains similar climatic conditions. Conversely, edge is defined as the contact zone between 2 different types of habitat. For this analysis, the first 300 feet of a patch was considered edge habitat; the remaining patch was considered interior forested habitat (*TABLE F-2 - EXISTING AND RESULTING FORESTED, INTERIOR, AND EDGE HABITAT ON THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT*).

Connectivity

Connectivity of forest cover between adjacent patches is important for promoting movements of species that are hesitant to cross broad, nonforest expanses. Stands that are pole-sized or greater with crown closure greater than 40 percent can be important for providing travel cover for forest-dwelling species. Across Stillwater State Forest, connectivity is high with few isolated stands. No harvest areas are proposed in key travel areas, such as saddles or near streams (*FIGURE F-1 – EXISTING FORESTED HABITATS IN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT*). See *Canada Lynx* and *Fisher* analyses for additional details on connectivity and travel cover.

Deadwood

Deadwood (downed trees and snags) is an important component of the forested ecosystems. The 5 primary functions of deadwood in the forested ecosystems are to:

1) increase structural diversity,
2) alter canopy microenvironment,
3) promote biological diversity,
4) provide critical habitat for wildlife, and
5) act as a storehouse for nutrient and organic matter recycling agents (*Parks and Shaw 1996*).

This analysis focuses on the importance of deadwood as wildlife habitat and the effects of this project on those habitats.

The presence of insects and predaceous birds and mammals are important to forest management. Both insects and birds associated with snags and downed wood are suspected of controlling insects that are harmful to wood production, such as the Douglas-fir tussock moth and spruce budworm. However, when insect populations reach epidemic levels, predation is often ineffective at controlling or reducing population levels (*Torgensen 1994*). Small mammals that are associated with downed wood distribute ectomychorrhizal fungus, which is needed for seedling establishment and tree growth (*Amaranthus 1998*). Therefore, maintenance of habitats for insectivorous birds and mammals is important for long-term forest health.

Snags and logs provide reproduction, feeding,

TABLE F-2 – EXISTING AND RESULTING ACRES OF FORESTED, INTERIOR, AND EDGE HABITAT IN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT

PARAMETER	NO-ACTION ALTERNATIVE A	ACTION ALTERNATIVE B	ACTION ALTERNATIVE C
Forested habitat	21,465	20,278	20,610
Interior habitat	14,771	13,245	13,635
Edge habitat	6,694	7,033	6,975

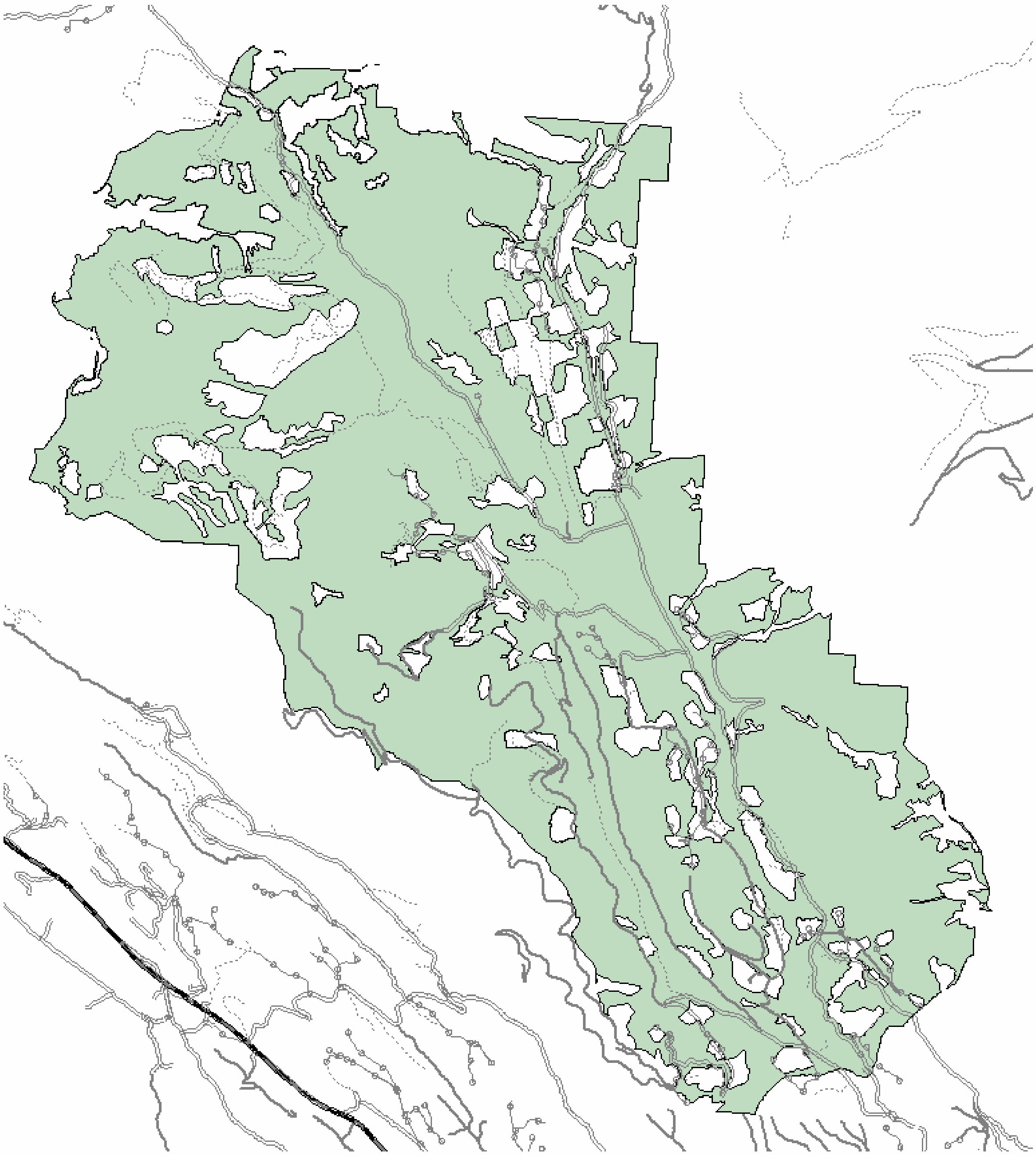


FIGURE F-1 - EXISTING FORESTED HABITAT IN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT

rearing, and/or shelter structure for an array of wildlife species. Deadwood provides insects, fungus, and wood food sources for small mammals. In turn, these small mammals provide prey for predatory birds and mammals. Additionally, deadwood provides animal areas with:

- stable temperatures and moisture,
- shelter from the environment,
- lookout areas, and
- food storage sites.

Small mammals, such as red-backed voles, to large mammals, such as black bears, rely on deadwood for survival and reproduction.

The size, length, decay, and distribution of deadwood affect their capacity to provide specific habitat. Logs less than 6 feet in length tend to dry out and provide limited habitat for wildlife species. Single, scattered logs could provide lookout and travel sites for squirrels or access under the snow for weasels and other small mammals, while log piles provide habitat for weasels, hares, other small mammals, etc. Similarly, diameters, heights, and snag densities determine the snag habitat value for wildlife species. Larger, taller snags tend to provide nesting sites, while shorter snags and stumps tend to provide feeding sites for birds and mammals. Cavity-nesting birds often nest in areas where several snags are available, using individual snags as feeding or roosting sites; therefore, considering the size and distribution of these resources is important.

Snag data were collected in areas where SLI data indicated the stand might meet the old-growth definition defined by *Green et al (1992)*. These areas occurred only in Harvest Area III, which is exclusive to Action Alternative B. Mean snag densities (greater than 14 inches dbh) ranged from 0 to ***64*** per acre, with an average of ***12.6*** ($n_{(stands)}$ = ***20 [standard deviation = 3.67]***) and ***14.0*** ($n_{(stands)}$ = ***4 [standard deviation = 4.12]***) for stands in cool and moist and cold and moderately dry habitat types, respectively. Only 2 of the sampled stands were harvested in the past. In the harvested stands, snag densities are among the lowest encountered. Whitebark pine was the most common snag encountered (36 percent of all snags), followed by subalpine fir (30 percent), Engelmann spruce (26 percent), and Douglas-fir (8 percent). The live-tree distribution is quite different; Engelmann spruce (75 percent) represents the highest proportion of large trees (greater than 21 inches dbh), followed by subalpine fir (12 percent), Douglas-fir (9 percent), whitebark pine (3 percent), and western larch (2 percent). These trees could provide snag and coarse-woody-debris recruitment in the future. Regeneration in the project area is primarily shade-tolerant Engelmann spruce and subalpine fir. Snag densities in the other harvest areas were subjectively assessed and appear to be relatively low in density, which is expected in previously harvested stands (*Harris 1999*) and near open roads (*Bate et al. 2002*).

COARSE FILTER

Direct Effects to Coarse Filter

- ***Direct Effects of No-Action Alternative A to Coarse Filter***

  No additional displacement or disturbance of wildlife is expected in the area.

- ***Direct Effects of Action Alternatives B and C to Coarse Filter***

  Displacement and/or disturbance of wildlife species would be expected due to these alternatives. Since different species react to human disturbance differently, the extent of disruption would be related to the species in question. Generally, the amount of harvest area, associated roads, and duration of the project provides an avenue to develop a hierarchy of potential disturbance to wildlife in the area. Both action alternatives would be implemented over a 3-year period. Action Alternative B proposes to harvest 9.5 mmbf of timber from 1,270 acres and construct 3.4 miles of new roads. Action Alternative C proposes to harvest 5.7 mmbf of timber from 938 acres and construct 3.1 miles of new roads. Due to the amount of acres and volume, Action Alternative B would be expected to take longer to complete than Action Alternative C. Due to the increased area and duration of Action Alternative B, Action Alternative B would be expected to produce more disturbances to wildlife species than Action Alternative C. However, the project design features would be incorporated to reduce widespread disturbance of the area (see *Grizzly Bear* analysis).

Indirect Effects to Coarse Filter

Covertypes

- ***Indirect Effects of No-Action Alternative A to Covertypes***

The stands considered for harvesting would continue to age, and the western larch/Douglas-fir covertypes would convert to mixed-conifer or subalpine fir covertypes. Where mixed-conifer and subalpine fir covertypes currently exist, these covertypes would be retained, but these stands would maintain or increase their canopy closure, shading out understory plants and shade-intolerant tree seedlings. In the long-term, species that use the more open stands and/or shade-intolerant tree species, would be negatively affected due to the loss of habitat, while species that use late-successional forest structure, would benefit by an increase in habitat.

- ***Indirect Effects of Action Alternative B to Covertypes***

Harvesting under this alternative would convert most stands to younger age classes, but would not necessarily change covertypes. On 138 acres, harvesting would promote more historic covertype representation. On the remaining 1,130 acres, the current covertype would be retained; however, shade-intolerant species, such as western larch and western white pine, would be planted in the regeneration-harvest areas to reintroduce or increase their representation in the future stand. DNRC would rely on natural regeneration of whitebark pine to increase or maintain this species in the future stand. These changes would favor wildlife species that use the more-open canopies and shade-intolerant tree species at the expense of wildlife species associated with closed-canopy, shade-tolerant tree species. If whitebark pine successfully regenerates, species such as Clarke's nutcrackers, grizzly bears, squirrels, etc., would benefit from an increase in key food sources.

- ***Indirect Effects of Action Alternative C to Covertypes***

Harvesting under this alternative would convert most stands to younger age classes, but not necessarily change covertypes. On 46 acres, harvesting would promote a more historic covertype representation. On the remaining 892 acres, the covertype would be retained; however, shade-intolerant species, such as western larch and western white pine, would be planted in regeneration-harvest areas to reintroduce or increase their representation in the future stand. These changes would favor wildlife species that use the more open canopies and shade-intolerant tree species at the expense of wildlife species associated with closed-canopy, shade-tolerant tree species. Whitebark pine regeneration is not expected in any of these harvest areas.

Patch Size and Interior and Edge Habitats

- ***Indirect Effects of No- Action Alternative A to Patch Size and Interior and Edge Habitats***

  Patch size and interior and edge habitats would not change in the near term. Through time, forested patch size and interior habitat are expected to increase, while edge habitat would be expected to decrease. These conditions would favor wildlife species that prefer dense, mature forests at the expense of wildlife species that use nonforest, open-canopied, or edge habitats.

- ***Indirect Effects of Action Alternative B to Patch Size and Interior and Edge Habitats***

  Forested habitat would decrease by 1,187 acres and interior forested habitat would decrease by 1,526 acres, while edge habitat would increase by 339 acres in the Upper Whitefish Grizzly Bear Subunit (*TABLE F-2 – EXISTING AND RESULTING ACRES OF FORESTED, INTERIOR, AND EDGE HABITAT ON UPPER WHITEFISH GRIZZLY BEAR SUBUNIT)*. Habitat for species that use forested and interior habitat would decrease, while species that use edge and regeneration or unforested habitats would be favored.

- ***Indirect Effects of Action Alternative C to Patch Size and Interior and Edge Habitats***

  Forested habitat would decrease by 855 acres and interior forested habitat would decrease by 1,136 acres, while edge habitat would increase by 281 acres in the Upper Whitefish Grizzly Bear Subunit (*TABLE F-2 – EXISTING AND RESULTING FORESTED, INTERIOR, AND EDGE HABITAT ON UPPER WHITEFISH GRIZZLY BEAR SUBUNIT*). Habitat for species that use forested and interior habitat would decrease, while species that use edge and regeneration or unforested habitats would be favored. These effects are intermediate between No-Action Alternative A and Action Alternative B.

Connectivity

- ***Indirect Effects of No-Action Alternative A to Connectivity***

  No change in forest connectivity is expected. Over time, forest connectivity would be expected to increase due to the succession of early seral stands and sparse stands. The increase in connectivity would benefit species that depend on dense interconnected forests by providing movement corridors and other habitats within the project area.

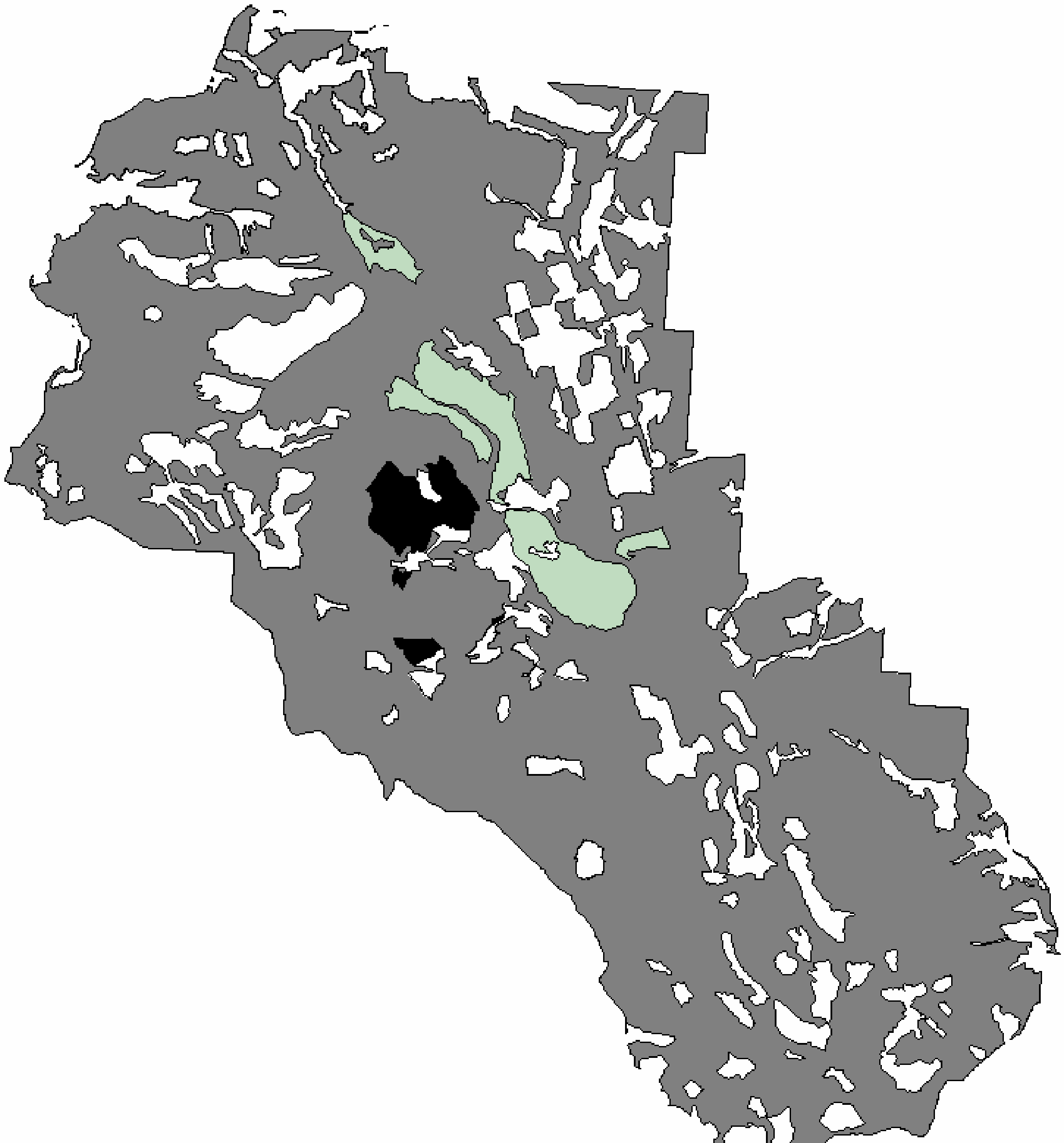
- ***Indirect Effects to Connectivity Common to Action Alternatives B and C***

  Timber harvesting under these alternatives does not substantially alter connectivity. In both alternatives, regeneration harvests would not result in barriers to forest dwelling species under either alternative (*FIGURE F-2 – FORESTED HABITAT IN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT*). However, Action Alternative B narrows the connectivity corridor along the West Fork to approximately 500 feet. Under both alternatives, substantial effects to connectivity are not expected; therefore, any effects are expected to be negligible.

Deadwood

- ***Direct and Indirect Effects of No-Action Alternative A to Deadwood***

  No changes in deadwood resources would occur. Tree mortality, especially shade-tolerant tree species, could increase due to insects and diseases or other



Forested habitat not affected under either action alternative
Forested habitat removed under Action Alternative B in addition to Action Alternative C
Forested habitat removed under Action Alternative C

FIGURE F-2—FORESTED HABITAT IN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT UNDER EITHER ALTERNATIVE

natural events. This situation would benefit species that use deadwood resources in the short term; however, because of the current lack of shade-intolerant tree species in the longer term, reductions in deadwood, especially shade-intolerant tree species, could occur.

- ***Direct and Indirect Effects to Deadwood Common to Action Alternatives B and C***

Under both alternatives, deadwood resources would be targeted to be retained in the harvest areas. Harvesting could remove recently dead trees that are merchantable, but would attempt to retain most of the cull material. Based on data collected by the USFS on Lolo National Forest, an estimate of snag loss during harvesting activities ranged from 50 to 100 percent (*Hillis 1993*). On a recent DNRC timber sale where all snags greater than 14 inches were to be retained, 60 percent were standing following harvesting; however, when all snags were considered, only 35 percent were left standing. A majority of the loss of snags occurred in the medium-size class, with retention of the larger snags appearing more successful. Therefore, nearly one-half of the snags, mostly small to medium sized, planned for retention in the area could succumb to operational or safety-related felling. These losses are expected to be larger in the cable-yarding harvest areas and exasperated if prescribed fire is used for site preparation.

In each harvest area, a minimum of 1 snag and 1 snag-recruitment trees over 21 inches dbh would be retained per acre (*ARM 36.11.411*). If snags planned for retention were felled for safety concerns, these trees/snags would be left on site to provide feeding substrate and habitat structure for wildlife species. In all harvest areas, decreases in feeding and nesting sites might occur due to the reduction in snags, while some ground structure and foraging sites could be removed by the harvesting and crushing of downed trees. Harvesting is expected to reduce the densities of small to medium-sized snags; therefore, these alternatives are likely to affect smaller cavity-nesting species and their associated secondary cavity species. However, retention of dominant trees, existing deadwood, and untreated piles of cull logs is expected to provide habitat for species associated with large deadwood in the short and long term. More deadwood habitat would be retained under Action Alternative C than under Action Alternative B. The loss of deadwood structure could reduce insectivorous wildlife species, which could result in increased populations of forest pests (*Torgenson 1994*) and could inhibit regeneration by reducing distribution of ectomychorrhizal fungus distributed by small mammals (*Amaranthus 1998*). However, not all deadwood would be removed from the stand, thereby providing some habitat for these species. The scale of the effects to these species is unknown, but is expected to be related to the reduction in deadwood habitat.

CUMULATIVE EFFECTS - COARSE FILTER

Cumulative Effects to Covertype and Age Class

- ***Cumulative Effects of No-Action Alternative A to Covertype and Age Class***

Covertypes would continue to convert from shade-intolerant to shade-tolerant covertypes, and stands in older age classes would continue to increase. Where shade-tolerant covertypes are present, shade-intolerant tree densities would continue to decline. This situation would affect wildlife species using the area by decreasing habitat diversity in the area and favoring species associated with late-succession, shade-intolerant tree species.

- ***Cumulative Effects to Covertype and Age Class Common to Action Alternatives B and C***

  Efforts under both action alternatives would be made to convert stands to more closely reflect the historic conditions outlined in *Losensky (1997)*. Under Action Alternative B, conversion would occur through the thinning of shade-tolerant species and regeneration harvesting. The harvesting would result in more closely reflecting historic covertypes and age classes. This alternative would benefit early successional species at the expense of mid– to later-successional species. The treatments are expected to increase the growth of retained trees, thereby decreasing the amount of time before large trees are available in these stands. These alternatives are expected to benefit native wildlife species by reproducing habitats to which the species are adapted.

Cumulative Effects to Patch Size, Interior and Edge Habitats, and Connectivity

Adjacent USFS lands are not expected to be harvested, thereby increasing forested habitat and patch size in those areas. The effects discussed under the indirect effects above would be cumulative to the conditions occurring on adjacent lands in the area.

Cumulative Effects to Deadwood Resources

Reductions in deadwood resources would be cumulative to past timber and salvage harvests. However, in these areas, mitigations to provide deadwood habitats are incorporated in all these projects. So, although deadwood resources would be reduced in the cumulative effects area, retention of specific snags and downed trees would continue to contribute habitat, albeit at a lower density in the short term, for species that use deadwood resources.

FINE FILTER

In the fine-filter analysis, individual species of concern are evaluated. These species include wildlife species listed under the Endangered Species Act, species listed as sensitive by DNRC (*ARM 36.11.436(6)*), and species managed as big game by DFWP.

THREATENED AND ENDANGERED SPECIES

- Bald Eagle

  The bald eagle is classified as "threatened" and is protected under the Endangered Species Act. Strategies to protect the bald eagle are outlined in the Pacific States Bald Eagle Recovery Plan (*USFWS 1986*) and the Montana Bald Eagle Management Plan (*Montana Bald Eagle Working Group 1994*). Management direction involves identifying and protecting nesting, feeding, perching, roosting, and wintering/migration areas (*USFWS 1986, Montana Bald Eagle Working Group, 1994*). For the nesting territory at Upper Whitefish Lake, *Paige (1997)* developed site-specific management guidelines that will be followed in this project.

  Bald eagles prefer multistoried nesting habitats with 40- to 70-percent canopy cover with emergent trees within topographic line-of-sight to an associated water source with an adequate food supply. The emergent trees and/or snags need to be large enough (more than 25 inches dbh) to support nesting or perching eagles. Additionally, eagles prefer cottonwood, Douglas-fir, and ponderosa pine trees *(Wright and Escano 1986)*. In western Montana, eagles also use western larch and Engelmann spruce.

Eagles nest south of Upper Whitefish Lake. *Paige (1997)* defined the nest area to include the south shoreline of the lake to West Fork Road; the primary use area includes the nest area and extends approximately 1 mile to the north. The home range of these eagles extends north from Swede Creek to Nasukoin Lake and east from the divide between the Swift Creek and West Fork drainages to Hay Lake (*FIGURE F-3 – UPPER WHITEFISH BALD EAGLE TERRITORY*). The eagles return to their breeding territory in February and, if successful in raising eaglets, will inhabit the nest area through August. No proposed harvest areas occur within the nest or primary-use area. However, haul routes intersect the nest and primary-use area. The West Fork Road (open road) borders the south boundary of the nest and primary-use area, while Whitefish Saddle Road (restricted road) cuts through the primary-use area.

To assess cumulative effects to bald eagles, the bald eagle territory home range was used. This area includes DNRC (approximately 33 percent) and National Forest System Lands (approximately 66 percent). Harvest Areas I, II-A, and II-C fall into the bald eagle's home range.

Direct Effects

- ***Direct Effects of No-Action Alternative A to Bald Eagles***

  No additional direct effects to nesting or wintering bald eagles would be expected.

- ***Direct Effects to Bald Eagles Common to Action Alternative B and C***

  No harvesting would occur in the nest or primary-use area. However, hauling through the primary-use area and along the boundary of the nest-site area would occur. To limit disturbance to nesting eagles, Harvest Areas I and II-A would not be harvested during the eagle nesting season (February 1 through August 15) unless the territory is determined to be unoccupied. If needed, logs could be loaded and hauled (but not cut, skidded, or processed) from Harvest Area II-A during the nesting season because the harvest area is along an open road. Loading and hauling would be a short-term disturbance consistent with disturbance found along open roads. However, if this activity is determined to be too disruptive to the nesting eagles, the hauling operation would be discontinued immediately and would start again after August 15. With these mitigation measures in place, no additional disturbance effects are expected.

Indirect Effects

- ***Indirect Effects of No-Action Alternative A to Bald Eagles***

  Timber stands that presently provide bald eagle habitat would continue to increase in density and proportion of shade-tolerant tree species, while decreasing in growth rates. Additionally, snags would continue to develop. Barring any natural disturbance, shade-intolerant trees would not regenerate over time. Existing younger stands would continue to grow and produce the structure needed by eagles, but at a slower rate due to dense stocking. Under this alternative, the quality of eagle nesting habitat would decrease as canopy cover increases above 70 percent (*Montana Bald Eagle Working Group 1991*). The potential of these effects limiting nest success of this breeding pair is low.

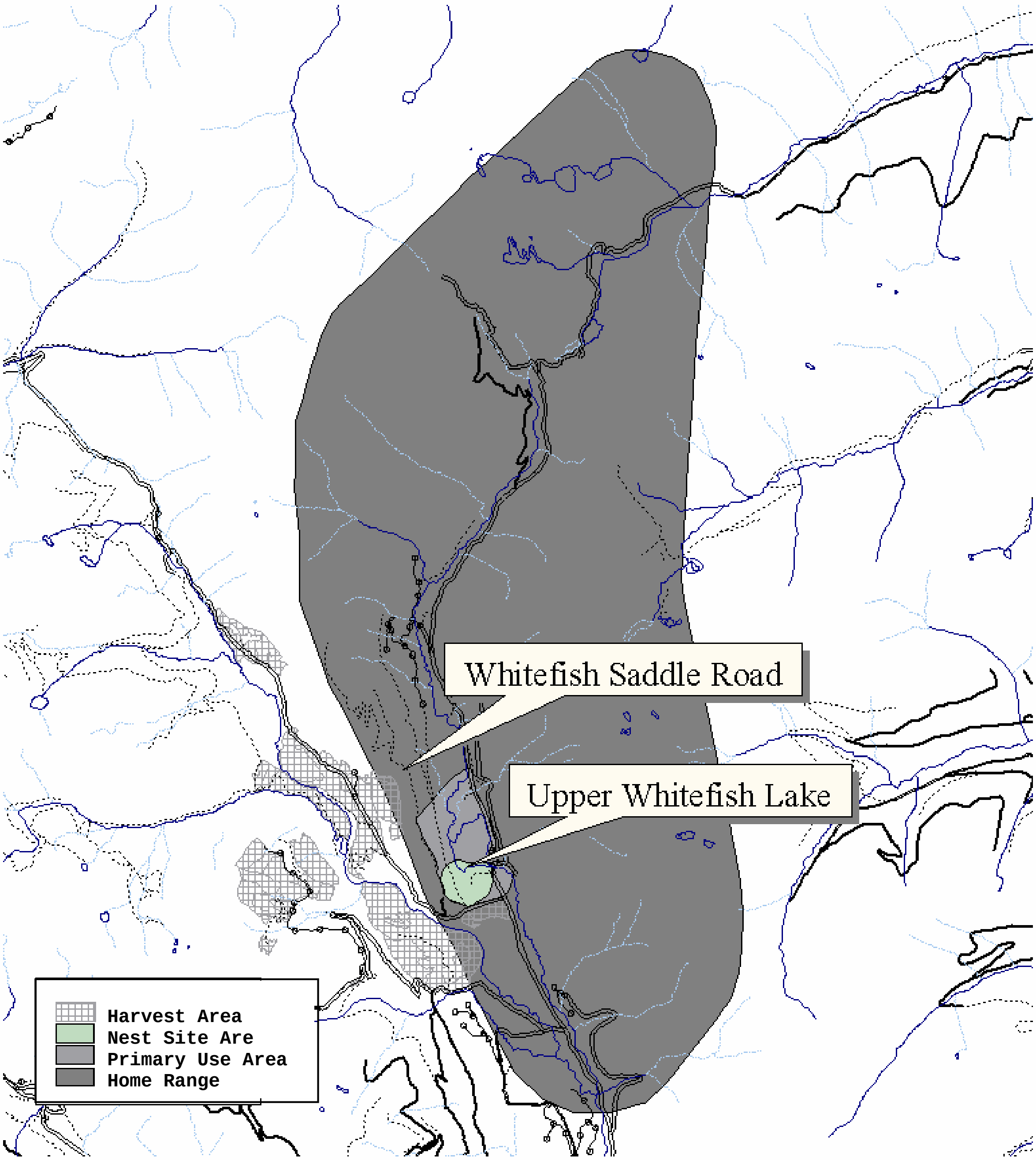


FIGURE F-3 - UPPER WHITEFISH BALD EAGLE TERRITORY

- ***Indirect Effects to Bald Eagles Common to Action Alternative B and C***

  No habitat modifications would occur in the nest site or primary-use area under these alternatives. Therefore, the effects discussed under No-Action Alternative A are expected to occur in these areas.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Bald Eagles***

  Under this alternative, no additional disturbance or habitat modification would occur in the analysis area. No other projects are proposed in the home-range area.

- ***Cumulative Effects to Bald Eagles Common to Action Alternative B and C***

  This alternative would result in treatment of 119 acres of timber within the 17,520-acre home range associated with this territory. None of these stands are located in a landscape position (outside line-of-sight of an associated waterbody) where they provide potential bald eagle nesting habitat. In both Harvest Areas II-A and II-C, regeneration and a group-select harvest prescriptions would be implemented. These treatments would open the overstory canopy, which would increase eagle access to small mammal prey, while retaining dominant trees scattered throughout the harvest area or in groups. Over time, these harvest areas would develop a multilevel canopy. These conversions are expected to be neutral to positive. However, harvesting in Harvest Area II-A would decrease visual screening between the open West Fork Road and the harvest area, thereby offsetting any benefit realized by reducing canopy cover. Otherwise, no other projects are planned in the cumulative-effects analysis area. The effects of these habitat alterations are expected to be neutral to slightly positive, but are not expected to change the reproductive success rate of this nesting pair.

- Canada Lynx

Canada lynx are listed as "threatened" under the Endangered Species Act. Currently, no recovery plan exists for Canada lynx. Several reports have been written to summarize the research on lynx and develop a conservation strategy (*Ruediger et al 2000*).

Lynx are associated with subalpine fir forests, generally between 4,000 and 7,000 feet in elevation, in western Montana (*Ruediger et al 2000*). Lynx habitat in western Montana consists primarily of young coniferous forest with plentiful snowshoe hares, stands with abundant coarse woody debris for denning and cover for kittens, and densely forested cover for travel and security. Additionally, the mature forests provide habitat for red squirrels, an alternative prey source. These conditions are found in a variety of habitat types, particularly within the subalpine fir series (*Pfister et al 1977*).

To assess lynx habitat, DNRC SLI data were used to map specific habitat classes used by lynx. These areas were considered *lynx habitat* (*ARM 36.11.403(40)*). Other parameters (stand age, canopy cover, amount of coarse woody debris) were used in modeling the availability of specific types of lynx habitat in the area (i.e. denning, forage, other, temporarily not available) (*ARM 36.11.435(2)*).

Based on field reconnaissance and SLI modeling, denning habitat is not expected to be affected, while all harvest areas occur in general or foraging habitat. The current conditions allow lynx to move through the project area and the proposed harvest areas. All stands proposed for harvesting likely provide red squirrel habitat, and stands or portion of stands with thick understories likely provide snowshoe hare habitat.

Cumulative effects were analyzed for lands in the Upper Whitefish Grizzly Bear Subunit. Based on the above analysis, lynx habitat comprised approximately 26,866 acres, nearly the entire DNRC ownership in the Upper Whitefish Subunit. Of these acres, 915 acres are modeled as denning habitat. The denning habitat component is difficult to model because lynx can den in small patches of downed wood within a large stand. The SLI is designed to identify general stand conditions and does not capture small dense patches of downed woody material; therefore, it is likely that more denning habitat occurs on the landscape than the model predicts. Other classifications used in the modeling effort appear more predictable. ***For existing lynx habitat, see TABLE F-3—EXISTING LYNX HABITAT ON DNRC OWNERSHIP WITHIN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT.***

TABLE F-3—EXISTING LYNX HABITAT ON DNRC OWNERSHIP WITHIN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT

LYNX HABITAT COMPONENT	EXISTING ACRES	EXISTING PERCENT
Denning	915	3.4
Mature foraging	4,915	18.3
Young foraging	5,025	18.7
Other available	13,406	49.9
Temporary nonhabitat	2,604	9.7
Totals	26,865	100.0

Direct Effects

- ***Direct Effects of No-Action Alternative A to Canada Lynx***

  No additional activities would occur; therefore, no direct effects would be expected.

- ***Direct Effects to Canada Lynx Common to Action Alternatives B and C***

  Some disturbance of lynx could occur in areas with adequate cover for lynx to travel through. However, lynx appear to be relatively tolerant of human presence and road use (*Mowat et al 2000*); therefore, no substantial direct effects would be expected. A slight potential increase for mortality due to road traffic on gated and/or new roads would be possible, though the risk of this occurring would likely be extremely small. Lynx do not appear to avoid roads at low traffic volumes (Ruediger 2000), so increased logging traffic on open and gated roads is not expected to displace or increase the energetic cost of individual lynx. The risks are higher under Action Alternative B than Action Alternative C, but both alternatives are expected to result in very minor risks of negative direct effects.

Indirect Effects

- ***Indirect Effects of No-Action Alternative A to Canada Lynx***

  Under No-Action Alternative A, lynx would continue to use the project area similarly in the short term because no lynx habitat would be modified under this alternative. In the longer term (barring natural disturbances), stands would continue to age and increase in the coarse woody debris needed for denning and security cover. Regenerating harvest areas would mature and reduce habitat quality for snowshoe hares, potentially resulting in decreased primary prey availability for lynx. As these stands mature, habitat for red squirrels would increase, somewhat lessening the loss of prey. However, a diet of red squirrels might not provide the nutrients needed for the successful reproduction and rearing of kittens (*Koehler 1990*). Therefore, in the short term, no effects to lynx are expected. In the longer term without disturbance, denning habitat is expected to increase, but foraging opportunities are expected to decrease.

- ***Indirect Effects of Action Alternative B to Canada Lynx***

Lynx habitat would be modified on 1,270 acres. A regeneration-harvest prescription would be implemented on 1,198 acres; a commercial-thin harvest prescription would occur on the remaining 72 acres. Regeneration harvests would render the harvest area temporarily unsuitable for lynx. Over time, if the harvest areas regenerate to a dense stocking of young trees, snowshoe hare populations in these areas are expected to increase, thereby providing an increase in lynx foraging opportunities. Due to the steep slopes and shrub competition, the harvest areas specific to this alternative (Harvest Area III) might not regenerate successfully enough to provide young foraging habitat. Past harvesting in adjacent areas show sparse regeneration over the past 20 to 30 years. In the proposed regeneration harvest areas (332 acres), tree density is not expected to meet young foraging-habitat criteria, however, the shrub component could provide summer cover for snowshoe hares. Therefore, lynx use of these areas is expected to be limited until the regenerating canopy exceeds 40 percent canopy closure, resulting in marginal habitat in 40 to 80 years. If these stands do not regenerate successfully, lynx habitat would be removed on 332 acres for a long period of time. In Harvest Area I, where a commercial-thin treatment is proposed, harvesting would remove trees that could lead to red squirrel population declines to an unknown degree due to the removal of cone-producing trees (*Pearson 1999*). However, canopy cover would be retained above 40 percent; therefore, the potential for lynx to use or move through this harvest area is expected to continue. Additionally, several slash piles throughout Harvest Area II would be retained following harvesting to potentially provide denning sites near future high quality foraging areas. The regeneration harvest areas and associated piles of cull logs are not expected to be used until dense regeneration occurs. In the short-term, available lynx habitat would decline. As stands regenerate, foraging and denning habitats are expected to increase.

- ***Indirect Effects of Action Alternative C to Canada Lynx***

The effects discussed above would apply to harvest areas proposed under this alternative; however, the 332 acres discussed above would not be harvested. This alternative is expected to result in the benefits discussed above without the potential long-term loss of habitat on 332 acres in Harvest Area III.

Cumulative Effects

- ***Cumulative Effects of the No-Action Alternative A to Canada Lynx***

  No habitat would be modified. In time, denning habitat would develop on much of the area at the expense of young forage. Snowshoe hare populations would remain relatively stable, but possibly at low densities due to the lack of the temporal high-density, young successional habitats. Under these alternatives, barring any disturbance, forage availability would decrease, while denning habitat would increase.

- ***Cumulative Effects of Action Alternative B to Canada Lynx***

  Under this alternative, 1,198 acres of lynx habitat in the Upper Whitefish Subunit would be converted to ‘unsuitable’ for 10 to 20 years. The conversion of habitat would be cumulative to other past harvesting on State land; some harvest areas have not fully regenerated in 20 to 30 years. Of this proposed alternative, 332 acres are in areas similar to those that have not regenerated in the past 2 to 3 decades. In the other harvest areas, young foraging habitat is expected to develop. Additionally, denning structure (piles of cull logs) would be left following harvesting, which could increase denning habitat in this subunit. ***Expected effects to lynx habitat components are presented in TABLE F-4 - LYNX HABITAT EXPECTED FOLLOWING HARVESTING UNDER ACTION ALTERNATIVE B.***

TABLE F-4 - LYNX HABITAT EXPECTED FOLLOWING HARVESTING UNDER ACTION ALTERNATIVE B

LYNX HABITAT COMPONENT	FOLLOWING HARVESTING	
	ACRES	PERCENT
Denning	915	3.4
Mature foraging	4,326	16.1
Young foraging	4,977	18.5
Other available	12,856	47.9
Temporary nonhabitat	3,791	14.1
Totals	26,865	100.0

- ***Cumulative Effects of Action Alternative C to Canada Lynx***

  Under this alternative, 866 acres of lynx habitat in the Upper Whitefish Subunit would be converted to *unsuitable* for 10 to 20 years. All proposed harvest areas in this alternative are expected to regenerate successfully; therefore, young foraging habitat is expected to develop in 10 to 20 years. Additionally, denning structure (piles of cull logs) would be left following harvesting, which could increase denning habitat in this subunit. This alternative is expected to impact lynx to a minor degree in the short-term, with greater long-term benefits. ***Expected effects to lynx habitat components are presented in TABLE F-5 - LYNX HABITAT EXPECTED FOLLOWING HARVESTING UNDER ACTION ALTERNATIVE C.***

TABLE F-5 - LYNX HABITAT EXPECTED FOLLOWING HARVESTING UNDER ACTION ALTERNATIVE C

LYNX HABITAT COMPONENT	***FOLLOWING HARVESTING***	
	ACRES	***PERCENT***
Denning	***915***	***3.4***
Mature foraging	***4,489***	***16.7***
Young foraging	***5,025***	***18.7***
Other available	***12,905***	***48.0***
Temporary nonhabitat	***3,531***	***13.1***
Totals	***26,865***	***100.0***

- Gray Wolf

The gray wolf is listed as "threatened" under the Endangered Species Act. The *Northern Rocky Mountain Wolf Recovery Plan* defines 3 recovery zones (*USFWS 1987*). The proposed project is in the Northwest Montana Recovery Zone. The 3 recovery zones met the recovery standards for the last 2 years and are expected to meet the 10 packs per recovery area this year, initiating the delisting process.

The wolf is a wide-ranging, mobile species. Adequate habitat for wolves consists of adequate vulnerable prey and minimal human disturbance, especially at den and/or rendezvous sites. Primary prey species in northwest Montana are white-tailed deer, elk, moose, and mule deer. The distribution of wolves is strongly associated with white-tailed deer winter ranges. Wolves in northwest Montana typically den in late April. Wolves choose elevated areas in gentle terrain near a water source (valley bottoms), close to meadows or other openings, and near big game wintering areas for dens and rendezvous sites.

The project area contains elk and white-tailed and mule deer nonwinter ranges, which could provide prey for wolves. However, due to the high elevation, denning and rendezvous sites are not expected and harvesting activities would not occur in spring when wolves and their pups are sensitive to human disturbance. Wolf use of the area is expected to be transitory or sporadic; therefore, this project is not expected to affect gray wolves, and this species was dropped from further analysis for this project

- Grizzly Bear

Grizzly bears are listed as "threatened" under the Endangered Species Act. The Grizzly Bear Recovery Plan defines 6 recovery areas (*USFWS 1993*). This project is proposed in grizzly bear habitat in the North Continental Divide Ecosystem Recovery Area. The North Continental Divide Ecosystem is divided into subunits. Each subunit approximates the size of a home range for a female bear and is separated from other subunits based on landscape features. This project is proposed in the Upper Whitefish Grizzly Bear Subunit.

The project area provides year-round habitat for grizzly bears. During the spring, bears search for winter-killed big game and lush green vegetation, especially in avalanche chutes. During the summer, bears seek lush green vegetation typically found in riparian areas. In late summer and into autumn, bears switch primarily to a berry diet. The project area contains high elevation, relatively flat basins bounded by steep slopes with numerous avalanche chutes and riparian habitats. Repeated spring observations indicate that grizzly bears could be migrating through the project area between denning sites and spring habitat. During summer and autumn, the basins and riparian habitats in

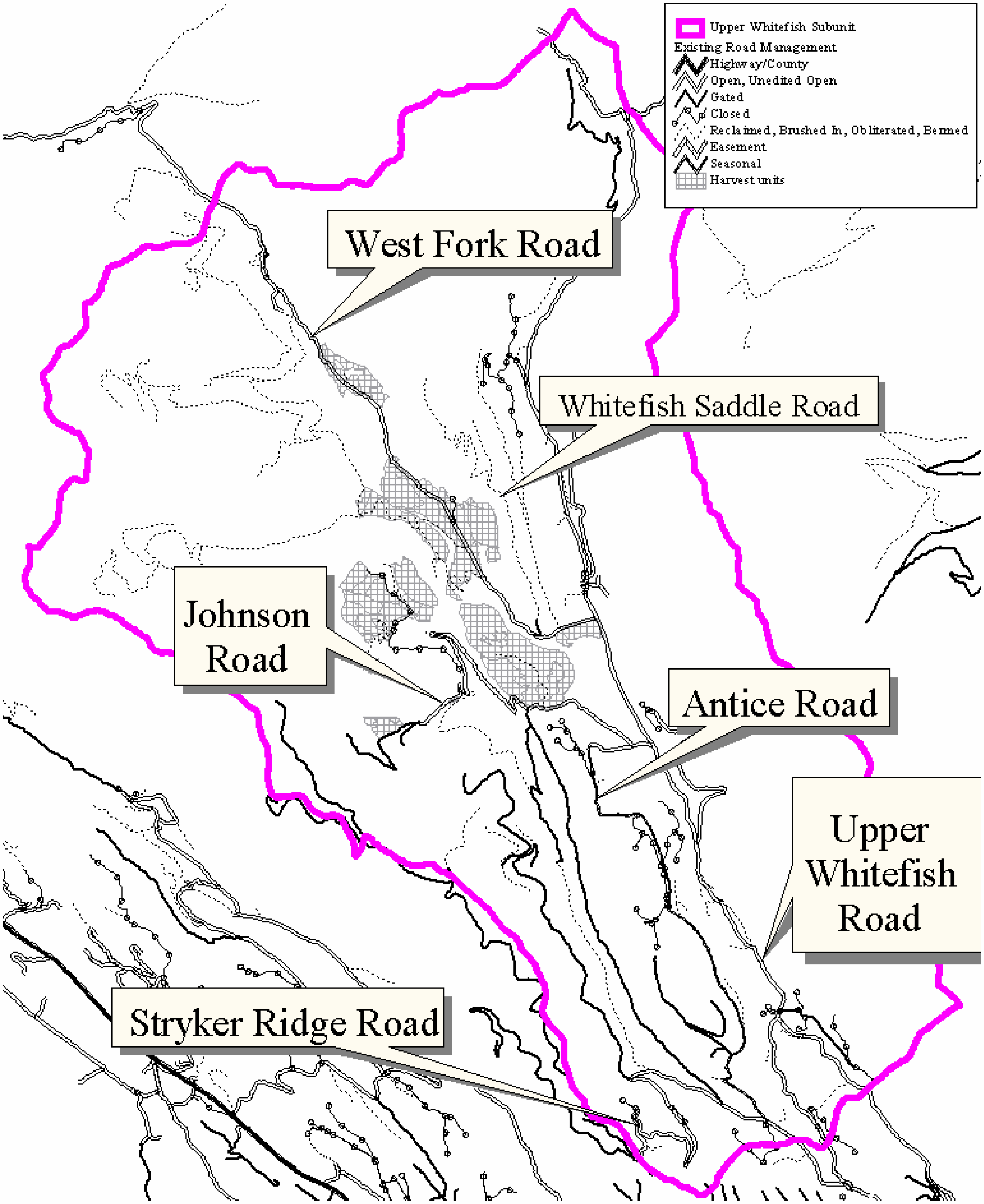


FIGURE F-4—EXISTING ROADS AND ROAD MANGEMENT IN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT

the project area provide high quality habitat for bears. This project could affect grizzly bears directly through increased road traffic, noise, and human activity indicated by changes in road densities, and indirectly by altering the amount and location of hiding cover and forage resources.

The cumulative effects analysis was conducted using the Upper Whitefish Subunit. This subunit is comprised of 84 percent DNRC- and 16 percent USFS-managed lands. This subunit receives a high amount of recreational activities, especially around Upper Whitefish Lake. Recreational use varies by season and includes snowmobiling, ice fishing, camping, fishing, ATV riding, firewood cutting, etc. During the nondenning season, these activities are generally confined to Upper Whitefish Lake, the surrounding area, and along open roads.

Access management is a major factor in managing grizzly bear habitat. The subunit includes several open roads (Upper Whitefish, West Fork, Swede, Stryker Ridge, and Johnson) and the seasonally restricted (March 15 through June 30) Antice Road. Other roads in the area are restricted year-round with gates or berms (*FIGURE F-4 – EXISTING ROADS AND ROAD MANAGEMENT IN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT*). To measure disturbance associated with open and total roads, a moving-windows analysis (*Ake 1994*) was used. Additionally, areas that are 500 meters from open or gated roads were defined as potential security core habitat. The road-management scenario in this subunit yields precise-open-road (POR) density (greater than 1 mile per square mile) of 31.8 percent; precise-total-road (PTR) density (greater than 2 miles per square mile) of 33.8 percent; and 51.6 percent of potential-security-core area. DNRC committed to design projects not to exceed the POR or decrease the amount of potential security core realized in 1996 baseline (*ARM 36.11.432 [1][c and d]*), unless approved by the Forest Management Bureau Chief (*ARM 36.11.432 [c][ii]* and *[d][i]*). In 1996, the POR was 32.9 percent, PTR was 41.2 percent (no commitment under *ARM*), and 43.8 percent was security core (*TABLE F-5 – EXISTING AND BASELINE ACCESS-MANAGEMENT PARAMETERS FOR THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT*). In the present situation, grizzly bears benefited by the reduced disturbance realized in the subunit. Managing motorized access reduces the potential for mortality, displacement from important habitats, and habituation to humans, and provides relatively secure habitat to reduce the energetic requirements (*Interagency Grizzly Bear Committee [IGBC] 1998*).

In addition to the timber harvesting proposed under this alternative, a native culvert restoration project is included. This project would require “walking” an excavator to the head of Stryker Basin to remove earthen fill from over numerous logs that were used to form a culvert for

TABLE F-5 - EXISTING AND BASELINE ACCESS MANAGEMENT PARAMETERS FOR THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT.

PARAMETER	CURRENT CONDITION	1996 BASELINE
POR density (percent exceeding 1 mile per square mile)	31.8	32.9
PTR density (percent exceeding 2 miles per square mile)	33.8	41.2
Potential security core area (percent greater than 500 meters from potential motorized disturbance)	51.6%	43.8%

the existing road prism. DNRC hydrologist and fisheries biologists are concerned that these culverts will fail in the future and contribute high amounts of sediment to the West Fork of Swift Creek, which could affect bull and westslope cutthroat trout reproduction and survival (refer to *APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS* and *APPENDIX E - FISHERIES ANALYSIS*). Access to these culverts would require use of a road that, presently, is bermed and water-barred, making it relatively impassable to motorized vehicles.

Direct Effects

- ***Direct Effects of No-Action Alternative A to Grizzly Bears***

  No additional direct effects would occur under this alternative.

- ***Direct Effects to Grizzly Bears Common to Action Alternative B and C***

  Under these alternatives, disturbance would increase due to activities in the harvest areas and on the associated access roads. Due to the amount of area, Action Alternative B is expected to result in more direct negative effects than Action Alternative C. The specific road disturbance will be discussed under the cumulative effects analysis.

  To accomplish the harvests, some restricted roads would be used for commercial purposes, but public use would not be allowed over a period of several years. Disturbances associated with these roads are expected to result in decreased use of adjacent habitats by grizzly bears and will be discussed under *Cumulative Effects*.

Indirect Effects

- ***Indirect Effects of No-Action Alternative A to Grizzly Bears***

  No additional habitat would be altered. Hiding cover would be retained within the proposed harvest areas. In time, increases in canopy cover could reduce forage production. No additional disturbance due to road use would occur. Therefore, negligible effects are expected.

- ***Indirect Effects to Grizzly Bears Common to Action Alternatives B and C***

  Under Action Alternatives B and C, timber harvesting would reduce hiding cover. To assess the reduction in hiding cover, hiding cover is expected to be removed in all harvest areas where harvesting reduces overstory cover to 50 percent or less. Timber harvesting would reduce hiding cover in the project area by 1,270 acres under Action Alternative B and 938 acres under Action Alternative C. In both cases, visual screening would be retained along open roads (*ARM 36.11.432[l]*). The loss of hiding cover is expected to be short-term due to the rapid regeneration expected from the shrub component. Therefore, this alternative is expected to result in negligible, short-term (5 to 10 years) negative effects to grizzly bears.

  Following treatment, reduced canopy cover and burning could stimulate berry-producing plants and other forage items (*Marten 1979, Zager 1980*). However, mechanical scarification or a hot fire may reduce the response of berry-producing plants (*Zager 1980*). In areas with large patches of berry-producing plants, attempts would be made to avoid these patches or minimize damage to vegetative organs when mechanically scarifying the area. Increased forage would be approximately proportional to canopy removal. Therefore, forage increases are expected to be higher with Action Alternative B than Action Alternative C. Additionally, Action Alternative B could increase reproduction of whitebark pine, a high energy autumn food source, by opening the forest canopy in Harvest Area III. The effects of both action alternatives would be positive and minor.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Grizzly Bears***

  Under No-Action Alternative A, motorized access to the area would remain unchanged. In the short-term, hiding cover would be retained at the highest amount of any alternative. Forest succession would continue and could reduce food sources for grizzly bears, but increase the amount of hiding cover. Since hiding cover does not appear limiting in the subunit, maintaining this cover at the expense of food resources could reduce the quality of grizzly bear forage habitat in the subunit through time, resulting in negative minor effects.

- ***Cumulative Effects of Action Alternative B to Grizzly Bears***

  Under Action Alternative B, timber harvesting would not reduce hiding cover below 40 percent in any subunit. Since the subunit contains over 40 percent hiding cover, no measurable effects to grizzly bears are expected.

  Impacts to grizzly bears occur when the open-road density exceeds 1 mile per square mile because at this road density bears tend to avoid otherwise suitable habitat (*Mace et al. 1997*). Under this alternative, grizzly bears are expected to avoid an additional 1,368 acres of habitat due to the increased motorized use on roads associated with the timber harvests. Additionally, 1,052 acres of potential security would be lost (*FIGURE F-5 – EXISTING POTENTIAL SECURITY CORE AREAS AND THOSE AFFECTED UNDER EACH ALTERNATIVE IN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT*). Additional losses to security core would occur due to the native-culvert removals in Stryker Basin; however, this disturbance would occur for only about 1 week during the summer period when habitat is most abundant. The disturbance associated with the native-culvert removals would be limited to a backhoe and a small crew that would remove culverts on Stryker Basin Road. This alternative would reduce the amount of habitat available to grizzly bears to less than was available in 1996 and exceeds *ARM 36.11.432(1)(c)* and *(d)*. During alternative development, this alternative received the approval by the Forest Management Bureau Chief (*ARM 36.11.432 [c][ii] and [d][i]*). The loss of habitat increases the energetic cost for grizzly bears using the area. In addition, increased access also increases the risk of mortality for bears. To mitigate this increased risk, any currently restricted road would retain the restriction to the general public. Additionally, contractors would not be allowed to carry firearms on restricted roads (*ARM 36.11.432[1][m]* referencing open-road density levels).

  To mitigate the loss of grizzly bear habitat, several scenarios exist. The use of 3 road systems (Whitefish Saddle, North

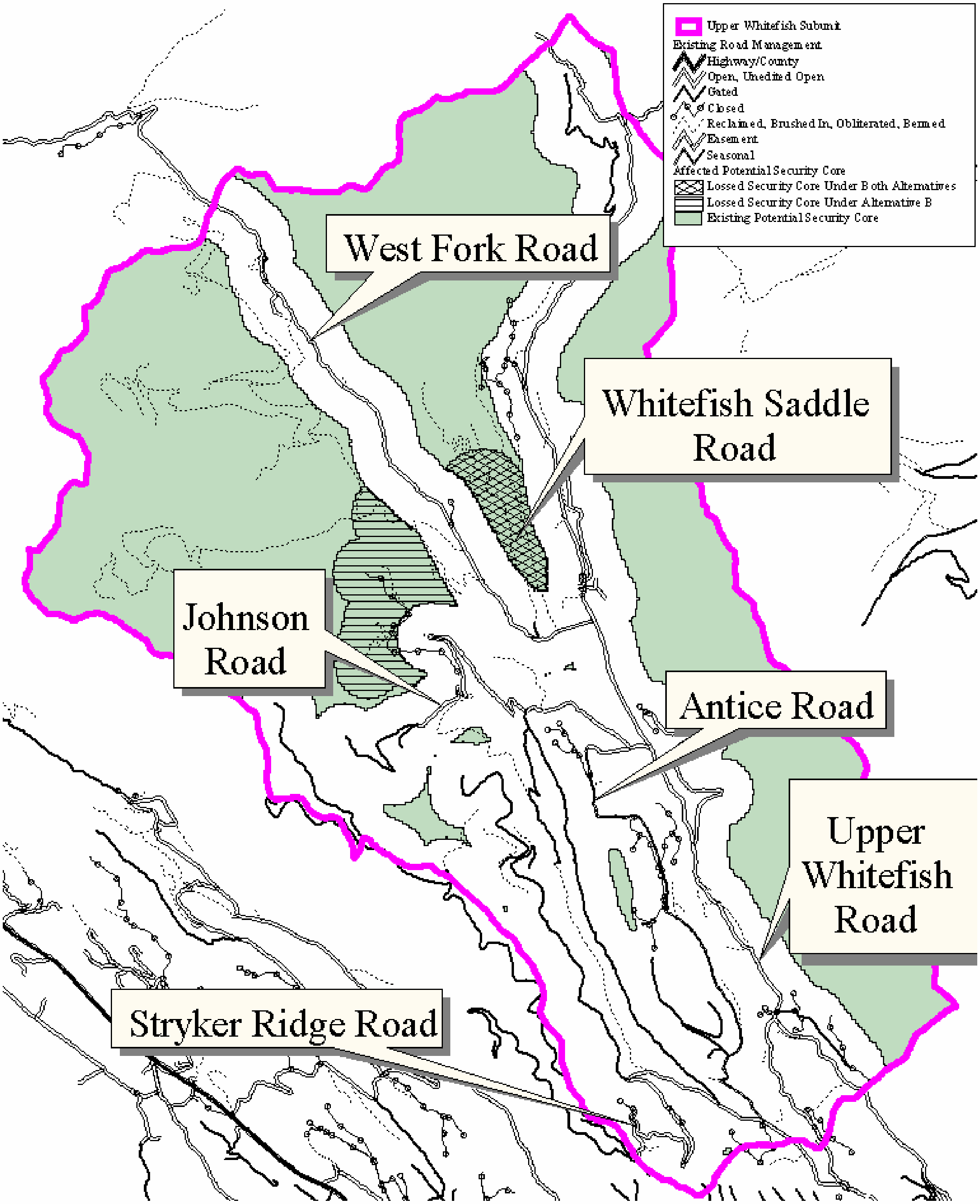


FIGURE F-5—EXISTING POTENTIAL SECURITY CORE AREAS AND THOSE AFFECTED UNDER EACH ALTERNATIVE IN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT

Johnson, and Twin Lakes roads) requires mitigation or an exception to *ARM 36.11.432(1)(c)(ii)*.

To mitigate the Whitefish Saddle Road, DNRC would move the existing gate on Johnson Road down to the base of the hill (Site A on *Alternative B Map* in *CHAPTER II*) to maintain road restrictions. Road restrictions would be maintained for the year (April 1 through November 15) that the Whitefish Saddle Road is used for more than 7 trips per week or 30 consecutive days. This scenario successfully mitigates the loss of habitat associated with the construction and use of Whitefish Saddle Road (*TABLE F-6 – THE EXISTING, PROPOSED, AND MITIGATED POR UNDER ACTION ALTERNATIVE B*).

There are several scenarios to mitigate for using the Johnson Road system:

⇒ Scenario 1 would require restriction of Stryker Ridge Road just past the intersection with Antice Road. This restriction would apply for the year(s) that the Johnson Road system was used for more than 7 trips per week or 30 consecutive days. If this were not acceptable,

⇒ Scenario 2 would extend the existing spring seasonal closure on the Antice Road to the full year for each year the Johnson Road system exceeds 7 trips per week or 30 consecutive days of motorized use.

With the Johnson closure mitigation included in the project design and implementation of 1 of the 2 scenarios, grizzly bears could be displaced from the project area; however, DNRC would reduce disturbance in other areas to offset the habitat affected by road use associated with the proposed timber harvests. If these mitigations were implemented, bears would be displaced from the specific habitats in the project area, but would have other habitats secured for them to 'displace into'. Therefore, with the above-mentioned mitigations, the effects of this alternative are expected to be negligible.

Scenarios 1 and 2 both increase the amount of habitat affected as compared to the existing condition; however, both scenarios reduce the amount of habitat affected to less than the 1996 baseline (*TABLE F-6 – THE EXISTING, PROPOSED, AND MITIGATED POR UNDER ACTION ALTERNATIVE B*).

⇒ Scenario 3 would not incorporate road-disturbance mitigations while harvesting in Harvest Area III. The alternative practice authorized by the Forest Management Bureau Chief (*ARM 36.11.432[c]* and *36.11.449*) would be required for this scenario.

With the authorized alternative practice, the increased road disturbance could result in grizzly bears

TABLE F-6 - THE EXISTING, PROPOSED, AND MITIGATED POR UNDER ACTION ALTERNATIVE B

1996 BASELINE	EXISTING CONDITION	ACTION ALTERNATIVE B WITHOUT MITIGATION	JOHNSON CLOSURE MITIGATION	HARVEST AREA III WITHOUT MITIGATION	HARVEST AREA III WITH STRYKER RIDGE CLOSURE MITIGATION	HARVEST AREA III WITH ANTICE CLOSURE MITIGATION
32.9%	31.8%	36.0%	32.7%	34.0%	31.5%	31.4%

avoiding an additional 732 acres over the currently available habitat and 358 acres over the levels experienced during the 1996 baseline. The area where displacement of bears is expected provides good quality summer and autumn habitat. Displacement from these areas during the summer and autumn periods could result in increased energy expenditures and decreased forage consumption resulting in reductions of weight gain. Since bears are dependent on weight gain for survival and reproduction during the denning period, the displacement of bears from these good quality habitats could affect winter survival and reproduction. The scope of these effects is unknown and depends on a bear's ability to live in a disturbed area or seek out suitable undisturbed habitat. These effects would be present for at least the duration of the harvesting activities in Harvest Area III (approximately 3 nondenning seasons).

The combination of the timber harvesting proposed under Action Alternative B and the native culvert removal would reduce potential security core areas to less than the 1996 baseline, thereby violating *ARM 36.11.432(d)*. If this alternative is selected, approval by the Forest Management Bureau Chief would be required (*ARM 36.11.432 [d][i]*). Road access to Harvest Areas III would reduce security core areas by 1,052 acres, but still retain enough security core area to exceed the 1996 baseline. After 1996, Stryker Basin Road was bermed and water barred. This action increased the potential security core by approximately 2,500 acres. Therefore, while the timber sale in Harvest Area III is active, security core areas would be reduced, but would still be above the levels experienced in 1996. The combined use of North Johnson Road for timber harvesting and Stryker Basin Road for accessing the native culverts would result in a loss of security core area to less than 1996 levels. Options to restrict other roads in the subunit for long periods of time are extremely limited and not overly practical. Therefore, an exception to *ARM 36.11.432(d)* would be required for the native culvert removal. This project would occur between August 15 and September 15 and would be expected to last approximately 1 week. The culvert removal could be expected to prevent impacts to bull and native cutthroat trout (see *APPENDIX C—WATERSHED AND FISHERIES ANALYSIS* and *APPENDIX E—FISHERIES ANALYSIS*). The loss of security core area for 1 week during the late summer period is expected to be negligible. In addition, the culvert removal would further inhibit illegal motorized use. Following completion of this project, all roads would revert to their existing management.

- ***Cumulative Effects of Action Alternative C to Grizzly Bears***

  Under Action Alternative C, timber harvesting would not reduce hiding cover below 40 percent in the subunit. Since the subunit estimates are well above 40 percent, no measurable effects to grizzly bears are expected.

  Impacts to grizzly bears could intensify when the open-road density exceeds 1 mile per square mile because at this road density bears tend to avoid otherwise suitable habitat (*Mace et al. 1997*). Under this alternative, grizzly bears are expected to avoid 556 acres of habitat due to the increased motorized use on roads associated with timber harvesting. To mitigate this increase, the gated closure on Johnson Road would be moved down to the base of the hill (Site A on *Alternative C Map* in *CHAPTER II*). This mitigation would reduce habitat avoidance to 309 acres over the existing condition. This increased amount of habitat disturbance is still less then those experienced during the 1996 baseline conditions. Additionally, 166 acres of potential security core area would be lost for the duration of the harvesting and postharvesting activities in Harvest Area II-P (*TABLE F-7 – THE EXISTING, PROPOSED, AND MITIGATED POR UNDER ACTION ALTERNATIVE C*). Additional losses to security core would occur due to the repair of the native culvert in Stryker Basin. However, this disturbance would occur for only about 1 week during the summer period when habitat is most abundant. This disturbance would be limited to a backhoe and a small crew that would remove culverts on Stryker Basin Road. This alternative would not reduce the amount of habitat available to grizzly bears to less than was available in 1996 and does not exceed the limit of *ARM 36.11.432(1)(c) or (d)*. During implementation of the project, small losses of habitat could occur that increase the energetic cost for grizzly bears using the area. In addition, increased access also increases the risk of mortality for bears. To mitigate this increased risk, any currently restricted road would retain the restriction to the general public. Additionally, contractors would be restricted from carrying firearms on restricted roads (*ARM 36.11.432[1][m]*). Since these losses would affect a small area and be short term, this alternative is expected to have minor negative effects. Following completion of this project, all roads would revert to their existing management.

TABLE F-7 - THE EXISTING, PROPOSED, AND MITIGATED POR UNDER ACTION ALTERNATIVE C

1996 BASELINE	EXISTING CONDITION	ALTERNATIVE C	
		WITHOUT MOVING THE JOHNSON GATE	MOVING THE JOHNSON GATE
32.9%	31.8%	34.0%	32.7%

SENSITIVE SPECIES

When conducting forest-management activities, the SFLMP directs DNRC to give special consideration to the several "sensitive" species. These species are sensitive to human activities, have special habitat requirements that may be altered by timber management, or may become listed under the Federal Endangered Species Act if management activities result in continued adverse impacts. Because sensitive species usually have specific habitat requirements, consideration of their needs serves as a useful "fine filter" for ensuring that the primary goal of maintaining healthy and diverse forests is met. The following sensitive species were considered for analysis. As shown in *TABLE F-8 - LISTED SENSITIVE SPECIES FOR NWLO SHOWING THE STATUS OF THESE SENSITIVE SPECIES IN RELATION TO THIS PROJECT,* each sensitive species was either included in the following analysis or dropped from further analysis for various reasons.

TABLE F-8 - LISTED SENSITIVE SPECIES FOR NWLO SHOWING THE STATUS OF THESE SPECIES IN RELATION TO THIS PROJECT

SPECIES	DETERMINATION - BASIS
Black-backed woodpecker	No further analysis conducted – No burned habitat occurs in the project area.
Coeur d'Alene Salamander	No further analysis conducted – No moist talus or streamside talus habitat occurs in the project area.
Columbian sharp-tailed grouse	No further analysis conducted – No suitable grassland communities occur in the project area.
Common loon	No further analysis conducted – Neither alternative would occur near Upper Whitefish Lake.
Ferruginous hawk	No further analysis conducted – No suitable grassland communities occur in the project area.
Fisher	*Included* – Potential fisher habitat occurs in the project area.
Flammulated owl	No further analysis conducted – No dry ponderosa pine habitats occur in the project area.
Harlequin duck	No further analysis conducted – Neither alternative would occur near Swift Creek.
Mountain plover	No further analysis conducted – No suitable grassland communities occur in the project area.
Northern bog lemming	No further analysis conducted – No sphagnum bogs or other fen/moss mats occur in the area.
Pileated woodpecker	*Included* – Western larch/Douglas-fir and mixed conifer habitats occur in the area.
Townsend's big-eared bat	No further analysis conducted – No caves or mine tunnels occur in the project area.

Fisher

Due to their use of mature and late-successional forested habitats, fishers are listed by DNRC as a sensitive species (*DNRC 1996*). DNRC's strategy to conserve fishers in a managed landscape is aimed at protecting valuable resting habitat near riparian areas and maintaining travel corridors.

Fishers are generalist predators and use a variety of successional stages, but are disproportionately found in stands with dense canopy (*Powell 1982, Johnson 1984*). Fishers appear to be highly selective of resting and denning sites. In the Rocky Mountains, fishers appear to prefer late-successional coniferous forests for resting sites and use riparian areas disproportionately to their availability. Fishers tend to use areas within 155 feet of water. Such areas contain large live trees, snags, and logs, which are used for resting and denning sites and dense canopy cover, which is important for snow intercept (*Jones 1991*). Field reconnaissance indicates that all of the proposed harvest areas provide fisher habitat. However, in some of the areas, large snags and downed wood are rare, while relatively abundant in other areas. Timber harvesting and associated road construction could affect fishers by altering habitat and/or increasing susceptibility to trapping.

Trapping pressure was responsible for the extirpation of fisher over most of their range by the 1930s. Although they again inhabit this area, populations remain vulnerable to trapping because fishers are easily caught in traps set for martens, bobcats, and coyotes; however, fishers are rare and are not trapped often. Vulnerability to trapping is influenced by the miles of road, both open and closed.

The Upper Whitefish Grizzly Bear Subunit was used to assess cumulative effects. For a description of the subunit and ownership, refer to the *Grizzly Bear* portion of this analysis. In the cumulative effects analysis area, State trust lands provide potential denning/resting, foraging, and travel habitats. Currently, these areas are highly connected, thereby allowing fishers to use and move relatively unimpeded through the project area and the subunit.

Direct Effects

- ***Direct Effects of No-Action Alternative A to Fishers***

  No additional human disturbance or increased vulnerability to trapping would occur.

- ***Direct Effects to Fishers Common to Action Alternative B and C***

  Under each action alternative, some displacement could occur; however, the effects of this displacement would be minor. The risk of displacement is approximately proportional to the amount of habitat affected; therefore, Action Alternative B (1,270 acres) poses more risk than does Action Alternative C (938 acres).

  Under Action Alternative B, 3.4 miles of new or temporary road would be constructed, while 3.1 miles of road would be constructed under Action Alternative C. The new temporary roads would increase access into the project area. Following use, these roads would be obliterated or restricted, thereby inhibiting use during the nonwinter period. However, during the winter period, access into the harvest areas via snowmobile would be increased. This increased access could result in increased fisher mortality due to trapping. However, since fishers are rare and many of the areas are already accessible, no substantial changes to fisher vulnerability are expected.

Indirect Effects

- ***Indirect Effects of No-Action Alternative A to Fishers***

  Fisher habitat would remain relatively unchanged in the short-term. In the longer-term, more resting/denning habitat would develop. Fishers would benefit from the increased habitat and no increase in mortality risk, resulting in a potential increase in fisher use in the area.

- ***Indirect Effects of Action Alternative B to Fishers***

  Under Action Alternative B, 1,270 acres of habitat would be modified. In regeneration-harvest areas (1,198 acres), harvesting would remove fisher habitat for a period of time (15 to 30 years) and reduce the habitat quality in the adjacent stands, because fishers avoid openings (*Roy 1991, Jones 1991*) and are rarely detected near abrupt-edge habitat adjacent to clearcuts (*Heinemeyer, unpublished*). The retention of seedtrees and snags would provide resting/denning structure for the future stand. However, these resources would be reduced by nearly 50 percent following harvesting. The regenerating areas could provide foraging habitat (snowshoe hare habitat) in the future (15 to 30 years). A 100-foot, no-harvest buffer along the West Fork and Stryker and Johnson creeks would be retained to protect potential high quality resting habitat and travel corridors, since fishers travel along stream courses and prefer habitats in proximity of water (*Jones 1991, Heinemeyer 1993*). This proposed alternative would reduce fisher habitat in the harvest areas; however, habitat and travel corridors along perennial streams would be retained to provide fisher resting/denning habitat and allow movement through the project area. Within each harvest area, snags and large trees would be retained to provide denning/resting sites in the future. This would reduce the amount of time needed to become fisher habitat from 100+ years to develop resting structure to 15 to 30 years needed to develop horizontal cover. The reduction of denning/resting sites and foraging habitat in the uplands would result in increased energy expenditures, while decreasing forage opportunities. This alternative is expected to remove fisher habitat, while retaining travel corridors along stream courses, resulting in minor negative effects to fishers.

- ***Indirect Effects of Action Alternative C to Fishers***

  Under Action Alternative C, the same effects discussed above are expected; however, this alternative would not harvest in Harvest Area III (332 acres). Harvest Area III has less desirable fisher habitat than the other areas in the flatter topography; therefore, this alternative would result in slightly less minor effects to fisher.

Cumulative Effects

- ***Cumulative Effects of All Alternatives to Fishers***

  Salvage operations and firewood cutting on State trust lands has decreased habitat. Salvage and regeneration harvests, especially in mature and late successional stands, has reduced the amount of habitat available on State trust lands. Habitat conditions on USFS lands are expected to improve in time; however, these lands occur higher in the drainage and are probably used less by fishers than the lower elevations. Under all alternatives, movement corridors from the project area into the cumulative effects area would be retained. The effects of the new roads discussed above would also apply to the cumulative effects area. Overall, Action Alternative B would combine with other activities on DNRC-managed to produce minor negative effects to fishers. Slightly less minor effects are expected under Action Alternative C.

- Pileated Woodpecker

Pileated woodpeckers, listed by DNRC as sensitive, play an important ecological role by excavating cavities that are used in subsequent years by many other species of birds and mammals.

Pileated woodpeckers excavate the largest cavities of any woodpecker. Preferred nest trees are western larch, ponderosa pine, cottonwood, and quaking aspen, usually 20 inches dbh and larger. Pileated woodpeckers primarily eat carpenter ants, which inhabit large downed logs, stumps, and snags. *Aney and McClelland (1985)* described pileated nesting habitat as "stands of 50 to 100 contiguous acres, generally below 5,000 feet in elevation with basal areas of 100 to 125 square feet per acre and a relatively closed canopy." The feeding and nesting habitat requirements, including large snags or decayed trees for nesting and downed wood for feeding, closely tie these woodpeckers to mature forests with late-successional characteristics. The density of pileated woodpeckers is positively correlated with the amount of dead and/or dying wood in a stand (*McClelland 1979*).

Potential pileated woodpecker nesting habitat was identified by searching the SLI database for 'old stands' with more than 100 square feet basal area per acre, more than 40 percent canopy cover, and below 5,000 feet in elevation. Due to the relatively high elevation of the project area, the pileated woodpecker is limited to the drainage bottoms in the project area. Only Harvest Area II (except Subarea II-H) provides pileated woodpecker habitat. Harvest Areas I and III are above 5,000 feet in elevation and are unlikely to be used often or heavily. Older-aged stands with dense amounts of deadwood would provide pileated with nesting habitat, younger-aged stands could provide feeding or lower quality nesting habitats. Since even the subareas in Harvest Area II are at the upper extremes used by pileated woodpeckers, this habitat is probably marginal.

The project area is large enough (approximately 5,035 acres) to provide habitat for several pairs of pileated woodpeckers. Of this area, approximately 3,000 acres occur at less than 5,000 feet in elevation, with 433 acres currently unsuitable due to past harvesting. Since the project area could provide habitat for several pairs of pileated woodpeckers, the cumulative-effects analysis area is the project area.

Direct Effects

- ***Direct Effects of No-Action Alternative A to Pileated Woodpeckers***

  No disturbance of pileated woodpeckers would occur.

- ***Direct Effects to Pileated Woodpeckers Common to Action Alternatives B and C***

  Under the action alternatives, pileated woodpeckers could be affected if harvesting occurred during the nesting period. Nesting woodpeckers could be displaced by harvesting activities. The effects of harvesting disturbance are unknown; however, *Bull et al. (1995)* observed a discernible woodpecker roosting near a harvest area consistently throughout harvesting. Additionally, mortality of individual woodpeckers could occur if nest trees were inadvertently cut. This risk would be low because most nest trees possess some rot; therefore, they have low merchantability and would likely not be harvested. Action Alternative B would result in a low risk of directly affecting pileated woodpeckers. Action Alternative C would result in a slightly less risk of directly affecting pileated woodpeckers than Action Alternative B.

Indirect Effects

- ***Indirect Effects of No-Action Alternative A to Pileated Woodpeckers***

  The existing trees would continue to grow and die, thus providing potential nesting and foraging substrate for pileated woodpeckers. However, as these trees die, barring any disturbance, replacement trees (shade-intolerant) would not be present. Therefore, under this alternative, pileated woodpecker habitat would increase through time, then decline, resulting in a short- to mid-term moderate beneficial effect to pileated woodpeckers, but a long-term minor negative effect.

- ***Indirect Effects to Pileated Woodpeckers Common to Action Alternatives B and C***

  Under Action Alternatives B and C, 775 acres of pileated woodpecker habitat in the project would be modified. All of these areas would experience a regeneration harvest, thereby reducing the quality of nesting habitat for a long period of time in all proposed harvest areas (*McClelland 1979*). Some of the dominant and clumps of trees would be retained and would be expected to increase growth rates due to reduced competition. Additionally, large snags would be targeted for retention, especially western larch snags greater than 21 inches dbh, thereby retaining some feeding and nesting structures in the harvest area. However, some snags could be lost due to harvesting. These snags would be left on site to provide feeding substrates for pileated woodpeckers and other wildlife species. These alternatives are expected to result in negligible negative effects to pileated woodpeckers. In the longer term, seral species would be planted under this alternative and could provide pileated woodpecker habitat in the distant future.

Cumulative Effects

- ***Cumulative Effects of No-Action Alternative A to Pileated Woodpeckers***

  Pileated woodpecker habitat in and around the project area would increase through time on DNRC lands, then decline. This alternative would result in continued retention of the existing pileated woodpecker habitat on DNRC lands. These conditions would result in continued retention of pileated woodpecker habitat.

- ***Cumulative Effects to Pileated Woodpeckers Common to Action Alternatives B and C***

  Under Action Alternatives B and C, potential habitat would be reduced; this loss would be additive to past harvesting and salvaging on DNRC lands. Under both action alternatives, pileated woodpecker habitat in the analysis area would be reduced by 775 acres. The reduction is expected to cumulatively contribute to reduced habitat quality and quantity in the analysis area. However, since the analysis area occurs in higher elevation and, presumably, lower habitat quality, any effects would be negligible. ***Following harvesting, enough habitat is expected to remain in the project area to support at least 1 pair of woodpeckers.*** The long-term minor benefit could be realized by the regeneration of shade-intolerant tree species that are important nesting structures.

BIG GAME SPECIES

Deer, elk, and moose inhabit the project area. However, due to heavy snow accumulations and high elevation, big game use of the project area is restricted to the nonwinter period. During the nonwinter period, forage and hiding cover are important components for these species. The project area provides dense hiding cover in both harvested and unharvested stands. To assess cumulative effects, the Upper Whitefish Grizzly Bear Subunit was considered.

DIRECT EFFECTS

- ***Direct Effects of No-Action Alternative A to Big Game Species***

  No additional human disturbance or increased vulnerability to hunting would occur.

- ***Effects of Action Alternative B and C to Big Game Species***

  Under each action alternative, some displacement could occur; however, the effects of this displacement would be minor. The risk of displacement is approximately proportional to the amount of habitat affected; therefore, Action Alternative B (1,270 acres) poses more risk than does Action Alternative C (938 acres). Any use of restricted roads during the project period would require the contractor to keep the road restricted to the public with a sign during active periods and with a locked gate during inactive periods (nights, weekends, breakdowns, etc.). This mitigation measure would result in no increased direct effects to big game species.

INDIRECT EFFECTS

- ***Indirect Effects of the No-Action Alternative A to Big Game Species***

  No changes to big game habitat would occur in the short-term. In the longer-term, forage items could be reduced as canopy cover increases. These changes would be slow and localized. Hiding cover is not expected to change dramatically over time. This alternative is expected to result in negligible effects.

- ***Indirect Effects of Action Alternative B and C to Big Game Species***

  Removal of the overstory canopy closure is expected to increase forage items, but would also reduce hiding cover. The reduction in hiding cover is expected to be short-term due to the rapid regrowth of shrubs in the project area. Visual screening would be retained along open roads in the project area. Since Action Alternative B would affect more area than Action Alternative C, these effects would be more pronounced in the project area under Action Alternative B.

However, these effects are expected to be negligible and could result in slight habitat shifts.

CUMULATIVE EFFECTS

- ***Cumulative Effects of All Alternatives to Big Game Species***

  Under all alternatives, vegetative cover, especially along streams, would allow movement into and out of the project area. Harvest areas are expected to increase forage production in the cumulative effects area, with Action Alternatives B expected to produce more forage than Action Alternative C. No increases in forage production are expected due to No-Action Alternative A. Since no other projects are planned in the cumulative effects area, the effects discussed for the project area also hold true for the cumulative effects area.

APPENDIX G
ECONOMIC ANALYSIS

INTRODUCTION

The West Fork Timber Sale Project is located in Stillwater State Forest, north of Whitefish in Flathead County. The project is in an area of relatively low population density and has produced timber for the area mills since the early 1900s. The focus of the economic section will be on market activities that directly or indirectly benefit the Montana education system, generate revenue for the school trust funds, and provide funding for public buildings.

Flathead and Lincoln counties have historically provided both manufacturing and recreational pursuits. Manufacturing has historically focused on mining and timber, as well as a limited amount of agriculture processing. Recreation has focused on Glacier National Park, as well as the many lakes and mountains in the region. Mining has declined within the area in recent years, while timber has remained comparatively steady or declined slightly.

EXISTING CONDITIONS

The location of Stillwater State Forest in relation to purchasers likely to be interested in timber sales necessitates analyzing economic and demographic data for both Flathead and Lincoln counties, although there is a potential for purchasers further south and west to be interested in this sale. *TABLE G-1 – SELECTED DEMOGRAPHIC INFORMATION FOR FLATHEAD AND LINCOLN COUNTIES* contains selected demographic information for each of these counties and for the entire State.

TABLE G-1 - SELECTED DEMOGRAPHIC INFORMATION FOR FLATHEAD AND LINCOLN COUNTIES

Demographic	Flathead	Lincoln	Montana
Population 1990	59,218	17,481	799,065
Population 2000	74,471	18,837	902,195
Growth Rate	2.4%	0.8%	1.2%
Median Age	37.2	38.2	37.8
School Enrollment	13,000	3,012	157,560

Flathead County is known for its production of “Flathead cherries”. Flathead County also has a large wood-products sector producing a variety of products that include dimensional lumber, plywood, and molding. In addition to wood products, Flathead County also has a large recreation industry that include the primary entrances to Glacier National Park and Big Mountain, a large and major ski destination.

Lincoln County is located in the northwest corner of Montana. Historically, both mining and wood manufacturing played a large role in the County’s economic activities. In recent years, mining has declined in the region and the timber industry has remained as one of the primary employers. An abundance of forests, lakes/streams, and wildlife have made the area also heavily used by recreationalists.

School enrollment for kindergarten through grade 12 in the 2 counties combined is over 16,000.

The data in *TABLE G-2 – COVERED WAGES AND EMPLOYMENT IN 2002 FOR SELECTED INDUSTRIES IN FLATHEAD AND LINCOLN COUNTIES* shows employment and income in selected industry categories for each of the 2

TABLE G-2 – COVERED WAGES AND EMPLOYMENT IN 2002 FOR SELECTED INDUSTRIES IN FLATHEAD AND LINCOLN COUNTIES

INDUSTRY	**FLATHEAD COUNTY**			**LINCOLN COUNTY**		
	AVERAGE ANNUAL EMPLOYMENT	**ANNUAL WAGES (000)**	**AVERAGE WAGE**	**AVERAGE ANNUAL EMPLOYMENT**	**ANNUAL WAGES (000)**	**AVERAGE WAGE**
Agriculture, forestry, and fishing	424	$13,717	$32,340	236	$6,655	$28,201
Forestry	70	10,392	36,898	210	5,893	28,020
Construction	2,411	73,054	30,295	193	5,190	26,928
Manufacturing	3,264	122,266	37,461	664	21,082	31,755
Lumber	1,426	55,536	38,945	575	19,190	33,384
Metals	475	21,280	44,800	NA	NA	NA
Transportation	659	18,072	27,410	127	2,554	20,180
Trade	5,776	124,546	21,563	640	10,144	15,850
Eating and drinking establishments	2,685	29,392	10,259	363	2,969	8,178
Finance, insurance, and real estate	1,797	57,826	32,180	163	7,388	19,907
Services	9,736	290,648	19,875	1,554	24,177	15,557
Hotels, etc.	1,254	18,908	15,074	99	1,101	11,109
Amusement and recreation	952	12,667	13,306	81	985	12,221
Government	4,389	136,196	31,035	1,393	42,552	30,542
Total all industries	33,446	$853,132	$25,508	5,085	$118,983	$23,399

counties that are included in the analysis. Economic activity within the 2 counties varies substantially, although both counties have timber-related industry present. Lincoln County is less populated and less developed than Flathead County.

Lincoln County has a substantially smaller labor force and a smaller number of workers employed in timber-related jobs. The average wage in the timber industry is 53 percent higher than the overall average wage in Flathead County (38,945 divided by 25,508 times 100) and 43 percent higher than the overall average wage in Lincoln County (33,384 divided by 23,399 times 100). Service-industry wages are lower than the overall average wage in both counties. The service industries provide employment for over twice as many workers as the timber industry in Lincoln County and nearly 9 times as many workers as the timber industry in Flathead County. The average wage in the service industry is almost one-half of the average wage in the timber industry in both counties.

ALTERNATIVE EFFECTS

DIRECT EFFECTS

Three options are being analyzed in this Environmental Impact Statement: No-Action Alternative A; Action Alternative B, which includes harvesting an estimated 61,750 tons (9.5 MMBF) of timber; and Action Alternative C, which includes harvesting an estimated 37,115 tons (5.7 MMBF) of timber. The following estimates are intended for relative comparison of alternatives and not intended to be absolute estimates of returns, taxes, employment, or wages.

- ***Direct Effects of No-Action Alternative A***

  None of the employment, income, or trust fund effects that result from the action alternatives would occur.

- ***Direct Effects of Action Alternatives B and C***

  Timber Sale Effects

  TABLE G-3 – ESTIMATED REVENUES AND EXPENDITURES FROM THE WEST FORK OF SWIFT CREEK TIMBER SALE PROJECT displays the estimated revenue and expenditures associated with the West Fork Timber Sale Project. The 2 alternatives analyzed may, for administrative purposes, be broken into smaller sales, but are treated as a unit for the purpose of this analysis. The volume for Action Alternative B is 61,750 tons, or 9.5 MMBF. The corresponding volume associated with Action Alternative C is 37,115 tons, or 5.7 MMBF. The areas associated with each alternative are identified in the map section of Chapter II.

TABLE G-3 – ESTIMATED REVENUES AND EXPENDITURES FROM THE WEST FORK OF SWIFT CREEK TIMBER SALE PROJECT

	ACTION ALTERNATIVE B	**ACTION ALTERNATIVE C**
Harvest volume	61,750 tons	37,115 tons
Stumpage price $/ton	$26.55	$25.50
Forest improvement ***fund revenue ($10.20/ton)***	$631,750	$379,700
Stumpage revenue ***(harvest volume times stumpage price)***	$1,639,100	$947,600
State income ***(FI revenue plus stumpage revenue)***	$2,270,850	$1,327,300
Trust income ***(stumpage revenue minus expenditures)***	$677,900	$359,000
Expenditures*	$961,200	$588,600

Source: DNRC, Trust Land Management.
The State does not identify expenses for individual timber sales. The estimates used here are based on area-wide averages* ***of the timber sale program**.*

Broader market and local stumpage prices are currently well above the long-term average. These prices are highly dependent on the housing market and foreign timber imports. The housing market is highly dependent on the interest rate, which, in part, determines who can “qualify” to purchase a home. Interest rates are currently at very low levels; these low levels have not been seen since the late 1950s and early 1960s. Low interest rates normally impact the housing market by stimulating new construction to satisfy the demand for housing from individuals who can now “qualify” to purchase a home. The growth of the economy appears to be increasing, as the economic effects of the bombing of the World Trade Center on September 11, 2001 continues to decline. The result of the growth and low interest rates has been a continued strong housing market. Mortgage interest rates appear to be remaining at low levels, which helps keep the demand for housing strong.

Restricted imports of timber and sheet goods from other countries, primarily Canada, have helped bolster prices by reducing the supply of timber available to homebuilders. In addition, the demand for U.S. timber has increase due to a combination of economic recovery in several countries and the devaluation of the U.S. dollar, which makes our timber relatively cheaper to foreign buyers. The timber prices used in this analysis attempt to recognize the current market conditions.

Underlying Assumptions

Project impact estimation and analysis assumes that most of the economic impact associated with the sales would take place in the 2-county area. The estimates are intended for comparative purposes and do not purport to be the value of the impacts in any absolute sense. Stumpage prices were determined using the current transaction equation modified by professional judgment to reflect current and local market conditions as much as possible. ***The estimated stumpage price per ton for Action Alternative B is slightly higher than Action Alternative C because Action alternative B has a greater volume of timber for sale, higher volume of timber per acre, and higher value material due to the quality of wood and average dbh.***

Fees collected for the FI fund are collected from the purchaser of the timber sale as part of their bid. Activities funded under this program include site preparation, tree planting, thinning, roadwork, right-of-way acquisition, etc. The current FI fee for the NWLO area is $66.50 per MBF.

TABLE G-4 – NUMBER OF STUDENTS SUPPORTED BY 1 YEAR OF ESTIMATED REVENUE shows the difference in revenue to the trusts from the 2 action alternatives.

The school trust income from a timber sale under Action Alternative B is estimated to be $677,900; enough to fund the education of 96 students for 1 year based on an average cost of $7,080, as determined by information provided by the Montana Office of Public Instruction. This information is shown in *TABLE G-4 – NUMBER OF STUDENTS SUPPORTED BY 1 YEAR OF ESTIMATED REVENUE*. If the sale does not take place, no students are benefited. A “cost” of not harvesting, compared to harvesting the timber under Action Alternative B, is the loss of financing for 96 kindergarten through grade 12 students for 1 year.

The school trust income from a timber sale under Action Alternative C is estimated to be $359,000; enough to fund the education of 51 students for 1 year based on an average cost of $7,080, as determined from information provided by the Montana Office of Public Instruction. This information is shown in *TABLE G-4 – NUMBER OF STUDENTS SUPPORTED BY 1 YEAR OF ESTIMATED REVENUE.* If the sale does not take place, no students are benefited. Thus, one of the “costs” of not harvesting the timber, compared to harvesting under Action Alternative C, is the loss of financing for 51 kindergarten through grade 12 students for 1 year.

If the trust does not fund these students through the sale of timber, funding must come from other sources, primarily property taxes.

TABLE G-4 – NUMBER OF STUDENTS SUPPORTED BY 1 YEAR OF ESTIMATED REVENUE

	ACTION ALTERNATIVE	
	B	**C**
Estimated school revenue	$677,900	$359,000
Students supported*	96	51

Source: Montana Department of Natural Resources and Conservation, Trust Land Management
**Assumes all of the “trust” income would be distributed for educational purposes. Depending on the trust, some of the income is distributed to a fund that earns revenue for future education funding.*

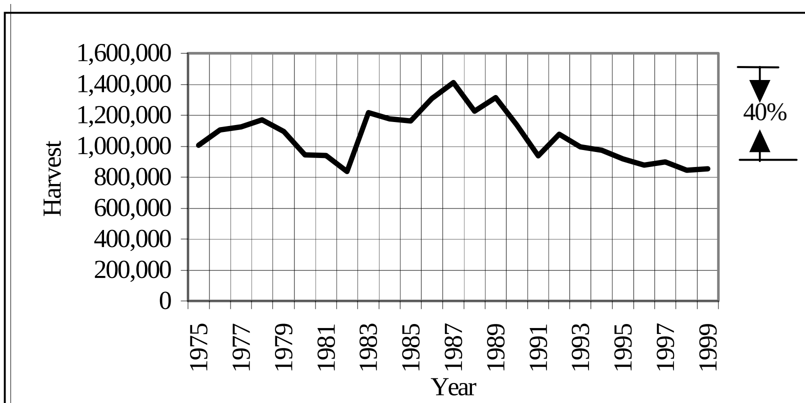
Timber-Related Employment

Timber harvesting generates employment. *Keegan et al* estimate that on average 10.58 jobs are created or maintained for every MMBF of timber harvested. Both economic theory and empirical analysis suggest that the marginal effect of an increase in the timber harvested is likely to be different than the average effect because of increasing returns. The marginal effect may be larger or smaller than the average. Empirical evidence would suggest that in a growing industry marginal effect on employment is likely to be smaller than the average. In a contracting industry, the marginal effect on employment could be either larger or smaller than the average. In most cases the marginal effect of increased or decreased timber sales is "lumpy", i.e. 2 sales of the same size under different conditions might induce a larger-than-average employment response in one case and a smaller-than-average, or nearly negligible, employment response in another.

FIGURE G-1 – TOTAL TIMBER HARVESTED FROM MONTANA FORESTS (MBF) demonstrates that the amount of timber being harvested in Montana from all sources has declined since 1987. The decrease in harvesting since the peak of 1,411 mmbf in 1987 has been nearly 40 percent to 854 mmbf in 1999. Mills, such as the Louisiana-Pacific Mill in Belgrade, recently closed, citing a lack of available timber as part of the cause of their closure. All of these point to an industry declining in size. Based on the previous discussion, the assumption of the average induced employment of 10.58 jobs per mmbf is reasonable. Because the exact conditions of this sale are unknown, the best estimate of employment, (i.e., the average effect on employment) should be used since it is the best estimate available and the marginal effect of the sale is unknown.

A ratio of 10.58 jobs per mmbf of wood harvested implies the direct generation of between 60 and 100 jobs and between $2.2 and $3.7 million in wages for each alternative as shown in *TABLE G-5 – WEST FORK I TIMBER SALE DIRECT EMPLOYMENT AND INCME IMPACTS*. The wages are based on an average wage of $37,347 for lumber industry in both counties, using the from data in *TABLE G-1—SELECTED DEMOGRAPHIC INFORMATION FOR FLATHEAD AND LINCOLN COUNTIES*. These are the wages that directly result from the timber harvest. Without a timber harvest, income would be lost to the State and communities. Wages in the timber industry are higher than

FIGURE G-1 – TOTAL TIMBER HARVESTED FROM MONTANA FORESTS (MBF)



Source: Montana Department of Natural Resources, Forest Management

TABLE G-5 - WEST FORK TIMBER SALE DIRECT EMPLOYMENT AND IMCOME IMPACTS

	ACTION ALTERNATIVE B	ACTION ALTERNATIVE C
Direct employment	100	60
Wages and salaries	$3,734,700	$2,240,800

average. This allows individuals working in the industry to obtain higher than average ownership of real personal property. Since much of the revenue for school funding comes from property taxation, higher levels of real property ownership should provide for better school funding.

In addition to these jobs, additional employment is created when the income earned within the timber industry is spent to purchase goods and services elsewhere in the economy. There are also impacts from the logging companies and timber mills when they purchase goods and services from the local economy. Both of these effects are important since they support other community businesses such as grocery and clothing stores, gas stations, etc. The loss of the income from this sale would mean not only the loss of the direct income, but the loss of the indirect income as well.

The economic impact on the schools occurs through ways other than just the direct contribution to the school trust fund from the revenue generated through timber sales. The timber industry pays taxes on the facilities it owns and operates. In the year 2000, the timber industry paid estimated taxes of over $848,600 to the schools in Flathead and Lincoln counties. The tax contribution, however, may decline in the future if more mills, such as American Timber Company in Flathead County, close. The closure of this mill has reduced the tax base by an estimated $4.4 million (*Jackson, South Wood Timber Sale EIS*), thereby reducing the taxes received by the school districts by about $28,500. This is a permanent reduction in school funding for over 4 students per year.

INDIRECT EFFECTS

Indirect economic impacts are much broader than those identified above. Some of these impacts are the result of the money from the timber sales "recycling" through the economy several times. For example, the money spent for groceries by the employee of the timber mill, in part, goes to pay the salary of the grocery store employees; the grocery store employees use that money to purchase groceries for themselves. This, in turn, generates more income for the grocery store employees, etc. Unfortunately, a model of the county that could be used to demonstrate secondary effects is not available. In a broader State-wide context, money paid to the woods industry workers results in increased State income tax collections as well as increased purchases in other areas of the State. Income tax collections from the wages of millworkers alone are estimated to generate between $87,000 and $146,000 in State tax revenue, depending on which alternative is selected. Taxes on indirect wages would add to this tax amount. Since State revenue is spent on projects State-wide, the entire State shares, in part, in the benefits that result from the timber sale. In particular, Montana schools benefit additionally by being able to use these revenues to fund schools throughout the State.

Nonmarket Issues

A quantitative analysis of the economic value of nonmarket benefits and costs will not be part of this analysis because they do not generate income for the trust, although they do affect the well-being of Montana residents. Because of their effects, a short qualitative discussion of nonmarket issues follows.

A brief description of the biological impacts is included in order to identify areas where economic values might be affected. A more detailed discussion of the biological impacts is found in other sections of the report.

Environmental Modifications - The harvest of the timber would modify the undisturbed development of the forest and, as a result, would affect both the short- and long-term habitat and wildlife regimes. How individuals value these modifications is an empirical question and may be viewed either positively or negatively by different individuals. The estimation of the net social benefit or loss of the impacts described in this EIS is an empirical issue that does not directly affect the school trust fund.

Human Use – The harvest area has been historically used for recreational purposes such as hiking, hunting, and fishing. While the use of these areas is likely to decline or change during the period of logging, long-term overall use of the area is expected to remain high. Some nonmarket uses are unlikely to change. Fishing, for example, should not be severely affected by the logging since SMZ laws protect streams. The aesthetics would be modified; some individuals would view this as a loss, others may prefer the more-open forest that would result from the harvest. Visual changes are minimized to the extent practicable by limiting the trees harvested in some areas and by "sculpting cuts" to avoid "unnatural" visual lines. Some activities may be enhanced. For instance, the logged area may enhance the habitat of some game species, and the increased use of areas by those game species may make the area more attractive to hunters. As in the case of the environmental modifications, the net social benefit or loss is an empirical issue dependent on individual values.

Social Impacts

The area has a substantial presence in the wood-processing industry and, as a result, has institutions established to handle the social requirements associated with this industry. This timber sale is unlikely to add sufficient pressures to these institutions to require their modification. A high rate of employment (low rate of unemployment) is associated with lower rates of crime, domestic violence, alcohol/drug problems, and a healthier, more satisfied community. To the extent that No-Action Alternative A might contribute to unemployment, the social impact of the harvest might be a short-term negative social impact on the community. Conversely, to the extent that the sale provides employment, the short-term impact would be positive.

Roads and Infrastructure

New roads are to be constructed for the sale(s). Existing roads would be improved to handle the logging truck traffic and provide transport for other equipment used in logging. Expenditures for road improvements are identified in both action alternatives as part of the sale development cost. Some improvements are also funded through FI funds, as well as other funds set up for this purpose. To the extent that these expenditures are spent locally, they will improve local economic conditions. A portion of the money will leave the area and provide income for other areas of the State and national economies. The culverts, for example, usually come from manufacturers outside of Montana; however, most of the road improvement expenditures will remain in Montana.

Population Impacts

Logging and milling activities associated with the timber sale are not anticipated to have any long-term impact on the population of the region or the State of Montana.

CUMULATIVE EFFECTS

This sale would be part of the annual harvest of timber from the State of Montana forest trust lands. The net revenue from this sale would add to the trust fund. Annual trust fund contributions have varied widely over the years, because the actual contribution to the trust is more a function of harvest levels than of sales. Harvest levels can vary substantially over time; sales tend to be more consistent. *TABLE G-6 - ANNUAL REVENUE FROM TIMBER HARVESTED FROM MONTANA TRUST LANDS* shows the annual revenue from harvesting for the last 5 years. The net contribution to the trust fund is also affected by the annual costs experienced by the Department for program management, which varies year to year. The Department should continue to make net annual contributions to the trust from its forest management program.

TABLE G-6 - ANNUAL REVENUE FROM TIMBER HARVESTED FROM MONTANA TRUST LANDS

YEAR	HARVEST REVENUE ($)
2003	8,270,589
2002	9,699,034
2001	8,524,150
2000	12,710,311
1999	6,998,847

DNRC has a State-wide sustained-yield annual harvest goal of 50 MMBF. If timber from this project is not sold, this volume could come from sales elsewhere; however, the timber may be from other areas and not benefit this region of the State. A long-term deferral of harvesting from this forest would impact harvest patterns, changing both the region where the trees are harvested and the volumes taken. This would impact other areas of the State where these changes occur.

APPENDIX H
COMMENTS AND RESPONSES

INTRODUCTION

This section contains comments received from parties interested in the West Fork Timber Sale Project DEIS and DNRC's responses to those comments. A response is not required for those portions of the comments that stated either an opinion or a recommendation. All comments were carefully reviewed. DNRC appreciates both the time and thought that was involved in producing these comments. The decisionmaker will carefully consider each received comment to aid him in deciding on a course of action for this project.

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November 19, 2004

Mike McMahon, Project Leader
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Olney, MT 59927

Mr. McMahon,

These are comments on the Department of Natural Resource's (DNRC's) West Fork Swift Creek Timber Sale Project Draft Environmental Impact Statement (DEIS), on behalf of the Ecology Center and the Alliance for the Wild Rockies.

Our organizations appreciate the genuine ecosystem restoration activities proposed, such as removing deteriorating bridges and stream crossings, and improving drainage on existing roads.

As far as the logging, we don't believe that timber production is the best and highest use of school trust lands. Once again we have State land managers proposing to log public lands under the guise of generating funding for schools. Conventional "wisdom" has been that logging is the only way these lands can positively benefit our state and our school children. This notion is false. Witness the Sprunger-Whitney Nature Trail in the Swan Valley, which is a model for state land management. The trail will provide valuable educational resources that cannot be duplicated in the class-

While the State Forest Management Plan states that, "In the foreseeable future timber management will continue to be our primary source of revenue and our primary tool for achieving biodiversity objectives…" *(DEIS, Chapter I, page I-2)*, timber harvesting on Stillwater State Forest is not the exclusive action taking place that provides opportunities to the public and revenue to the school trusts. Many forms of recreation and education can, and do, take place in conjunction with timber-management activities. Stillwater Unit has provided opportunities for students ranging from elementary to college graduates to utilize the forest

room, and will also help pass down the importance of our state's natural heritage to our children for generations to come. We would also point you to economist Thomas Power's 1996 study of the State's forest management plan. Dr. Power's further reinforces that the DNRC's fundamental assumption that logging is the way to manage trust lands is seriously flawed.

So no, we don't believe that logging habitat for the threatened grizzly bear and Canada lynx, and the Endangered gray wolf, to be the highest and best use of the lands in this unique area. Nor do we believe that causing unwarranted sediment increases to degrade bull trout habitat in an already Water Quality Limited Segment to be a wise choice for out future. We believe that the DNRC is squandering an opportunity to educate citizens of the State of Montana and beyond about the ecological interrelationships and interplay between old-growth forests, fires, lynx, bears, hydrology, native fish—essentially the processes of a fully functioning ecosystem. Creating and providing an outdoor classroom for citizens to learn about the ecosystems in which they live, however subversive to the DNRC's rigid bureaucratic timber extraction paradigm, will absolutely contribute the most toward improving our dwindling chances of cultural survival.

We recommend that the DNRC analyze an alternative that is consistent with the Forest Restoration Principles and Criteria (DellaSala, et al., 2003). These principles have been developed and adapted by a number of conservation groups and forest practitioners across the nation.

for educational purposes and will continue to explore other ways to achieve this in the future. Forest-management activities also, in many ways, provide additional educational opportunities for students. During the public-comment period for this project, the initial proposal stated, "DNRC would consider other opportunities that would produce long-term revenue, meeting or exceeding that from any timber harvest that must be foregone." No specific proposals were received.

DNRC designs forest-management activities in a way that complies with the Federal Enabling Act designating State lands and their uses, Montana law governing State lands timber sales (*77-5-221-223 MCA*), and the Administrative Rules of Forest Management (*ARM 36.11.401* through *450*). The alternatives in this project were designed to meet the project objectives identified in the DEIS (*CHAPTER I, page I-2*) and address the issues that were identified through the scoping process. Restoration as a project objective exclusive of a timber sale project was not proposed or developed during project scoping.

Despite the Water Quality Limited Segment (WQLS) status of Swift Creek, the DEIS omits an alternative that would carry out only restoration activities and that wouldn't do more unnecessary damage. This is not reasonable. The DNRC must always include an alternative that removes or fixes all the roads having design flaws, are otherwise contributing to soil and watershed problems, or are not needed for foreseeable management activities. The citizens of our state need to know how much it will cost us to manage these watersheds correctly.

In project development, DNRC considered the improvements and restoration work needed to improve the BMP and water-quality status of the roads. Major aspects of these improvements are shown in the *DEIS, CHAPTER II - ALTERNATIVES, pages II-8 and II-9).* We have not developed a separate and unique alternative since this would be a different project requiring separate funding. The proposed project, in part, is a means to accomplish the identified work and also provide monetary return to the trust. As described in the *DEIS*, alternatives in this project were designed to meet project objectives identified in the *DEIS (CHAPTER I– PURPOSE AND NEED, page I-2)* and address the issues that were identified through the scoping process. Both action alternatives include roadwork *(DEIS, CHAPTER II–ALTERNATIVES, pages II-6 through II-8)* and mitigations *(DEIS, APPENDIX A - STIPULATIONS AND SPECIFICATIONS)* that address soil and watershed issues. Based on analysis of the scope and issues as the EIS was developed, no unresolved issues were identified that would have required the development of additional alternatives.

Since Swift Creek is a WQLS in regards to Clean Water Act and Montana water quality regulations, and a clean-up plan (TMDL) is to be prepared, the wisest course of action would be to prepare the TMDL for the needed restoration of the watershed, so that it can be determined when and if more logging can be consistent with the TMDL and the law.

The *DEIS* states that, *"Under the Montana TMDL Law, new or expanded nonpoint-source activities affecting a listed waterbody may commence and continue provided they are conducted in accordance with all reasonable land, soil, and water conservation practices and BMPs." (DEIS, page C-3)* DNRC is currently participating in the development of a TMDL and Water Quality Restoration Plan for Stillwater River (including Swift Creek) with Montana DEQ through the Swift Creek Coalition. Until the TMDL and Water Quality Restoration Plan are developed, DNRC will continue to comply with Montana law and apply all reasonable land, soil, and water conservation practices to forest-management activities.

The precision, or amount of error, in the modeled or otherwise estimated effects analysis estimates for measures of just about all resource conditions is not disclosed in the DEIS. The DEIS misrepresents them as precise measurements

Most of the figures in the *DEIS* are based on SLI data and mapping calculations. These estimates are based on single-point estimates or model outputs that do not have any measured variation. Where data was used to represent an average or mean, information on the precision of that estimate is incorporated in the *DEIS (eg. APPENDIX E–FISHERIES ANALYSIS, page E-12; APPENDIX*

when in fact they are estimates, based upon limited sampling or no sampling, that inherently has an amount of error. To illustrate what we're talking about refer to the U.S. Forest Service's "Response to Motion for Preliminary Injunction" brief in the ongoing litigation on the Kootenai National Forest. In regards to a scientific report, the Forest Service stated "Dr. Schloeder's purported 'statistical analysis' reports no confidence intervals, standard deviations or standard errors in association with its conclusions." The DNRC must be held to the same standards of data and information quality. However, the West Fork Swift Creek DEIS failed to present any "confidence intervals, standard deviations or standard errors in association with its conclusions" regarding the estimates or modeled effects analyses. Since the DEIS does not provide the public or decision maker with any kind of information on the accuracy of its estimates, the information is not scientifically valid nor reliable.

We don't believe the proposed management activities would severely hinder the *processes* that naturally shaped the ecosystem and resulted in a range of natural structural conditions. Generally, past process regimes are better understood than past forest structure. How are you factoring in fire, insects, tree diseases, and other natural disturbances in specifying the conditions you assume to be representative of the natural, historic range?

Many adverse consequences to soil, ecological processes, wildlife, and other elements of the natural environment are associated with logging. (Ercelawn, 1999; Ercelawn, 2000.) For example: "Salvage or thinning operations that remove dead or decayed trees or coarse woody debris on the ground will reduce the availability of forest structures used by fishers and lynx."

F—WILDLIFE ANALYSIS, page F-5).

The *Stand Development* section of the *DEIS* describes the effects site characteristics, environmental conditions, and past management activities have had on timber stands within the project area *(DEIS, APPENDIX B - VEGETATION ANALYSIS, pages B-6 through B-9* and *B-13 through B-15)*. To determine representation of natural historic ranges, DNRC uses a coarse-filter approach *(ARM 36.11.404)* and models the desired future conditions for covertypes as described in *ARM 36.11.405;* see *DEIS, APPENDIX B - VEGETATION ANALYSIS, pages B-1 through B-4 and B-9 through B-11.*

(Bull et al., 2001.)

The DEIS fails to provide maps of grizzly bear habitat that depict current core, during project core and post project core. Theses maps should include the roads layer and indications of which roads have fully effective road closures as well as the outline of road buffers that delineate core areas.

The DEIS also fails to provide a genuine cumulative effects analysis if cumulative effects on grizzly bears in the affected recovery area, in conformance with scientific principles of analysis.

The DEIS fails to discuss impacts on grizzly bear seasonal habitat. It has been well established in the scientific literature that of the seasonal habitats, spring range is the least available to bears due to high road densities in lower elevation habitat. The timing of den emergence and use of spring habitat is likely dependent on weather patterns, for example how long it takes for the snow pack to melt in higher elevation summer range. Another factor that should be considered is the quality of spring habitat: will it be or is it already highly fragmented? Are desirable spring forage plant species removed/destroyed as a result of logging? The grizzly bear analysis must consider these factors when gauging the impacts on grizzly bears.

All roads opened for log hauling and other timber sale related traffic constitute an open road from a grizzly bears' perspective, regardless of whether or not "closed" to the public.

The DEIS does not address the recent proliferation of recreational motorized access (ATVs, motorcycles, snowmo-

Maps of grizzly bear existing security core is mapped in the *DEIS (APPENDIX F—WILDLIFE ANALYSIS, page F-21, FIGURE F-5 - EXISTING FORESTED HABITAT IN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT).*

Cumulative effects on grizzly bears were conducted at the subunit scale. This is the scale of analysis recommended by the *Interagency Grizzly Bear Committee Task Force (IGBC 1998).*

Existing seasonal habitats are discussed in the *DEIS (APPENDIX F - WILDLIFE ANALYSIS, page F-17*), and the effects of this project in relationship to those seasonal habitats are discussed on *pages F-20, F-23, and F-24*.

Roads used for hauling logs were considered as open roads and analyzed as such. Mitigations to offset increased open-road disturbance were described and analyzed in the *DEIS (APPENDIX F - WILDLIFE ANALYSIS, pages F-20 through F-24.* Prohibiting public use on currently restricted roads that would be used for harvesting timber and prohibiting contractors from carrying firearms would maintain security for grizzly bears in these areas *(DEIS, APPENDIX F - WILDLIFE ANALYSIS , pages F-22* and *F-24).*

biles) and the potential to increase that use in the project area.

The DNRC so often makes a case for logging as a way to reduce insect and disease damage to timber stands. As far as we are aware, the DNRC has no empirical evidence to indicate its "treatments" for "forest health" decrease, rather than increase, the incidence of insects and diseases in the forest. "Forest health" discussions are unscientific and biased toward logging as a "solution."

The DEIS blames the lack of soil scarification for the "problem" of only spruce and subalpine fir (III-6 and 7). Ecosystems are so complex, with innumerable interrelated structures and functions, we wonder how the DNRC can pinpoint regeneration problems onto too little heavy machinery use, rather than too much. Please consider the large body of research that indicates logging, roads, and other human caused disturbance <u>promote</u> the spread of tree diseases and insect infestation.

For example, multiple studies have shown that annosus root disease (Heterobasidion annosum, formerly named Fomes annosus), a fungal root pathogen that is often fatal or damaging for pine, fir, and hemlock in western forests, has increased in western forests as a result of logging (Smith 1989). And researchers have noted that the incidence of annosus root disease in true fir and ponderosa pine stands increased with the number of logging entries (Goheen and Goheen 1989). Large stumps served as infection foci for the stands, although significant mortality was not obvious until 10 to 15 years after logging (Id.).

Complete removal of insect or disease problems from the forest, which is neither possible or practical, is not the intention of this project. One objective of the project is to improve the long-term productivity of timber stands by increasing stand vigor, reducing the incidence of insect infestations and disease infections, and regenerating portions of stands where timber-stand growth is decreasing *(DEIS, CHAPTER I - ALTERNATIVES, page I-2).*

An evaluation of the insect and disease conditions in the project area identified specific pathogens and determined that their effects are not severe *(DEIS, APPENDIX B - VEGETATION ANALYSIS, page B-7).* Risks associated with taking silvicultural actions or not are assessed during project development. One of the risks assessed is loss of volume, value, and vigor of the timber on site if no action is taken at this time.

To assess the risks, we regularly consult with the professional literature, as well as entomologists and pathologists, to determine prudent courses of action for proposed projects. The proposed silvicultural prescriptions would limit the incidence of insects and disease problems by:

- **identifying trees that are already infected by pathogens and infested by insects and salvaging their stumpage value;**
- **limiting the extent and season of machine use to reduce damage to the remaining trees *(DEIS, APPENDIX D - SOILS ANALYSIS, page D-1 to D-3);***
- **retaining disease-resistant/tolerant tree species, including western larch, Douglas-fir, and rust-resistant western white pine, in partially harvested stands *(DEIS, CHAPTER II - ALTERNATIVES, page II-10 to II-12);***
- **replanting with disease-resistant tree species in regeneration harvest units *(DEIS, CHAPTER II - ALTERNATIVES, page II-10 to II-12, and APPENDIX B - VEGETATION ANALYSIS, page B-13 and B-14);* and**

The proportion of western hemlock trees infected by annosus root disease increased after precommercial thinning, due to infection of stumps and logging equipment wounds (Edmonds et al. 1989, Chavez, et al. 1980).

Armillaria, a primary, aggressive root pathogen of pines, true firs, and Douglas-fir in western interior forests, spreads into healthy stands from the stumps and roots of cut trees (Wargo and Shaw 1985). The fungus colonizes stumps and roots of cut trees, then spreads to adjacent healthy trees. Roots of large trees in particular can support the fungus for many years because they are moist and large enough for the fungus to survive, and disease centers can expand to several hectares in size, with greater than 25% of the trees affected in a stand (id.). Roth et al. (1980) also noted that Armillaria was present in stumps of old-growth ponderosa pine logged up to 35 years earlier, with the oldest stumps having the highest rate of infection.

Filip (1979) observed that mortality of saplings was significantly correlated to the number of Douglas-fir stumps infected with Armillaria mellea and laminated root rot (Phellinus weirii). McDonald, et al. (1987) concluded the pathogenic fungus Armillaria had a threefold higher occurrence on disturbed plots compared to pristine plots at high productivity sites in the Northern Rockies. Those authors also reviewed past studies on Armillaria, noting a clear link between management and the severity of Armillaria-caused disease.

Morrison and Mallett (1996) observed that infection and mortality from the root disease Armillaria ostoyae was several times higher in forest stands with logging disturbance

- **improving vigor of residual trees by reducing competition from infected trees and allowing more moisture and sunlight to reach the remaining trees *(DEIS, APPENDIX B - VEGETATION ANALYSIS, page B-14, and DEIS, CHAPTER II - ALTERNATIVES, page II-10* through *II-11).***

than in undisturbed stands, and that adjacent residual trees as well as new regeneration became infected when their roots came into contact with roots from infected stumps.

Precommercial thinning and soil disturbance led to an increased risk of infection and mortality by black-stain root disease (Leptographium wageneri) in Douglas-fir, with the majority of infection centers being close to roads and skid trails (Hansen et al. 1988). Also another Black-stain root disease (Verticicladiella wagenerii) occurred at a greater frequency in Douglas-fir trees close to roads than in trees located 25 m or more from roads (Hansen 1978). Witcosky et al. (1986) also noted that precommercially thinned stands attracted a greater number of black-stain root disease insect vectors.

Complex interactions involve mechanical damage from logging, infestation by root diseases, and attacks by insects. Aho et al. (1987) saw that mechanical wounding of grand fir and white fir by logging equipment activated dormant decay fungi, including the Indian paint fungus (Echinodontium tinctorium).

Trees stressed by logging, and therefore more susceptible to root diseases are, in turn, more susceptible to attack by insects. Goheen and Hansen (1993) reviewed the association between pathogenic fungi and bark beetles in coniferous forests, noting that root disease fungi predispose some conifer species to bark beetle attack and/or help maintain endemic populations of bark beetles.

Goheen and Hansen (1993) observed that live trees infected with Laminated root rot (Phellinus weirii) have a greater

likelihood of attack by Douglas-fir beetles (Dendroctonus pseudotsugae). Also, Douglas-fir trees weakened by Black-stain root disease (Leptographium wageneri var. pseudotsugae) are attacked and killed by a variety of bark beetle species, including the Douglas-fir bark beetle (D. pseudotsugae) and the Douglas-fir engraver (Scolytus unispinosis) (id.).

The root disease Leptographium wageneri var. ponderosum predisposes ponderosa pine to several bark beetle species, including the mountain pine beetle (D. ponderosae) and the western pine beetle (D. brevicomis) (Goheen and Hansen 1993).

A variety of root diseases, including black-stain, Armillaria, and brown cubical butt rot (Phaeolus schweinitzii), predispose lodgepole pine to attack by mountain pine beetles in the interior west. The diseases are also believed to provide stressed host trees that help maintain endemic populations of mountain pine beetle or trigger population increases at the start of an outbreak (Goheen and Hansen 1993).

Grand and white fir trees in interior mixed-conifer forests have been found to have a high likelihood of attack by the fir engraver (Scolytus ventralis) when they are infected by root diseases, such as laminated root rot, Armillaria, and annosus (Goheen and Hansen 1993).

More western pine beetles (Dendroctonus breviformis) and mountain pine beetles (D. ponderosae) were captured on trees infected by black-stain root disease (Ceratocystis wageneri) than on uninfected trees (Goheen et al. 1985). The two species of beetle were more frequently attracted to wounds

on trees that were also diseased than to uninfected trees. They also noted that the red turpentine beetle (Dendroctonus valens) attacked trees at wounds, with attack rates seven-to-eight times higher on trees infected with black-stain root disease than uninfected trees. Spondylis upiformis attacked only wounded trees, not unwounded trees (Id.).

Any contentions that potential insects and tree diseases in the project area would be something to be concerned about ecologically runs counter to more enlightened thinking on such matters. For example, Harvey et al. 1994 state:

> **Although usually viewed as pests at the tree and stand scale, insects and disease organisms perform functions on a broader scale.**
>
> **…Pests are a part of even the healthiest eastside ecosystems. Pest roles—such as the removal of poorly adapted individuals, accelerated decomposition, and reduced stand density—may be critical to rapid ecosystem adjustment**
>
> **…In some areas of the eastside and Blue Mountain forests, at least, the ecosystem has been altered, setting the stage for high pest activity (Gast and others, 1991). This increased activity does not mean that the ecosystem is broken or dying; rather, it is <u>demonstrating functionality, as programmed during its developmental (evolutionary) history</u>. (Emphasis added.)**

The DEIS fails to disclose how much forest—including old growth, by type, has been clearcut, salvaged, intermediate cut, thinned, etc. in the analysis area. This makes the cumulative effects discussion of vegetative conditions of little

DNRC's discussion on the coarse-filter approach to forest covertypes and age classes is based on an existing condition and the modeling of SLI data *(STW 2003 SLI)*; past harvests and management activities are included in the SLI data, as well as in the coarse-filter analysis (see *DEIS, APPENDIX B - VEGETATION ANALYSIS, under ANALYSIS METHODS, COVERTYPE, AND AGE CLASSES)*. DNRC's SLI includes periodic annual harvest updates.

value.

The cumulative effects analysis is largely a listing of projects, there is no meaningful analysis of how all activities have affected or will affect wildlife, fish, water quality, soils, or any resource. It is important that the results of past project-level and programmatic plan-level monitoring be incorporated into project-level analysis. In order for a cumulative effects analysis to be sufficient, the following must be included in an EIS:

- **A list of all past projects (completed or ongoing) implemented.**
- **An integrated discussion of those projects' impacts on the resources potentially affected by the proposed action.**
- **The results of all monitoring done in the project areas as committed to in the MEPA documents of those past projects.**
- **A description of any monitoring, specified in those past project MEPA documents for those past projects, which has yet to be gathered and/or reported.**
- **A discussion of how all those projects did, or did not, meet objectives and the needs for which the projects were designed.**

The DNRC has failed to evaluate or define a landscape program for old-growth habitat, and in effect, thus plan for the long term viability of old-growth associated wildlife, prior to extensive logging of old-growth habitat. As a result, the cumulative impacts of existing levels of old growth and distribution in the analysis area are never evaluated. Yet existing and planned landscape distribution of old growth will be key to many associated species, including the pine marten,

Cumulative effects were considered for the applicable resources throughout the effects analysis. The *DEIS* describes the cumulative effects analysis for wildlife *(APPENDIX F - WILDLIFE ANALYSIS)*, fisheries *(APPENDIX E - FISHERIES ANALYSIS)*, water quality *(APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS)*, and soils *(APPENDIX D - SOILS ANALYSIS)*. Effects from past projects are incorporated into DNRC databases over time and become part of the existing condition that is used in each analysis (see *DEIS, CHAPTER III - EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES, page III-1)*. *Ongoing and proposed projects are considered for each resource based on the appropriate analysis area* (see *CHAPTER I - PURPOSE AND NEED, page I-3)*. This project was designed and would be implemented in accordance with the *Administrative Rules of Montana* for forest management, which include project-level and programmatic monitoring and reporting requirements *(ARM 36.11.448)*. Monitoring results are incorporated into management direction over time. Project design, including stipulations and specifications, is based on that guidance.

DNRC conducts a cumulative effects analysis for old growth in each project that proposes to harvest in old growth; the methods are described in the *DEIS (APPENDIX B - VEGETATION ANALYSIS, page B-2)*. The Department made no viability analysis requirements in either the *SFLMP* or *ARM*. Analysis of old growth on Stillwater Unit, in accordance with the general direction provided by *ARM*, suggest that the amounts of old growth currently on Stillwater Unit's landscape are not outside of a historical range of variation.

pileated woodpecker, northern goshawk, fisher, boreal owl, great gray owl, flammulated owl, and black-backed woodpecker since they require large blocks of high quality old growth. Logging of small fragmented old growth will possibly limit recovery of landscape distributions of old growth to required densities for some or all of these species.

The DNRC has failed to complete an adequate assessment of logging impacts on sensitive wildlife associated with old growth. The analysis draws conclusions without any demonstration that landscape densities and quality of old growth are currently adequate for these species.

Juday (1978) discusses in detail how the protection of old-growth forests greatly sustains the many uses of our national forests, as mandated by federal laws. As interest in intrinsic and ecosystem values of old-growth forests on State lands grows, as plainly evidenced in recent years, these values will be best met by preserving and protecting all old growth values Juday identified. Instead, Alternative B proposes to obliterate the largest unfragmented block of old growth remaining in the Stillwater State Forest.

Through a patch analysis of old-growth stands, at least 6 other larger continuous blocks of old growth are located on Stillwater State Forest.

The DEIS fails to provide an adequate definition of old-growth habitat. The DNRC has failed to clearly define what old growth is as per specific criteria, or how these criteria will be affected with the proposed logging.

See the *DEIS GLOSSARY (page 4, 'Old growth')*. *Also see DEIS, APPENDIX B - VEGETATION ANALYSIS (page B-11, Direct Effects of Action alternative B to Old-Growth Distribution and Attributes)*, which states "The posttreatment timber stand would no longer meet DNRC's criteria for old growth." *CHAPTER II - ALTERNATIVES (pages II-12 and II-13)* describes that those areas of old-growth would receive a regeneration harvest, and existing snags and an average of 1 live large-diameter tree per acre would be retained.

What specific criteria for old growth have been used to identify old growth stands in the project and analysis area? We would like to know these criteria for average number of large trees per acre, the minimum dbh of these large trees, the minimum age of large trees, the average basal area for the stand, the average snags per acre over 9 inches dbh, the average number of trees over 9 inches dbh with broken tops, and the average percent of trees greater than 9 inches dbh showing decay.

Have all stands been evaluated according to the above criteria? If not, how has old growth been identified?

How do your criteria for old growth compare to those defined by Region 1 of the Forest Service for old growth on the Kootenai National Forest? Specifically, what Old Growth Type Codes defined by Region 1 occur in the project area?

As noted above, the DNRC definition of old growth are those stands having the minimum number of trees per acre that have a minimum dbh and a minimum age for a given site. These minimums are listed in ***Old Growth Forest types of the Northern Region*** *(Green et al 1992)*, although some minor adaptations have been made due to data compatibility. Within the Stillwater Unit Analysis Area, *STW 2003 SLI* data was reviewed. Models within the SLI identify stands that have the potential of meeting the old-growth definition. Within proposed project areas, field verification is conducted, which can be either reconnaissance surveys or plot surveys. Information gathered would update or change SLI data such as habitat types, live trees per acre, age of overstory, number and size of snags, etc.

As noted in the *DEIS (APPENDIX B - VEGETATION ANALYSIS, page B-6)* 95 percent of the project area acreage is in the "cool and moist" habitat group. Of the 777 acres of old growth identified in the project area, approximately 736 acres are located in cool and moist habitat types (Habitat Type Group E), which requires that 10 trees per acre that are 21 inches dbh or greater and at least 180 years old be present to be labeled as old growth. The other 41 acres of old growth are located in a cool and moderately dry habitat group (Habitat Type Group G) that requires an average 10 trees per acre 17 inches dbh or greater and 180 years old be present to be labeled as old growth.

The DEIS fails to demonstrate that the proposed activities would be in compliance with all of the State Programmatic Plan old-growth and wildlife standards. Similarly, the DEIS's analyses for old-growth dependent wildlife species makes no <u>connection</u> between the areas designated for old-growth management and old-growth wildlife species. The existing amounts, block sizes, connectivity, spatial relationships, and integrity free from edge effects and fragmentation are not at all related to old-growth wildlife species' habitat

DNRC developed the project under the philosophies of the SFLMP and has designed the alternatives to meet the SFLM Rules for Biodiversity, including Old-Growth Management, and for the various wildlife species noted in the *DEIS*.

Forest-habitat fragmentation was analyzed in the *DEIS, APPENDIX F - WILDLIFE ANALYSIS (pages F-2 and F-7, under COARSE-FILTER ASSESSMENT)* and the effects to specific threatened, sensitive, and big game species were discussed under the species heading *FINE-FILTER ASSESSMENT*. Since DNRC lands comprise a small portion of the landscape, the species viability analysis is beyond the scope of the wildlife analysis.

needs, and thus viability.

As far as we're aware, the state has never specified the amount and distribution of habitat necessary to maintain viable populations of these species. Nor has it gathered any data on population trends of these species.

USDA Forest Service (2004a) discusses the value of small patches of old-growth habitat and cites scientific studies and lists many adverse impacts from fragmentation of old growth habitat:

> Harvesting or burning adjacent to old growth can remove the edge buffer, reducing the effective size of old growth stands by altering interior habitats (Russell and Jones 2001). Weather-related effects have been found to penetrate over 165 feet into a stand; the invasion of exotic plants and penetration by predators and nest parasites may extend 1500 feet or more (Lidicker and Koenig 1996).
>
> …Harvest or burning in stands immediately adjacent to old growth mostly has negative effects on old growth, but may have some positive effects. Harvesting or burning adjacent to old growth can remove the edge buffer, reducing the effective size of old growth stands by altering interior habitats (Russell and Jones 2001). Weather-related effects have been found to penetrate over 165 feet into a stand; the invasion of exotic plants and penetration by predators and nest parasites may extend 1500 feet or more (Lidicker and Koenig 1996).
>
> … The occurrence of roads can cause substantial edge effects on forested stands, sometimes more than the harvest areas they access (Reed, et al. 1996; Bate and Wisdom, in prep.). Roads that are open to the public expose many important wildlife habitat features in old growth and other forested stands to loss through firewood gathering and increased fire risk.
>
> Effects of disturbance also vary at the landscape level. Conversion from one stand condition to another can be detrimental to some old growth associated species if amounts of their preferred habitat are at or near threshold levels or dominated by linear patch shapes and limited in-

DNRC rarely collects data on population levels; however, we do participate in interagency efforts to collect such data. DNRC ownership represents a small portion of the landscape. Due to the limited contribution these lands provide, DNRC focuses on more localized effects at a scale of a species' home range. DNRC bases the analysis on habitat parameters, not population levels.

terconnectedness (Keller and Anderson 1992). Reducing the block sizes of many later-seral/structural stage patches can further fragment existing and future old growth habitat (Richards et al. 2002). Depending on landscape position and extent, harvest or fire can remove forested cover that provides habitat linkages that appear to be "key components in metapopulation functioning" for numerous species (Lidicker and Koenig 1996, Witmer et al. 1998).

The DNRC must maintain enough old-growth habitat for decades to come on the Stillwater State Forest. There are no solid data on how much old-growth forest existed before logging nor what the normal historical ranges have been. The DEIS provides no information on how much has been logged or lost due to road building, wildland fire, or simple forest succession. There is no discussion as to the impacts of this cumulative loss of old growth on wildlife species. And there is no disclosure on how much effective old growth is expected to be lost in the future due to these effects.

USDA Forest Service (1999a) discussed the relationship between wildlife species and the habitat components found only in mature an old growth forests:

> Fishers occur most commonly in landscapes dominated by mature to old-forest cover." (III-254.) "Fishers prefer habitats with high canopy closure (greater than 80 percent) and avoid areas with low canopy closure (less than 50 percent). …The habitat requirements of fishers are thought to be associated with the physical structure of the forest and associated prey. This structure includes the vertical and horizontal complexity created by a diversity of trees sizes and shapes, light gaps, dead and downed wood and layers of overhead cover. Large-diameter spruce and grand-fir snags and large downed material are used for

As stated, there is no estimate of how much forest would have historically met DNRC's current restrictive definition of old growth. Several approaches estimate historic or naturally occurring amounts of stands with older-aged trees, but these approaches were not addressed in this DEIS. Prior to adoption of the *SFLM Rules* in 2003, comparisons were made and displayed that Stillwater Unit was within naturally occurring levels of Older Stands or stands where the primary age class was greater than 150 years.

In 2000, Stillwater Unit was estimated to have approximately 32 percent of its land base in Old Stand status, and based on modeling of *Flathead National Forest's Amendment 21*, Stillwater Unit had an estimated 29 percent of its land base in a late seral stage *(DNRC 2000)*. Based on *STW 2003 SLI* data, 48 percent of Stillwater Unit's forested landbase is over 150 years old *(DEIS, APPENDIX B - VEGETATION ANALYSIS, page B-4)*.

DNRC discussed the effects of the proposed harvest (not only old growth) at the project and landscape scale *(DEIS, APPENDIX F - WILDLIFE ANALYSIS, pages F-2, F-3, and F-7)*. DNRC considered the existing condition (which includes past harvests and other disturbances) and potential cumulative effects of known proposed future actions in this analysis.

denning and foraging. Fishers tend to avoid non-forested areas. (III-254.)

Many wildlife species occurring on the IPNF prefer or only occur in mature and old-growth forests. Mature and old forests are more likely than younger forests to provide habitat for species which prefer large trees, structural and biological diversity, and closed canopies, and/or which depend on snags or down logs for nesting, foraging or raising their young. (Id. at III-243.)

Over 40 wildlife species depend on snags (dead trees) for their forage, cover or a place to raise their young. (III-244.)

Existing structurally immature stands could provide old-growth habitat over time if not disturbed or if managed to maintain large, old, diseased and dead structural components of the forest within the levels needed to provide suitable habitat. (III-243.)

Most species identified as “Sensitive” by the Forest Service are associated with later successional habitats, or habitat and cover types in short supply (such as cottonwood communities, large standing dead trees or large downed trees.). (III-244.)

Large-diameter snags provide habitat for the greatest variety of cavity users and remain standing longer than smaller snags. (III-244.)

Snags provide den sites for fishers and other mammals, and roosts for several species of bats and owls. (III-244.)

Goshawks have habitat requirements associated with components and attributes of late successional forests. While associated with mature to old growth habitat, they utilize other successional stages. For example, feeding habitat can be found in pole-sized timber stands. …Old growth is important for northern goshawks not only for prey species habitat but also for the large trees that provide the substrate for their substantial nest structures. (III-255.)

In the western United Stares, marten are most abundant in mature to old-growth true-fir or spruce-fir forests and generally avoid open, drier coniferous forest. They prefer forest stands greater than 40 percent

> tree canopy closure, which protects them from predators and enhances the moist conditions favorable for prey species. (III-257.)
>
> Marten are closely associated with mature to old-growth timber stands, preferring moist habitat types where small mammals are more abundant. American marten prefer stands with greater than 40 percent canopy closure, and tend to avoid those stands with less than 30 percent closure. In addition to a closed canopy, marten require an abundance of large downed logs and snags. This provided secure resting locations, denning habitat and winter access to small mammals living beneath the snow. (III-580, 581.)
>
> Pileated Woodpecker. This species nests and roosts in cavities in large diameter (20 inches diameter or greater) live or dead trees. It selects nest trees in clumps of snags in stands with at least 70% canopy cover. …Pileated woodpeckers feed on beetles, carpenter ants and other insects in live and dead trees, logs and stumps. (III-258.)

The DNRC has failed to cite any evidence that its managing for old growth habitat (i.e., logging and burning old growth) strategy will improve old-growth wildlife species' habitats over the short-term or long-term. In regards to this popular DNRC theory:

(T)here is the question of the appropriateness of management manipulation of old-growth stands… Opinions of well-qualified experts vary in this regard. As long term results from active management lie in the future – likely quite far in the future – considering such manipulation as appropriate and relatively certain to yield anticipated results is an informed guess at best and, therefore, encompasses some unknown level of risk. <u>In other words, producing "old-growth" habitat through active management is an untested hypothesis.</u>
(Pfister et al., 2000, pp. 11, 15 emphasis added).

Lesica (1995) stated that maintaining 10% of forest landscapes as old growth may result in extirpation of some wildlife species. This is based on his estimate that 20-50% of low and many mid-elevation forests were in old growth condition prior to European settlement.

USDA Forest Service, 2004a at page 3-199 states:

> Across the Interior Columbia River Basin (Quigley, et al. 1996), old forests have declined by 27 to 60 percent over that past 100 years and large

DNRC does not claim that managing old growth in this project will improve habitat conditions. In the short term, old-growth habitat would decrease. In the distant long term, a new stand with a different composition of tree species would regenerate to

residual trees and snags have decreased by 20 percent. Fire exclusion and timber harvest have altered the structure and composition of forests throughout the Basin, resulting in a 60 percent increase in susceptibility to insects, disease, and stand-replacing fires. These changes have contributed to declining habitat conditions for numerous species of wildlife associated with old growth forests.

potentially provide habitat. Based on the composition changes in tree species, DNRC expects future stands to include a higher density of shade-intolerant tree species. The presence and increased representation of these tree species is expected to benefit species that use deadwood in the future.

The Stillwater State Forest is home for Canada lynx, listed as a Threatened species under the Endangered Species Act (ESA). The DEIS fails to adequately address the effects of logging on landscape pattern, which is essential for designation of critical habitat for the Canada lynx. The Lynx Conservation Assessment and Strategy (LCAS—as cited in the DEIS) require that federal actions must:

Maintain suitable acres and juxtaposition of lynx habitat through time. Design vegetation treatments to approximate historical landscape patterns and disturbance processes.

If the landscape has been fragmented by past management activities that reduced the quality of lynx habitat, adjust management practices to produce forest composition, structure, and patterns more similar to those that would have occurred under historical disturbance regimes.

The LCAS sets Standards, which include:

Identify key linkage areas that may be important in providing landscape connectivity within and between geographic areas, across all ownerships. (LCAS at 89.)

Develop and implement a plan to protect key linkage areas on federal lands from activities that would create barriers to movement. Barriers could result from an accumulation of incremental projects, as opposed to any one project. (Id.)

The *DEIS* discussed the current landscape patterns and the effects to those patterns in the coarse-filter analysis *(DEIS, APPENDIX F - WILDLIFE ANALYSIS, pages F-2, F-3,* and *F-7).*

> Map and monitor the location and intensity of snow compacting activities that coincide with lynx habitat, to facilitate future evaluation of effects on lynx as information becomes available. (LCAS at 83.)On federal lands in lynx habitat, allow no net increase in groomed or designated over-the-snow routes and snowmobile play areas by LAU.

Among the standards set out in the LCAS are provisions to maintain denning habitat as discussed in the programmatic lynx BO:

> Denning Habitat - Within developmental land allocations, existing Plan direction to maintain old growth habitat was judged to be adequate to provide for lynx denning habitat for all geographic areas except the Great Lakes. (BO at 31.)

The DEIS does not disclose how the loss of lynx habitat is consistent with scientific lynx management. In fact, the DEIS proposes a "taking" of lynx, an action prohibited under the Endagnered Species Act.

The impacts of both winter and non-winter motorized route densities have not been adequately considered. The LCAS states, "the effects of open road densities on lynx are poorly understood" (LCAS at 95). It is not clear that the DNRC has a complete understanding of the current level of use of the project area for snowmobiles. Moreover, the DEIS fails to disclose the expected level of cumulative impacts on lynx from the additional new roads, additional skid trails, and

other logging access routes to be constructed in the project area—roads/access routes that could be used by snowmobilers, snowshoers, and cross country skiers long after the logging activities have stopped. These roads/access routes can also impact lynx habitat during other seasons because of increased access for humans.

From Ruggiero, et al. (1999, p. 24): "Lynx metapopulation dynamics operate at regional scales." Lacking maps and adequate discussion of the connectivity issue in the DEIS, it is impossible to see the landscape features that affect connectivity and metapopulation dynamics within and outside the project area.

Ruggiero, et al. 1994 provide guidance for reconciling the disparity between the geographic size of project analyses vs. the needs of species: "The disparity between the scale of a local management action (e.g., a timber sale) and the scale of the ecological response (e.g., species viability) is a fundamental problem in assessing population viability."

Both Ruggiero, et al. 1994 and Lindenmayer, et al. 1993 provide discussion on why population viability analysis is the best available tool assessing population viability, the latter providing examples of population viability analysis being used for several species of wildlife and one plant species. Lacy and Clark, 1993 provide an example of population viability analysis used to design a computer simulation of risk of extinction of the pine marten.

In a scientific document prepared as a part of ICBEMP, Witmer, Martin, & Sayler (1998) make recommendations which reinforce our comments about population dynamics, population

The *FEIS* incorporates lynx habitat estimations that were not reported in the *DEIS*. DNRC did not adopt the guidelines in the *Lynx Conservation Assessment and Strategy* to manage effects to lynx habitat. All alternatives meet the *ARM*, which DNRC is legally obligated to meet; they also meet the *Lynx Conservation Assessment and Strategy* thresholds for temporarily unsuitable habitat.

These effects were discussed in the *DEIS (APPENDIX F - WILDLIFE ANALYSIS, page F-14.*

The *DEIS* discussed forest connectivity on forest-dwelling species, such as Canada lynx, in the coarse-filter analysis *(DEIS, APPENDIX F - WILDLIFE ANALYSIS, pages F-3 and F-7)* and provided *FIGURE F-1 - EXISTING FORESTED HABITAT IN THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT* to depict forest connectivity.

viability analysis, and monitoring. From the Abstract:

> Forest carnivores in the Pacific Northwest include 11 medium- to large-sized mammalian species of canids, felids, mustelids, and ursids. These carnivores have widely differing status in the region, with some harvested in regulated furbearer seasons, some taken for depredations, and some protected because of rarity. Most large carnivores have declined in numbers or range from human encroachment, loss or modification of forest habitat, accidental deaths (e.g., mortality from vehicles), illegal kills, and our inability to adequately monitor and protect populations. Efforts to reverse these trends include new approaches to reduce conflicts with humans, research to better define habitat needs, formation of expert carnivore working groups, and use of Geographic Information System models to predict specific impacts of habitat modifications. <u>Long-term preservation of large carnivores in the region is problematic unless we reduce forest fragmentation and conflicts with humans and improve our ability to quantitatively integrate population dynamics with landscape level habitat requirements.</u> (Emphasis added.)

The issue of providing for the larger landscape needs of far-ranging forest carnivores (including the grizzly bear, gray wolf, wolverine, fisher, pine marten, lynx, goshawk, etc.) reveals the need to utilize the principles of Conservation Biology on a landscape level. Core areas of relatively undisturbed habitats need to be maintained. Linkages with other core areas need to be established, providing sufficient habitat components so the linkages, or corridors, are functional for genetic interchange purposes.

Both core areas and linkages should be the focus of the watershed rehabilitation and recovery discussed above (such as road removal). Buffer zones around core areas should also be recognized in their contribution to habitat needs for these wildlife species.

State-of-the-art conservation biology principles require an increasing focus on the landscape-scale concept and design of large biological reserves accompanied by buffer zones and habitat connectors as the most effective (and perhaps only) way to preserve wildlife diversity and viability (Noss, 1993).

Cumulative effects on old-growth habitat and on old-growth associated species include increased fragmentation, reduced older forest patch sizes, increased high-contrast edge, reduced availability of interior habitat, and decreased forested connectivity. Forest fragmentation is a major ongoing concern. It is documented that edge effects occur 10-30 meters into a forest tract (Wilcove et al., 1986). The size of blocks of interior mature and old-growth forest that existed historically before management (including fire suppression) was initiated must be compared to the present condition. The DEIS fails to disclose the degree to which edge effects on old growth species' habitat exist, and how much total edge effect would be increased, by the alternatives. Such effects would reduce the ability to provide for the habitat needs of old-growth associated species for decades to come following implementation of the project and other activities in the watershed.

Mills (1994) points out the necessity of considering habitat fragmentation and current landscape pattern, caused by past logging and road building, for wildlife movements and therefore

These figures are displayed in the *DEIS (APPENDIX F - WILDLIFE ANALYSIS, page F-3, TABLE F-2 - EXISTING AND RESULTING ACRES OF FORESTED, INTERIOR, AND EDGE HABITAT ON THE UPPER WHITEFISH GRIZZLY BEAR SUBUNIT).*

viability. Mills points out that the FS's use of the term "viable" refers to habitat characteristics, not population dynamics. Mills goes on to explain the range of parameters that must be used to make a scientifically sound assessment of the viability of wildlife species. Population dynamics refers to persistence of a population over time—which is key to making predictions about population viability. Population dynamics include assessing population size, population growth rate, and linkages to other populations and must be included in a scientifically sound Population Viability Analysis (hereafter "PVA"). Ruggiero, et. al. (1994) also point out that a sound PVA must utilize measures of population dynamics. Also, temporal considerations of the impacts on wildlife population viability must be considered (id.) but this has never been done by the DNRC. It is also of paramount importance to monitor population trends in order to validate assumptions used about long-term species persistence i.e., population viability (Marcot and Murphy, 1992; Lacy and Clark, 1993).

USDA Forest Service (2004a) states:

> Forested connections between old growth patches …(widths) are important because effective corridors should be wide enough to "contain a band of habitat unscathed by edge effects" relevant to species that rarely venture out of their preferred habitats (Lidicker and Koenig 1996 and Exhibit Q-17). (Page 3-201.)
>
> Timber harvest patterns across the Interior Columbia River basin of eastern Washington and Oregon, Idaho, and western Montana have caused an increase in fragmentation of forested lands and a loss of connectivity within and between blocks of habitat. This has isolated some wildlife habitats and reduced the ability of some wildlife

> populations to move across the landscape, resulting in long-term loss of genetic interchange (Lesica 1996, U.S. Forest Service and Bureau of Land Management 1996 and 1997). (Page 3-216.)

USDA Forest Service (2004a) discusses the fragmentation effects on old-growth habitat, effects that would be exacerbated by the project without consideration of fragmentation effects on viability in the DEIS:

> Harvest or burning in stands immediately adjacent to old growth mostly has negative effects on old growth, but may have some positive effects. Harvesting or burning adjacent to old growth can remove the edge buffer, reducing the effective size of old growth stands by altering interior habitats (Russell and Jones 2001). Weather-related effects have been found to penetrate over 165 feet into a stand; the invasion of exotic plants and penetration by predators and nest parasites may extend 1500 feet or more (Lidicker and Koenig 1996). On the other hand, adjacent management can accelerate regeneration and sometimes increase the diversity of future buffering canopy.
>
> The occurrence of roads can cause substantial edge effects on forested stands, sometimes more than the harvest areas they access (Reed, et al. 1996; Bate and Wisdom, in prep.). Roads that are open to the public expose many important wildlife habitat features in old growth and other forested stands to loss through firewood gathering and increased fire risk.
>
> Effects of disturbance also vary at the landscape level. Conversion from one stand condition to another can be detrimental to some old growth associated species if amounts of their preferred habitat are at or near threshold levels or dominated by linear patch shapes and limited interconnectedness (Keller and Anderson 1992). Reducing the block sizes of many later-seral/structural stage patches can further fragment existing and future old growth habitat (Richards et al. 2002). Depending on landscape position and extent, harvest or fire can remove forested cover that provides habitat linkages that appear to be "key components in metapopulation functioning" for numerous species

> (Lidicker and Koenig 1996, Witmer et al. 1998). Harvest or underburning of some late and mid seral/structural stage stands could accelerate the eventual creation of old growth in some areas (Camp, et al. 1996). The benefit of this approach depends on the degree of risk from natural disturbances if left untreated.
>
> Effects on old growth habitat and old growth associated species relate directly to … "Landscape dynamics—Connectivity"; and … "Landscape dynamics—Seral/structural stage patch size and shapes." (Pages 3-196 to 3-197.)

Harrison and Voller, 1998 state, "connectivity should be maintained at the landscape level." They adopt a definition of landscape connectivity as "the degree to which the landscape facilitates or impedes movement among resource patches." Also:

> Connectivity objectives should be set for each landscape unit. …Connectivity objectives need to account for all habitat disturbances within the landscape unit. The objectives must consider the duration and extent to which different disturbances will alienate habitats. … In all cases, the objectives must acknowledge that the mechanisms used to maintain connectivity will be required for decades or centuries.

(Id., internal citations omitted.) Harrison and Voller, 1998 further discuss these mechanisms:

> Linkages are mechanisms by which the principles of connectivity can be achieved. Although the definitions of linkages vary, all imply that there are connections or movement among habitat patches. Corridor is another term commonly used to refer to a tool for maintaining connectivity. …the successful functioning of a corridor or linkage should be judged in terms of the connectivity among subpopulations and the maintenance of potential metapopulation processes. (Internal citations omitted.)

L. Harris discusses connectivity and effective interior habitat of old-growth patches:

> Three factors that determine the effective size of an old-growth habitat island are (1) actual size; (2) distance from a similar old-growth island; and (3) degree of habitat difference of the intervening matrix. …(I)n order to achieve the same effective island size a stand of old-growth habitat that is surrounded by clearcut and regeneration stands should be perhaps ten times as large as an old-growth habitat island surrounded by a buffer zone of mature timber.

L. Harris discusses habitat effectiveness of fragmented old growth:

> (A) 200-acre (80 ha) circular old-growth stand would consist of nearly 75% buffer area and only 25% equilibrium area. …A circular stand would need to be about 7,000 acres (2,850 ha) in order to reduce the 600-foot buffer strip to 10% of the total area. It is important to note, however, that the surrounding buffer stand does not have to be old growth, but only tall enough and dense enough to prevent wind and light from entering below the canopy of the old-growth stand.

L. Harris believes that “biotic diversity will be maintained on public forest lands only if conservation planning is integrated with development planning; and site-specific protection areas must be designed so they function as an integrated landscape system.” Also:

> Because of our lack of knowledge about intricate old-growth ecosystem relations (see Franklin et al. 1981), and the notion that oceanic island never

> achieve the same level of richness as continental shelf islands, a major commitment must be made to set aside representative old-growth ecosystems. This is further justified because of the lack of sufficient acreage in the 100- to 200-year age class to serve as replacement islands in the immediate future. …(A) way to moderate both the demands for and the stresses placed upon the old-growth ecosystem, and to enhance each island's effective area is to surround each with a long-rotation management area.

Logging and other disturbance associated with the project and other cumulative impacts would affect goshawk nesting, post-fledging family habitat, alternative nesting, foraging, competitors, prey and potential habitat, including areas far from cutting units. Research in the Kaibab National Forest found that goshawk populations decreased dramatically after partial logging, even when large buffers around nests were provided (Crocker-Bedford, 1990).

Reynolds, et al., provide a basis for a northern goshawk conservation strategy that could be implemented if landscape habitat considerations were to be taken into account. It is essential to viability of goshawks that 20-50% of old growth within their nesting areas be maintained (Id.). (See also Suring et al. 1993.) Graham, et al. 1999, USDA Forest Service 2000b, Iverson et al. 1996, and Suring et al. 1993 are more examples of northern goshawk conservation strategies the DNRC might adopt, if emphasis was more appropriately placed on species conservation and insuring viability rather than resource extraction.

USDA Forest Service, 2000b recommends that forest opening greater than 50-60 acres be avoided in the vicinity of goshawks. At least five years of monitoring is necessary to allow for effective estimates of habitat quality (Id.). Research suggests that a localized distribution of 50% old growth should be maintained to allow for viability of goshawks (Suring et al. 1993).

The scientific information provided in Center for Biological Diversity, 2004 also includes vital information on goshawks.

Goshawks are often associated with a thick overstory cover and areas with a large number of large trees. For example, Hayward and Escano (1989) recommend an overstory canopy between 75 and 80%. According to the BE/BA for the Keystone Quartz EIS in the Beaverhead-Deerlodge NF, "Goshawks prefer vegetation structure that permits them to approach prey unseen and to use their flight maneuverability to advantage (Widen, 1989, Beier and Drennan 1997)…"

The issue of fragmentation should have been more thoroughly considered with respect to goshawks. Other edge-adapted species may compete with the goshawk and displace the goshawk if adequate amounts of forest interior habitat is not provided. Crocker-Bedford (1990) recommends that a foraging area of >5000 acres of dense forest, in which no logging is permitted, be designated for goshawks, with additional areas of 2500-5000 acres of more marginal habitat designated beyond this 5,000 acre foraging area.

The DEIS failed to disclose and analyze the uncertain and precarious population status of the fisher, as described in Witmer, et al., 1998:

> **The status of the fisher in the Western United States is poorly known but generally perceived as precarious and declining. This is a serious issue alone, but it also is a component of the larger problem of the decline of biological diversity. Recovery of species of concern must necessarily focus on the population level, because this is the scale at which genetic variation occurs**

A fine-filter analysis was not conducted on goshawks. This species is neither listed under the Endangered Species Act nor considered a sensitive species by DNRC. The effects to this species are expected to be covered by the coarse-filter analysis.

> **and because population [sic] are the constituent elements of communities and ecosystems. Systematic habitat alteration and overexploitation have reduced the historical distribution of fishers in suitable habitat in the interior Columbia basin to isolated and fragmented populations. Current populations may be extremely vulnerable to local and regional extirpation because of their lack of connectivity and their small numbers (Id. at 14, internal citations omitted).**

The proposed project would adversely impact fisher habitat. Habitat elements for natal and maternal dens are found in large diameter logs or snags. These would be reduced in stands intensively managed for timber. "Though the post-treatment stand condition would not be 'clear cuts', they would be fairly open and Jones (1991) did not expect to find substantial fisher hunting use of plantations by fishers until canopy approached 80% and 10-15 feet respectively (depending on snow depths)" (Flathead NF's Spotted Beetle EA, p. 3-62). The extensive logging, snag removal and other activities associated with the project would negatively affect fisher habitat. Movement, denning, resting areas, genetic diversity, and other aspects of fisher life cycles and fisher survival could be impacted by the project; the FS does not fully consider these elements of the project or adequately mitigate their impacts. A finding of no significant impact is not warranted.

Jones (undated) and Johnsen, 1996) provides examples of beginning developments of conservation strategies for the fisher.

Regarding another logging-sensitive species, the black-backed

DNRC recognizes the status of the fisher; thus, DNRC listed this species as sensitive *(DEIS, APPENDIX F - WILDLIFE ANALYSIS, pages F-25* and *F-26)*. As such, a fine-filter analysis was conducted *(DEIS, APPENDIX F - WILDLIFE ANALYSIS, pages F-26* through *F-28)*.

woodpecker, Cherry (1997) states:

> The black-backed woodpecker appears to fill a niche that describes everything that foresters and fire fighters have attempted to eradicate. For about the last 50 years, disease and fire have been considered enemies of the 'healthy' forest and have been combated relatively successfully. We have recently (within the last 0 to 15 years) realized that disease and fire have their place on the landscape, but the landscape is badly out of balance with the fire suppression and insect and disease reduction activities (i.e. salvage logging) of the last 50 years. Therefore, the black-backed woodpecker is likely not to be abundant as it once was, and continued fire suppression and insect eradication is likely to cause further decline.

Past actions were, unfortunately consistent with this policy, and now the proposed project would further that failed policy. Nowhere does the DEIS disclose the impacts on woodpeckers and other species that rely on agents causing tree mortality.

The Region 1 black-backed woodpecker assessment (Hillis et al., 2003) notes that the black-backed woodpecker depends upon the very forest conditions that the DNRC so often vilifies:

> **Black-backed woodpeckers occupy forested habitats that contain high densities of recently dead or dying trees that have been colonized by bark beetles and woodborer beetles (Buprestidae, Cerambycidae, and Scolytidae). These beetles and their larvae are most abundant within burned forests. In unburned forests, bark beetle and woodborer infested trees are found primarily in areas that have undergone natural disturbances, such as wind-throw, and within structurally**

The fine-filter analysis discusses the potential effects to fishers and rationale for disclosure of minor negative effects under both alternatives *(DEIS, APPENDIX F - WILDLIFE ANALYSIS, pages F-26* through *F-28).*

> **diverse old-growth forests. (Internal citations omitted.)**
>
> **…Black-backed woodpeckers also occur in unburned landscapes Bull et al.1986, Goggans et al. 1987, Bate 1995, Hoffman 1997, Weinhagen 1998, Steeger and Dulisse in press, Taylor unpublished data). Taylor's observations of black-backed woodpeckers in unburned forests in northern Idaho suggest that they may occur at substantially lower densities in unburned forests, but no rigorous comparisons between black-backed woodpecker densities in burned and unburned forests have been done. Hutto (1995) hypothesized that black-backed woodpeckers reproduce at *source* reproductive levels in burns, but may drop to *sink* reproductive levels in the intervening periods between large burns.**

Dolan (1998a,b) states in regards to impacts on the black-backed woodpecker due to fire suppression and post-fire logging states:

> **It seems that we have a huge cumulative effects problem here, and that each salvage sale removes habitat that is already very limited. We are having trouble avoiding a "trend to federal listing" call for the BBWO in salvaging burns, unless comparable acres of fire-killed dead are being created through prescribed burns.**

The comments by other biologists attached to Dolan, 1998a,b reveal that no one has yet designed a consistent, workable, scientifically defensible strategy to ensure viable populations of the black-backed woodpeckers. The fire suppression and "salvage" logging policies of our land managing agencies are the biggest threat to black-backed woodpecker population viability, unfortunately in failing to create a conservation strategy the cumulative impacts of ongoing fire suppression policy will remain unexamined.

The coarse-filter analysis pertaining to deadwood discusses the effects to insectivorous species *(DEIS, APPENDIX F - WILDLIFE ANALYSIS, pages F-3, F-5, F-7, and F-8).*

Lofroth (1997) in a study in British Columbia, found that wolverines use habitats as diverse as tundra and old-growth forest. Wolverines are also known to use mid- to low-elevation Douglas-fir forests in the winter (USDA Forest Service, 1993).

Ruggerio, et al. (1998) and Bull and Blumton, 1999, indicate that vertical and horizontal diversity provided by snags and large down woody debris are important habitat characteristics for the pine marten, another old-growth wildlife species. The logging proposed for this project would reduce the availability of prey species for the marten.

Old growth allows martens to avoid predators, provides resting and denning places in coarse woody debris and large diameter trees, and allows for access under the snow surface. USDA Forest Service (1990) is summary of old-growth habitat needs of martens reviewed research suggesting that martens prefer forest stands with greater than 40% tree canopy closure and rarely venture more than 150 feet from forest cover, particularly in winter. It also cites research suggesting that at least 50% of female marten home range should be maintained in mature or old growth forest. Also, consideration of habitat connectivity is essential to ensuring marten viability: "To ensure that a viable population of marten is maintained across its range, suitable habitat for individual martens should be distributed geographically in a manner that allows interchange of individuals between habitat patches (Ibid.).

The flammulated, boreal owl and the great gray owl are species of concern that are sensitive to logging and other management activities. See, for example, Hayward and Verner, 1994.

The paltry number of snags and green tree replacements to be retained in some logging units and the failure to specify snags of adequate size contrasts with scientifically determined habitat needs acknowledged

elsewhere by the FS. The DEIS doesn't even refer to recently developed Regional snag guidelines (USDA Forest Service, 2000d. Harris (1999—cited in the DEIS) and ICBEMP DSEIS Appendix 12 present scientific information that contrasts with the DEIS on this topic.

The high density of snags and defective trees within old growth (Green et al. 1992) would be substantially eliminated with the planned logging. And the DEIS does not disclose how many old logging units in the project area are deficient in snags, another vital and necessary component of old-growth habitat.

Bull, et al., 1997 state:

> This document presents new information on the retention and selection of trees and logs most valuable to wildlife.
>
> …Current direction for providing wildlife habitat on public forest lands does not reflect this new information. Since the publication of Thomas and others (1979), new research suggests that to fully meet the needs of wildlife, additional snags and habitat are required for foraging, denning, nesting, and roosting. Although we do not suggest specific numbers or snags to retain by forest type, tow recent studies indicate that viable woodpecker populations occurred in areas with about four snags per acre.
>
> We suggest that the next step in snag management should involve creating a model that incorporates the new information on woodpecker foraging substrates (live trees, snags, and logs), home range sizes, number and characteristics of roost trees, multiple occupancy of snags, and needs for other habitat structures. Once this information is incorporated, the model may suggest changes to guidelines that specify numbers of snags and other habitat features by forest type and geographic area. Additional information on fall rates of snags, foraging needs of black-backed and three-toed woodpeckers, relation of the density of woodpeckers to that of secondary cavity nesters, and relation of snag density to woodpecker density would greatly improve the model.

The DEIS does not adequately consider that snags may be cut down for safety reasons during logging operations (due to OSHA regulations). The DEIS fails to disclose the amount of snag loss expected because of safety concerns and also skyline corridors and other methods of log re-

Typically, data to assess these densities are not collected until timber sale preparation. In this project, snag sampling occurred and was reported; however, the quarter-acre plot means, not snag densities, were erroneously reported. This error was corrected in the *FEIS*.

DNRC committed to retain large snags (21 inches dbh or

moval—the loss could be more significant that disclosed, because the DEIS doesn't provide any idea the degree of snag loss due to these concerns. The paucity of snag habitat in previously logged areas is no doubt at least partially attributed to concerns over logger safety.

The degree to which pileated woodpeckers prefer larger trees/snags for nesting is not recognized by the DEIS. Also, USDA Forest Service, 1990 states, "To provide suitable pileated woodpecker habitat, strips should be at least 300 feet in width…" The DEIS also ignores many structural habitat components necessary for the pileated woodpecker. USDA Forest Service, 1990 indicates that measurements of the following variables are necessary to determine quality and suitability of pileated woodpecker habitat:

- Canopy cover in nesting stands
- **Canopy cover in feeding stands**
- **Number of potential nesting trees >20" dbh per acre**
- **Number of potential nesting trees >30" dbh per acre**
- **Average DBH of potential nest trees larger than 20" dbh**
- **Number of potential feeding sites per acre**
- **Average diameter of potential feeding sites**

The preferred very large diameter of nesting trees for the pileated woodpecker recognized by USDA Forest Service (1990) (and ignored by the snag retention strategy in the DEIS) is notable. McClelland and McClelland, 1999 found similar results in their study in northwest Montana, with the average nest tree being 73 cm. (almost 29") dbh. With the value of trees—live, dead, and down—being so disproportionately high the larger the size they attain, one might think that limiting the size of trees for removal would be important. The DEIS doesn't recognize such a basic concept. The DEIS effectively provides no commitments for leaving specific numbers and sizes of largest trees favored by so many wildlife species.

It is also unclear as to how it's possible for the DEIS to estimate, without any field survey validation, the amount of existing snags and coarse woody debris.

"Well distributed habitat is the amount and location of required habitat

greater) in development of this timber sale project in accordance with ARM 36.11.411. DNRC will ensure that the minimum standard is met postharvest. This rule, however, does not require the retention of smaller snags. For this project, some additional snags of varying size classes are planned for retention to mitigate effects to species that use snags. The effects of snag loss were discussed in the *DEIS, (APPENDIX F - WILDLIFE ANALYSIS, page F-9).*

The DEIS acknowledges the potential loss of retention snags due to operational/safety constraints *(DEIS, APPENDIX F - WILDLIFE ANALYSIS, page F-9; APPENDIX B - VEGETATION ANALYSIS, page B-11; and CHAPTER II - ALTERNATIVES, page II-12).* The *DEIS (APPENDIX A - STIPULATIONS AND SPECIFICATIONS, page A-3, under SNAG RETENTION)* displays the minimum number and size of snags and snag recruitments that should be retained in the proposed harvest areas.

which assure that individuals from demes, distributed throughout the population's existing range, can interact. Habitat should be located so that genetic exchange among all demes is possible." (Mealey, 1983.) That document also provides guidance as to how habitat for the pileated woodpecker must be distributed for populations to persist.

The IPNF's Forest Plan provides an example of better management directives for the pileated woodpecker than does the DNRC. IPNF's Forest Plan Wildlife Standard #10f requires "One or more old-growth stands per old-growth unit should be 300 acres or larger. Preference should be given to a contiguous stand; however, the stand may be subdivided into stands of 100 acres or larger if stands are within one mile. The remaining old-growth management stands should be at least 25 acres in size. Preferred size is 80 plus acres." IPNF Forest Plan at II-29. This and other IPNF old growth Standards are based upon what the IPNF recognizes are pileated woodpecker habitat needs:

To retain a viable population of pileated woodpeckers on the IPNF … our recommendations are:

1. Retain 10 percent old-growth throughout the Forests.
2. Distribute the old-growth so that old-growth compartments with 5 percent old-growth retain at least 5 percent old-growth. All old-growth stands 25 acres should be retained in old-growth compartments containing less than 5 percent old-growth.
3. In each 10,000 acre unit at least 300 acres should be managed specifically for pileated woodpeckers. To maximize benefits to other species as well as pileateds the 300 acres should be either contiguous or divided into subunits no smaller than 100 acres. The subunits should be within approximately two square miles.
4. The areas managed for pileated woodpeckers should be at least 200 yards wide.
5. Areas selected for old-growth management for pileated woodpeckers should also be close to water. Old-growth larch stands are highly recommended for pileated woodpecker management.

(IPNF Forest Plan EIS Appendix 27 at p. II-40.)

Since the DEIS provides inadequate analysis regarding the size and quality of habitat blocks needed by the pileated woodpecker, the analysis completely fails to disclose the quantitative or qualitative significance of cumulative effects due to past logging in the area.

The description of habitat features used by pileated woodpeckers acknowledges the need for large trees and snags* (DEIS, APPENDIX F - WILDLIFE ANALYSIS, page F-28*).

ARM 36.11.411 **requires that 1 large snag and 1 large snag-recruitment tree per acre be retained following harvesting** ***(DEIS, APPENDIX F - WILDLIFE ANALYSIS, page F-9).*** **In the proposed alternatives, large snags and large snag-recruitment trees would be targeted for retention** ***(DEIS, APPENDIX A - STIPULATIONS AND SPECIFICATIONS, page A-3).***

Snag densities were determined through plot data on the stands that were field surveyed for old-growth verification. ***SLI data*** **displays snag sizes and the number of snags per acre that are based on field reconnaissance and point sampling within the stand. Estimates of coarse woody debris are made by transect samples conducted within stands.**

B.R. McClelland has extensively studied the pileated woodpecker habitat needs. To quote a March 12, 1985 letter from B.R. McClelland to Flathead NF Supervisor Edgar B. Brannon:

> Co-workers and I now have a record of more than 90 active pileated woodpecker nests and roosts, …the mean dbh of these trees is 30 inches… A few nests are in trees 20 inches or even smaller, but the <u>minimum</u> cannot be considered suitable in the long-term. Our only 2 samples of pileateds nesting in trees <20 inches dbh ended in nest failure… At the current time there are many 20 inch or smaller larch, yet few pileateds selected them. Pileateds select <u>old</u>/old growth because old/old growth provides habitat with a higher probability of successful nesting and long term survival. They are "programmed" to make that choice after centuries of evolving with old growth.

We request that you apply research from McClelland (1977), which states:

> (The Pileated Woodpecker) is the most sensitive hole nester since it requires old growth larch, ponderosa pine, or black cottonwood for successful nesting. The Pileated can be considered as key to the welfare of most hole-nesting species. If suitable habitat for its perpetuation is provided, most other hole-nesting species will be accommodated.
>
> Pileated Woodpeckers use nest trees with the largest dbh: mean 32.5 inches;
>
> Pileated Woodpeckers use the tallest nest trees: mean 94.6 feet;
>
> The nest tree search image of the Pileated Woodpecker is a western larch, ponderosa pine, or black cottonwood snag with a broken top (status 2), greater than 24 inches dbh,

The *DEIS (APPENDIX F - WILDLIFE ANALYSIS, page F-28)* describes how potential pileated woodpecker habitat was identified by searching the *SLI* database. It has already been described that this database considers past harvests. Rationale is also given as to why the project area would be considered the analysis area for cumulative effects.

Past harvests contributed to the existing condition. Each alternative was compared to this condition to

> taller than 60 feet (usually much taller), with bark missing on at least the upper half of the snag, heartwood substantially affected by Fomes laracis or Fomes pini decay, and within an old-growth stand with a basal area of at least 100 sq feet/acre, composed of large dbh classes.
>
> A cluster analysis based on a nine-dimensional ordination of nest tree traits and habitat traits revealed close association between Yellow-bellied Sapsuckers, Mountain Chickadees, and Red-breasted Nuthatches. These three species plus the Pileated Woodpecker and Hairy Woodpecker are relatively grouped by coincident occurrence in old growth. Tree Swallows, Black-capped Chickadees, and Common Flickers are separated from the above five species by their preference for more open areas and their frequent use of small dbh nest trees.
>
> Limiting Factors
>
> In old-growth, western larch-Douglas-fir forests, snags or culls suitable for nest sites do not seem to be generally limiting. … Probably no single factor limits hole nesters, but rather a complex interplay of factors. Either nest trees or food supply may be limiting in logged areas.

We also urge you to consider the “Management Implications” McClelland, 1977 makes.

McClelland, et al., 1979 state:

> (Most) species found optimum nesting habitat in stands with a major component of old growth, particularly larch. Mean basal area for pileated woodpecker nest sites was 150 square feet per acre. (McClelland. B.R. and others, 1979)

assess effects. Therefore, past harvests were considered in the analysis, but not itemized. Additional harvests within the project area are not expected in the foreseeable future. Therefore, cumulative effects are expected to be similar to the direct and indirect effects.

In western larch-Douglas-fir forests, nest sites of pileated woodpeckers appear to be limited to areas with an old-growth component. The feeding territory used by one pair on a year-round basis is large, between 500 and 1,000 acres.

Many large snags are being cut for firewood. Forest managers should limit firewood cutting to snags less than 15 inches in d.b.h. and discourage use of larch, ponderosa pine, and black cottonwood. Closure of logging roads may be necessary to save high-value snags. Logging slash can be made available for wood gatherers.

The DEIS doesn't genuinely contain a cumulative effects analysis for wildlife species. Effects, either adverse or beneficial, of past management activities are not disclosed. There is no discussion of the connection between the major individual management actions carried out in the past, and the environmental harms or benefits.

The fact that Swift Creek is a WQLS means that most of the DEIS's standard mitigation and modeling assumptions cannot be relied upon for maintaining and improving water quality and fish populations.

The DEIS fails to use the best science concerning road densities and bull trout. The US Fish and Wildlife Service's Bull Trout Interim Conservation Guidance states:

> **Bull trout are less likely to use streams in highly roaded areas for spawning and rearing, and where found in highly roaded areas are less likely to be at strong population levels. Bull trout strongholds in the Interior Columbia River Basin showed a very strong (P=0.0001) negative correlation with road densities. The average road density in bull trout strongholds was 0.45 mi/mi^2, which is considerably less than the standard 2-3 mi/mi2 reported as adequate for populations of anadromous salmonids. Bull trout populations classified as "depressed" had an average watershed road density of 1.4 mi/mi^2 and bull trout typically were absent in an average road density of 1.7 mi/ mi^2. Although some variability in these patterns was apparent the association was strong, suggesting that bull trout are exceptionally sensitive to the direct, indirect, or cumulative effects of roads. (From information contained in the ICBEMP aquatic assessment by Quigley et al. 1997, emphasis added.)**

Past harvests contributed to the existing condition. Each alternative was compared to this condition to assess effects. Therefore, past harvests were considered in the analysis, but not itemized.

Data on effectiveness of BMPs statewide may be found in the *Forestry BMP Audit Report (DNRC, 1990, 1992, 1994, 1996, 1998, 2000, 2002, 2004)*. DNRC also conducts evaluations of mitigation measures through timber sale administration inspection reports and internal BMP audits annually. Results of the internal BMP audits can be found in monitoring reports prepared for the Montana Board of Land Commissioners.

DNRC has conducted a qualitative analysis for potential effects to fish populations throughout the project area even though DNRC is not specifically responsible for maintaining or improving fish populations. DFWP is responsible for the management of fish populations, and the qualitative analysis of this variable within the DEIS was conducted in an effort to provide the maximum level of practical information to the project decisionmaker.

Road densities exceed the level needed to support healthy populations of bull trout. One bull trout conservation objectives is to: "Manage or reduce negative effects of roads to habitat in bull trout watersheds by repairing and relocating roads, and by decreasing current road densities" (emphasis added). The proposed project does not adequately meet this objective.

The fisheries analysis of the *DEIS* does not analyze for road densities relative to bull trout for 4 reasons:

1) **The limited amount of scientific literature related to road densities and bull trout and other native salmonids pertains to broad generalizations of large geographic areas, such as the bulk of the Columbia River basin *(Quigley et al 1997).***
2) **Mean qualitative or quantitative values of road density (as they relate to bull trout) derived from large demographic areas do not take into account the road maintenance guidelines and standards of different landowners throughout watersheds.**
3) ***Although reductions in road densities can potentially lead to reduced sedimentation, there are no known regionally established indices for road densities in northwestern Montana that are correlated to bull trout and other native salmonid densities.***
4) ***Due to the lack of regional or agency-specific baseline data of road density related to bull trout success, a minimal narrative or other qualitative effects analysis of the issue could not accurately determine if decreased or increased road densities within the project area would adversely affect bull trout (or other native salmonids).***

The detailed fisheries analysis within the *DEIS (APPENDIX E - FISHERIES ANALYSIS)* describes the direct, indirect, and cumulative effects of road mitigations and potential sedimentation as a result of each alternative; this information is a more effective methodology for describing the effects of roads within the project area on bull trout than road density. *(*Quigley, T.M. and S.J. Arbelbide, tech eds., 1997. An assessment of ecosystem components in the interior Columbia basin and portions of the Klamath and Great Basins: volume 3. Gen Tech Rep. PNW-GTR-405. Portland, OR: U.S.D.A., Forest Service, Pacific Northwest Research Station, 4 vol.)*

The *Quigley et al 1997* study is an excellent assessment that evaluates trends in general road densities (which

The DEIS's watershed analysis relies, to a great degree, upon the ECA (Equivalent Clearcut Acres) modeling procedure. Please consider the fact that research (King, 1989) is critical about the accuracy of a peakflow model, similar to the ECA method, in estimating increases in peakflows from logging and roads in nearby northern Idaho. King (1989) examined the veracity of a model for changes in peakflow as a function of ECA. He found that the ECA model consistently underestimated measured increases in flow caused by roads and logging.

are cited in the study as a surrogate for human disturbance) relative to bull trout success throughout a very large geographic area. However, if DNRC had determined that road density relative to bull trout success was an appropriate measure of analysis for this *DEIS* project area, *Quigley et al 1997* would not be an accurate set of criteria to determine potential effects for several reasons. The *Quigley et al 1997* study area encompasses large areas of underlying granitic geology (batholiths), which tend to be more susceptible to erosion from road construction and maintenance than the glacial-dominated belt-rocks predominantly found throughout this project area *(J. Collins, 2004 [personal conversation] December, Missoula, MT:DNRC)*. An increased risk of erosion per road mile, in this case would generally translate to an increased risk to bull trout success. The study incorporates large areas of federal lands, which may take into account road systems throughout steep, high elevation, and potentially more erosive terrain than those found in the lower elevation, and potentially less erosive, land that is typically found throughout the project area. The study also does not distinguish between different road types, such as open/closed, reclaimed, brushed in, hydrologically stabilized, etc. Different road types are typically susceptible to different levels of erosion, which could lead to compounding error when using the values found in *Quigley et al 1997* as a baseline for any analysis of potential road impacts throughout the project area on State trust lands.

As described above, road densities are not an appropriate measure or surrogate for analyzing potential effects to bull trout populations throughout this project area. The objective stated by the commenter is presumably taken from the Bull Trout Interim Conservation Guidance *(USFWS 1998)*, which is not intended to provide site-specific land-management prescriptions. Although DNRC may take steps to reduce sedimentation from existing roads by implementing BMPs, removing several deteriorating log and earthen stream crossings, and relocating segments of road away from stream channels, DNRC is under no obligation to adhere

The ECA model outputs are also inadequate to disclose the effects of the alternatives and cumulative effects on peakflows and resultant impacts on aquatic resources, because the model estimates changes in <u>average monthly</u> peakflow caused by logging and roads. Does the DEIS's analysis only discusses cumulative and alternative effects on these average monthly peakflows? King (1989) clearly noted that estimates of average monthly peakflows triggered by logging and roads are not adequate for estimating likely changes in channel conditions and sediment transport caused by logging and roads. He noted:

…the largest 7 or 8 days of streamflow account for the majority of the bedload movement…Average monthly streamflows are usually not a good index of bedload transport, and 'changes in average annual monthly peakflows have no meaningful effect on sediment transport' (Megahan, 1979) and are thus poor indicators of changes in channel-forming flows.

King (1989) also stated:

> **Thus, it is the relatively few <u>high flow days</u> that have the potential for shaping the channel. Increases in <u>short duration high flows</u> following harvesting and road building are more important in terms of potential channel erosion and bedload transport than increases in longer duration high flows such as the <u>maximum mean monthly streamflows…</u> (emphasis added).**
>
> **Therefore, increases in short-duration highflows are more important than longer duration highflows in shaping the channel, and any procedure to estimate streamflow responses and set limits on harvesting should focus on these shorter duration highflows.**

to or meet the objectives outlined in the *Bull Trout Interim Conservation Guidance (USFWS 1998).*

In his summary, *King (1989)* states, "The ECA procedure currently estimates streamflow responses in third- to fifth-order watersheds and does not directly consider hydrologic responses in smaller headwater streams." In the introduction of the *King (1989)* study, the author states, "This analysis will be used to describe the peakflow responses for small south-facing watersheds. These results cannot be used to improve any relationship in the ECA procedure because the procedure is usually applied to much larger watersheds." *Under the Peak Streamflows* section, *King (1989)* states, "The modifications in maximum monthly streamflow from the Horse Creek watersheds with harvest units and roads cannot be compared with predicted responses in the ECA procedure because of the small size of the Horse Creek areas. The ECA procedure was developed for much larger watersheds and does not consider modifications in streamflow in headwater basins." These statements show that the author is continually reminding the reader that the model being critiqued is not designed to show results in small first-order watersheds. It is not surprising that ECA model results underestimated water-yield increases to first- and second-order watersheds ranging in size from 58 acres to 364 acres. The ECA model is designed for third- to fifth-order watersheds ranging in size from several thousand acres to 50,000 acres. At small scales of analysis, water-yield increases would be more pronounced. Use of the ECA model on areas over 50,000 acres would also yield inaccurate results with impacts being "washed out" by an area larger than the model is designed to approximate. Choosing the appropriate scale of analysis and finding the proper tool to accomplish that analysis is an important step in a watershed assessment and comparison of expected watershed impacts. The primary purpose of any water-yield model is to simplify extremely complex natural systems, not to provide precise or exact quantities of expected results.

King (1989) clearly indicates that the estimates of effects on average monthly peakflows is inadequate for determining the effects of the alternatives and cumulative effects on peakflows and resultant impacts on channel erosion, bedload transport, sedimentation, bank erosion, fish habitat, fish survival, and downstream flooding impacts. Certainly, the lack of models' proven reliability and validity indicate the need for an alternative that would create no more of the WQLSs' probable sources and probable causes, which include sediment induced by logging, road building, and simply the present road conditions.

The DEIS's analysis of changes in monthly peakflow is not a surrogate for estimates of daily and instantaneous peakflows triggered by the alternatives and in combination with the cumulative effects of the existing road network and past logging. These peakflow attributes, which are ignored in the EIS, are most important for determining the likely effects on channels and sediment transport triggered by logging and roads (King, 1989). Average peakflows are not of greatest concern. Sediment transport and channel change are greatly affected during extreme events.

The ECA model relies on climatic conditions averaged over long periods. Therefore, the model is less reflective of individual drought or flood years. The ECA model is intended for use to develop a baseline condition (fully forested), describe the changes caused by past management (existing conditions), and compare each of these to anticipated changes from the alternative proposals. Peak-flow events are included in the climatic data used to establish the baseline, but are not directly and separately considered since they relate primarily to meteorological phenomena that are outside the scope of this analysis.

Within portions of this region, rain-on-snow (ROS) events during the fall, winter and spring months have been found to be a dominant mechanism causing peak flows (MacDonald and Hoffman, 1995). The DEIS fails to disclose that the modeling the DEIS relies upon does not estimate the effects of ROS events and other instantaneous peak flow events, which the DEIS itself discloses may result in significant damage to project area watersheds.

As stated in the *DEIS (APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS, pages C-5* through *C-8)* each of the action alternatives would reduce the sediment load to the West Fork of Swift Creek and Swift Creek. Please see the 2 prior responses in addressing the validity of the ECA model.

Another major problem with the water models, such as the ECA, is that they fail to take into account the extreme peak flow increases due to the high density of roads in the project area. Kootenai National Forest Hydrologist Steve Johnson, states, "Impacts from roads basically fall into three areas: introduced sediment into streams; snowmelt re-direction and concentration; and surface flow production." (Johnson, 1995)

Johnson (1995) discusses how "snowmelt re-direction and concentration and surface flow production" increase peak flow amounts <u>multiplicatively</u> by the presence of roads in a drainage. The DEIS fails to acknowledge the degree to which roads increase peak flows <u>above the amounts models estimate</u>.

Stream-channel stability is one of the primary factors in determining the resistance of a stream channel to resist degradation during high-flow events. As discussed in the *DEIS (APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS, pages C-1* through *C-4)*, channel stability was assessed in the project area, and allowable water-yield increases were set based on these assessments, watershed sensitivity, and acceptable risk. In his *Summary and Recommendations* section, *King (1989)* stated, "...the results would indicate that harvesting in low-order watersheds that have channel conditions that may be sensitive to increases in short duration peakflows should proceed on a conservative basis. In many instances, the channels may be stable enough to withstand fairly large increases in short duration peakflows without any channel alteration." In addition, *MacDonald and Hoffman (1995)* state, "...there was no apparent correlation between the magnitude of peak flows and the amount of forest harvest," and further, "It appears that local climatic conditions are the dominant control of the magnitude of peak flows."

Johnson (1995) adds, "For the roads we no longer actively use, our dwindling road maintenance budget will make it

difficult to maintain the culvert crossings. When these fail during storm and runoff events, tremendous amounts of sediment can be delivered directly to the channel and from there down to lower streams with significant beneficial uses such as sensitive fish habitat." The DEIS fails to disclose the significance of any foreseeable lack of maintenance, and the direct, indirect and cumulative effects poorly maintained roads have on water quality.

Johnson (1995) also pointed out that an old road design that utilized ditches on the inside of the road greatly increases drainage efficiency, causing peak flows to go far beyond any modeled predictions. The very existence of the current road network is causing major water quality impacts.

It is totally misleading to state that BMPs will assure water quality will be maintained, when present conditions are already in violation of the standards. BMPs were either ineffective or must have been violated—which is it?

The failure of BMPs is obviously implicated in this watershed. Beschta et al. (2004) state:
It is perhaps widely accepted that "best management practices" (BMPs) can reduce damage to aquatic environments from roads. Time trends in aquatic habitat indicators indicate, however, that BMPs fail to protect salmonid habitats from cumulative degradation by roads and logging (Espinosa et al. 1997.) Ziemer and Lisle (1993) note a lack of reliable data showing that BMPs are cumulatively effective in protecting aquatic resources from damage.

While it is agreed that rain-on-snow events have the potential to alter stream channels, the occurrence duration and intensity of these events cannot be predicted. Meteorological phenomena, such as droughts, high precipitation, and warm spells (winter or summer), are difficult to model more than several days in advance. It would be nearly impossible to model these events for any given year with statistical accuracy. It is, therefore, infeasible to include such phenomena in a water-yield model. The results of the anticipated average annual water-yield changes as a result of the proposed project are reported in the ***DEIS (APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS, pages C-9*** through ***C-11).***

The water-yield analysis ***(DEIS, APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS, pages C-9*** through ***C-11)*** has incorporated the expected water-yield increases from all past activities, including the existing road system. The ECA spreadsheet used in this analysis doubles the percent of increase on roads that is assigned to clearcut equivalents. These values are incorporated into the numbers reported in the ***DEIS, (APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS).***

Through ARM 36.11.421, DNRC will manage roads to minimize maintenance, maintain roads commensurate with expected road use and appropriate resource protection, and inspect road conditions on both restricted and open roads every 5 years. Maintenance needs are prioritized

The DEIS failed to provide a genuine watershed-wide cumulative effects analysis for Swift Creek.

The DEIS fails to disclose the sediment yield due to simply increase use of the roads due to logging and administrative traffic. From an investigation of the Bitterroot Burned Area Recovery Project, hydrologist Rhodes (2002) notes, "On all haul roads evaluated, haul traffic has created a copious amounts of mobile, non-cohesive sediment on the road surfaces that will elevate erosion and consequent sedimentation, during rain and snowmelt events."

The DEIS does not provide any analysis of the synergistic cumulative effects of openings created by roads and logging. This includes their spatial relations, their juxtaposition, considering such factors as slope, road drainage system condition, aspect, elevation, etc.

There is inadequate disclosure of the present and expected levels of fine and bedload sediment transport and deposit for analysis area streams. The present conditions concerning the two are not distinguished from each other in terms of cumulative effects.

and funding may come from the FI program, grants, or be incorporated into planned projects such as timber sales or permits.

The effects to water quality are displayed in the *DEIS (APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS, pages C-5* through *C-8).*

The water-yield analysis *(DEIS, APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS, pages C-9* through *C-11)* has incorporated the expected water-yield increases from all past activities, including the existing road system. The ECA spreadsheet used in this analysis doubles the percent of increase on roads that is assigned to clearcut equivalents. These values are incorporated into the numbers reported in the *DEIS (APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS).*

The *2002 Forestry BMP Audit Report* found a 97 percent effectiveness rate for all practices in State-wide audits and a 99 percent effectiveness rate for practices on DNRC timber sales. In addition to standard BMPs, the *DEIS (APPENDIX C – WATERSHED AND HYDROLOGY ANALYSIS, pages C-5 through C-8)* discloses the anticipated impacts of BMPs and other improvements and repairs to existing sediment sources in the proposed project area. All of the existing roads in the proposed project area were constructed prior to the development of BMPs, and most have not been used for timber management since the adoption of BMPs. Road segments that have been used since the adoption of BMPs have had applicable measures applied in order to reduce sediment delivery. For these reasons, the BMPs have not failed or been violated, they were neither applied nor required at the time of use. If BMPs at individual sites lead to reductions in sediment delivery, it stands to reason that cumulatively BMPs are protecting and, in some cases, improving water quality.

The DEIS does not utilize up-to-date fish population surveys and surveys of fish habitat conditions. The DEIS cites no population or inventory or monitoring data for the native fish species at issue in the project area or for Swift Creek as a whole. Distribution, status and population trends have not been determined.

A definition of the analysis area is found in the DEIS (APPENDIX C-WATERSHED AND HYDROLOGY ANALYSIS, page C-2); the cumulative-effects analysis is found on pages C-7 through C-11.

In the sediment-yield analysis, loss of vegetation from road surfaces was accounted for on all roads proposed for log hauling according to procedures detailed in *the DEIS (APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS, page C-1).*

Through *ARM 36.11.421,* DNRC will manage roads to minimize maintenance, maintain roads commensurate with expected road use and appropriate resource protection, and inspect road conditions on both restricted and open roads every 5 years. Maintenance needs are prioritized and funding may come from the FI program, grants, or incorporated into planned projects such as timber sale or permits.

The water-yield analysis conducted includes both logging units and roads constructed. The water-yield analysis procedures are described in the DEIS, APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS, pages C-1 and C-2. The ECA model includes the precipitation zone when calculating existing conditions and estimating the effects of proposed management on both existing and proposed harvesting and roads. The condition of the road drainage system is considered in the DEIS, CHAPTER II, pages II-18 and II-19; CHAPTER III, pages III-12 through III-15; and APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS, pages C-3 through C-8.

The *DEIS (APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS, pages C-3* through *C-8)* disclose the current and expected levels of fine sediment delivered to streams. As reported, fine-sediment levels are expected to decrease as a result of the proposed action alternatives. Likewise, with a reduction in sediment delivery to streams, bedload sediment would also be reduced from current levels.

Why does the DNRC not survey for fry emergence as suggested by Rieman and McIntyre, 1993 (cited in the DEIS) since that is such an important factor for maintaining populations?

Has the DNRC validated its modeled sediment estimates vs. the amounts measured at monitoring stations?

The DEIS fails to disclose the risk of resulting chronic watershed impacts of continuing sub-standard roads. Even if all roads were to be brought up to BMP standards, maintenance will be needed in following years, with uncertain funding to achieve it.

The DEIS does not disclose the degree to which commitments for watershed restoration, road maintenance, and road obliteration will be completed in a reasonable time frame, which means that project activities could simply cause additional damage to project area streams and the money for road work will run out even though watershed-

The fisheries analysis portion has compiled and described all known up-to-date fish population surveys for the project area. The DEIS (APPENDIX E - FISHERIES ANALYSIS, TABLE D-1 - BULL TROUT POPULATION ESTIMATES IN WEST FORK SWIFT CREEK, 1995 THROUGH 2003) **describes bull trout population estimates from DFWP in West Fork from 1995 through 2003. Up-to-date redd count data from DFWP, which is one indicator of general fish populations trends, has also been used for both bull trout and westslope cutthroat trout population assessments in the West Fork. Up-to-date quantitative R1/R4 data for describing fish habitat conditions in the West Fork is detailed in** ***DEIS (APPENDIX E - FISHERIES, TABLE D-3 - R1/R4 FISH HABITAT STANDARD INVENTORY RESULTS FROM THE WEST FORK SWIFT CREEK [KOOPAL 2001]).*** **Other recent assessments of fish habitat conditions are described in the habitat variables sections for the Existing Conditions of both Stryker and Johnson creeks.**

Population, inventory, and monitoring data for bull trout and westslope cutthroat trout was not compiled and analyzed for the main stem of Swift Creek. In respect to fisheries, the main stem of Swift Creek is downstream and well outside of the project area, and this higher order reach was determined to have a large order of differential spatial magnitude compared to those fish-bearing streams within the project area. Therefore, the effects analysis for the fisheries portion of the DEIS is limited in scope to those fish-bearing streams within the project area where a reasonably accurate effects analysis could be conducted.

Within the fisheries-analysis portion of the ***DEIS (APPENDIX E - FISHERIES ANALYSIS)*** **bull trout and westslope cutthroat trout distribution, status, and population trends have been identified in the** ***Existing Conditions*** **section for the West Fork and Stryker and Johnson creeks using current data that was logistically and financially available for the project area.**

damaging logging will go on.

The DEIS acknowledges that skidding could negatively effect 12.4% to 14% of each cutting unit. (p. III-17). Yet there is no cumulative effects analysis of land base compacted and/or negatively impacted from past roading and logging nor an analysis of how these negative soil impacts affect productivity.

The DEIS does not disclose how past management has impacted soil productivity in the project area. There is nothing in the DEIS that itemizes the various kinds and levels of soil damage in the various disturbed sites from past logging activities in the watershed. While representing its management as "sustained yield" the DNRC really has no idea how its heavy-handed timber management has, or will, affect timber production in the second, third, and later rotations on school trust land. The DNRC is, in effect, spending the school trust's "capital" while somehow expecting the "interest" (timber yields) to remain constant. This makes no sense whatsoever.

The DNRC is avoiding the entire issue of maintaining soil productivity. The Forest Service's Northern Region (FSM 2500-99-1) defines "Soil Function" thus:

> **Primary soil functions are: (1) the sustenance of biological activity, diversity, and productivity, (2) soil hydrologic function, (3) filtering, buffering, immobilizing, and detoxifying organic and inorganic materials, and (4) storing and cycling nutrients and other materials.**

Grier and others (1989), adopt as a measure of soil produc-

DNRC is responsible for the management of State trust lands, and DFWP is responsible for conducting various fish-population surveys, such as fry emergence surveys. That is the reason DNRC does not survey for fry emergence. DNRC has ongoing interagency agreements to logistically and financially support many of the various fish population surveys that DFWP conducts on trust lands, including those within the project area.

The sediment-modeling procedure used in the DEIS is a model; values are not intended as absolute values, but rather as a comparison between the current situation and the proposed action alternatives. The methodology used was initially developed by the *Washington Forest Practice Board (1997)*, and is a quantifiable, repeatable process with values and coefficients based on field research and extrapolated to the project area. Water-quality monitoring sites would not be able to distinguish the levels of total suspended solids attributed to the road system from the natural background levels of total suspended solids in the project area watersheds.

Through *ARM 36.11.421*, DNRC will manage roads to minimize maintenance, maintain roads commensurate with expected road use and appropriate resource protection, and inspect road conditions on both restricted and open roads every 5 years. Maintenance needs are prioritized and funding may come from the FI program, grants, or be incorporated into planned projects such as timber sales or permits.

The DEIS *(CHAPTER II, page II-2)*, indicates that BMP improvements on roads would be made prior to hauling logs over them. The timing of restoration activities, road maintenance, and road reclamation would be described in Contract Agreements with DNRC. Stipulations found in *APPENDIX A - STIPULATIONS AND SPECIFICATIONS* would be followed. The financing of those projects covered under the *TIMBER SALE AGREEMENT* are the responsibility of the Purchaser, and the administration of the timely implementation associated with the contract is DNRC's responsibility.

tivity: "the total amount of plant material produced by a forest per unit area per year." (P. 1.) And "Soil Quality" is defined as "The capacity of a specific soil to function within its surroundings, support plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation." (USFS Northern Region FSM 2500-99-1.)

Further, the scientific adequacy of the DNRC's methodology for maintaining soil productivity has never been demonstrated. This includes BMPS and all the mitigation measures proposed. They've never been validated as to protecting the productivity of the land. And BMP monitoring does not even attempt to measure post-project soil productivity, since the audits are not scientifically designed to do so.

The chemical and biological make-up of the specific soils in the project area, and their ability to withstand detrimental disturbance that lowers soil productivity is not a subject adequately taken up by the DEIS. Harvey et al., 1994 state:

> **The ...descriptions of microbial structures and processes suggest that they are likely to provide highly critical conduits for the input and movement of materials within soil and between the soil and the plant. Nitrogen and carbon have been mentioned and are probably the most important. Although the movement and cycling of many others are mediated by microbes, sulfur phosphorus, and iron compounds are important examples.**
>
> **The relation between forest soil microbes and N is striking. Virtually all N in eastside forest ecosystems is biologically fixed by microbes... Most forests, particularly in the inland West, are likely to be limited at some**

Refer to the updated soils analysis for data on existing harvest impacts in the proposed project area. The analysis has been revised to report results of the aerial photo interpretation in addition to the field verification of the condition of the existing skid-trial system.

DNRC recognizes the potential negative effects of excessive soil displacement, compaction, and erosion. Moderate levels of ground disturbance of surface litter is desired to promote regeneration. Detrimental soil impacts are soil displacement (when duff and mineral soils are removed) and where that area combined with other impacts (erosion, compaction) exceeds 15 percent of the harvest unit.

> **time during their development by supplies of plant-available N. Thus, to manage forest growth, we must manage the microbes that add most of the N and that make N available for subsequent plant uptake. (Internal citations omitted.)**

Adams and Froehlich (1981) provide reasons why impacts beyond directly compacted skid trails must be considered in any reasonable definition of soil productivity:

> Since tree roots extend not only in depth but also in area, the potential for growth impact also becomes greater as compaction affects more of the rooting area. In a thinned stand, for example, you can expect the greatest growth impacts in residual trees that closely border major skid trails or that have been subject to traffic on more than one side of the stem.

In other words, tree growth outside skid trails—beyond the compacted area—is detrimentally affected. This is ignored by the DNRC.

For a study done on the Kootenai and Flathead National Forests, soil scientists measured soil bulk densities, macropore porosities, and infiltration rates using paired observations of disturbed vs. undisturbed soils. They discovered that although "the most significant increase in compaction occurred at a depth of 4 inches… some sites showed that maximum compaction occurred at a depth of 8 inches… (and) Furthermore, ... subsurface compaction occurred in glacial deposits to a depth of at least 16 inches." (Kuennen, Edson, and Tolle, 1979.) The DNRC does not have enough soil bulk density and other compaction monitoring data col-

Since 1998, DNRC has required timber-harvest projects to retain proportions of coarse woody debris and fine litter for nutrient cycling and wildlife needs. DNRC's goals for coarse-woody-debris levels are based on research by *Graham et al, 1994.*

Graham, Russell T.; Alan E. Harvey; Martin F. Jurgensen, Theresa B. Jain, Jonalea R. Tonn, and Deborah S. Page-Dumroese. 1994. Managing coarse woody debris in forests of the Rocky Mountains. Research Paper INT—RP-477. Moscow, ID: U.S. Department of Agriculture, Forest Service, Intermountain Research Station; 1994.

lected at the adequate soil depths and in enough sites on the Stillwater State Forest to be able to make accurate predictions about the effects of soil compaction.

Following another study carried out on the Kootenai NF and the Flathead NF, Cullen et al. (1991) concluded: "This result lends support to the general observation that most compaction occurs during the first and second passage of equipment." And Page-Dumroese (1993), in a research report investigating logging impacts on volcanic ash-influenced soil in the Idaho Panhandle NF, states, "Moderate compaction was achieved by driving a Grappler log carrier over the plots twice." Page-Dumroese (1993) also cited other studies that indicated: "Large increases in bulk density have been reported to a depth of about 5 cm with the first vehicle pass over the soil." Williamson and Neilsen (2000) assessed change in soil bulk density with number of passes and found 62% of the compaction to the surface 10cm to come with the first pass of a logging machine. In fine textured soils Brais and Camire (1997) demonstrated that the first pass creates 80 percent of the total disturbance to the site.

DNRC recognizes the finding of the Kootenai study and extensive research related to soil impacts and design of mitigation measures intended to minimize excessive impacts and to verify the effects analysis. Previous studies have not quantified a direct effect based on distance to skid trails, but it is likely the trees near skid trails have a portion of their root systems that can be impacted and could result in reduced growth. Design of harvest plans and mitigation measures are intended to control the area of impacts to less than 15 percent of the area in detrimental soils through design of silvicultural treatments and skid-trail planning. Higher levels of soil impacts can occur if BMPs and mitigation measures are not implemented.

DNRC has completed postharvest soil monitoring on

Adams and Froehlich (1981) state, "Unfortunately, little research has yet been done to compare the compaction and related impacts caused by low-pressure and by conventional logging vehicles."

The Forest Service's Northern Region recognizes that soil quality standards must be validated. FSM 2500-99-1 recognizes that managers must:

Assess … whether (soil quality standards) are effective in maintaining or improving soil quality;

Evaluate the effectiveness of soil quality standards and recommend adjustments …

Consult with soil scientists to evaluate the need to adjust management practices or apply rehabilitation measures.

Page-Dumroese et al. (2000) emphasize the importance of validating soil quality standards using the results of monitoring:

> Research information from short- or long-term research studies supporting the applicability of disturbance criteria is often lacking, or is available from a limited number of sites which have relative narrow climatic and soil ranges. …Application of selected USDA Forest Service standards indicate that blanket threshold variables applied over disparate soils do not adequately account for nutrient distribution within the profile or forest floor depth. These types of guidelines should be continually refined to reflect pre-disturbance conditions and site-specific information. (Abstract.)

The DEIS relies upon mitigation measures and vague soil restoration measures, yet fails to disclose the reliability of those measures for actually protecting soil productivity and water quality.

Grier et al. (1989), cite a study finding "a 43-percent reduction in seedling height growth in the Pacific Northwest on primary

similar soils on Stillwater Unit. The results of this monitoring showed a range of soil impacts from 9 percent of the harvest area *(Lower Stillwater Timber Sale)* to 12.4 percent of the harvest area *(Chicken Werner* and *Ewing Extension timber sales)* when BMPs were implemented. DNRC has also completed soil monitoring State-wide to determine impacts of timber harvesting to many soil properties, including bulk density, displacement, and erosion. DNRC would implement BMPs and site-specific mitigation measures to minimize soil impacts on the proposed harvest project. DNRC has been, and continues to be, a lead agency at implementation of soil mitigation measures in timber sale contracts. These measures include, but are not limited to, the following: limits on season of operations to dry or winter conditions, slope restrictions on ground-based equipment, skid-trail planning to control the area of effect.

skid trails relative to uncompacted areas" for example. And in another report, Adams and Froehlich (1981) state:

> Measurements of reduced tree and seedling growth on compacted soils show that significant impacts can and do occur. Seedling height growth has been most often studied, with reported growth reductions on compacted soils from throughout the U.S. ranging from about 5 to 50 per cent.

Alexander and Poff (1985) reviewed literature and found that as much as 10% to 40% of a logged area can be disturbed by skyline logging. They state:

There are many more data on ground disturbance in logging, but these are enough to indicate the wide diversity of results obtained with different equipment operators, and logging techniques in timber stands of different composition in different types of terrain with different soils. Added to all these variables are different methods of investigating and reporting disturbance.

In sum, the DEIS does not rely upon scientifically credible data or analysis, yet proposes more soil disturbance, resulting in unknown reductions in soil productivity.

A big problem is the DNRC's failure to deal forthrightly with the noxious weed problem. The long-term costs are never adequately disclosed or analyzed. The school trust is

Resource professionals evaluate through timber sale administration and on-site reviews the reliability of mitigation measures to protect soil productivity. In addition, past and ongoing soil monitoring efforts by DNRC evaluate the reliability of soil mitigation measures. Data on effectiveness of BMPs State-wide may be found in the *Forestry BMP Audit Report (DNRC, 1990, 1992, 1994, 1996, 1998, 2000, 2002, 2004).*

expected to continuously foot the bill for noxious weed treatments—the need for which increases yearly as the DNRC continues the large-scale propagation of weeds, and fails to monitor the effectiveness of its noxious weed treatments.

A component of the DEIS that is noticeably missing is a cumulative impacts analysis for all of the above resource concerns. This timber sale is not occurring in an area without past impacts from logging and road building. MEPA requires an evaluation of cumulative (defined as: the collective impacts on the human environment of the proposed action when considered in conjunction with other past and present actions related to the proposed action by location or generic type) and secondary (defined as: a further impact to the human environment that may be stimulated or induced by or otherwise result from a direct impact of the action) impacts on the physical environment. Such analyses are extremely inadequate in this DEIS.

According to *ARM 36.11.420 (1)*, "The department shall design all prescribed silvicultural treatments to maintain the long-term productivity of the site in order to ensure the long-term capability to produce trust revenue." DNRC reviews soils data and past effects to design mitigation measures to limit the area and degree of soil impacts and promote healthy forests. DNRC reviews ongoing harvesting activities to ensure implementation of mitigation measures and continues to monitor soil effects on a portion of completed timber harvest projects. Soils evaluations begin with review of mapped soil types. Through on-site field reviews, resource professionals then consider site variables, limitations, and appropriate mitigation measures. Expected effects are then compared with monitoring and research to ensure protection of soil productivity.

The economics analysis is completely inadequate. There is no itemized disclosure of costs vs. benefits, nor discussion.. In other words, you should give consideration to, and adequately document, who benefits by these projects and who "pays" for them. We ask that all costs and benefits be itemized in the analysis, so the pubic can see these figures.

Net public benefit is determined by numerous inputs and outputs, some of which are quantifiable and others which are more qualitative. Economic analysis can provide a use-

DNRC shares the concern of noxious-weed infestations and control of those infestations with county weed districts and the public. Weeds are limited to spot infestations in the project area. Means to mitigate or minimize the chances of noxious weeks becoming established on the proposed timber sale project area

ful basis for evaluation only if the economic evaluation is comprehensive and documents all costs and benefits related to the proposed action. We would like the analysis to:
(1) Insure that the economic analyses are meaningful, by including in the analyses both direct and induced costs;
(2) Adequately assess all current, in-place benefits;
(3) Include impacts to hunter opportunity and other forms of recreation (how will the proposed project impact the quality of backcountry hiking, for example?);
(4) Quantify all induced losses to outfitters and guides who may currently derive economic benefits from the areas;
(5) Consider all costs related to the projects, including the costs of preparing the analyses, all specialist support and consultation, costs associated with travel management and administration, road construction and engineering expenses, weed control, reforestation and planting, stand exams, timber stand improvement, and all other costs.

It is our intention that you include in the record and review

are described in *APPENDIX A - STIPULATIONS AND SPECIFICATIONS, page A-5,* and *ARM 36.11.445.*

DNRC's noxious-weed program categorizes species with various goals and methods for control consistent with the County Weed District agreement. Stillwater Unit's noxious week coordinator monitors the noxious weed situation, especially new invader species, in order to prioritize and implement control measures.

The cumulative impacts of logging and road building in the analysis area were adequately considered and discussed in several places in the *DEIS*, including *APPENDIX B - VEGETATION ANALYSIS; APPENDIX C - WATERSHED AND HYDROLOGY ANALYSIS; APPENDIX D - SOILS ANALYSIS; APPENDIX E - FISHERIES ANALYSIS; APPENDIX F - WILDLIFE ANALYSIS; and APPENDIX G - ECONOMIC ANALYSIS.* Cumulative impacts were addressed in a manner appropriate for the scope and issues developed in the *DEIS*.

An analysis is made of relevant "local" costs in the *DEIS (APPENDIX G - ECONOMIC ANALYSIS, pages G-3* through *G-8*). This analysis is directed primarily to look quantitatively at estimated direct impacts of the sale on the trusts and, to a lesser extent, on the local community. Some cost and benefits, particularly when they relate to indirect issues, are dealt with qualitatively *(DEIS, APPENDIX G - ECONOMICS ANALYSIS, pages G-6* and *G-7).* In a recent State court ruling, Judge Sherlock, in his Order Granting Summary Judgment *(#BDV-2003-527),* determined that DNRC did not have an obligation to do individual sale accounting. Consequently, the analysis of the estimated revenues and costs from the sale are based on broad averages in order to ensure that, on average, DNRC can expect to

all of the literature and other incorporated documents we've cited herein. Please contact us if you have problems locating copies of any of them. Thank you for your attention to these concerns. Please keep each organization on your list to receive further mailings on the proposal.

We conclude this comment letter with this passage from Frissell and Bayles (1996):

> Most philosophies and approaches for ecosystem management put forward to date are limited (perhaps doomed) by a failure to acknowledge and rationally address the overriding problems of uncertainty and ignorance about the mechanisms by which complex ecosystems respond to human actions. They lack humility and historical perspective about science and about our past failures in management. They still implicitly subscribe to the scientifically discredited illusion that humans are fully in control of an ecosystemic machine and can foresee and manipulate all the possible consequences of particular actions while deliberately altering the ecosystem to produce only predictable, optimized and socially desirable outputs. Moreover, despite our well-demonstrated inability to prescribe and forge institutional arrangements capable of successfully implementing the principles and practice of integrated ecosystem management over a sustained time frame an at sufficiently large spatial scales, would-be ecosystem managers have neglected to acknowledge and critically analyze past institutional and policy failures. They say we need ecosystem management because public

show a net benefit to the trusts from its sale activities. Induced or secondary effects are based on the estimates derived from averages. No attempt is made to do the individual sale accounting as suggested by the comments.

Based on the above discussion and the DEIS documents, where it is relevant:

1) **The economic analysis is meaningful and the analysis includes a direct-effects analysis as well as an indirect-effects analysis *(DEIS, APPENDIX G - ECONOMICS ANALYSIS, page G-3, TABLE G-3 - ESTIMATED REVENUES AND EXPENDITURES FROM THE WEST FORK OF SWIFT CREEK TIMBER SALE PROJECT; and page G-4, TABLE G-4 - NUMBER OF STUDENT SUPPORTED BY 1 YEAR OF ESTIMATED REVENUE).***

2) **The analysis assesses all relevant current 'in-place' benefits.**

3) **Recreational benefits and costs, including those associated with hunting, are discussed *(DEIS, APPENDIX G - ECONOMICS ANALYSIS, page G-6, Nonmarket Issues).***

4) **All costs needed to do the required analysis are considered (DEIS, APPENDIX G - ECONOMICS ANALYSIS, page G-3, TABLE G-3 - ESTIMATED REVENUES AND EXPENDITURES FROM THE WEST FORK OF SWIFT CREEK TIMBER *SALE PROJECT).***

The purpose of DNRC timber sales is to provide revenue to the trust, and, as a means of accomplishing this objective, to maintain forest health and biodiversity. This is the premise of the Omega Alternative **identified in the *State Forest Land Management Plan,* and it is at this programmatic level that the broader net benefits of the program are analyzed. As a result, the DEIS analysis focuses on the net benefits to the trust, forest health, and biodiveristy and considers other net benefits as external to the primary requirements of the DEIS.**

DNRC acknowledges the reference listing forwarded to us; your use makes them part of the record.

> opinion has changed, neglecting the obvious point that public opinion has been shaped by the glowing promises of past managers and by their clear and spectacular failure to deliver on such promises.

Sincerely,

/s/

Jeff Juel

And on behalf of:
Michael Garrity
Alliance for the Wild Rockies
P.O. Box 505
Helena, Montana 59624
406-459-5936

Literature cited

Adams, P.W, and Froehlich, H.A. 1981. Compaction of Forest Soils, PNW-217, Pacific Northwest Extension Publication.

Aho, P. E., G. M. Filip and F. F. Lombard. 1987. Decay fungi and wounding in advance grand and white fir regeneration. Forest Science 33: 347-355.

Alexander, E.B., and R. Poff. 1985. Soil disturbance and compaction in wild-land management. USDA Forest Service, Pacific Southwest Region, Earth Resources Monogr. 8. 157 p.

Beschta, Robert L., Jonathan J. Rhodes, J. Boone Kauffman, Robert E. Gresswell, G. Wayne Minshall, James R. Karr, David A. Perry, F. Richard Hauer and Christopher A. Frissell. 2004. Postfire Management on Forested Public Lands of the Western United States. Conservation Biology, Vol. 18, No. 4, August 2004, Pages 957-967.

Brais, S. and C. Camire. 1997. Soil compaction induced by careful logging in the claybelt region of northwestern Quebec (Canada). Can. J. Soil Sci. 78:197-206.

Bull, E., K.B. Aubrey, and B.C. Wales, 2001. Effects of Disturbance on Forest Carnivores of Conservation Concern in Eastern Oregon and Washington. Northwest Science. Vol 75, Special Issue, 2001.

Bull, Evelyn L. and Arlene K. Blumton, 1999. Effect of Fuels Reduction on American Martens and Their Prey. USDA Forest Service Department of Agriculture, Pacific Northwest Research Station, Research Note PNW-RN-539, March 1999.

Bull, Evelyn L., Catherine G. Parks, and Torolf R. Torgersen, 1997. Trees and Logs Important to Wildlife in the Interior Columbia River Basin. Gen. Tech. Rep. PNW-GTR-391. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 55p.

Center for Biological Diversity, 2004. Petition To The Northern And Intermountain Regions Of The U.S. Forest Service To Amend National Forest Plans To Protect The Northern Goshawk. Center for Biological Diversity, Alliance for the Wild Rockies, Biodiversity Conservation Alliance, Friends of the Clearwater, Idaho Conservation League, Wyoming Wilderness Association.

Chavez, T. D., R. L. Edmonds and C. H. Driver. 1980. Young-growth western hemlock stand infection by Heterobasidion annosum 11 years after precommercial thinning. Canadian Journal of Forest Research 10: 389-394.

Cherry, M.B. 1997. The Black-Backed And Threetoed Woodpeckers: Life History, Habitat Use, And Monitoring Plan. Unpublished Report. On File With: U.S. Department Of Agriculture, Lewis And Clark National Forest, P.O. Box 869, Great Falls, Mt 59403. 19 P.

Crocker-Bedford, D.C. 1990. Goshawk reproduction and forest management. Wildlife Society Bulletin; v. 18, no. 3, pp. 262-269.

Cullen, S.J., C. Montagne, and H Ferguson, 1991. Timber Harvest Trafficking and Soil Compaction in Western Montana. Soil Sci. Soc. Am. J., Vol. 55 (1416-1421), September-October 1991.

DellaSala, Dominick A., Anne Martin, Randi Spivak, Todd Schulke, Bryan Bird, Marnie Criley, Chris van Daalen, Jake Kreilick, Rick Brown, and Greg Aplet, 2003. A Citizen's Call for Ecological Forest Restoration: Forest Restoration Principles and Criteria. *Ecological Restoration*, Vol. 21, No. 1, 2003 ISSN 1522-4740

Dolan, P., 1998a, b. Email discussion with USFS Region One wildlife biologists regarding black-backed woodpecker and attached "Salvage of Burned Stands: Wildlife Considerations." On file at Lolo National Forest.

Edmonds, R. L., D. C. Shaw, T. Hsiang and C. H. Driver. 1989. Impact of precommercial thinning on development of Heterobasidion annosum in western hemlock. pp. 85-94 in Proceedings of the Symposium on Research and Management of Annosus Root Disease (Heterobasidion annosum) in Western North America. W. J. Otrosina and R. F. Scharpf, tech. coord. GTR-PSW-116. USDA Forest Service. Pacific Southwest Forest and Range Experiment Station.

Ercelawn, A. 1999. End of the Road -- The Adverse Ecological Impacts of Roads and Logging: A Compilation of Independently Reviewed Research. 130 pp. Natural Resources Defense Council. New York. Available online at: http://www.nrdc.org/land/forests/roads/eotrinx.asp

Ercelawn, A. 2000. Wildlife Species and Their Habitat: The Adverse Impacts of Logging -- A Supplement to End of the Road. 41 pp. Natural Resources Defense Council. New York. Available online at: http://www.nrdc.org/land/forests/eotrsupp.asp

Espinosa, F. A., Jr., J. Rhodes, and D. McCullough. 1997. The Failure of

Existing Plans to Protect Salmon Habitat in the Clearwater National Forest in Idaho. Journal of Environmental Management 49, 205-230p.

Filip, G. M. 1979. Root disease in Douglas-fir plantations is associated with infected stumps. Plant Disease Reporter 63: 580-583

Frissell, C.A. and D. Bayles, 1996. Ecosystem Management and the Conservation of Aquatic Biodiversity and Ecological Integrity. Water Resources Bulletin, Vol. 32, No. 2, pp. 229-240. April, 1996

Goheen, D. J. and E. M. Hansen. 1993. Effects of pathogens and bark beetles on forests. pp. 175-196 in Beetle-Pathogen Interactions in Conifer Forests. T.D. Schowalter and G.M. Filip, eds. Academic Press. San Diego.

Goheen, D. J., F. W. Cobb Jr., D. L. Wood and D. L. Rowney. 1985. Visitation frequencies of some insect species on Ceratocystis wageneri infected and apparently healthy ponderosa pines. Canadian Entomologist 117: 1535-1543.

Goheen, E. M. and D. J. Goheen. 1989. Losses caused by annosus root disease in Pacific Northwest forests. pp. 66-69 in Proceedings of the Symposium on Research and Management of Annosus Root Disease (Heterobasidion annosum) in Western North America. W. J. Otrosina and R. F. Scharpf, tech. coord. GTR-PSW-116. USDA Forest Service. Pacific Southwest Forest and Range Experiment Station.

Graham, Russell T.; Rodriguez, Ronald L.; Paulin, Kathleen M.; Player, Rodney L.; Heap, Arlene P.; Williams, Richard. 1999. The northern goshawk in Utah: habitat assessment and management recommendations. Gen. Tech. Rep. RMRS-GTR-22. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 48 p.

Green, P., J. Joy, D. Sirucek, W. Hann, A. Zack, and B. Naumann, 1992. Old-growth forest types of the northern region. Northern Region, R-1 SES 4/92. Missoula, MT.

Grier, C. C., K. M. Lee, N. M. Nadkami, G. O. Klock, & P. J. Edgerton, 1989 Productivity of Forests of the United States

RECEIVED
NOV 24 2004

Jane Adams
Montana Old Growth Project
1401 4th Avenue West
Kalispell, Montana 59901

Mike McMahon
Stillwater State Forest
P.O. Box 164
Olney, Montana 59927

November 20, 2004

Dear Mike,

Please accept these comments on the West Fork of Swift Creek Timber Sale DEIS.

The Montana Old Growth Project prefers alternative A or C, neither of which propose to harvest in old growth forest. We are strongly opposed to alternative B, which would harvest 286 acres of old growth by regeneration harvest method. The DEIS states that the harvest in area III (where the old growth is) would be so intense as to simulate a stand-replacing fire.

As your DEIS states, currently only 8,693 acres, or 8.7% on the Stillwater are currently old growth. Along with the harvest of old growth in nearby recent past and future sales, choosing alternative B would reduce the old growth on the Stillwater down to 8.2% of the forest. The DEIS neglected to report on historical estimates of old growth on the Stillwater State Forest or in **climatic section M333C, information which should be included in the FEIS for the public and the decision maker to consider. Historical estimates of old stands in Climatic Section M333C** average 29% for all cover types (Losensky 1997). DNRC's estimate of the amount of old growth historically existing on the Stillwater State Forest is 32% (DNRC 2000). Contrary to **statements made in the DEIS, harvesting this old growth WILL NOT move conditions towards historical conditions, but further away.**

The DEIS states that this timber sale was prepared under the philosophy of the State Forest Land Management Plan (SFLMP) and the guidance of the recently adopted Administrative Rules. **While the numerical old growth commitment of the SFLMP is not within the rules, both the SFLMP and the rules are clear on the basic philosophy regarding maintenance of biodiversity** and emulating historical conditions. Several sections in the administrative rules address old growth and historical conditions:

IV- BIODIVERSITY - COARSE FILTER APPROACH " ***The department shall promote biodiversity by taking a coarse filter approach thereby favoring an appropriate mix of stand structures and compositions on state lands***". The definition for coarse filter states "*A coarse filter approach assumes that if landscape patterns and process similar to those species evolved with are maintained, then the full complement of species will persist and biodiversity will be maintained*".

Your comments appear to be concerned with age classes of timber stands, particularly the older age class. Age-class distribution is discussed in the *DEIS, CHAPTER III, pages III-4, III-7,* and *III-8, APPENDIX B – VEGETATION ANALYSIS, pages B-4* and *B-9 through B-11*. However, some confusion regarding the terms "old stands" and "old growth" is evident in the comments and should be clarified.

In his compilation of an inventory conducted in the 1930s, *Lozensky* shows that 29 percent of the area within the M333C Climatic Section was classified as "old stands" (meaning they were older than 150 years and contained a minimum of 4 mbf per acre). In 2000, using the best available data, DNRC estimated that, on average, 32 percent of Stillwater Unit would have been in "old stands". At the time, DNRC used the definition for "old stands" from the *Lozensky* work as a surrogate for "old growth" because no estimates for naturally occurring amounts of "old growth" were available. Thirty-two percent of Stillwater Unit would have historically met DNRC's then-current definition of "old growth", which were "stands with a substantial overstory component of trees 150 years old and older and with a minimum of 4 mbf per acre". Lodgepole pine stands were only required to be 140 years old to meet the definition.

In 2003, 48 percent of the area on Stillwater Unit was in the older age class (*DEIS, APPENDIX B – VEGETATION ANALYSIS, page B-4*). This, too, is an estimate of "old stands" and not "old growth". The estimate is directly comparable to the 29 and 32 percent of "old stands" discussed in the preceding paragraph whereas the amount of "old growth" described in the DEIS is not directly comparable due to the different definitions.

DNRC's definition of old growth is now based upon *Green et al.*, and there is no direct link to estimating naturally occurring old-growth amounts based on the current definition. DNRC's current old-growth definitions are described in *ARM 36.11.403.48*.

VII - BIODIVERSITY - MANAGEMENT ON BLOCKED LANDS: "*Within areas of large blocked ownership, the department shall manage for a desired future condition that can be characterized by the proportion and distribution of forest types and structures historically present on the landscape*".

XVIII - BIODIVERSITY - OLD GROWTH MANAGEMENT "*Stand age distributions, including old growth, shall be evaluated and managed as described in New Rules VII and XVI based on the patterns historically present on the landscape as a result of natural disturbances.*

It appears to me that there is no justification for harvesting old growth on the Stillwater when the current amount of old growth is only about one-fourth of the historical amount. Given the philosophy and guidance of the SFLMP and rules to manage for a desired future condition based on historic structures and forest types, and to promote biodiversity by managing for the conditions that species evolved with, any further unnecessary reduction of old growth is unjustified. Especially given the large and disproportionate contribution that old growth makes to the maintenance of biodiversity. Harvesting old growth will only move conditions further away from historic conditions, and from conditions that species evolved with.

In addition to the acreage of old growth that would be harvested, the type of harvest proposed would create discrete edges between harvested and unharvested areas. I see that the wildlife analysis does mention the edge effect under the coarse filter analysis, and does a quantitative assessment of the change in edge versus interior forest. However, lacking is any comparison to historic conditions or description of the negative impacts of edge habitats. The analysis merely states "Habitat for species that use forested and interior habitat would decrease, while species that use edge habitat and regeneration or unforested habitats would be favored". This statement is essentially useless to the decision maker or the general public, giving no frame of reference or information on which to judge whether conditions are moving towards or away from historic conditions, or whether this is better or worse for wildlife.

Two MSU professors, Kerrie Forseman and Colin Henderson, while under contract with DNRC, found that problems with the old growth situation on the Swan River state forest were not so much with the total amount of forest, but with fragmentation. Compared with historic conditions, current conditions are highly fragmented, having higher edge to interior ratios, smaller patch size, and reduced connectivity (DNRC 1997). Forest fragmentation is generally ubiquitous in managed landscapes and a big problem for many wildlife species, particularly those species that are rare and/or whose conservation is a concern (Noss 1996). Species that do well in edge habitats, such as cowbirds, American robins and white-tailed deer, are generally widespread and are of little conservation concern. Negative impacts due to the "edge effect" have been documented for many species, and include increased exposure to predators, increased penetration by noxious weeds, and increased exposure to wind and temperature extremes. All of these may impact the ability of old growth dependant plants and animals to survive and successfully reproduce. The DEIS states that the adjacent harvested areas may act as a fire-break. While this may be true sometimes, it is also true that the openings will allow the drying effects of wind and sun to penetrate into the forest, making it less resistant to fire.

Please keep me informed of all developments regarding this timber sale, and particularly let me know if there are any opportunities to view the stands in Area III. Thank you for considering my comments.

Sincerely,

Jane Adams

Jane Adams

<u>Citations</u>

DNRC. 2000. Old Growth Management on Montana State Trust Lands.

DNRC. 1997. Middle Soup Creek Project, FEIS. Department of Natural Resources and Conservation, NWLO, Swan River State Forest.

Losensky, John B. 1997. Historical Vegetation of Montana. Prepared under contract DNRC #090900, With the Department of Natural Resources and Conservation.

Noss, Reed F. 1996. Conservation of Biodiversity at the Landscape Scale. In Biodiversity in Managed Landscapes. Szaro, Robert C. and David W. Johnson, editors. Oxford University Press.

OWENS & HURST LUMBER CO., INC.

November 10, 2004

RECEIVED
NOV 15 2004

Mike McMahon, Project Leader
Stillwater State Forest
P.O. Box 164
Olney, MT 59927

Re: West Fork Timber Sale Project

Dear Mike:

Owens & Hurst Lumber Company, Inc., supports your Action Alternative B for the above designated Timber Sale Project. We agree with your reasoning that harvest activities in old growth stands would take on the role of a stand-replacing fire in old growth. It has been reported by some scientists that old growth stands do need management to maintain those attributes we identify with old growth. We also know that with no management, old growth stands will be destroyed, usually through a stand-replacing fire event.

The long term benefits far outweigh any short term adverse effect on grizzly bear habitat. It has been reported by Canadian researchers that the grizzly bear prefers larger disturbed areas. This increases forage area but does decrease hiding cover. However, hiding cover is not a limiting factor for the bear.

Commercial thinning utilizing a skyline cable system is not impossible but is expensive. Forwarder logging has been used in some skyline cable units. Would that be a possibility in this project area?

Thank you for the opportunity to comment.

Keith Glover
Keith Glover
Resource Manager

KG/rw

P.O. BOX 1316 EUREKA, MONTANA 59917 TELEPHONE 406-297-3114 FAX 406-296-2334

Ground-based forwarding operations may take place in some locations, but a substantial amount of steep topography would still require skyline cable operations.

Thank you for your interest in the project.

APPENDIX I
PEOPLE CONTACTED

Jane Adams
Alliance for the Wild Rockies
Frances Anderson
Tony Arnold
Jane Bartolini
Brad and Kelly Beck
Brad and Margaret Beck
DeWayne Beck
Jack Beckstrom
Jerry Benbrook
Wes and Monica Benbrook
Ed Benz
Big Sky Girl Scout Council
Charles and Kathleen Bogle
Jim Bower (DNRC)
Kathy Bramer (Office of Public Instruction)
Reggie and Donna Briggs
Thad and Debbie Briggs
Brian C. Bring
Bob Brown (Secretary of State)
Doug and Pam Brown
G.I. Burk
Norma Burk
Stan and Roxy Burk
Dan Bushnell (DNRC)
Darlene Hersey Byers
John Byers
Sara Cadenhead
James Carr
Veronica Carr
Kevin Chappell (DNRC)
Cliff and Pam Christensen
Citizens for a Better Flathead
Nathan and Patti Conkle
Ted and Val Corne
Jon Dahlberg (DNRC)
Tony and Lisa Darsow
Connie Daruk (DNRC)
Jeff Dayhuff
Mark Deleray (Department of Fish, Wildlife and Parks)
Kay DeMoss
Bryan Donner (U.S. Forest Service, Tally Lake District)
Paul Engelman (DNRC)
Citizens for a Better Flathead
Ecology Center
Steve and Christina Eisenberg
F.H. Stoltze Land and Lumber Company
Mike Filipek
Tracy Filipek
Neil Franson
Roger and LaVern Fredenberg
Keith and Renae Fredrickson
John Gangemi
Ted Giesey (DNRC)
Al Gouzene
Dan Grandkoski
Elsie Gress
Rocky Gress
David Groeschl (DNRC)
Dave Haake
Gary and Rita Hall
Harley Harris (Department of Justice)
Roger and Rhonda Hatlen
Cary Hegreberg (Montana Wood Products Association)
Peter Hersey
Gary and Lisa Hill
Ruth and Rusty Hill
Betty Holder (U.S. Forest Service, Murphy Lake Ranger District)
Allen and Cindy Horn (Castle Rock Entertainment)
Jerald and Maimie Hudson
Hungry Horse News
Leo Keane
Mr. and Mrs. Pat Kearney
Steve Kelly
Rick Kerr
Kurt and Becka Keys
Heather Kiedrowski (Governor’s Office)

Louis Knudsen
Gary and Kathy Kober
Jane Kollmeyer (U.S. Forest Service, Tally Lake Ranger District)
Rick and Charlotte Komenda
Jim Krantz (Plum Creek Timber Company)
Joe and Kathleen Krass
K. Kusumoto
Charles Langlois
Ted and Brenda Larsen
Tom and Erika Larsen
Tom Larsen
Bill Leonard (Whitefish Water and Sewer District)
Stuart Lewin
LeAnn Libby
Pat and Marion Libby
Bob Love
Jim Mann (Daily InterLake Newspaper)
Jane Markland (DNRC)
Gary Marks (Whitefish City Manager)
Carol Massman (DNRC)
Mike and Norma McBroom
Linda McCullough (Office of Public Instruction)
Mike and Sandra McDonald
Mike McGrath (Department of Justice)
Norm Merz (DNRC)
Jeff Mielke
Mike Miller
Ed Monnig (Murphy Lake Ranger District)
Montana Ecosystem Defense Council
Montana Wilderness Association
Montana Wood Products Association
Montanans for Multiple Use
Arlene Montgomery (Friends of Wild Swan)
William Montgomery
Jerry Morris
John Morrison (State Auditor’s Office)
Geary and Debbie Murphy
Dick and Carol Nelson
Tony Nelson (DNRC)
Rick and Nita Newton
Kathy O’Conner (DNRC)
Todd O’Hair (Govenor’s Office)
Mike O’Herron (DNRC)
Richard and Judy Ottwell
Owens and Hurst Lumber Company
Edwin Payne
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Rollie Peters
Tana Rae Peterson
Mr. and Mrs. Donald Phelps
Sarah Pierce (DNRC)
William Polus
Lonny and Janet Quimbey
Sheila and Roy Quimby, Jr.
Vince and Mary Reed
Bill and Jan Richardson
Dan and Sheila Richardson
Evelyn Richardson
Barb Roberts
Jerry Roberts
Merlin and Chris Rose
Roselles (Potters Field)
Bruce Rowland (DNRC)
Dave Russell
Larry and Alice Ryerson
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Gerald and Christine Schwegel
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Dore Schwinden (State Auditor’s Office)
Sylvia Shaddon
Greg Shildwachter (Intermountain Forest Industries)
Ralph Simpson
Mike and Rachel Singer
Angie Storkson
Carl Storkson
Delbert Storkson
Scott and Sylvia Storkson
John and Karen Strean
Bruce and Roxanne Street
Michael Sullivan (Secretary of State’s Office)
Rita, David, and Erik Summers
Betty Thomas
Kyle Thomas
Steve Thompson

Minnie Torgerson
Tom and Margaret Torgerson
Larry and Becky Tracy
Salish and Kootenai Tribes
Jodee Triplett
Jeff Ulsamer (Dog Sled Adventures)
Art Vail (Plum Creek Timber Company)
H.T. Vars
Jim Vashro (Department of Fish, Wildlife and Parks)
Aaron and Jo Voorhies
Richard E. Wackrow (Northfork Improvement Association)
Peg Wagner (Montanans for Multiple Use)
Dianna Warner
Gary Watson
Ted Weber
William John Welch
Tana and Norman Weller
Kay Wenzel
Candace West (Department of Justice)
Allen and Pam Whitaker
Allen Wolf (DNRC)
Kane Youngquist
Donna Yutsy

ACRONYMS

ARM	Administrative Rules of Montana
BMP	Best Management Practices
cmp	corrugated metal pipe
CS	Common Schools (trust)
dbh	diameter at breast height
DEQ	Department of Environmental Quality
DFWP	Department of Fish, Wildlife and Parks
DNRC	Department of Natural Resources and Conservation
DEIS	Draft Environmental Impact Statement
EA	Environmental Assessment
ECA	Equivalent Clearcut Acres
EIS	Environmental Impact Statement
EPA	Environmental Protection Act
FEIS	Final Environmental Impact Statement
FI	Forest Improvement
FNF	Flathead National Forest
IGBC	Interagency Grizzly Bear Committee
mbf	thousand board feet
MCA	Montana Codes Annotated
MEPA	Montana Environmental Protection Agency
mmbf	million board feet
MNHP	Montana Natural Heritage Program
NCDE	Northern Continental Divide Ecosystem
NWLO	Northwestern Land Office
RMZ	Riparian Management Zone
SFLMP	State Forest Land Management Plan
SLI	Stand Level Inventory
SMZ	Streamside Management Zone
TLMS	Trust Land Management System
TMDL	Total Maximum Daily Load
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service

ID Team	Interdisciplinary Team
Land Board	Montana Board of Land Commissioners
124 Permit	Stream protection Act Permit
3A Permit	Authorization A — Short-term Exemption from Montana’s Surface Water-Quality Standards
SFLM Rules	State Forest Land Management Rules

DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION
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Persons with disabilities who need an alternative, accessible format of this document should contact DNRC at the address or phone number shown above.