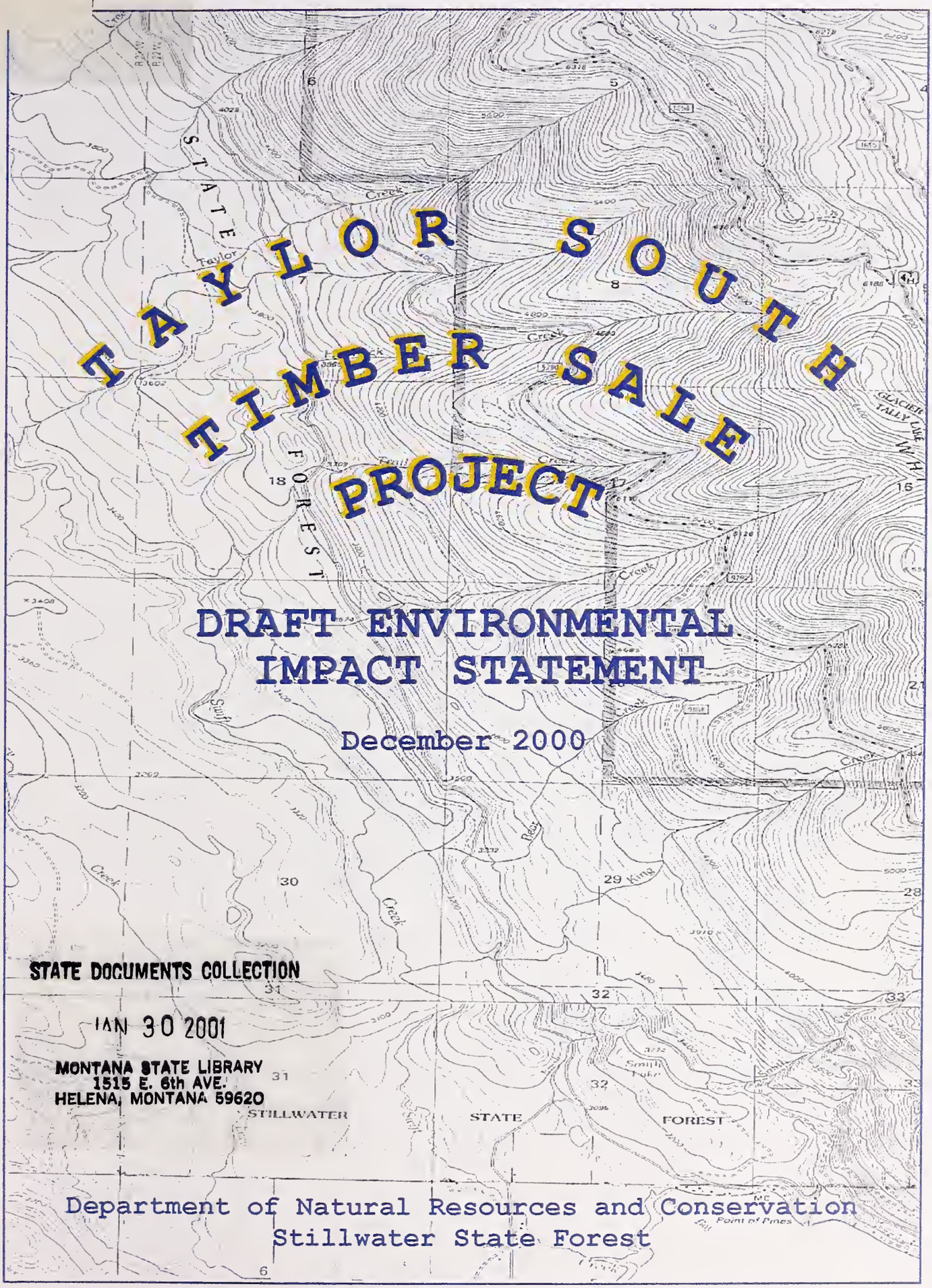


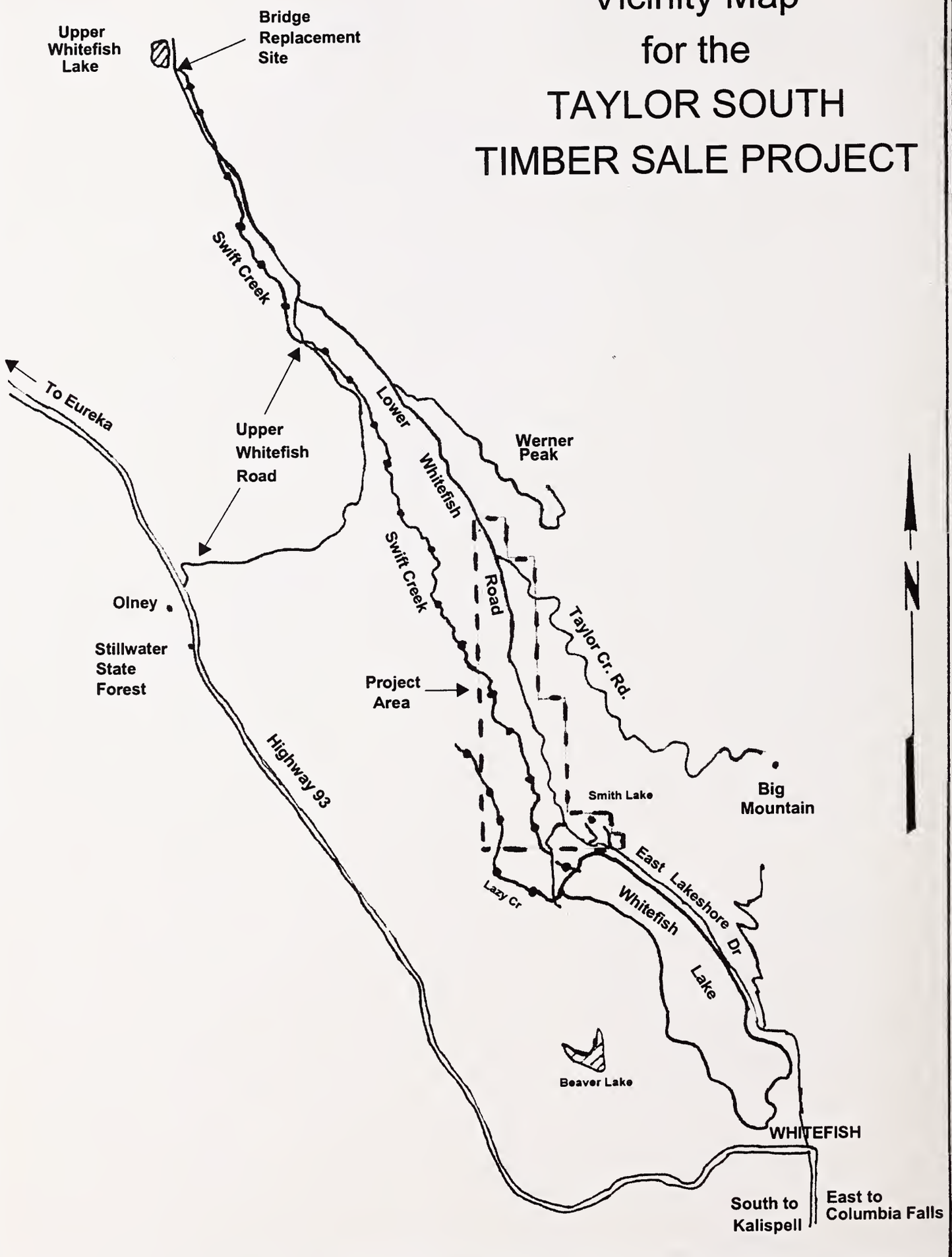
TAYLOR SOUTH TIMBER SALE PROJECT

DRAFT ENVIRONMENTAL IMPACT STATEMENT

December 2000

Department of Natural Resources and Conservation
Stillwater State Forest

Vicinity Map for the TAYLOR SOUTH TIMBER SALE PROJECT



DEPARTMENT OF
NATURAL RESOURCES AND CONSERVATION

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December 19, 2000

TAYLOR SOUTH TIMBER SALE PROJECT
DRAFT ENVIRONMENTAL IMPACT STATEMENT

Enclosed is a copy of the Taylor South Timber Harvest Project Draft Environmental Impact Statement (DEIS). I encourage you to carefully review the information presented in the DEIS and provide comments to Mike McMahon, Project Leader, Stillwater State Forest, P.O. 164, Olney, Montana 59927. **Comments must be received by January 18, 2000**. Along with your comments, please be sure to include your name, address, telephone number, and the title of the DEIS for which you are providing comments.

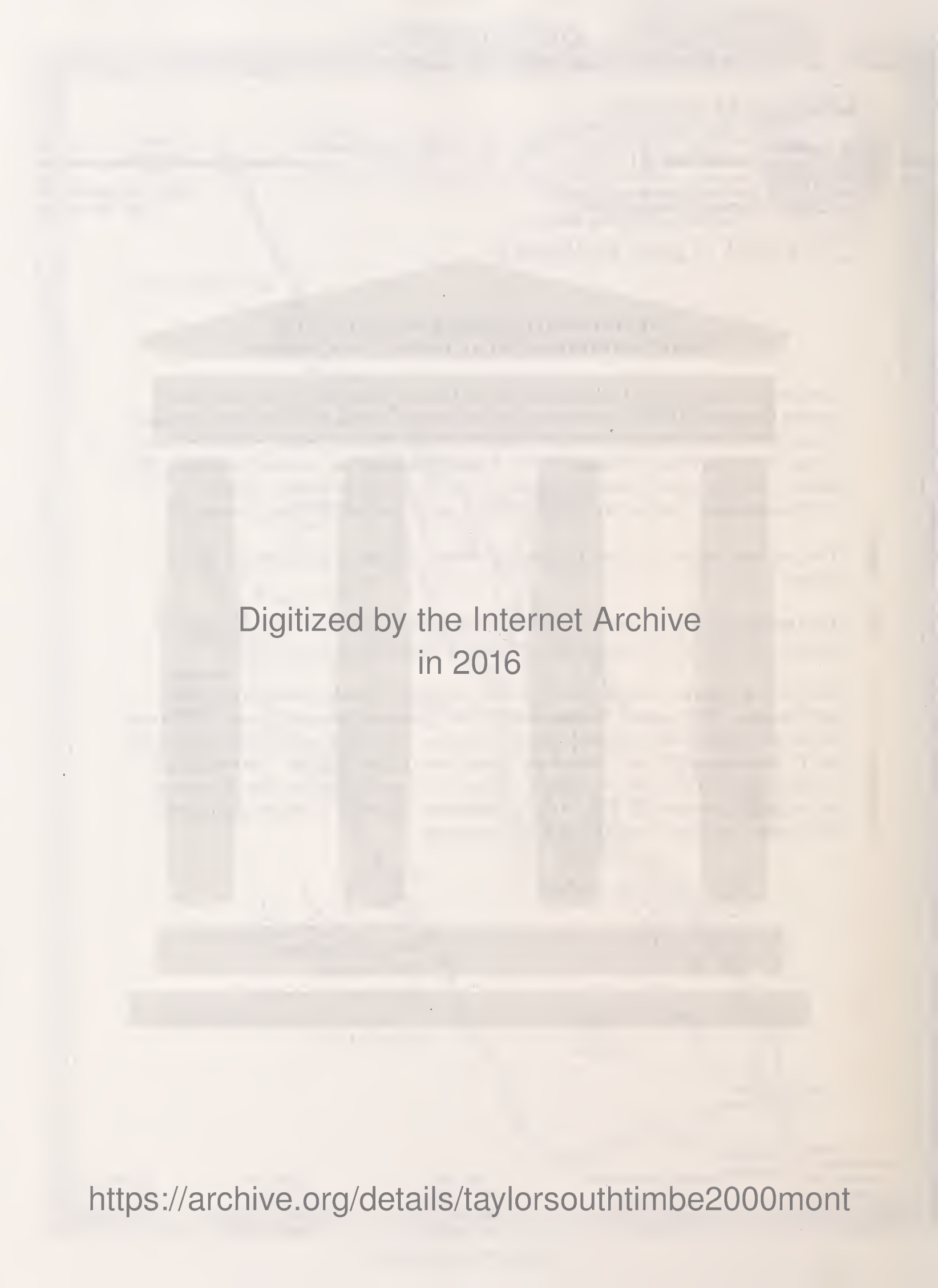
The proposed project is located just north of Whitefish Lake in the Stillwater State Forest.

The Department does not present a preferred alternative of the four action alternatives analyzed in the DEIS. Proposed harvest volumes range from 0 to 4.6 MMBF.

The DEIS is written in a different format than previous Stillwater State Forest DEIS publications. The Summary incorporates pictures to convey information and is written so that all education levels can understand the contents. The DEIS consolidates chapters III and IV into one section that summarizes the analysis in plain English. The bulk of the scientific analysis is located in a tabbed Appendix. I hope this format change improves our ability to communicate with all of the individuals interested in the management of State lands. I welcome your thoughts and comments.

Sincerely,

Robert L Sandman
Unit Manager
Stillwater State Forest
P.O. Box 164, Olney, MT 59927
(406) 881-2371



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ENVIRONMENTAL IMPACT STATEMENT PREFACE

The format of the Taylor South Environmental Impact Statement (EIS) is different than, probably, any other EIS you have ever read. We felt it was important to have a preface to explain what is unique about this EIS. The key reasons for this format change is:

- We wanted to present a document that all interested parties could, regardless of their knowledge level, read and fully comprehend the project and its analyses.

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

The Executive Summary of the EIS is designed to encompass the Montana Environmental Protection Act (MEPA) rules. The information is written so that it is easily understood with the supporting photographs and maps.

The body of the EIS was redesigned to combine Chapters III and IV into a single chapter, Chapter III. The analyses and conclusions that were completed by the ID Team are summarized in plain language, thus, ensuring that all interested parties, regardless of their scientific or technical abilities, can understand this proposal and its effects.

The Interdisciplinary Team (ID Team) members prepared the resource appendices; the discussions include citations from other sources such as research documents, environmental assessments, etc. The lengthy technical 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 required highly advanced technical procedures and terminology, that information is presented in the appendices. The information in the appendices would need to be utilized for any scientific, technical, or legal review.

ACRONYMS

TAYLOR SOUTH TIMBER SALE PROJECT

ACRONYMS

A.C.B.	Montana State University Grant
A.C.I.	Montana State University - Morrill Grant
BMP	Best Management Practices
CCC	Civilian Conservation Corps
C.S.	Common School Grant
dbh	Diameter at breast height
D.D.& A.	Deaf Blind School Grant
DEQ	Department of Environmental Quality
DFWP	Montana Department of Fish, Wildlife and Parks
DEIS	Draft Environmental Impact Statement
DNRC	Department of Natural Resources and Conservation
EA	Environmental Assessment
ECA	equivalent clearcut acres
EIS	Environmental Impact Statement
FEIS	Final Environmental Impact Statement
FI	forest improvement
FNF	Flathead National Forest
HB	House Bill
ID Team	Interdisciplinary Team
FOGI	Full Old-Growth Index
Land Board	Board of Land Commissioners
MBF	thousand board feet
MCA	Montana Codes Annotated
MEPA	Montana Environmental Policy Act
MMBF	million board feet
NWLO	Northwestern Land Office
SFLMP	State Forest Land Management Plan
SLI	stand-level inventory
S.M.	School of Mines Grant
SMZ	streamside management zone
S.N.S.	State Normal School
SSFI	sale-specific forest improvement
TMDL	total maximum daily load
TPA	trees per acre
USFS	United States Forest Service
WYI	water yield increase

124 Permit	Stream Preservation Act Permit
3A Authorization	A Short-term Exemption from Montana's Surface Water Quality Standards

CHAPTER I

PURPOSE AND NEED

TAYLOR SOUTH TIMBER SALE PROJECT

CHAPTER I

PURPOSE AND NEED

DESCRIPTION OF PROPOSED ACTION

Stillwater State Forest, Montana Department of Natural Resources and Conservation (DNRC), is proposing the Taylor South Timber Sale Project. The proposal includes timber-harvesting activities, replacement of a bridge at Upper Whitefish Lake Campground, and drainage improvements on roads within the project area.

If a harvest alternative were selected, 4 to 5 million board feet (MMBF) of timber would be harvested from, approximately, 640 acres; most of those acres would be prepared to grow new stands of timber. The dilapidated bridge at the outlet of Upper Whitefish Lake on the East Fork of Swift Creek would be replaced with a new bridge and bridge abutments. Several large-diameter culverts on Lower Whitefish Lake Road would also be replaced.

The project area is located approximately 6 air miles northwest of Whitefish, Montana, within Sections 6, 7, 17, 18, 19, 20, 29, 30, 31, 32, and 33, Township 32 north (T32N), Range 22 west (R22W) *(see VICINITY MAP)*.

PURPOSE

The lands involved in the proposed project are held by the State of Montana in trust 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--1-202, 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. The SFLMP outlines the management philosophy of DNRC in the management of State forested trust lands and sets out specific Resource Management Standards for 10 resource categories.

The Department will manage the lands involved according to the philosophy and standards in the SFLMP, which states:

> ***Our premise is that the best way to produce long-term income for the trust is to manage intensively for healthy and biologically 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, DNRC has set the following specific project objectives:

- Harvest 3 to 5 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.

- Replace the bridge at Upper Whitefish Lake Campground.

- Improve the long-term productivity of timber stands by increasing stand vigor, reducing incidence of insect infestations and diseases, and regenerating portions of the 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 species mixes.

- 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 (BMPs) Standards for Forestry

RELATIONSHIP TO THE SFLMP

The SFLMP is a programmatic plan that provides field personnel with consistent policy, direction, and guidance for the management of State forested lands. It contains the general philosophies and management standards that will provide the framework for project-level decisions.

The planning of the proposed Taylor South Timber Sale Project was guided by the SFLMP. The SFLMP philosophy and appropriate Resource Management Standards have been incorporated into the design of the proposed actions. The Taylor South Timber Sale Environmental Impact Statement (EIS) is not intended as a programmatic or area plan and is limited to addressing specific proposed actions in reference to issues that were identified through public involvement and interdisciplinary input.

EIS PROCESS

EIS DEVELOPMENT

This EIS was prepared in compliance with MEPA, which requires State government to include the consideration of environmental impact in its decisionmaking process. It also requires agencies to inform the public and other interested parties about proposed projects, the environmental impacts that may result, and the alternative actions that could achieve the project objectives.

PUBLIC SCOPING

The initial stage of an EIS is the pubic scoping process, which is used to:

- inform the public that a State agency is proposing an action, and
- receive comments or concerns about the possible impacts of the project.

Three public-comment periods have taken place; each comment period was initiated with an advertisement, a letter, or a newsletter. Several small field tours in the project area have also taken place; the project was discussed during those tours.

In March 1998, DNRC solicited public participation in the Taylor South Timber Sale Project Proposal by placing a paid advertisement in Kalispell's Daily Interlake and the weekly Whitefish Pilot, Hungry Horse News, and North Valley Advertiser newspapers. In addition, a letter, which included maps and general information about the project, was sent by mail 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 located in the project file.

The public comment period for the initial project proposal was open for 30 days. The issues and concerns identified through public scoping were summarized and used to further refine the project.

By October 1999, the ID Team, which is made up of DNRC's wildlife biologist, hydrologist, economist, and the project leader, further defined an action alternative, complete with maps of potential harvest areas and their respective silvicultural treatments. The first newsletter explained the action alternative in general terms and where it was located in the project area. The newsletter was mailed out to people on the updated mailing list; the second 30-day comment period followed.

In May 2000, a second newsletter was mailed out displaying further project refinements and the introduction of a second action alternative. Another 30-day comment period followed.

Numerous field tours were conducted within the project area since 1998, some relating directly to the timber sale proposal and others relating to other interests or resources within the project area.

DRAFT ENVIRONMENTAL IMPACT STATEMENT (DEIS)

Preparation of this DEIS was the next step. Public comments related to issues that could affect the project have been incorporated into the document. Upon publication, notification that the DEIS is available will be sent to those on the mailing list; the DEIS and/or a Summary of the DEIS will be circulated to interested parties requesting the documents. Comments will be accepted for 30 days.

FINAL ENVIRONMENTAL IMPACT STATEMENT (FEIS)

After public comments are received, compiled, and addressed, DNRC will prepare a FEIS or adopt the DEIS as the FEIS. The FEIS consists, primarily, of a revision of the DEIS that incorporates new information based on public and internal comments.

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? Why?

These determinations will be published and all interested parties will be notified. The decisions presented in the published document would become DNRC's recommendations

to the Land Board. Ultimately, the Land Board would make the final decisions regarding the actions to be implemented.

PROPOSED SCHEDULE OF ACTIVITIES

After a decision is published, and if a timber-harvesting alternative is selected, a Timber Sale Contract package would be prepared in the winter/spring of 2001.

This contract package is tentatively scheduled for presentation to the Land Board in June 2001. If the Land Board approves the timber sale, the sale may be advertised that spring/summer. Harvesting and roadwork would occur for approximately 3 years after the sale is sold. Postharvest activities, such as site preparation, planting, and hazard reduction, would occur following harvesting activities.

OTHER ENVIRONMENTAL REVIEWS RELATED TO THE PROJECT

In order to address the direct, indirect, and cumulative effects to resources on a landscape level, resource analyses will consider potential effects from past, present, and future actions as required for that resource and within a defined analysis area. A list of other ongoing projects and/or timber sales can be found in ***Appendix A – List of Related Environmental Reviews.***

OTHER AGENCIES WITH JURISDICTION/ PERMIT REQUIREMENTS

MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

Montana Department of Fish, Wildlife, and Parks (DFWP) has jurisdiction over the management of fisheries and wildlife in the project area. DFWP is on the mailing list and has received the initial proposal and newsletters.

DNRC has had an ongoing contract with DFWP to collect data and monitor streams in Stillwater State Forest for existing fisheries habitat and the presence/absence of bull trout and westslope cutthroat trout.

A Stream Preservation 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

A Short-term Exemption from Montana's Surface Water Quality Standards (3A Authorization) issued by the Montana Department of Environmental Quality (DEQ), 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 in the 124 Permit.

MONANA AIRSHED GROUP

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

UNITED STATE FOREST SERVICE (USFS)

The Flathead National Forest shares a nonexclusive easement to segments of Taylor Creek Road (USFS Road 9790) within State ownership (Sections 6 and 7, T32N, R22W).

PUBLIC CONCERNS

Through the public involvement process, resource specialists of DNRC and other agencies and the public raised concerns about the project's potential impacts on the environment. DNRC used these concerns in developing the project design, mitigation measures, and alternatives *(see Chapter II)*. A paraphrased summation of the comments incorporated into the alternatives is presented below.

WATER QUALITY AND WATER YIELD

- There is concern that logging and associated activities may negatively impact the water quality in Whitefish Lake, Swift Creek, and 7 tributary streams to Swift Creek. Concern was expressed that long-term timber management may lead to cumulative effects to the Lower Swift Creek watershed.

- Timber- and road-management activities may lead to sedimentation from in-stream erosion due to higher water yields and soil disturbance associated with these activities. The increase in siltation may have an effect on water quality and "beneficial uses".

- Concern was raised that timber-harvesting and road-management activities, including culvert replacements, may generate sediment above naturally occurring levels if not properly mitigated.

FISHERIES

The primary concern is that cumulative impacts of all proposed activities on bull trout and westslope cutthroat trout habitat be fully analyzed.

VEGETATION

Landscape

Timber harvesting and the associated disturbances (site preparation) that could result from this proposal may cause a change in stand development and the structural composition of stands within the proposed harvest areas. The concern involves whether the proposed actions would be within the range of natural variation for stand structure, species composition, and diversity of vegetative components related to natural fire regimes.

Maintenance of Forest Health in Relation to Timber Stands in the Project Area

There is concern that the present species mix and stocking levels in timber stands represent risks in terms of insect and disease outbreaks, potential losses to wildfire, loss of sawlog value due to rot and firewood gathering, and, potentially, lower stand productivity.

Old Growth

Concern was expressed that old-growth levels should not fall below the amounts necessary to ensure the viability of old-growth-associated species and that those components naturally occurring in the old-growth structure be maintained or be moved toward.

WILDLIFE

Threatened and Endangered Species

Eagle

- Concerns were raised that the proposed project may increase human disturbance or alter habitat that may cause the degradation and abandonment of the Whitefish Lake bald eagle nest. Important

habitat elements include perching and potential nesting habitat on or near Whitefish Lake and Swift Creek.

- Another concern is unrestricted access on Smith Lake Road that may allow for direct and indirect human disturbance of the Whitefish Lake bald eagle nest and may have possible impacts on the eagles' reproductive success.

Grizzly Bear

Concerns were raised that the current road densities, past timber harvests, and the proposed timber harvest may affect the seasonal habitat, hiding cover, and security core areas of the grizzly bear within the Lazy Creek Bear Management Subunit.

Wolf

Concerns were raised that the proposed timber-harvesting project may displace wolves from relatively secure seasonal habitats, which include the big game winter range and den and rendezvous sites for the wolves.

Lynx

Concerns were raised that the proposed project may affect lynx habitat by increasing human disturbance and reducing habitat patch size and connectivity. Concerns were also raised that the harvest of old growth would reduce lynx habitat.

Sensitive and Old-Growth-Associated Species

Concerns were raised that the proposed project may increase human disturbance to several sensitive wildlife species and cause increased fragmentation by reducing connectivity within these species' habitats.

For old-growth-associated species, concerns were raised that old-growth stands of sufficient size, shape, and quality supporting species associated with mature to old stands would not be retained due to the location and type of proposed and past timber harvesting. The concerns emphasized that the old-growth stands should contain large-diameter trees and snags, abundant coarse woody debris, and connective corridors between stands.

Big Game

Timber-harvesting activities have the potential to affect forage availability, hiding cover, thermal cover, and travel patterns of white-tailed deer and other big game species.

ECONOMICS

Some concerns were expressed that adequate information be presented to enable decisionmakers and the general public to consider both the short- and long-term economic effects of the proposed activities, including no action, on the individual beneficiary trusts. DNRC completed a report on the return on investments for classified forest lands in September 2000. For information on the return on investment by beneficiary, please consult this report.

Some individuals are concerned the State is not producing the largest legitimate return from School Trust lands due to complicated harvesting plans and contracts with a high degree of restrictive clauses. An additional specific concern about costs related to the required haul route.

Other concerns related to the haul route include potential damage to the road surface of East Lakeshore Drive and safety.

AESTHETICS

Concerns were expressed relating to the foreground, or close-up views, of harvest units as seen from traveled roadways. Individuals have expressed dislike for abrupt edges along cutting-unit boundaries, visible skid trails (primarily excavated trails and a high density of trails), landings with ruts, and incomplete burns within landing piles.

RECREATION

Concern was expressed that additional road improvements made to the Smith Lake Road would increase traffic and recreationists on and around Smith Lake.

Some people are concerned with potential conflicts between winter recreation (snowmobiling) and logging activities on Lower Whitefish Lake Road if harvesting activities are conducted in the winter season.

Conflict between project activities and recreation may result in a decrease of revenues generated from licenses and permits.

AIR QUALITY

Some people are concerned about the dust and smoke particulate generated from logging and hazard-reduction activities during the spring, summer, and fall seasons.

SOILS

A concern was expressed that cumulative soil impacts may reduce site productivity through soil compaction and displacement.

CHAPTER II

ALTERNATIVES

TAYLOR SOUTH TIMBER SALE PROJECT

CHAPTER II

ALTERNATIVES

INTRODUCTION

The purpose of Chapter II is to introduce 2 action alternatives for the Taylor South Timber Sale Project area and summarize the effects of implementing each alternatives, including the No-Action Alternative. The chapter will first focus on the development of the action alternatives and summarize the description of each alternative. Then the probable environmental consequences associated with each alternative will be briefly outlined. *TABLE II-3—SUMMARY OF THE ENVIRONMENTAL EFFECT* summarizes effects of the detailed environmental analysis in *Chapter III or the Appendices*.

DEVELOPMENT OF ALTERNATIVES

An ID Team was formed in the spring of 1999 to work on the Taylor South Timber Sale Project. The role of an ID Team is to summarize issues and concerns, develop management options within a project area, and analyze the potential impacts of a proposal on the human and natural environments.

Throughout 1999, ID Team members and other DNRC personnel were involved in a thorough field reconnaissance of the project area. Data was collected for the project area resources to aid in the analyses of wildlife habitat, hydrology, timber harvesting, road standards, economics, and the development of mitigation that could be applied to the proposal. The ID Team developed an action proposal within the framework of the SFLMP and associated Resource Management Standards; public comments were also taken into consideration.

Water quality is a major concern during the development of projects such as this timber sale proposal. The EIS for the Chicken/Werner Timber Sale Project ran a WATSED model to determine conditions in the Lower Swift watershed in 1999. Since this proposal is within the Lower Swift watershed, threshold levels and current cumulative effects to the watershed have been updated. Therefore, the proposals for this project were designed to be within threshold levels for water yield.

There is an overlying public issue with any harvest proposal that includes clearcutting. The initial harvest alternative (Action Alternative B) proposes a clearcut with group retention in most harvest units, regardless of the issue of clearcutting, for the following reasons:

- Previous harvesting has left very few shade-intolerant trees that are healthy and fire resistant, which would be good candidates for retention as seedtrees or snag-recruitment trees.

- The clearcut with group retention treatment emulates natural fire disturbances in the area.

- The clearcut with group retention treatment prepares the harvest units well for regenerating a species mix that includes a high

percentage of shade-intolerant species (western larch, Douglas-fir, and rust-resistant western white pine). This would meet the SFLMP biodiversity objectives.

- The proposed treatment includes some retention of vegetation along roadways, irregularly shaped harvest units, and retention of small groups of trees within the unit to mitigate for visual impacts.

A newsletter defining this alternative and requesting additional public comments was published and mailed in October 1999.

The concerns against clearcutting were again brought forward several times during the public comment period; some people do not want *any* clearcut harvests. The concerned people provided examples of previous timber harvests that had less than desirable aesthetic results. In regard to visual considerations of logging along open roadways, the issue against clearcutting remained and drove the alternative development even though the proposed clearcut with group retention prescription was not described as a typical clearcut.

Based on this concern, the ID Team developed Action Alternative C. A modified shelterwood harvest is the primary silvicultural treatment of Action Alternative C. When possible:

- 15 to 35 trees per acre that are greater than 7 inches diameter at breast height (dbh) would be retained, and
- visual buffers would be left along open roads.

Implementation of forest management practices under Action Alternative C would attempt to follow the basic philosophy of the SFLMP, meet the associated Resource Management Standards, and still meet the project objective of generating a revenue return to the trusts.

ALTERNATIVE DESCRIPTIONS

This section describes the No-Action Alternative A, as well as the developed Action Alternatives B and C. Components and mitigation measures that are common to the action alternatives are described in this section. Stipulations and specifications designed to protect resources during harvesting and road-improvement activities are incorporated into the timber sale contract or site preparation clauses and are implemented through contract administration. These stipulations and specifications are a form of mitigation; those that would be applied to an action alternative in this project are listed in *Appendix B – STIPULATIONS AND SPECIFICATIONS*. Mitigations designed to reduce impacts on a particular resource are also discussed in Chapter III and the corresponding resource appendix.

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

  No timber harvesting would take place; salvage logging and firewood gathering would likely continue. Road reconstruction, beyond coordinated maintenance agreements, would not be conducted. The bridge over the East Fork of Swift Creek would not be replaced at this time.

  Unauthorized off-road trails would likely be closed when DNRC has equipment in the area. Numerous off-road trails have been found throughout the project area and appear to be used to access firewood or dispersed camping areas.

  Other recreational uses of the area, such as hiking, biking, berry picking, and fishing, 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 go through the appropriate environmental analysis before implementation.

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

- ***Description of Components Common to Action Alternatives B and C***

Introduction

(The decisionmaker may select a modification or combination of alternatives.)

The ID Team developed the timber-harvesting alternatives based on an analysis of current and appropriate timber-stand conditions. Proposed treatments would move the timber-stand conditions toward the desired age-class and cover-type conditions that were historically present upon the landscape. Details on appropriate conditions are described in the DNRC Biodiversity Guidance.

Action Alternatives B and C were designed to be within the allowable water yield increases for all watersheds influenced by this timber harvesting proposal.

This project was designed in accordance with *The Montana Bald Eagle Management Plan* and *The Habitat Management Guide for Bald Eagles in Northwestern Montana.* Although a site-specific bald eagle nest plan is not complete, the *Report on the Whitefish Lake Bald Eagle Territory, (Paige, 1991)* was used as an information base.

Concepts Used in Project Design

The following concepts were instrumental in the design of the harvest unit prescriptions and locations:

- Forest health:
  - By harvesting grand fir stands infected with Indian paint fungus, the sawlog volume loss would be reduced.
  - Species with a higher resistance to root rot infections would be regenerated.
  - To increase the growth and vigor of the remaining trees, portions of the stands would be thinned.
  - To minimize the risk of intense stand-replacement fires over the long-term, fuel loading would be reduced.

- The design of the project limited the harvesting of stands having high-attribute old-growth levels.

- Portions of the project area are west of Swift Creek; this area was dropped from further consideration because:
  - approximately 50 percent of Section 31 was harvested in 1995-96,
  - most of Sections 19 and 30, west of Swift Creek, are in the old-growth western larch/ Douglas-fir cover type, and
  - this portion of the project area is accessed by a different transportation system; the installation of a temporary bridge over Lazy Creek is

required to access this area.

No harvesting would take place within 165 feet of those perennial creeks listed on the timber sale proposal maps, with the exception of Vars Creek. On perennial streams, this 165 feet meets or exceeds SFLMP Resource Management Standards and guidelines with respect to watershed and sensitive wildlife species. Less than 3 acres are proposed for harvesting within the 165-foot zone along Vars Creek; the harvesting would be accomplished in small group openings less than 0.4 acres in size and distributed approximately 200 feet apart. These openings would not be within the streamside management zone (SMZ) of Vars Creek.

Follow-up, or forest improvement (FI), treatments usually follow harvesting activities. Both alternatives would:

- reduce the slash (fuel load) caused by logging by piling or trampling the slash;
- burn landing and slash piles (some piles may require repiling to ensure a complete burn);
- machine scarify the soil in logging units to prepare the soil for natural regeneration and, potentially, sites for planting seedlings,
- sow grass seed on spur roads, landings, and some of the main skid trails;
- plant a mix of western larch and rust-resistant western white pine seedlings.

Road Work and Road Use

Existing roads and temporary spur (jump-up/jump-down) roads would be used to access harvest units. Jump-up or jump-down roads are short spur access roads leading to landing and loading areas off the main road. These spur roads, which would reduce logging operations along the main road, would be reclaimed following logging operations.

Road reconstruction would:

- replace 1 culvert each at Anchor, Brush, and Hemlock creeks on Lower Whitefish Road;
- replace 1 culvert at Vars Creek along Lower Whitefish Road if project road-development funds are available;
- replace 1 culvert each at Vars and Taylor creeks on Taylor Creek Road;
- replace a bridge and its abutments at the outlet of Upper Whitefish Lake on the East Fork of Swift Creek;
- improve all roads to be used for log-hauling purposes to meet BMPs by improving ditch-relief and road-surface drainage.

With one exception, the log trucks and equipment-transport trucks would travel the route through Olney and not along the DelRey or East Lakeshore roads. Approximately 15 truck loads of timber harvested from Section 32 and 33 on East Smith Lake Dam Road would be, due to the design of the existing junction, hauled on East Lakeshore Road.

- ***Description of Alternative B***

Alternative B suggests clearcutting as the method to convert the current species of trees toward the desired forest cover-type condition of predominantly western larch, Douglas-fir, and rust-resistant western white pine. This species conversion would be similar to results expected from a mixed-severity fire to a more intense stand-replacement fire.

The method to achieve this goal is described as "a regeneration harvest with groups of retention trees and/or varying levels of

individual tree retention".
The Clearcut/Seedtree with Group Retention prescription proposes to harvest most of the trees within the units, yet retain healthy individual seedtrees, groups of trees in all size classes (saplings to large diameter), and trees within stream corridors in the major harvesting areas, primarily Sections 6 and 7. This treatment proposal was designed to create a landscape patterned after a combination of mixed-severity and stand-replacement fire regimes.

This proposal would harvest an estimated 4.4 MMBF of sawlogs. An estimated 85 percent of the proposed harvest area would be harvested to the clearcut/seedtree prescription option. To meet other objectives, such as feathering edges, roadside buffers, and SMZ regulations, the other 15 percent would leave areas uncut or with heavier retention.

FIGURE II-1—ALTERNATIVE B TAYLOR SOUTH TIMBER SALE PROPOSAL depicts road and proposed unit locations and *TABLE II-1 - SILVICULTURAL TREATMENTS AND OBJECTIVE OF ALTERNATIVE B* describes aspects of the harvest treatments particular to Alternative B.

- ***Description of Alternative C***

Alternative C proposes shelterwood harvests as the method to reduce the visual impacts of timber harvesting and promote the conversion of tree species to the more appropriate cover types over time. Achieving and maintaining the desired cover types, in the long term, would involve a commitment to reenter the harvest areas in 5 to 15 years with an additional harvest proposal.

The shelterwood-harvest method is based on a regeneration prescription, which would retain a uniform distribution of individual trees in the overstory. Stream corridors would be maintained on Hemlock, Vars, and Taylor creeks. This treatment may portray a light underburn.

This harvest would produce an estimated 4.6 MMBF of sawlogs. An estimated 95 percent of the proposed harvest area would receive the shelterwood harvest. Minor areas, such as within SMZs or within 50 feet of those roads driven by the public, would leave more trees.

FIGURE II-2—ALTERNATIVE C TAYLOR SOUTH TIMBER SALE PROPOSAL depicts road and proposed unit locations and *TABLE II-2 - SILVICULTURAL TREATMENTS AND OBJECTIVE OF ALTERNATIVE C* describes aspects of the harvest treatments particular to Alternative C.

FIGURE II-1

ALTERNATIVE B

TAYLOR SOUTH TIMBER SALE PROPOSAL

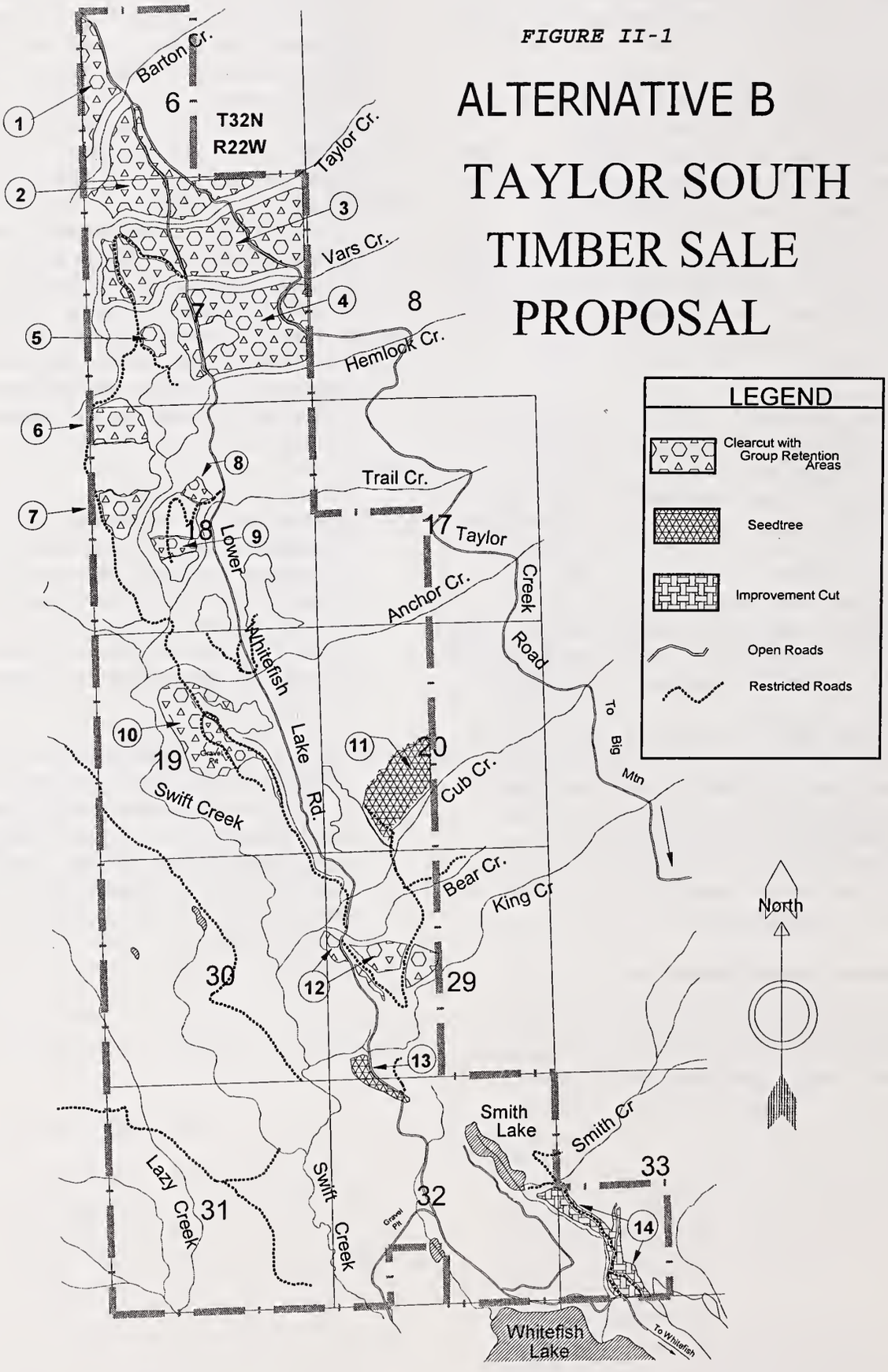


TABLE II-1—SILVICULTURAL TREATMENTS AND OBJECTIVES OF ALTERNATIVE B

SILVICULTURAL PRESCRIPTION	HARVEST UNIT	ACRES	UNIQUE OBJECTIVES OF HARVEST PRESCRIPTION	METHODS
Clearcut/ seedtree with group retention (80 to 90 percent of the acres would be treated for regeneration purposes)	1 2 3 4 5 6 7 8 9 10 12 TOTAL	34 77 171 112 5 20 25 5 9 60 34 552	Regenerate seral tree species such as western larch, lodgepole pine, and western white pine. Retain healthy, quality trees for a seed source when available Retain snags and cull trees for wildlife if they are windfirm; leave extra trees around them when possible. Retain healthy groups of young pole-sized lodgepole pine and western larch trees (3 to 7 inches diameter at breast height[dbh]). The groups are generally less than ½ acre and were established following harvesting in the 1950s. Retain groups of trees around springs and intermittent streams.	Create openings in the canopy large enough to allow establishment and growth of these tree species. Complete site preparation on 450 acres. Plant approximately 365 acres. Seedtree quality trees would be greater than 16 inches dbh, have greater than 40 percent live crown, show good vigor, and contain a minimal amount of diseases. Trees displaying some resistance to blister rust and mistletoe would be preferred for retention. Distribution would vary throughout the units. Some overtopped trees may be harvested.
Seedtree with reserve – *6 to 10 seedtrees per acre would be retained*	11 13 TOTAL	43 19 62		
Improvement cut	14	24	Reduce tree crown competition.	Harvest overtopped trees, trees with insects or diseases, and grand fir sawlog-sized trees.

FIGURE II-2

ALTERNATIVE C
TAYLOR SOUTH TIMBER SALE PROPOSAL

TABLE II-2—SILVICULTURAL TREATMENTS AND OBJECTIVES OF ALTERNATIVE C

SILVICULTURAL PRESCRIPTION	HARVEST UNIT	ACRES	UNIQUE OBJECTIVES OF HARVEST PRESCRIPTION	METHODS
Shelterwood with reserves	1 2 3 4 5 6 7 8 9 10 11 13 TOTAL	34 77 171 112 5 20 25 5 9 60 43 19 580	Regenerate seral tree species such as western larch, lodgepole pine, and western white pine. Retain a uniform distribution of trees across the harvest area. Retain snags and cull trees for wildlife if they are windfirm. Retain healthy groups of young pole-sized lodgepole pine and western larch (3 to 7 inches dbh). The groups are generally less than ½ acre and were established following harvesting in the 1950s. Retain trees around springs and intermittent streams.	Create openings in the canopy large enough to allow establishment and growth of these tree species. Complete site preparation on 395 acres. Plant approximately 300 acres. Between 15 and 35 trees per acre greater than 7 inches dbh would be left on site. A tree every 40 feet would be approximate to 25 trees per acre. Preferred species for retention would be in the following order: • seedtree-quality serals, such as western larch, Douglas-fir, and western white pine (see same section for Alternative B), • western larch, Douglas-fir, or western white pine meeting spacing guidelines • western hemlock, grand fir, subalpine fir, and lodgepole pine Some overtopped trees may be harvested.
Improvement cut	12 14 Total	28 24 52	Reduce tree crown competition.	Harvest overtopped trees, trees with insect or disease problems, and grand fir sawlog-sized trees.

ALTERNATIVES CONSIDERED BUT NOT GIVEN DETAILED STUDY

SMITH LAKE ROAD MANAGEMENT OPTIONS

The ID Team considered several options in regard to managing Smith Lake Road in Section 32. The options initially considered included:

- closing the road at the DelRey Road junction,
- applying seasonal closures, and/or
- reconstructing portions of the road and obliterating other portions.

This issue was discussed with the decisionmaker, and, although all options are feasible and would likely have beneficial effects to various resources, the level of public involvement has not been met to proceed with a road-management option. Early in the development of the alternatives some timber-management options were considered that would have utilized this road system. These portions of the stands were dropped from the harvest proposal, partly due to the status of the stand in relation to old growth and its associated attribute levels.

DNRC's preferred approach would be to develop a management plan for the Smith Lake area. This may encompass road management and biological, recreational, and developmental strategies for the area. Proceeding with this plan would depend on various factors, including appropriation of funds and time.

SUMMARY OF ENVIRONMENTAL EFFECTS

Table II-3—SUMMARY OF THE ENVIRONMENTAL EFFECTS summarizes the primary environmental consequences of the alternatives by resource issue, as well as describes several design features specific to the issue. The basis for the conclusions of environmental effects summarized here is discussed in more detail in Chapter III and the associated resource appendix.

TABLE II-3—SUMMARY OF THE ENVIRONMENTAL EFFECTS

RESOURCE ISSUE	EXISTING CONDITION	DIRECT EFFECTS OF EACH ALTERNATIVE	INDIRECT EFFECTS OF EACH ALTERNATIVE	CUMULATIVE EFFECTS OF EACH ALTERNATIVE
Annual water yield for Lower Swift Creek watershed	Currently is 4 percent over naturally occurring levels	**A** - There would be no change. **B/C** - Would increase 1 percent.	**A** - There would be no change. **B/C** - There would be no measurable change to channel stability due to the 1 percent increase.	**A** - Would increase 1 percent (5 percent total). **B/C** - Would increase 2 percent (6 percent total).
Annual water yield for entire Swift Creek watershed	Currently is 5.6 percent over naturally occurring levels	**A** - No change **B/C** - Would increase 0.4 percent.	**A** - No change **B/C** - No measurable change in channel stability due to any increase	**A** - Would increase 0.3 percent (5.9 percent total) **B/C** - Would increase 0.7 percent (6.3 percent total)
Forest cover-type distributio ns	Existing cover types are not the desired cover types; mixed-conifer stands are overrepresented.	**A** - No immediate change would take place. **B** - The mixed-conifer cover type would be reduced by 148 acres; the western white pine and western larch/ Douglas-fir cover type would increase, collectively, by the same amount of acres. **C** - Mixed conifer reduced by 144 acres; western white pine and western larch/ Douglas-fir increased, collectively, by same acres.	**A** - There would be no immediate change. **B** - 450 acres would be regenerated to desired tree species. **C** - 395 acres would be regenerated to desired tree species.	**A/B/C** - The western larch/Douglas-fir cover types would increase by 3 percent; the mixed-conifer, subalpine fir, and lodgepole pine cover types would decrease, collectively, by the same percent.
Acres and percentage of old-growth on Stillwater State Forest that are over DNRC's minimum commitment levels	Western larch/ Douglas-fir is 107 percent, or 775 acres, over commitment; western white pine is 826 percent, or 5,596 acres, over commitment; mixed conifer is 465 percent, or 6,990 acres, over commitment.	**A** - No immediate change **B** - Western larch/Douglas-fir would be 107 percent, or 760 acres, over commitment; western white pine would be 793 percent, or 5,339 acres, over commitment; mixed conifer would be 462 percent, or 6,926 acres, over commitment. **C** - Western larch/Douglas-fir would be 108 percent, or 802 acres, over commitment; western white pine would be 830 percent, or 5,633 acres, over commitment; mixed conifer would be 462 percent, or 6,926 acres, over commitment	The information is not pertinent for comparison purposes.	**A** - Western larch/Douglas-fir would be 107 percent, or 701 acres, over commitment; western white pine would be 818 percent, or 5,533 acres, over commitment; mixed conifer would be 450 percent, or 6,692 acres, over commitment. **B**- Western larch/Douglas-fir would be 107 percent, or 686 acres, over commitment; western white pine would be 785 percent, or 5,279 acres, over commitment; mixed conifer would be 447 percent, or 6,628 acres, over commitment. **C** - Western larch/Douglas-fir is 107 percent, or 728 acres, over commitment; western white pine is 822 percent, or 5,570 acres, over commitment; mixed conifer is 447 percent, or 6,628 acres, over commitment.

RESOURCE ISSUE	EXISTING CONDITION	DIRECT EFFECTS OF EACH ALTERNATIVE	INDIRECT EFFECTS OF EACH ALTERNATIVE	CUMULATIVE EFFECTS OF EACH ALTERNATIVE
Bald eagle	Currently, nests are located in suitable habitat. Firewood cutting and recreation cause disturbances. Both eagle pairs have produced young.	**A/B/C** - No direct effects are anticipated.	**A/B/C** - Anticipated effects are expected to be negligible.	**A/B/C** - Availability of nest and perch trees and the security level of the Whitefish Lake pair may be reduced.
Grizzly bear	Currently, there are open-road densities of 46 percent, which is 4 percent less than the baseline set by DNRC guidance. Hiding cover on State land is 92.2 percent, (DNRC guidance has committed to 40 percent). The project area is mainly spring habitat.	**A** - No change in direct effects is anticipated. **B/C** - Open-road densities would temporarily increase, but would remain below the baseline. Hiding cover would be reduced approximately 4.5 percent. Chances of disturbance from harvesting activities in the spring would be, potentially, reduced.	**A** - Feeding opportunities may decline. **B/C** - No long-term increase of open-road or total-road densities would be expected.	**A** - Open-road and total-road densities remain below the baseline. **B/C** - Open-road and total-road densities would remain below the baseline. Reduction in the hiding cover would continue, but would stay above the minimum set by the DNRC guidance.
Lynx	The 785 acres above 4,000 feet may contain lynx denning habitat.	**A** - No change in direct effects is anticipated. **B/C** - 205 acres of possible denning habitat would be harvested.	**A** - Foraging opportunities may decline. **B/C** - Security for prey base would be temporarily reduced.	**A/B/C** - Adds to the cumulative reduction of denning habitat in association with other harvesting activities.
Fisher	3,100 acres of mature and old stands represent fisher habitat. 1,200 acres represent riparian fisher habitat.	**A** - No changes in fisher habitat are anticipated. **B/C** - Fisher habitat would be reduced by, approximately, 15 percent.	**A** - Foraging opportunities may decline. **B/C** - No indirect effects to fisher were identified.	**A** - No anticipated changes **B/C** - Would add to the reduction in future accumulations of mature-forest attributes. Mature, closed-canopy conditions in the riparian corridors would be 78.8 percent of the area within the Lazy Creek Bear Management Unit.
Pileated woodpecker	There are 3,900 acres of mature and old stands (less than 40 percent canopy closure) representing pileated woodpecker habitat.	**A** - No changes to pileated woodpecker habitat are anticipated. **B/C** - Pileated woodpecker habitat would be reduced by, approximately, 15 percent.	**A** - Preferred pileated woodpecker habitat would probably increase due to increased tree growth, decadence, and canopy closure. **B/C** - No indirect effects to pileated woodpeckers were identified.	**A/B/C** - Pileated woodpecker habitat would be reduced in conjunction with past and ongoing timber harvesting activities on State and adjacent ownerships.

RESOURCE ISSUE	EXISTING CONDITION	DIRECT EFFECTS OF EACH ALTERNATIVE	INDIRECT EFFECTS OF EACH ALTERNATIVE	CUMULATIVE EFFECTS OF EACH ALTERNATIVE
Economic return from the project area	Currently, $6,090 per year from leases and licenses are deposited into the school trust account.	**A** - No change is anticipated. **B** - $721,875 would be deposited into the school trust account; $227,500 would be deposited in the **FI** account. **C** - $782,880 would be deposited in the school trust account; $242,320 would be deposited into the **FI** account.	**A/B/C** - There would be no appreciable changes to the annual cash flow for DNRC's Statewide timber program.	N/A
Estimated project costs	Currently, an average of $2,000 are spent per year to maintain roads within the project area.	**A** - No change is anticipated. **B** - Road and bridge replacement work costing $280,000 would be done; hazard reduction and reforestation work costing $102,760 would be accomplished. **C** - Road and bridge replacement work costing $280,000 would be done; hazard reduction and reforestation work costing $76,785 would be accomplished.	**A** - No change. **B** - 450 acres would be regenerated; 365 of those acres would be planted with 220 trees per acre. **C** - 395 acres would be regenerated; 300 of those acres would be planted with 170 trees per acre.	N/A
Aesthetics	Foreground views are of open and dense forests with minor disturbances occurring from firewood and recent timber harvesting. Middleground views are very limited, yet visible.	A - No changes are anticipated in the short term. B - Foreground views would be opened up, allowing slash, limbs, skid trails, and landings to be visible; current foreground views would become middleground views. C - Foreground views would be opened up, allowing slash, limbs, skid trails, and landings to be visible through a 50-foot retention buffer; foreground views would be changed, but would not be opened up to middleground views.	A - No effects were determined. B - Harvesting would attempt to portray patterns of natural disturbances (such as those associated with mixed-severity fires) with large open areas, areas with scattered overstory, and areas with heavy overstory retention. C - Within harvest units, an even distribution of trees would be left; from a background view, the effects of harvesting would be minimized by the amount of the remaining tree canopy.	A/B/C - Depending upon which alternative is selected, foreground views may also change due to the right-of-way clearing along DelRey Road, continued firewood cutting, the potential salvaging of trees on the project area, and, just to the north of this project area, the harvesting of Stillwater Unit's Chicken-Werner Timber Sale.

RESOURCE ISSUE	EXISTING CONDITION	DIRECT EFFECTS OF EACH ALTERNATIVE	INDIRECT EFFECTS OF EACH ALTERNATIVE	CUMULATIVE EFFECTS OF EACH ALTERNATIVE
Recreation	This area receives both commercial and noncommercial recreational uses. Most commercial uses involve snowmobile outfitting.	A/B/C - Direct effects to recreation would not be anticipated.	A - Effects would not be expected to change B/C - Winter logging could increase the number of conflicts between snowmobile and logging traffic; revenues from commercial licenses may decrease.	A/B/C - Winter logging could increase the number of conflicts between snowmobile and logging traffic due to the Chicken/Werner Timber Sale; revenues from commercial licenses may decrease.

CHAPTER III

EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

TAYLOR SOUTH TIMBER SALE PROJECT

CHAPTER III

EXISTING ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

INTRODUCTION

Chapter III is a summary of resource conditions as they relate to the proposed Taylor South Timber Sale Project. The resource issues discussed are arranged in the same order as they are mentioned in Chapter I. The current, or existing, condition can be viewed as a baseline condition to compare changes resulting from the selection of any alternative. Also described are the how the different alternatives may affect the environment. For more complete assessments and analyses related to the resources, for both scientific and judicial review, refer to the appropriate appendices of this EIS.

PROJECT AREA DESCRIPTION

The Taylor South Timber Sale Project area is located primarily south of Taylor Creek (Section 7, T32N, R22W) and north of Whitefish Lake.

- The project encompasses approximately 5,000 acres in 11 sections and is located primarily in the Swift Creek drainage. The main Swift Creek drainage flows from Upper Whitefish Lake into the north end of Whitefish Lake. In that distance, 9 smaller streams flow into Swift Creek. Lazy, Brush, and Smith creeks, and smaller watersheds and streams within the project area flow directly into Whitefish Lake.

- The topography is gently sloping on the western and southern sides of the project area, steepening toward a ridge on the Whitefish Range to the east. Elevations range from nearly 3,000 feet at Whitefish Lake to 4,800 feet on the northern end of the project.

- The project area may be accessed from Whitefish via East Lakeshore Drive/DelRey Road, a county road. The road is plowed in the winter, providing year-round access into Section 32 and 33. The project area may also be accessed from the north via Upper Whitefish Road, which, due to snow, is often closed during winter and spring months. Upper Whitefish Road intersects with Lower Whitefish Road near Milemarker 9. Lower Whitefish Road junctions at Milemarker 6 with Taylor Creek Road, which goes to the back side Big Mountain.

- Adjacent landowners include private ranches and homesteads, industrial and nonindustrial timberlands, and USFS.

WATER QUALITY AND YIELD

INTRODUCTION

The environment affected by the proposed Taylor South Timber Sale project concerning hydrology includes the portion of the Flathead River drainage that encompasses Swift Creek and it tributaries. The methodologies used to portray the existing condition and determine the hydrological impacts include sediment source surveys, a channel stability analysis, and computer-modeling estimates of annual water yield. In combination, these methodologies portray the potential impacts to water quality. The areas analyzed include Swift Creek and all its tributaries, the bridge replacement site, and all roads that may be used for hauling.

EXISTING CONDITION

The vast majority of sediment comes from clay banks that slough naturally along the lower reaches of Swift Creek. Additional sediment comes from roads. Taylor Creek Road lacks adequate surface drainage. Both Taylor Creek and Lower Whitefish roads have undersized culverts that would not work properly for 50-year flood events. The remaining State-owned road systems used for hauling in the project area meet surface drainage standards (BMPs). The Upper Whitefish Lake bridge is not a source of sediment. Channel stability is in the good to fair range for most reaches of the tributaries. The stability of the Swift Creek channel is poor due to its naturally slumping clay banks. Current water-quality standards require no increase in sediment levels over naturally occurring levels. Given the instability of Lower Swift Creek's clay banks, the natural levels of sediment could be exceeded when annual water yield increases only 8 percent. The current annual water yield increase is 4 percent for Lower Swift Creek, and 5.6 percent for the entire Swift Creek watershed.

Upper Whitefish Lake bridge

DIRECT EFFECTS

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

  No change is expected in sediment sources, channel stability, or annual water yield from the existing environmental condition.

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

  Sediment delivery to streams would be reduced by repairs to Taylor Creek and Lower Whitefish roads. Replacement of the bridge would not likely increase sediment delivery. Timber harvesting would increase water yield for the Lower Swift Creek watershed by 1 percent.

INDIRECT EFFECTS

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

  No change is expected in sediment sources, channel stability, or annual water yield from the existing environmental condition.

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

  No measurable change in channel stability is expected. Once the stream-crossing sites revegetate, a net improvement of less sediment over the existing condition would be likely in the long term. No direct effects to water quality were identified due to the bridge replacement on the East Fork of Swift Creek.

CUMULATIVE EFFECTS

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

  The number of sediment sources from roads would be reduced due to the repairs done by the Chicken/Werner Timber Sale Project. No measurable change in channel stability is expected. The annual water yield for the Lower Swift Creek watershed would change from 4 to 5 percent with the completion of the Chicken Werner Timber Sale; the entire Swift Creek watershed would change from 5.6 to 5.9 percent.

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

  The number of sediment sources from roads would be reduced due to the repairs done to Taylor Creek and Lower Whitefish roads by the Chicken/Werner Timber Sale Project and by this project . No measurable change in channel stability is expected. The annual water yield for the Lower Swift Creek watershed would change from 4 to 6 percent with both projects; the entire Swift Creek watershed would change from 5.6 to 6.3 percent with both projects.

FISHERIES

INTRODUCTION

The fisheries species affected by the proposed project, and chosen for analysis, are westslope cutthroat trout and bull trout. The methodologies used to portray the existing condition and determine the impacts to fisheries include the Hydrology Appendix and surveys for fish species presence. When either trout is present, spawning surveys and tests are completed by the Department of Fish, Wildlife and Parks (DFWP) to evaluate specific sediment conditions that impact the quality of the spawning habitat. The areas analyzed include most of Swift Creek, creeks that flow year-round into Swift Creek inside the project area, and the site of the bridge replacement.

EXISTING CONDITION

Population surveys show both the presence of westlope cutthroat trout and bull trout in Swift Creek. No bull trout were found in the creeks that flow year-round into Swift Creek, but westslope cutthroat trout were found. Westlope cutthroat trout and bull trout populations that are not connected to other populations in the Swift Creek drainage (disjunct) exist at the bridge-replacement site. Currently, the annual water yield is below a level that could increase sediment above normal conditions for all analyses areas. DFWP has not yet completed the spawning surveys on the main stem of Swift Creek. No redds had been found during the 1995, 1996, 1997, or 1999 redd surveys (locates areas where eggs are laid) done in the East Fork of Swift Creek below Upper Whitefish Lake.

FISHERIES

DIRECT EFFECTS

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

  No change from the existing environment condition is expected .

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

  Repairs to Lower Whitefish and Taylor Creek roads would reduce sediment delivery to streams. Replacement of the bridge would not likely increase sediment delivery. Water yield would likely increase less than 1 percent. No direct effects were identified due to the proposed bridge replacement.

INDIRECT EFFECTS

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

  No indirect effects to fisheries populations or habitat were identified.

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

  No measurable change in channel stability is expected. Spawning habitat could improve with the reduction in sediment delivery. No indirect effects were identified due to the proposed bridge replacement.

CUMULATIVE EFFECTS

- ***Cumulative Effects of Alternative A***

  The repairs done by the Chicken/ Werner Timber Sale would reduce the number of sediment sources from roads. The stability of the stream channel would not be expected to change measurably. With the completion of the Chicken/Werner Timber Sale Project, the annual water yield would change from 4 percent to 5 percent; the entire Swift Creek watershed would change from 5.6 percent to 5.9 percent. Spawning habitat could improve with the reduction in sediment delivery.

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

  The repairs done by the Chicken/ Werner Timber Sale Project and this project to Lower Whitefish and Taylor Creek roads would reduce the number of sediment sources from roads. The stability of the stream channel would not be expected to change measurably. With the completion of the Chicken/Werner Timber Sale Project, the annual water yield would change from 4 percent to 6 percent; the entire Swift Creek watershed would change from 5.6 percent to 6.3 percent with both projects. Spawning habitat could improve with the reduction in sediment delivery. The bridge replacement would have no cumulative effect.

VEGETATION

INTRODUCTION

The vegetation most affected by the proposed project, and chosen for analysis, are the stands of timber. The methodologies used to portray the existing condition and determine impacts to vegetation include:

- an evaluation of the appropriate type (timber species that grew in this area historically), mix, and ages of timber stands;
- an analysis of forest insect and disease activity; and
- a comparison of amounts and quality of the old-growth to DNRC's old-growth commitment.

The areas analyzed include individual timber stands to be harvested in the project area, all timber stands on Stillwater State Forest (including areas in the Tobacco Valley), and the Upper Flathead Valley climatic section described by *Losensky, 1997*.

EXISTING CONDITION

Wildland-fire suppression, past logging and forestry practices, insects, diseases, and site conditions have resulted in the current condition being different than the desired condition. Mixed-conifer stands are currently overrepresented and western larch/ Douglas-fir stands are underrepresented. Western white pine has drastically declined due to the white pine blister rust disease. Stillwater State Forest is low in stands of the seedling/sapling age class and high in the 40-year age class and older.

Insects and diseases present at normal levels include mountain pine beetles, armillaria root rot, white pocket rot, rhabodocline needlecast, and fir engravers. Insects and diseases above normal levels include Indian paint fungus, Douglas-fir beetles, western larch dwarf mistletoe, and white pine blister rust.

DNRC has committed to retain at least 1/2 of the amount old growth on Stillwater State Forest that would exist with natural processes on similar sites. Approximately 38 percent of Stillwater State Forest is considered old growth by DNRC, which is 2.3 times as many old-growth acres as DNRC's commitment. The western larch/Douglas-fir cover types have about 107 percent of the required minimum; the western white pine cover type has about 826 percent; and the mixed-conifer cover type has about 465 percent. In this project area, 134 acres of old growth have low attribute levels; 1,217 acres have medium attribute levels; 1,240 acres have high attribute levels; and 117 acres do not have enough data collected to determine their attribute levels.

DIRECT EFFECTS

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

  No immediate change is expected from the existing environmental condition.

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

  The mixed-conifer stands would be reduced by 148 acres; western white pine stands would be increased by 115 acres; and the western larch/Douglas-fir stands would be increased by 33 acres. Harvesting would change 148 acres of 40-year-old mixed-conifer stands to the 0 age class; 436 acres of 100-year-old western white pine would change to the 0 age class; and 20 acres of 100-year-old western larch/Douglas-fir stands would change to the 0 age class. Harvesting would immediately reduce the number of acres infected by stem rot, dwarf mistletoe, and white pine blister rust by 638 acres. The acres of western larch/Douglas-fir old-growth would be reduced by 0.1 percent; the acres of western white pine old-growth would be reduced 3.9 percent; and the acres of mixed-conifer old-growth would be reduced 0.7 percent. Overall, all old-growth acres would be reduced by 0.9 percent, but would still exceed DNRC's commitment for retention.

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

  The representation of mixed-conifer stands would be reduced by 144 acres; the western white pine stands would be increased by 115 acres; and the western larch/Douglas-fir stands would be increased by 29 acres. Following harvesting, the Stand Level Inventory (SLI) would likely display no change in age classes. However, harvesting would take place in 144 acres of mixed-conifer stands, 436 acres of western white pine stands, 20 acres of western larch/Douglas-fir stands, and 8 acres of ponderosa pine stands, all over 150 years old; a new age class of trees would be regenerated. The level of stands infected with stem rot, dwarf mistletoe, and white pine blister rust would immediately be reduced by 632 acres; some infestations would remain. The acres of mixed-conifer old-growth would be reduced by 0.8%, thereby increasing the acres of western larch/Douglas-fir by 0.2 percent and western white pine by 0.6 percent. Overall, all old-growth acres would not be reduced or increased from the retention commitment, although the old-growth attribute levels would be considered low following harvest.

INDIRECT EFFECTS

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

  No immediate change is expected from the existing environmental condition. Sawlog volume would continue to be lost at abnormally high levels due to stem rot, dwarf mistletoe, and white pine blister rust.

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

  Approximately 450 acres would be regenerated with tree species similar to the results from a wildland fire. Stem rot, dwarf mistletoe, and white pine blister rust would, in the long term, be significantly reduced in stands that are harvested. This would be accomplished by removing species that are more susceptible to these diseases and regenerating trees that are less susceptible to these diseases.

Western larch and rust-resistant western white pine seedlings would be planted on 365 acres.

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

  Approximately 395 acres would be regenerated with tree species similar to the results from a wildland fire. However, the overstory trees made up of grand fir and western hemlock most likely would not be the species that would survive a wildland fire. Stem rot, dwarf mistletoe, and white pine blister rust would, in the long term, be moderately reduced in the stands that are harvested. Some infected trees would remain. Regenerating trees would be susceptible to these diseases. To reduce the effects of these diseases in the long term, western larch and rust-resistant western white pine seedlings would be planted on 300 acres.

CUMULATIVE EFFECTS

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

  Assuming the harvesting of the planned salvage permits and the Upper Stryker Ridge, Stewart-Butcher, Mud Creek, Edmonds CT, Spring Rock, Beaver 99, Beaver 2000, Good/Long/Boyle, Chicken/Werner, and the proposed Young/Sophie timber sales are completed, the 0-to-39-year age class would increase from 8.3 to 9.4 percent on Stillwater State Forest, while the other 3 age classes would decrease by less than 0.5 percent each. Some of the sales have already been completed. When all of these sales have been harvested, the acres of western large/Douglas-fir stands would increase by, approximately, 3 percent and decrease the acres of mixed-conifer, subalpine fir, and lodgepole pine stands, combined, by the same amount. All of the changes would bring Stillwater State Forest, as a whole, toward the stand type, structure, and composition that is desired. These aforementioned sales harvest stands with high amounts of stem and root rots; those areas would be regenerated with trees that are more resistant to these diseases. The old-growth commitment for Stillwater State Forest would be exceeded by 701 acres for western larch/Douglas-fir stands, 5,533 acres for western white pine stands, and 6,692 acres for mixed-conifer stands. For all stand types, old-growth would be reduced by 483 acres. DNRC would be in compliance with the old-growth-retention commitments with these projects.

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

  The sales listed in Alternative A also apply to the cumulative effects for Alternative B. Alternative B increases the 0-to-39-year age class from 8.3 to 10 percent on Stillwater State Forest and decreases the the 40-to-99-year age class by 0.3 percent, the 100-to-149-year age class by 0.7 percent, and 150-years-plus age class by 0.8 percent. The sales would also increase the acres of western larch/Douglas-fir and western white pine stands by, approximately, 3 percent and decrease the acres of mixed-conifer, subalpine-fir, and lodgepole pine stands, combined, by the same amount. The timber sales listed in *Cumulative Effects for Alternative A* harvest timber stands with high amounts of stem and root rots; those areas would be regenerated with trees that are more resistant to these diseases. Stillwater State

Forest would exceed its old-growth commitment by 686 acres for the western larch/Douglas-fir stands, 5,279 acres for the western white pine stands, and 6,628 acres for the mixed-conifer stands. For all stand types, old-growth would be reduced by 816 acres. DNRC would be in compliance with the old-growth-retention commitments with these projects. Stand inventories have not been completed to indicate the change in attribute levels to old growth.

- ***Cumulative Effects of Action Alternative C***

The sales listed for Alternative A also apply to the cumulative effects for Alternative C. Alternative C increases the 0-to-39-year age class from 8.3 to 9.4 percent on Stillwater State Forest and decrease the 40-to-99-year age class by 0.3 percent, the 100-to-149-year age class by 0.4 percent, and the 150-years-plus age class by 0.5 percent. These sales would also increase the acres of western larch/Douglas-fir and western white pine stands by approximately 3% and decrease the acres of mixed-conifer, subalpine fir, and lodgepole pine stands, combined, by the same amount. The timber sales listed in *Cumulative Effects for Alternative A* harvest timber stands with high amounts of stem and root rots; those areas will be regenerated with trees that are more resistant to these diseases. Stillwater State Forest would exceed its old-growth commitment by 728 acres in the western larch/Douglas-fir stands, 5,570 acres in the western white pine stands, and 6,625 acres in the mixed-conifer stands. For *all* stand types, old growth would be reduced by 483 acres. DNRC would be in compliance with the old-growth-retention commitments with these projects. Stand inventories have not been completed to indicate the change in attribute levels to old growth.

WILDLIFE

INTRODUCTION

Determining the effects of the proposed actions on all wildlife species within a project area is an impossible task. DNRC believes that if landscape patterns and processes are maintained, a full complement of wildlife species will exist across the landscape. DNRC also believes that certain species and their habitats should be evaluated to adequately estimate the effects to wildlife. Therefore, the methodologies used to portray the existing condition and determine wildlife impacts include determining the changes of forest structure and composition in general; evaluating the modification to habitats of specific species; and, evaluating the level of human disturbance caused by or resulting from the project. The analysis areas vary in size by species, with the largest analysis area (grizzly bear and fisher) approximating 34,560 acres, including portions of the Swift and Lazy creek drainages. Also analyzed is the bridge-replacement site.

EXISTING CONDITION

The existing forest structure and composition condition is displayed under Vegetation on page 6. This condition has changed since European settlement with both positive and negative effects to the different wildlife species.

Individual species analyzed:

- *Bald eagle* - There are 2 bald eagle territories: one at Whitefish Lake, the other at Upper Whitefish Lake. The health of the forest stands used for nesting is satisfactory. Though firewood cutting and recreational activities cause disturbances, nestlings have been produced in both nest in recent years.
- *Grizzly bear* - The project area is, generally, composed of spring grizzly bear habitat; summer and fall habitat is marginal. DNRC's *Interim Grizzly Bear Guidance (1995)* has committed to no net increases in the amount of total or open-road densities and no net decrease in security core areas. DNRC has complied with both requirements in the project area. The Guidance directs DNRC to retain a minimum 40 percent of State lands within each bear management unit as hiding cover. There is adequate hiding cover on 92.2 percent of State-owned land within the Lazy Creek Grizzly Bear Subunit.
- *Wolf* - The Whitefish wolf pack currently uses the project area, which has an adequate prey base; breeding occurred on adjacent ownership during the spring of 2000.
- *Lynx* - The northern portion of the project area is habitat suitable for lynx; the southern portion of the project area, which is 3,500 to 4,000 feet in elevation, has marginal habitat for lynx.
- *Boreal owl* - There are 68.3 acres of preferred habitat for boreal owls in the project area; 40 acres are marginal habitat.
- *Harlequin duck* - Harlequin ducks use Swift Creek; observations suggest that they may also breed there.
- *Fisher* - In the project area, there are 3,091 acres of preferred fisher habitat; 79.3 percent of the riparian buffers (key habitat located next to streams or lakes) is adequately stocked with mature trees.
- *Pileated woodpecker* - There are 3,876 acres of preferred habitat for pileated woodpeckers in the project area.
- *White-tailed deer* - Approximately 77 percent of the acres within the project area have timber stands that are suitable for white-tailed deer thermal cover during the winter.

DIRECT EFFECTS

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

  No anticipated direct effects to the following species are expected: bald eagle, grizzly bear, wolf, lynx, boreal owl, harlequin duck, fisher, pileated woodpecker, and white-tailed deer.

  No changes would be expected in the structure and composition of the forest in general, the level of human disturbance, or the habitats of specific species that would affect the existing condition relative to these species.

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

  No direct effects to bald eagles, boreal owls, or harlequin ducks are anticipated. No change in use by these species is expected due to changes in the structure and composition of the forest in general, the levels of human disturbance, or modification to habitats.

  The percent of the Lazy Creek Bear Management Subunit with an open-road density exceeding 1 mile per square mile would temporarily increase from 46 to 49 percent. Upon completion of the project it would revert back to 46 percent. The open-road density remains below the 1996 baseline of 50 percent. The security core area would not be reduced. Harvesting operations would not use restricted roads during spring, reducing human disturbance to the grizzly bear. Within the State-owned portions of the Lazy Creek Bear Management Subunit, hiding cover for grizzly bears would decline from 92.2 percent of the area to 87.9 percent for Alternative B and 87.8 percent for Alternative C.

  Hiding cover for wolves would be reduced, although they would still be capable of using the Swift Creek drainage under land management similar to that proposed under this project.

  Within the project area, approximately 205 of the 785 acres of mature and old-growth stands that are above 4,000 feet in elevation would be harvested. These 205 acres, which contain large downed logs, may be appropriate forest types for lynx denning habitat.

  Action Alternatives B reduces preferred fisher habitat that is not along streams by 597 acres, while Action Alternative C reduces it by 601 acres. Both reductions are approximately 15 percent of the preferred fisher habitat outside the streamside buffers within the proposed project area. Between 1 and 3 acres of the 692 acres of streamside fisher buffer would be harvested along Vars Creek.

  Action Alternatives B reduces pileated woodpecker habitat by 597 acres, while Action Alternative C reduces it by 601 acres. These reductions are approximately 15 percent of the preferred pileated woodpecker habitat within the proposed project area. The retention of snags and live trees may promote the recovery of preferred pileated woodpecker habitat in harvested areas.

  The acreage of winter thermal cover for white-tailed deer would be reduced by 6 percent on the project area.

INDIRECT EFFECTS

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

  Forest insects and diseases may affect the current and potential bald eagle nest stands, making them less suitable for nesting.

  Feeding opportunities for grizzly bear, lynx, fisher, and white-tailed deer may decline due to the lack of diversity in habitat, such as forest edge and younger forest stands.

  No indirect effects to white-tailed deer, boreal owls, harlequin ducks, fisher, or pileated woodpeckers were identified.

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

  The effect on the long-term ability of the white-tailed deer herd to provide carrion within the Whitefish bald eagle territory could indirectly effect bald eagles. These effects are expected to be low or negligible.

  No long-term increase in the open or total road densities within the Lazy Creek Subunit would occur as a result of the proposed project.

  Open-road density would not be increased, therefore, effects to wolves and their primary prey (white-tailed deer) should be low or negligible.

  Security and browse for the primary prey of the lynx (snowshoe hare) would be temporarily suppressed until trees and shrubs regenerate to provide cover.

CUMULATIVE EFFECTS

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

  No long-term, substantial changes are expected in wolf, boreal owl, or harlequin duck uses of Stillwater State Forest or adjacent Federal and private property. No changes in uses by these species are expected due to changes in the structure and composition of the forest in general, the levels of human disturbance, or the modification of habitats.

  Residential development, timber harvesting, firewood gathering, and recreational use may continue to reduce the available bald eagle nest and perch trees of suitable diameter, crown type, and security level within the home range of the Whitefish Lake bald eagle pair.

  Grizzly bear hiding cover may continue to decline on adjacent private lands, although the security core area levels and open-road densities should remain at existing levels across all ownership.

  Pileated woodpeckers would continue to lose habitat on adjacent private lands and, possibly, on Stillwater State Forest.

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

  No substantial changes are exoected in harlequin duck or boreal owl uses of Stillwater State Forest or adjacent private ownership. No changes in uses are expected by these species due to changes in the structure and composition of the forest in general, the levels of human

disturbance, or the modification to habitats.

Residential development, timber harvesting, firewood gathering, and recreational use may continue to reduce the available bald eagle nest and perch trees of suitable diameter, crown type, and security level within the home range of the Whitefish Lake bald eagle pair.

The loss of grizzly bear hiding cover on State ownership, and the probable further loss of hiding cover on other ownership in adjacent areas, would continue to reduce grizzly bear security within the Lazy Creek Bear Management Subunit. The existing amount (greater than 60 percent) is well over 40 percent, the minimum set by DNRC guidance.

Current State and adjacent private timber-harvesting activity would reduce security to wolves in the general vicinity of the project. However, due to the existing road closures and amount of vegetative cover, no substantial change in wolf use of State or adjacent private lands is anticipated.

Current timber harvesting activity on State and adjacent private lands would reduce possible lynx denning habitat and security cover within the general vicinity of the project.

Preferred fisher habitat of mature forest stands would be less available within the general vicinity of the project area. Preferred fisher habitat on the adjacent Plum Creek Timber Company lands, which may be more suitable for fisher due to its lower elevation, would continue to decline. Within the Lazy Creek Bear Management Subunit, 1,183 to 1,185 acres of riparian fisher habitat would be retained. Fisher could still inhabit the general vicinity, but would probably avoid recently harvested areas.

Preferred pileated woodpecker habitat of mature forest stands would be less available within the general vicinity of the project. Preferred pileated woodpecker habitat on the adjacent Plum Creek Timber Company lands, which may be more suited due to lower elevation, may continue to decline. Within the project area and on State land within 1 mile south of the proposed project area, approximately 3,400 acres of mature to old stands representing preferred pileated woodpecker habitat would be retained. The Chicken/Werner Timber Sale Project area, which encompasses 7 square miles directly north, retains approximately 1,572 acres, or 81 percent, of the available mature and old stands preferred by pileated woodpeckers. Pileated woodpeckers may still inhabit the general vicinity of the proposed project area, but at reduced levels in the vicinity of harvested areas until stands regenerate to maturity.

Past, current, and future timber-harvesting activities on State and adjacent private lands have reduced and would further reduce white-tailed deer security and thermal cover within the general vicinity of the project area.

Grizzly bear

Bald eagle

Grey wolf

ECONOMICS

INTRODUCTION

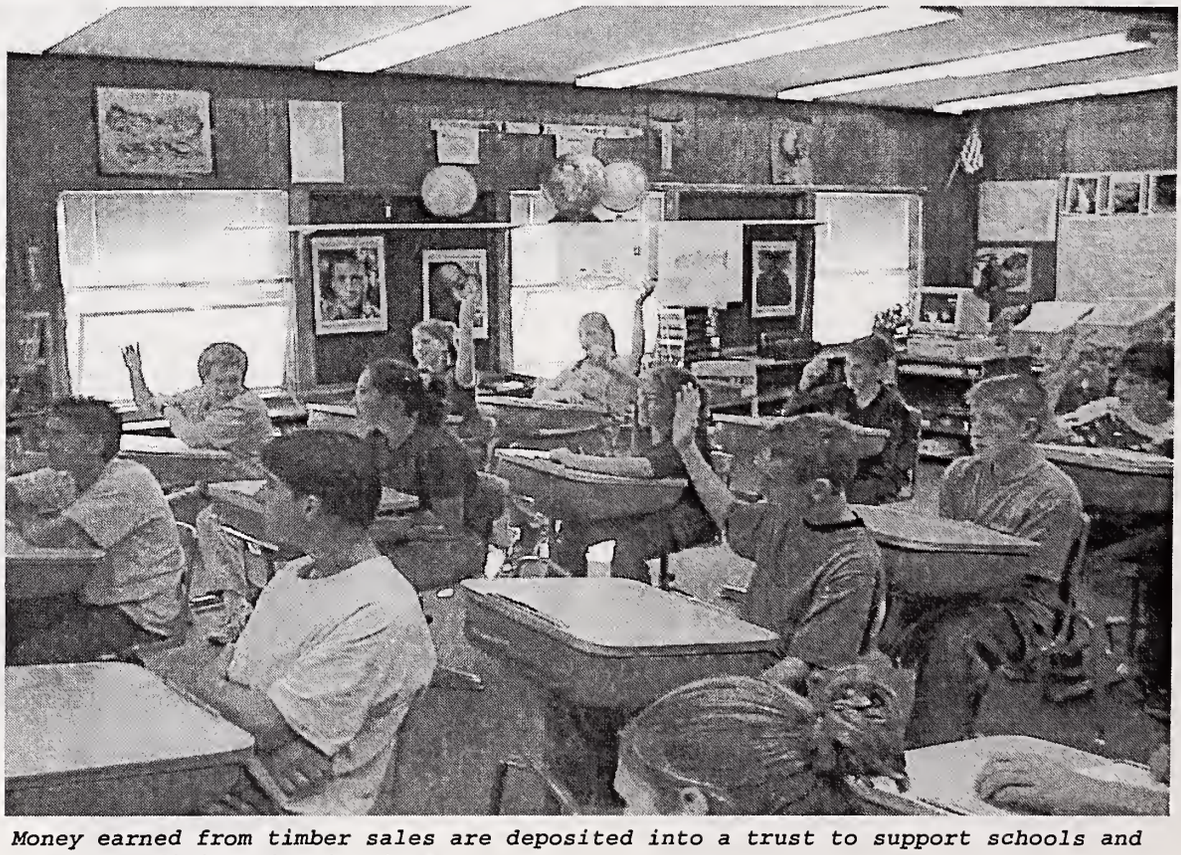
DNRC does not have a formal accounting system to track costs from start to finish for individual projects. Therefore, the methodologies used to portray the existing condition and determine the economic impacts of a project include determining DNRC's annual cash flow for the timber program; the effects to northwest Montana's forest-product-related economies; and, the project's cash flow and nonadministrative costs. The analysis areas include the State, DNRC's Northwestern Land Office (a 4-county area of Lincoln, Lake, Flathead, and Sanders counties), the project area, and the bridge-replacement site. The dollars displayed are estimates for comparing alternatives and making decisions and may not reflect actual returns or costs.

EXISTING CONDITION

DNRC's timber program and the Northwestern Land Office exceed a 1:1 revenue-to-cost ratio, which means that DNRC's timber program is profitable. In Fiscal Year 1999 and 2000, DNRC's total program reflected a 1.36 and a 2.78 revenue-to-cost ratio.

Flathead County can attribute 20 to 25 percent of their economy to the wood-product industry. The Northwestern Land Office currently supplies, approximately, 5 percent of the material used by mills in the 4-county area. The lumber market appears to heading downward with the recent drop of more than $75.00 per thousand board feet (MBF) in Lumber Futures.

Currently, the project area's cash flow, about $6,090 per year, is collected from several leases and licenses. Nonadministrative costs are estimated to be approximately $2,000 per year.



Money earned from timber sales are deposited into a trust to support schools and other beneficiary institutions.

DIRECT EFFECTS

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

  Project area revenue would not change from the existing condition.

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

  The estimated project revenue to be deposited into trust accounts is $721,875; the estimated revenue to be deposited into the Forest Improvement (FI) account is $227,500. Nonadministrative costs for road work and the bridge replacement are estimated at $280,000. Hazard reduction and reforestation costs are estimated at $102,760, which is funded by the by FI account.

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

  The estimated project revenue to be deposited into trust accounts is $782,880; the estimated revenue to be deposited into the FI account is $242,320. Nonadministrative costs for road work and the bridge replacement are estimated at $280,000. Hazard reduction and reforestation costs are estimated at $76,785, which is funded by the by FI account.

INDIRECT EFFECTS

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

  No change would be expected to the annual cash flow for DNRC's Statewide timber program provided another sale can be substituted to replace this project. No change to the area's economy would be expected provided a local mill purchases a substituted amount of timber. Lack of a viable substitution could result in a negative effect on either DNRC's annual cash flow or the local economy. No change to existing nonadministrative costs would be expected.

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

  No appreciable changes from the existing condition to the annual cash flow for DNRC's statewide timber program or to the area's economy would be expected. Initial long-term road improvement and bridge replacement costs are estimated at $280,000, which frees up the nonadministrative road-maintenance fund to be used elsewhere during the life of the project. The cost of reforestation is estimated at $102,760.

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

  No appreciable changes from the existing condition to the annual cash flow for DNRC's statewide timber program or to the area's economy would be expected. Initial long-term costs for road improvement and bridge replacement are estimated at $280,000, which frees up the nonadministrative road-maintenance fund to be used elsewhere during the life of this project. The reforestation cost reforestation is estimated at $76,785.

CUMULATIVE EFFECTS

Because of the methodologies used to analyze economics, the cumulative effects (revenues and costs) of other DNRC projects in the State and NWLO are included as part of the existing condition. Consequently, the direct and indirect effects analysis includes the cumulative economic effects.

AESTHETICS

INTRODUCTION

The public currently views the forests of this project area while sightseeing; in some instances they may see a background view. The methodologies used to portray the existing conditions and determine impacts to the visual resources include an analysis of the foreground, middleground, and background views. The foreground and middleground views will be discussed in regards to vegetation and soils disturbances, changes to stand conditions, and the distances of harvest treatments along traveled routes. Background views were analyzed based on the openness of the proposed harvest areas and the patterns of trees to be left in those areas. The analysis area for the foreground and middleground viewpoints is along the DelRey and Lower Whitefish roads, and the 2 roads into Smith Lake Reservoir. The analysis area for background views includes portions of the Whitefish Divide as viewed from the Whitefish Lake area and a point along the Upper Whitefish Lake Road (Milepost 5).

EXISTING CONDITION

Along the open roads, there are both open and dense forest conditions, though the view is generally limited to around 200 feet. Firewood gathering and salvage logging cause some damage to the live trees; limbs and tops are left scattered along roads and ditches. Middleground views, which are very limited, cover distances between 200 and 1,000 feet. Background views of most of the project area, located in the lower elevational portions of the Swift Creek drainage, is broken up by ridges and trees. Nonetheless, DNRC ownership is visible mostly as a uniform forest cover.

Landscape view of harvested areas

DIRECT EFFECTS

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

  Effects would not be expected to change from the existing condition in the short term.

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

  Harvesting would aesthetically affect the harvest area by removing mature trees and opening the view; damaging vegetation; slashing, limbing, and topping fallen trees; disturbing soil along major skid trails and landings; and creating landing piles along, approximately, 2.5 miles of the Lower Whitefish and Taylor Creek roads. Current foreground views would become more open middleground views. Measures would be taken to limit views into harvest units.

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

  Harvesting would aesthetically affect the harvest area by removing some mature trees and causing some damage to vegetation; slashing, limbing, and topping fallen trees; disturbing soil along major skid trails and landings; and creating landing piles along, approximately, 2.5 miles of the Lower Whitefish and Taylor Creek roads. Current foreground views would be altered and have fewer trees; however, in most circumstances, the views would not change to allow for middleground views. Measures would be taken to limit views into harvest units.

INDIRECT EFFECTS

- ***Indirect Effects to No-Action Alternative A***

  No indirect effects to aesthetics were determined.

- ***Indirect Effects to Action Alternative B***

  The pattern of trees remaining and size of the area being treated would appear similar to the results of a moderately severe fire. Portions of the harvest units would be visible from various vantage points.

- ***Indirect Effects to Action Alternative C***

  The pattern of trees remaining would appear similar to the results of a low-severity fire, though the size of the area is likely much larger than would burn with this type of fire. Portions of the harvest units would be visible from various vantage points, but the pattern of the cover would be uniform.

CUMULATIVE EFFECTS

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

  The following effects will occur by other projects, in addition to the direct and indirect effects of this project.

  Slash would be visible from foreground views where right-of-way clearing, chipping, and/or slash burning along the DelRey Road are proposed by the Flathead County Road Department. These would be short-term effects, although the roadway would have an "opened-up" appearance.

  The Chicken-Werner Timber Sale will aesthetically affect the view by harvesting mature trees; damaging vegetation; creating slash and landing piles; and disturbing soil along major skid trails and landings along, approximately, 5.5 additional miles of the Lower Whitefish and Werner Peak roads. Foreground view would now open up to middleground views. The pattern of trees remaining and the size of the area being treated would appear similar to the results of a moderately severe fire. Roadside vegetation that is protected from harvesting activities would limit views into harvest units from roadways. Portions of the harvest units would be visible from various vantage points. Openings would be visible, with the patterns and sizes similar to the expected results of fire.

RECREATION

INTRODUCTION

The project area currently experiences various recreational uses by the general public. The methodologies used to portray the existing condition and determine recreational impacts of the project include determining the recreational uses, approximate revenues, and the potential for conflict between project activities and recreational uses. The analysis area includes all legally accessible State land within the project area and the roads that would be used to haul equipment and logs. The dollars displayed are estimates for comparing alternatives and making decisions and may not reflect actual returns or costs.

EXISTING CONDITION

Existing recreational uses encompass most of the activities allowed with the purchase of a State Recreational Use License, such as berry picking, snowmobiling, sightseeing, hiking, biking, overnight camping, and hunting. Revenue from Recreational Use Licenses from the project area are approximately $280 per year. Four snowmobile outfitters, which generate about $2,200 per year, are the only current commercial licenses. Trapping occurs, but is managed by DFWP; no trapping revenues are collected by DNRC. Conflicts have occurred between snowmobilers and loggers when roads have been plowed open during the winter. The Smith Lake area has experienced conflicts between local walk-ins and motorized day/overnight users.

RECREATION

DIRECT EFFECTS

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

  Effects would not be expected to change from the existing condition.

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

  Recreational uses and revenues are not anticipated to change from the existing condition. Road restrictions would be in place for several days to accommodate road work; delays would occur for several hours at the bridge-replacement site during construction.

INDIRECT EFFECTS

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

  Effects would not be expected to change from the existing condition.

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

  The amount of recreation may change during the winter months. Revenue from existing commercial licenses may decrease. Winter logging operations could increase the number of conflicts between snowmobilers and loggers. Conflicts at Smith Lake should not substantially change from the existing condition.

CUMULATIVE EFFECTS

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

  Winter logging operations on the Chicken/Werner Timber Sale could increase the number of conflicts between snowmobilers and loggers.

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

  The amount of recreation may change during the winter months. Revenue from existing commercial licenses may decrease. In coordination with the Chicken/ Werner Timber Sale Project and this timber sale, there is an increased likelihood of winter logging activity on Lower and Upper Whitefish roads. Winter logging operations could increase the number of conflicts between snowmobilers and loggers. Conflicts at Smith Lake should not significantly change from the existing condition.

AIR QUALITY

INTRODUCTION

Air quality could be effected by prescribed burning and road dust created by project-related activities. The methodologies used to analyze effects to air quality include estimating the location, amount, and timing of smoke generated from prescribed burns, and road dust created by project-related activities. The air quality analysis area includes all of Flathead County, which is a part of Montana Airshed 2 as defined by the Montana Airshed Group.

EXISTING CONDITION

The project area currently contributes very low levels of air pollution to the analysis area or local population centers. Temporary reductions to air quality from the project area exist in the summer and fall due smoke generated from prescribed burns and dust produced by vehicles driving on dirt and gravel roads. None of the reductions to air quality affect local population centers beyond EPA standards. All burning activities comply with emission levels authorized by the Montana Airshed Group in the analysis area by all major burners. The project area is outside any of the local Impact Zones where additional restrictions may be imposed to protect air quality.

DIRECT EFFECTS

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

  Effects would not be expected to change from the existing condition.

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

  Postharvest burning would produce smoke emissions; log hauling and other project-related traffic on dirt roads would increase the amount of road dust during dry periods. Provided that burning is completed within the requirements imposed by the Montana Airshed Group and dust-abatement material is applied to roads during dry periods, none of the increases in emissions is expected to exceed standards or impact local population centers.

INDIRECT EFFECTS

- ***Indirect Effects Common to All Alternatives***

  Since emissions are expected to remain within the standards for air quality, no indirect effects to human health at local population centers are anticipated.

CUMULATIVE EFFECTS

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

  Effects would not be expected to change from the existing condition.

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

  Additional smoke from prescribed burning produced on adjacent USFS, private industrial forest lands, and State trust lands would remain within the standards for air quality, but the cumulative effect during peak burning periods could affect individuals with respiratory illnesses at local population centers for short durations. All known major burners operate under the requirements of the Montana Airshed Group, which regulates the amount of emissions produced cumulatively by major burners.

SOILS

INTRODUCTION

Soil productivity could be affected by activities related to the project. The methodologies used to portray the existing condition and determine impacts to the productivity of the soil include estimating the amount of soil compacted and displaced from roads, skid trails, and areas scarified to prepare the sites for tree regeneration. The analysis area for soils includes the locations proposed for timber harvesting.

EXISTING CONDITION

Most of the proposed harvest locations have been harvested in the past with ground-based machinery, such as skidders and dozers. The existing spacing of the trails is, approximately, 200 feet. The trails, which have grown vegetation well since the original harvests, are not eroding. Soils on the midslope are generally well drained and have an average-to-long season of use with the soil productivity minimally impacted. Less than 15 percent of the area is impacted by the compaction or displacement of soils. Up to 15 percent of an area could be impacted by compaction or displacement before productivity would be negatively impacted.

DIRECT EFFECTS

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

  Soils on inadequately drained roads would continue to erode.

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

  Approximately 80 acres, or 12.5 percent, of the acres within the proposed harvest units may be impacted. Project design mitigations would comply with BMPs to maintain long-term soil productivity. In addition, debris would be left on the ground to decompose and provide useful nutrients to the soil in the future.

- ***Direct Effects to Action Alternative C***

  Approximately 72 acres, or 11.4 percent, of the acres within the proposed harvest units would be impacted. Project design mitigations would comply with BMPs to maintain long-term soil productivity. In addition, debris would be left on the ground to decompose and provide useful nutrients to the soil in the future.

INDIRECT EFFECTS

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

  Effects would not change from the existing condition in the short term. In the long term, soil compaction would decrease as vegetation root mass helps break up the soils.

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

  The growth rates of trees in skid trails and landings would be reduced. Runoff infiltration in compacted areas would be reduced.

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

  The growth rates of trees in skid trails and landings would be reduced. Runoff infiltration in compacted areas would be reduced.

CUMULATIVE EFFECTS

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

  In the short term, effects would not change from the existing condition. In the long term, soil compaction would decrease as vegetation root mass helps break up the soils. Currently, no other projects are proposed inside the proposed harvest units that would additionally compact or displace soils.

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

  Less than 15 percent of the harvested areas would be impacted from soil compaction and/or soil displacement from both past activities and the proposed project. Currently, no other projects are proposed inside the proposed harvest units that would additionally compact or displace soils.

IRRETRIEVABLE AND IRREVERSIBLE COMMITMENTS OF NATURAL RESOURCES

IRRETRIEVABLE

According to Shipley *(1995)*, irretrievable commitments of resources are lost for a period of time. Some stands in the project area are mature, with individual trees more than 150 years old. Any of the timber-harvesting alternatives would cause some of these large, old, live trees to be irretrievably lost; they would no longer contribute to future snag recruitment, stand structure and compositional diversity, aesthetics, wildlife habitat, nutrient-recycling processes, or any other important ecosystem functions.

Areas that will be 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

According to Shipley *(1995)*, irreversible commitments of resources are commitments that 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 allow for the continued growth of established trees, they would ultimately become equivalent in size to the irretrievably harvested trees.

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.

SUMMARY OF RELATIONSHIP BETWEEN SHORT-TERM AND LONG-TERM PRODUCTIVITY

Generally, short-term uses are those that occur annually. Long-term productivity refers to the ability of the land to produce a continuous supply of a resource.

All harvest alternatives are designed to protect the long-term productivity of the sites. The stocking reduction that would occur under each action alternative would be anticipated to increase the health and growth of new stands, as well as residual stands, resulting in increased long-term productivity. The postharvest stands would more closely resemble stands that existed historically and provide a variety of opportunities for use in the long term.

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TAYLOR SOUTH TIMBER SALE PROJECT

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REFERENCES

TAYLOR SOUTH TIMBER SALE PROJECT

REFERENCES

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GLOSSARY

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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.

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

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

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 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.

Compaction
Increase in 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.

Core area
See Security Habitat (grizzly bears).

Cover
See HIDING COVER and/or THERMAL COVER.

Co-dominant tree
A tree which 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.

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

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 harvest.

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.

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

Discounting
In economics, a method of accounting for the value of money over time, its ability to earn interest, so that costs and benefits occurring at different points in time are brought to a common date for comparison.

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

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 area (ECA)
The total area within a watershed where timber has been harvested, including clearcuts, partial cuts, roads, and burns.

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 harvest that may occur without substantially increasing the risk of causing detrimental effects to stream-channel stability.

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.

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; road maintenance; resource monitoring; noxious weed management; and right of way acquisition on a State Forest.

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

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

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.

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

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

Landscape
An area of land with interacting ecosystems.

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

Moving-window analysis
A computer-based method that, in this EIS, is used to quantify the area influenced by roads in a study area. Starting with the pixel in the upper left corner of the computerized subunit map, the computer calculates how many miles of road exist within a 1-square-mile "window" around that pixel. It moves to the next pixel and repeats the process until the road density is calculated in a 1-square-mile area around every pixel in the study area. The number and percentage of pixels in the study area that fall into different road density classes are then calculated by the computer.

Based on research studying the effects of roads on grizzly bears, the effects of open roads are measured by the percentage of the pixels in the study area that have at least 1.0 mile of open road in the surrounding 1-square-mile window. The effects of total roads (open, gated, barricaded, bermed, but not brushed, etc.) are measured by the percentage of pixels in the study area that have at least 2 miles of open or restricted roads in the surrounding 1-square-mile window.

Multistoried stands
Timber stands with two 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. It is either mapped for a specific nest, based on field data, or, if that is impossible, is defined as the area within a ¼-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 and/or not implementing the proposed project.

Nonforested area
A naturally occurring area where trees do not establish over the long term, such as a bog, natural meadow, avalanche chute, and alpine areas.

Old growth
Working definition - Old growth is defined by DNRC as stands that are 150 years and older (140 for lodgepole pine) and that exhibit a range of structural attributes associated with old age.

Conceptual definition - The term old growth is sometimes used to describe the later, or older, stages of natural development of forest stands. Characteristics associated with old-growth generally include relatively large old trees, containing a wide variation in tree sizes, exhibiting some degree of a multi-storied structure, having signs of decadence, such as rot and spike-topped structure, and containing standing large snags and large down logs.

Old-growth network
A collection of timber stands that are selected to meet a management strategy that would retain and recruit old growth over the long term. Elements that are considered in the selection of stands include biodiversity, wildlife, the spatial arrangement of stands and their relationship to landscape patterns and processes.

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.

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 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 Beaver Lake Timber Sale Project 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 cutting operation.

Road construction activities
In general, "road construction activities" refers to all the activities conducted while building new roads, reconstructing existing roads, and obliterating roads. These 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
- blading and shaping road surfaces

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

Saplings
Trees 1.0 inches to 4.0 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.

Security habitat (grizzly bears)
An area of a minimum of 2,500 acres that is at least 0.3 miles from trails or roads with motorized travel and high-intensity, nonmotorized use during the nondenning period.

Seedlings
Live trees less than 1.0 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 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 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, Douglas-fir, Engelmann spruce, and western red cedar.

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

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, 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 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 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 with overtopping trees.

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% 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% 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, 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 standing trees and bucking into logs
- skidding logs to a landing
- processing, sorting, and loading logs at the landing
- hauling logs to a mill
- slashing and sanitizing residual vegetation damaged during logging
- machine piling logging slash
- burning logging slash
- scarification, site preparation
- planting trees

Transaction Evidence Equation
Multivariant regression based on past sales and market variables.

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 mammals, such as mule deer, white-tailed deer, elk, moose, which are mostly herbivorous and many are horned or antlered.

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

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
An increase in average annual runoff over natural conditions due to forest canopy removal.

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.

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