UPPER SWEDE TIMBER SALE

Environmental Assessment

MONTANA DEPARTMENT OF NATURAL RESOURCES AND CONSERVATION

Northwest Land Office – Stillwater Unit

FEBRUARY 2020

Upper Swede Timber Sale

Environmental Assessment

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Environmental Assessment

Project Name: Upper Swede Timber Sale
Proposed Implementation Date: June 2020
Proponent: Stillwater Unit, Northwest Land Office, Montana DNRC
County: Flathead

Type and Purpose of Action

Description of Proposed Action:

The Stillwater Unit of the Montana Department of Natural Resources and Conservation (DNRC) is proposing the Upper Swede Timber Sale Project. The project is located approximately 8 miles Northeast of Olney, Montana (refer to Attachments Vicinity Map A-**1** and Project Map A-**2**) and includes the following sections:

Beneficiary	Legal Description	Total Acres	Treated Acres
Common Schools	**Sec. 2,3,10,11,12,13,14, T33N R23W & Sec. 34, 35 T34N R23W**	**2,036**	**420**
Public Buildings			
MSU 2nd Grant			
MSU Morrill			
Eastern College-MSU/Western College-U of M			
Montana Tech			
University of Montana			
School for the Deaf and Blind			
Pine Hills School			
Veterans Home			
Public Land Trust			
Acquired Land			

Objectives of the project include:

- Establish areas of regeneration for the desired species mix, improve vigor/tree growth, and meet the HCP commitments and Forest Management Rules in relation to wildlife, fisheries, and water quality.
- Contribute to the DNRC and Northwestern Land Office's annual targets of timber-harvest volumes. DNRC is required by state law (77-5-221 through 223, MCA) to annually harvest approximately 56.9 million board feet (MMbf) statewide.
- Apply Best Management Practices (BMPs) or meet design criteria that are necessary to promote long-term water quality and fishery habitat during logging and road improvement operations.
- Develop and implement a transportation plan for forest management activity within the Upper Swede Project area.

Proposed activities include:

Action	Quantity
Proposed Harvest Activities	# Acres
Clearcut	
Seed Tree	420
Shelterwood	
Selection	
Commercial Thinning	
Salvage	
Total Treatment Acres	**420**
Proposed Forest Improvement Treatment	# Acres
Mechanical Site Preparation	119
Broadcast Burning	301
Planting	205
Proposed Road Activities	# Miles
New permanent road construction	1.2
New temporary road construction	3.7
Road maintenance	15.0
Road reconstruction	0.03
Road abandoned	
Road reclaimed	0.64
Other Activities	
Install Fish Passage Culvert	

Duration of Activities:	4.5 years
Implementation Period:	June 2020 – December 2025

The lands involved in this proposed project are held in trust by the State of Montana. (Enabling Act of February 22, 1889; 1972 Montana Constitution, Article X, Section 11). The Board of Land Commissioners and the 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 the beneficiary institutions (Section 77-1-202, MCA).

The DNRC would manage lands involved in this project in accordance with:

- The State Forest Land Management Plan (DNRC 1996)
- Administrative Rules for Forest Management (ARM 36.11.401 through 471)
- The Montana DNRC Forested State Trust Lands Habitat Conservation Plan (HCP) (DNRC 2010)
- All other applicable state and federal laws

Project Development

SCOPING:

- DATE:
  - July 18, 2019
- PUBLIC SCOPED:
  - The scoping notice was posted on the DNRC Website: http://dnrc.mt.gov/public-interest/public-notices for 30 days.
  - In July 2019, DNRC solicited public participation for 30 days on the Upper Swede Timber Sale Project. The Initial Proposal with maps was sent to 66 individuals, agencies, and other organizations that have expressed interest in DNRC's management activities. A notification of this project was also placed in the Whitefish Pilot and Daily Interlake newspapers, as well as being posted at the Olney Post Office.
- AGENCIES SCOPED:
  - MT Fish, Wildlife, & Parks; all DNRC Bureaus; and Montana tribes.
- COMMENTS RECEIVED:
  - How many: 1
  - Concerns:
    - Letter received from MT Fish, Wildlife, & Parks with no specific comment, only informing the DNRC that they would have additional follow-up with our project Wildlife Biologist.
  - Results (how were concerns addressed): There were no public concerns to address and DNRC's biologist consulted with the MFWP biologist.

Internal and external issues, as well as resource concerns, were considered by the Interdisciplinary Team (ID) and project Decision Maker (Stillwater Unit Manager). These issues and concerns were incorporated into project planning and design phases of the project and would be implemented in associated actions and contracts. The ID Team developed an action alternative within the framework of the SFLMP, HCP, and DNRC Forest Management Rules. One action alternative was developed because the various issues and concerns the ID Team can be addressed with adequate planning and associated mitigations.

INTERDISCIPLINARY TEAM (ID):

- Project Leader: Jeremy Akin
- Archeologist: Patrick Rennie
- Wildlife Biologist: Leah Breidinger
- Hydrologist: Marc Vessar
- Real Estate Specialist: Nicole Stickney

PROJECT DEVELOPMENT:

The development of this timber sale included the prioritization of timber stands for harvesting, transportation planning, and development of mitigations to reduce resource impacts. These items are discussed in detail below:

- **Stand Prioritization**:
  The following types of forest conditions focused foresters on considering treatments to improve stand health and stocking densities. These included:
  - Areas of advanced insects/disease issues (primarily root rot, and bark beetle activity)
  - Previously forested areas, currently occupied by grass/shrubs and brush.
  - Cover types:
    - Historically, nearly 71% of the project area was a western white pine cover type, 26% western larch/Douglas-fir and approximately 3% mixed conifer cover type. Today, only 11% of the project area is in the western white pine cover type, 33% is in the mixed conifer cover type, and 22% in the subalpine fir cover type. Transition of these stands to their historic cover types may be achieved through harvesting shade-tolerant species and implementing site preparation following timber harvest. Also, planting a desirable species mix may be appropriate where healthy/adequate seed sources are not available.
  - Mature forests and old-growth:
    - Within the project area there is approximately 588.75 acres of old growth of which approximately 152 acres are classified as "high attribute". Through field reconnaissance and ID Team field visits, it was determined that we would focus on retaining the high attribute old growth stands within ground-based harvesting units where stand health was not a major issue. This influenced some stands being deferred from entry with this proposed timber sale project.

- **Transportation Development**:
  The development of a transportation plan for the Upper Swede Project is a primary objective for forest management in this area. The following were influencing factors on the proposed new permanent road location:
  - Sensitive areas (wetlands, marshes/riparian):
    - Numerous springs, streams, and sensitive riparian areas are spread throughout the project area and within/adjacent to proposed harvest units. As these areas were identified during field layout, proposed road locations were adjusted to avoid these areas when feasible.
  - Stream crossings & crossing type (bridge, culvert)
    - Two culvert crossings inhibit passage of fish. One crossing has minimal forest land tributary to the crossing site; the other crossing does not allow fish passage and the road is not wide enough to facilitate log hauling. DNRC would remove the culvert at the first site (unnamed tributary in west half of Section 34, T34N, R23W) and rehabilitate the stream channel to minimize sediment and facilitate fish passage. The culvert on Swede Creek in east half of Section 3 T33N, R23W would be replaced to allow fish passage through the culvert and the road would be widened to allow log-trucks to haul.
  - Economics (construction/maintenance costs, depreciation of infrastructure)
    - New road construction/maintenance can be an expensive cost associated with timber sales. Transportation planning and road layout included: reviewing volume associated with proposed harvest units, BMP issues (replacing old culverts, installing new fish passage pipe), and maintenance requirement of the transportation plan into the future.
  - Optimization for future uses:
    - Assessment of existing road locations and standards were conducted during the initial field reconnaissance. Existing roads have been reviewed to see if BMPs are met, if the standard is suitable for this proposal and future uses, and what improvements would be required to meet safety standards and BMPs.
    - The ID Team utilized the rules associated with Road Management (*ARM 36.11.421*). The DNRC would follow the HCP by implementing the 50-year transportation plan to minimize the amount of road needed, as well as to optimize the locations of those roads across the project area to reach these areas now and into the future.

- **Mitigations Applied During Project Design:**
  - To accomplish the various elements of the proposed project, certain mitigation measures were designed into the project. Mitigation measures are designed to reduce impacts and protect resources during harvesting and road-improvement activities. Many of the listed mitigations are written into the HCP conservation commitments and *Forest Management Rules* (ARM); others have been utilized with desired results by DNRC in similar projects. Specific mitigations will be addressed throughout this EA under individual Resource sections.

OTHER GOVERNMENTAL AGENCIES WITH JURISDICTION, LIST OF PERMITS NEEDED: ***(Conservation Easements, Army Corps of Engineers, road use permits, etc.)***

- **United States Fish & Wildlife Service-** DNRC is managing the habitats of threatened and endangered species on this project by implementing the Montana DNRC Forested Trust Lands Habitat Conservation Plan (HCP) and the associated Incidental Take Permit that was issued by the United States Fish & Wildlife Service (USFWS) in February of 2012 under Section 10 of the Endangered Species Act. The HCP identifies specific conservation strategies for managing the habitats of grizzly bear, Canada lynx, and three fish species: bull trout, westslope cutthroat trout, and Columbia redband trout. This project complies with the HCP. The HCP can be found at http://dnrc.mt.gov/divisions/trust/forest-management/hcp.

- **Montana Department of Environmental Quality (DEQ)-** DNRC is classified as a major open burner by DEQ and is issued a permit from DEQ to conduct burning activities on state lands managed by DNRC. As a major open-burning permit holder, DNRC agrees to comply with the limitations and conditions of the permit.

  A Short-term Exemption from Montana's Surface Water Quality Standards (318 Authorization) would also be required from DEQ with the installation of new culverts and with the removal and replacement of culverts within streams, if it is deemed to introduce sediment above natural levels into streams.

- **Montana/Idaho Airshed Group-** The DNRC is a member of the Montana/Idaho Airshed Group which was formed to minimize or prevent smoke impacts while using fire to accomplish land management objectives and/or fuel hazard reduction (Montana/Idaho Airshed Group 2006). The Group determines the delineation of airsheds and impact zones throughout Idaho and Montana. Airsheds describe those geographical areas that have similar atmospheric conditions, while impact zones describe any area in Montana or Idaho that the Group deems smoke sensitive and/or having an existing air quality problem (Montana/Idaho Airshed Group 2006). As a member of the Airshed Group, DNRC agrees to burn only on days approved for good smoke dispersion as determined by the Smoke Management Unit.

- **Montana Department of Fish, Wildlife and Parks (DFWP)-** A Stream Protection Act Permit (124 Permit) is required from DFWP for activities that may affect the natural shape and form of a stream's channel, banks, or tributaries. Such activities include:
  - Installation/replacement of culverts on existing and temporary roads
  - Installation and removal of temporary bridges

ALTERNATIVES CONSIDERED:

No-Action Alternative:
Under this alternative, no timber would be harvested and therefore no revenue would be generated from the project area for the Common Schools Trust at this time. Salvage logging, firewood cutting, recreational use, fire suppression, noxious-weed management, and additional requests for permits and ongoing management would continue to occur. Natural events such as plant succession, tree mortality due to insects and disease/windthrow, downed fuel accumulation, in-growth of ladder fuels, and wildfires would continue to occur.

Action Alternative:
A commercial timber harvest would occur on 420 acres, removing approximately 4 MMbf of timber. This volume would be harvested utilizing ground-based equipment on 119 acres and skyline yarding on 301 acres. Mechanical piling and scarification would be performed on ground-based harvesting units and prescribed broadcast burning or herbicide treatments would be applied on skyline yarding units to reduce slash fuel loading or reduce brush competition allowing for natural regeneration/planting sites. Specific harvest unit data is provided in **Attachment B – Upper Swede Timber Sale Project Prescription Table**; using this table and associated maps in **Attachment A - Maps** will provide further details for this project.

An even-aged management strategy would be applied across the harvested units to promote DNRC's desired future conditions (*ARM 36.11.405*). The DNRC's desired future condition would be obtained through seed tree harvests, in which 6 to 8 trees per acre would be retained for seed source, thus promoting healthy regeneration of the desired species mix.

Road maintenance and Best Management Practices (BMP) improvements would be performed on approximately 15 miles of existing roads. Additionally, there would be the rehabilitation of one fish barrier culvert installation, installation of one large fish passage culvert, approximately 1.2 miles of new permanent road construction and 3.7 miles of new temporary roads to facilitate harvest operations.

Impacts on the Physical Environment

VEGETATION:

Issues and Concerns- The following issue statements were developed during scoping regarding the effects of the proposed action to vegetation:

- Many forest cover types found in the project area do not match the DNRC's desired future condition (DFC) for those stands.
- Timber harvesting and road construction through old growth stands may affect the amount, quality, attribute level, and distribution within the project area as well as on the Stillwater Unit.
- Slow growth, decreased vigor, fading crowns and the occurrence of insects/disease (bark beetle/rot) is common throughout stands within the project area.

- Noxious weeds are present along open and closed roads within the project area. Further soil disturbance and logging equipment activity could increase the amount and distribution of noxious weeds in the project area.

Recommended Mitigation Measures for Vegetation- The analysis and levels of effects to vegetation resources are based on implementation of the following mitigation measures.

- Require all tracked or wheeled equipment to be cleaned of noxious weeds prior to beginning project operations.
- Control the spread of noxious weeds with pre– and post- herbicide treatments on established weed populations.
- Require prompt vegetation seeding of all disturbed roadside sites. Roads used and closed as part of this proposal would be reseeded and reshaped to prevent motorized use.

FOR COMPLETE VEGETATION ANALYSIS SEE APPENDIX A.

SOILS:

Issues and Concerns- The following issue statements were developed during scoping regarding the effects of the proposed action to soils:

- Timber harvesting activities may adversely affect soil resources due to increased compaction, displacement and erosion.
- Removal of both coarse and fine woody material off site during timber harvest operations can reduce nutrient pools required for future forest stands and can affect the long-term productivity of the site.

Recommended Mitigation Measures for Soils- The analysis and levels of effects to soils resources are based on implementation of the following mitigation measures:

- Limit equipment operations to periods when soils are relatively dry, (less than 20 percent oven-dried weight), frozen, or snow-covered to in order to minimize soil compaction and rutting and maintain drainage features. Check soil moisture conditions prior to equipment start-up.
- On ground-based units, especially on previously harvested areas, the logger and sale administrator would agree to a skidding plan prior to equipment operations. Skid-trail planning would identify which main trails to use and how many additional trails are needed. Trails that do not comply with BMPs (i.e. trails in draw bottoms) would not be used unless impacts can be adequately mitigated. Regardless of use, these trails may be closed with additional drainage installed, where needed, or grass-seeded to stabilize the site and control erosion.
- Tractor skidding should be limited to slopes of less than 40 percent unless the operation can be completed without causing excessive displacement or erosion. Based on site review, short, steep slopes may require a combination of mitigation measures, such as adverse skidding to a ridge or winchline, and skidding from more moderate slopes of less than 40 percent.

- Keep skid trails to 20 percent or less of the harvest unit acreage. Provide for drainage in skid trails and roads concurrently with operations.

- Skyline corridors shall be spaced not less than 75 feet apart. In the case of ridges where fan-shaped settings are required, the minimum distance at the widest divergence will be 150 feet. Clearing width for corridors to accommodate yarding should not exceed 12 feet. Where skyline is required, harvest would be by log-length skidding. Leading end of the logs would be carried free of the ground at all times except during lateral yarding. Erosion control, such as slashing or retaining tops, would be required within cable skidding corridors where excessive soil disturbance may be of an extent to cause erosion. The contract administrator would monitor conditions and recommend erosion control as needed.

- Slash disposal: Limit the combination of disturbance and scarification to 30 to 40 percent of the harvest units. No dozer piling on slopes over 35 percent; no excavator piling on slopes over 40 percent, unless the operation can be completed without causing excessive erosion. Consider lopping and scattering or jackpot burning on the steeper slopes. Consider disturbance incurred during skidding operations to, at least, partially provide scarification for regeneration.

- Retain 12 to 24 tons of large woody debris and a feasible majority of all fine litter following harvesting operations. On units where whole tree harvesting is used, implement one of the following mitigations for nutrient cycling: 1) use in-woods processing equipment that leaves slash on site; 2) for whole-tree harvesting, return-skid slash and evenly distribute within the harvest area; or 3) cut tops from every third bundle of logs so that tops are dispersed as skidding progresses.

FOR COMPLETE SOILS ANALYSIS SEE APPENDIX B.

WATER AND FISHERIES RESOURCES:

Issues and Concerns- The following issue statements were developed during scoping regarding the effects of the proposed action to water resources:

- Timber harvesting and road construction has the potential to increase water yield, which, in turn, may affect erosive power, in-stream sediment production, and stream channel stability.
    - *Measurement Criteria:* Annual water yield increase will serve as measure. Risk of adverse impacts will be based on channel condition, beneficial uses present and watershed thresholds. A qualitative risk assessment will assess potential impacts of peak flows.

- Timber harvesting and road construction may increase sediment delivery into streams/lakes and affect water quality.
    - *Measurement Criteria*: Risk assessment using DNRC road inventory sediment risk ratings for existing; erosion risk from the GEOLOGY AND SOILS ANALYSIS portion of the EA coupled with sediment travel distances found in relevant literature.

- Timber harvesting activities may adversely affect water quality by reducing shade and increasing stream temperature.
    - *Measurement Criteria:* Changes in riparian canopy due to the project proposal.

- Fisheries resource issues raised internally include: the proposed actions may adversely affect fisheries habitat features, including channel forms, stream temperature and connectivity.

Recommended Mitigation Measures for Water and Fisheries Resources- The analysis and levels of effects to water resources are based on implementation of the following mitigation measures.

Hydrologic related resource mitigations that would be implemented with the proposed Action Alternative include:

- Limit equipment operations to periods when soils are relatively dry, (less than 20 percent oven-dried weight), frozen, or snow-covered to minimize soil compaction, rutting and maintain drainage features. Check soil moisture conditions prior to equipment start-up.

- On ground-based units, especially on previously harvested areas, the logger and sale administrator would agree to a skidding plan prior to equipment operations. Skid-trail planning would identify which main trails to use and how many additional trails are needed. Trails that do not comply with BMPs (i.e. trails in draw bottoms) would not be used unless impacts can be adequately mitigated. Regardless of use, these trails may be closed with additional drainage installed, where needed, or grass-seeded to stabilize the site and control erosion.

- Tractor skidding should be limited to slopes of less than 40 percent unless the operation can be completed without causing excessive displacement or erosion. Based on site review, short, steep slopes may require a combination of mitigation measures, such as adverse skidding to a ridge or winchline, and skidding from more moderate slopes of less than 40 percent.

- Keep skid trails to 20 percent or less of the harvest unit acreage. Provide for drainage in skid trails and roads concurrently with operations.

- Slash disposal: Limit the combination of disturbance and scarification to 30 to 40 percent of the harvest units. No dozer piling on slopes over 35 percent; no excavator piling on slopes over 40 percent, unless the operation can be completed without causing excessive erosion. Consider lopping and scattering or jackpot burning on the steeper slopes. Consider disturbance incurred during skidding operations to, at least, partially provide scarification for regeneration.

- Follow all Forestry Best Management Practices for road construction and maintenance to minimize the risk of sediment delivery, including dewatering channels when installing or removing crossing structures.

FOR COMPLETE WATER AND FISHERIES RESOURCE ANALYSIS, SEE APPENDIX C.

WILDLIFE:

Issues and Concerns- The following issue statements were developed during scoping regarding the effects of the proposed action to wildlife:

- *Mature forest cover and connectivity*. The proposed activities could decrease mature forested cover, which could reduce habitat connectivity and suitability for wildlife species associated with mature forests.

- *Old-growth forests*. The proposed activities could affect wildlife species associated with old-growth forests by reducing habitat availability and increasing fragmentation.

- *Canada lynx.* The proposed activities could reduce landscape connectivity and the availability of suitable Canada lynx habitat, reducing the capacity of the area to support Canada lynx.

- *Grizzly bears*. The proposed activities could affect grizzly bear cover, affect important habitat, and increase human access, which could adversely affect bears by displacing them from important habitat, and/or by increasing risk of human-caused bear mortality.

- *Fishers*. The proposed activities could reduce the availability and connectivity of suitable fisher habitat and increase human access, which could reduce fisher habitat suitability and increase trapping mortality.

- *Pileated woodpeckers.* The proposed activities could reduce tree density and alter the structure of mature forest stands, which could reduce habitat suitability for pileated woodpeckers.

Recommended Mitigation Measures for Wildlife- The analysis and levels of effects to wildlife are based on implementation of the following mitigation measures:

- If a threatened or endangered species is encountered, consult a DNRC biologist immediately. Similarly, if undocumented nesting raptors or wolf dens are encountered within ½ mile of the Project Area contact a DNRC biologist.

- Prohibit contractors and purchasers conducting contract operations from carrying firearms while on duty as per *ARM 36.11.444(2)* and *GB-PR2* (*USFWS and DNRC 2010)*.

- Contractors will adhere to food storage and sanitation requirements as described in the timber sale contract. Ensure that all attractants such as food, garbage, and petroleum products are stored in a bear-resistant manner.

- Restrict public access at all times on restricted roads that are opened for harvesting activities. Effectively close all restricted roads following harvest completion.

- Retain patches of advanced regeneration of shade-tolerant trees as per *LY-HB4* in all harvest units (*USFWS and DNRC 2010*).

- Prohibit motorized activities including commercial forest management from April 1-June 15 to provide seasonal security for grizzly bears as per *GB-NR3* (*USFWS and DNRC 2010*). Harvest units accessed from the Upper Swede Road have a longer timing restriction from April 1–June 30.

- Retain visual screening along open roads to prevent human-wildlife conflict and increase security for bears and big game as per *GB-NR4* (*USFWS and DNRC 2010*).

- Within seed tree units, no point in the harvest unit can be >600 feet to hiding cover or a topographic break.

- Retain at least 2 snags and 2 snag recruits per acre that are ≥ 21 inches diameter or the next largest available size class, favoring western larch and Douglas-fir for retention. If snags are cut for safety concerns, they must be left in the harvest unit.

- Retain coarse-woody debris according to *ARM 36.11.414* and emphasize retention of 15-inch diameter downed logs aiming for at least one 20-foot-long section per acre.

FOR COMPLETE WILDLIFE ANALYSIS SEE APPENDIX D.

AESTHETICS:

Any change to the scenery in the area from these alternatives would be in addition to past activity within the project area. This analysis includes all past and present effects.

Issues and Concerns- The following issue statement was developed during scoping regarding the effects of the proposed action to aesthetics:

- Activities associated with the proposed action may affect the visual quality as seen from a variety of locations both within and adjacent to the project area.

Recommended Mitigation Measures for Aesthetics- The analysis and levels of effects to aesthetics are based on implementation of the following mitigation measures:

- Retain visual buffers along open roads.
- Locate new road construction on benches and topographic breaks to minimize cut-and-fill slope visibility.
- Grass seeding newly exposed cut and fill slopes.
- Incorporate irregular-shaped harvest unit boundaries.

Existing Conditions - Potential impacts on the visual resource caused by timber harvesting and road building were determined based on foreground, middle ground, and background viewpoints.

The foreground and middle ground views can be seen occasionally from open road systems within the project area, such as the Upper Whitefish and Swede Creek Roads. The background view of the proposed project area can be seen from mile marker 9 of the Upper Whitefish Road and multiple locations along the Stryker Ridge Road.

The predominant forest cover types visible in the project area are dense stands of mature conifer timber with few openings created from prior harvest operations. These stands are multi-storied that change structural composition as you move along in elevation and aspect.

Environmental Effects

No-Action Alternative:
Direct, Secondary, and Cumulative Effects
Timber harvesting and road construction would not take place at this time. Natural processes such as wildfire, blowdown events, insect infestations, or disease infections would continue to alter the visual resource. Cumulatively, there would not be any additional harvest units visible. No additional effects to visual quality would occur if this alternative is implemented.

Action Alternative:
Direct, Secondary, and Cumulative Effects
Under the Action Alternative, the foreground and middle ground views into the project area would be increased due to timber harvest and reduction in tree densities. View distance would vary greatly throughout the project area depending on topography and harvest unit prescription. New road construction cut/fill slopes would be noticeable but in the years following harvest, there would be in-growth of seedlings and brush inside harvest units, skyline corridors, and on cut/fill slopes of new road construction. In the short-term the effects would be moderate until new seedlings and brush regenerate.

The background views of the proposed harvested areas would be pronounced with the surrounding untreated forested areas from certain locations mentioned above (Existing Conditions). The pronounced differences in stand edges would be anticipated to change with growth of regeneration and blowdown along non-harvested stand edges. Designing irregular shaped harvest units by following irregular shaped streamside management zones would also help reduce the visual impact of straight edges and skyline corridors.

Cumulative effects to the background views seen from the Upper Whitefish and Stryker Ridge Roads are that these proposed units and roads would be additive to the open views associated with the Swedish Chicken, Antice Knobs, and Antice Central timber sale harvest units.

Noise

No-Action Alternative:
Under the No-Action Alternative, no increase in audible noise related to forest management would be anticipated to occur.

Action Alternative:

Direct, Secondary, and Cumulative Effects
Harvest activities would be quite audible, and, depending upon air conditions, equipment could be heard many miles from their location. Noise would be generated by harvest operations, harvest related traffic, road construction, and administrative oversight. This could be expected to be present for the entire season of harvest, typically from mid-June through mid-March of the following year, for the duration of the harvest during the general “work week” (Monday through Friday).

Cumulatively the noise associated with proposed harvest and road construction would be additive to the other active timber sales in the nearby vicinity. Based on the anticipated operating periods direct, secondary, and cumulative effects of noise will be low.

HISTORICAL AND ARCHEOLOGICAL SITES:
A Class I (literature review) level review was conducted by the DNRC staff archaeologist for the area of potential effect (APE). This entailed inspection of project maps, DNRC's sites/site leads database, land use records, General Land Office Survey Plats, and control cards. The Class I search revealed that no cultural or paleontological resources have been identified in the APE. Because the APE on state land is extremely steep, the Holocene age soils in the APE are relatively thin, and because the local geology is not likely to produce caves, rock shelters, or sources of tool stone, no additional archaeological investigative work will be conducted in response to this proposed timber sale. However, if previously unknown cultural or paleontological materials are identified during project related activities, all work will cease until a professional assessment of such resources can be made.

DEMANDS ON ENVIRONMENTAL RESOURCES OF LAND, WATER, AIR, AND ENERGY:
There will be no measurable direct, secondary, and cumulative impacts related to environmental resources of land, water, air, and energy due to the relatively small size of the timber sale project.

OTHER ENVIRONMENTAL DOCUMENTS PERTINENT TO THE AREA:

- Swede Chicken Fish Passage Construction Environmental Assessment, June 2010
- Swedish Chicken Timber Sale Environmental Assessment, February 2011
- Upper Whitefish Timber Sale Environmental Assessment, March 2012

Impacts on the Human Population

HUMAN HEALTH AND SAFETY:

1) Air Quality
The DNRC is a member of the Montana/Idaho Airshed Group which was formed to minimize or prevent smoke impacts while using fire to accomplish land management objectives and/or fuel hazard reduction (Montana/Idaho Airshed Group 2006). The Group determines the delineation of airsheds and impact zones throughout Idaho and Montana. Airsheds describe those geographical areas that have similar atmospheric conditions, while impact zones describe any area in Montana or Idaho that the Group deems smoke sensitive and/or having an existing air quality problem (Montana/Idaho Airshed Group 2006).

The project area is located within Montana Airshed 2, which encompasses portions of northern Flathead County. Currently, this Airshed is north of any impact zones.

Issues and Concerns- The following issue statements were developed during scoping regarding the effects of the proposed action to air quality:

- Air quality could be affected by smoke produced during burning of logging slash generated by harvest activities.
- Air quality could be affected by dust produced during harvesting and hauling activities.

Recommended Mitigation Measures for Air Quality- The analysis and levels of effects to air quality are based on implementation of the following mitigation measures:

- Only burn on days approved by the Montana/Idaho Airshed group, DEQ, and Flathead County.
- Conduct test burn to verify good dispersal.
- Application of dust abatement on roads as necessary.
- Requiring slower speed limits as necessary to reduce dust.

-SLASH BURNING

No-Action Alternative:
No slash would be burned within the project area. Thus, there would be no effects to air quality within the local vicinity and throughout Airshed 2. Prescribed or pile burning by other nearby airshed cooperators (i.e., USFS) and other DNRC projects would have potential to affect air quality. All cooperators currently operate under the same Flathead County and Airshed Group guidelines. The State, as a member, would

burn only on approved days. This should decrease the likelihood of additive cumulative effects. Thus, cumulative effects to air quality due to slash burning associated with the No-Action Alternative are expected to be minimal.

Action Alternative:

Direct and Secondary Effects
Slash consisting of tree limbs and tops and other vegetative debris would be piled throughout the project area during harvesting. Slash would ultimately be burned after harvesting operations have been completed. Burning would introduce particulate matter into the local airshed, temporarily affecting local air quality. Over 70% of emissions emitted from prescribed burning are less than 2.5 microns (National Ambient Air Quality PM 2.5). High, short-term levels of PM 2.5 may be hazardous.

Burning within the project area would be short-lived and conducted when conditions favor good to excellent ventilation and smoke dispersion as determined by the Montana Department of Environmental Quality and the Montana/Idaho Airshed Group. The DNRC, as a member of the Montana/Idaho Airshed Group, would burn only on approved days.

Thus, direct and secondary effects to air quality due to slash burning associated with the proposed action would be minimal.

Cumulative Effects
Cumulative effects to air quality would not exceed the levels defined by State of Montana Cooperative Smoke Management Plan (1988) and managed by the Montana/Idaho Airshed Group. Prescribed burning by other nearby airshed cooperators (for example the U.S. Forest Service) would have potential to affect air quality. All cooperators currently operate under the same Airshed Group guidelines. The State, as a member, would burn only on approved days. This should decrease the likelihood of additive cumulative effects. Thus, cumulative effects to air quality due to slash burning associated with the proposed action would also be expected to be minimal.

-DUST

No-Action Alternative:
No increased dust would be produced as a result of the No-Action Alternative. Current levels of recreational and timber harvest activities would produce dust on native and gravel-surfaced roads. These uses and operations are short in duration. Thus, the cumulative effects would be expected to be minimal.

Action Alternative:

Direct, Secondary, and Cumulative Effects
Harvesting operations would be short in duration. Dust may be created from log hauling on portions of native surface roads during summer and fall months. Contract clauses would provide for the use of dust abatement or require trucks to reduce speed if necessary to reduce dust near any affected residences.

Thus, direct, secondary, and cumulative effects to air quality due to harvesting and hauling associated with the proposed action would be minimal.

2) Log Hauling Traffic
Log hauling traffic is common in the project area.

Issues and Concerns- The following issue statements were developed during scoping regarding the effects of the proposed action to log hauling traffic:

- Increased traffic, especially log truck traffic, may increase the hazards the public encounters while driving the Upper Whitefish Road, which is narrow and has limited visibility along some sections.

Recommended Mitigation Measures for Log Hauling Traffic- The analysis and levels of effects of log hauling traffic is based on implementation of the following mitigation measures:

- Log hauling would take place typically during the general "work week" (Monday – Friday) especially during winter period. Some equipment and, occasionally, logs may be hauled on weekends.
- Signs will be posted making the public aware of log hauling traffic in the area.
- The Upper Whitefish Road is posted at 25 MPH but if necessary, a slower speed limit may be imposed in the timber harvest contract or during administration of the project.

No-Action Alternative:
No increase in log-truck traffic would occur, but other timber sale projects would continue to haul on the Upper Whitefish Road.

Action Alternative:

Direct, Secondary, and Cumulative Effects
Log truck traffic in the area would increase for the duration of the timber sale. However, signs will be posted indicating that log truck traffic is present in the area. If necessary, a slower speed limit may be imposed in the timber harvest contract.

Based on the mitigation measures direct, secondary, and cumulative effects of log hauling on human health and safety would be minimal or low.

RECREATION *(including access to and quality of recreational and wilderness activities):*

Issues and Concerns- The following issue statements were developed during scoping regarding the effects of the proposed action to recreation:

- Log hauling and harvest activities could affect licensed commercial as well as general recreational use with potential road closures, delays, detours and the shared use of plowed roads during the winter season.

Recommended Mitigation Measures for Recreation- The analysis and levels of effects to recreation are based on implementation of the following mitigation measures:

- Installation of signs notifying recreationalists of trail and road closures, detours, and delays.
- If winter harvest activities and log hauling take place, then DNRC would:
    - Restrict log hauling to weekdays only, Monday – Friday.
    - Prohibit log hauling between the periods of December 24 and January 2.

- Further develop safety measures that ensure safe travel and communication between commercial harvesting operations and recreationalists (signage, reduced speed, softened approaches onto plowed roads, and designated parking areas.)
- Coordinate road plowing with trail grooming to provide a wide enough road for log trucks and snowmobiles to pass one another safely during the winter season. Current road restrictions for wheeled vehicles for the public would still be implemented.

Existing Conditions
The Upper Whitefish Road is an open, high-use road shared by recreationists and commercial timber harvesting operations and is part of the main haul route for timber sales in the Upper Whitefish Lake area. This road is part of a system of open gravel roads that connect the following areas: Olney, Stryker, Whitefish, Upper Whitefish Lake Campground, Red Meadow Lake and Polebridge. Because of this, the area has become popular with tourists and receives a moderately high amount of use.

During summer and fall, the area is primarily used for general recreation such as berry picking, hunting, fishing, camping, hiking, biking and sightseeing. A historic hiking trail, the Swede Creek Trail, begins at the junction of the Swede Creek road and parallels Swede Creek through the project area for approximately 2 miles until its junction with the Ralph Thayer Memorial Trail located atop the Whitefish Range.

In winter months, commercial recreation increases while the primary general recreation uses are snowmobiling and trapping. The Upper Whitefish Road is part of a 60+-mile system of groomed snowmobile trails licensed and maintained by the Flathead Snowmobile Association. Three licensed snowmobile rental businesses are authorized to utilize this trail system for guided commercial tours. Concurrently, the Olney snowmobile trailhead located near the junction of Highway 93 and the Upper Whitefish Road is the most popular snowmobile trailhead located on Stillwater State Forest. Most of the main haul route is groomed for snowmobile travel between December 1st – April 1st, when conditions allow.

The junction of Highway 93 and the Upper Whitefish Road is also the location of a commercial lease issued to a recreation-related business as a primary business location. This business operates yearlong under a commercial lease and has an associated land use license for guided and unguided snowmobile rentals utilizing the Flathead Snowmobile Association's groomed trail. In the summer of 2019, the business was issued a Special Recreational Use License for guided ATV/UTV tours and rentals utilizing open roads on Stillwater State Forest.

No-Action Alternative:
Direct, Secondary, and Cumulative Effects
No changes in recreation or road status would occur. Therefore, there would be no measurable direct or secondary impacts on recreation from this proposed action. Cumulatively, if another timber sale is log hauling in the winter, minor effects would occur, and similar mitigations noted above would apply.

Action Alternative:

Direct, Secondary, and Cumulative Effects

Recreation within the project area would continue to be available year-round. Although new permanent roads and temporary roads would be built, these roads would not be open for public motorized use except between December 1 and March 31st.

Temporary road closures would occur on the Swede Creek Road in conjunction with planned road work as well as during harvesting operations in units 7, 10, 11, 12, & 13. Temporary delays along Upper Whitefish Road or detours via the lower part of Stryker Ridge Road and Antice Loop Road would likely be necessary to harvest the roadsides in Unit 1, 2, 6 and 9. Additionally, the Swede Creek Trail would be closed temporarily due to safety concerns while logging is active in harvest unit 7. However, these closures are anticipated to be short and cause minor effects to recreationalists.

There would be negative effects to winter recreational pursuits if winter harvesting and hauling were to occur. Snow plowing the Upper Whitefish and portions of Swede Creek Road would be necessary, however following the mitigations mentioned above, the effects to winter recreation would be minimized.

Indirectly, recreational opportunities in the project area would likely benefit. Harvest operations would create openings that could be used for a multitude of activities, such as downhill skiing, hunting, and snowmobiling, until regeneration grows to a large enough diameter and restricts travel.

Cumulatively, over the next three to five years, this project plus 7 other timber sales could be hauling logs on portions of the Upper Whitefish road system adding to the vehicle traffic recreationists might encounter. Likewise, commercial recreational licenses utilizing the Upper Whitefish Road may be halted during peak seasons of log truck traffic to alleviate traffic congestion.

Will the Alternative result in potential impacts to:	**Impact**												**Can Impact Be Mitigated?**	**Comment Number**
	Direct				**Secondary**				**Cumulative**					
	No	Low	Mod	High	No	Low	Mod	High	No	Low	Mod	High		
No-Action														
Health and Human Safety	**x**				**x**				**x**					
Industrial, Commercial, and Agricultural Activities and Production	**x**				**x**				**x**					
Quantity and Distribution of Employment	**x**				**x**				**x**					
Local Tax Base and Tax Revenues	**x**				**x**				**x**					
Demand for Government Services	**x**				**x**				**x**					
Density and Distribution of Population and Housing	**x**				**x**				**x**					
Social Structures and Mores	**x**				**x**				**x**					
Cultural Uniqueness and Diversity	**x**				**x**				**x**					
Action														
Health and Human Safety		**x**			**x**				**x**				**Yes**	**R-1**

Will the Alternative result in potential impacts to:	Impact												Can Impact Be Mitigated?	Comment Number
	Direct				Secondary				Cumulative					
	No	Low	Mod	High	No	Low	Mod	High	No	Low	Mod	High		
Industrial, Commercial, and Agricultural Activities and Production	x				x				x					R-2
Quantity and Distribution of Employment		x			x				x					R-3
Local Tax Base and Tax Revenues	x				x				x					
Demand for Government Services	x				x				x					
Density and Distribution of Population and Housing	x				x				x					
Social Structures and Mores	x				x				x					
Cultural Uniqueness and Diversity	x				x				x					

Comments:

R-1: Mitigations have been developed for all log hauling to allow for safe travel and shared use of plowed roads during the winter season (see "Mitigations" above).

R-2: Due to the relatively small size of the proposed timber sale, no measurable direct, indirect, or cumulative effects would be likely.

R-3: Employment within the logging industry is common in the Flathead area, and this project could in a small way contribute to local employment.

LOCALLY ADOPTED ENVIRONMENTAL PLANS AND GOALS:

- There are no locally adopted environmental plans or goals associated with this proposal.

OTHER APPROPRIATE SOCIAL AND ECONOMIC CIRCUMSTANCES:

The Upper Swede Timber Sale would generate approximately $381,301 for the Common Schools Trust, invest $85,000 into road improvements/maintenance, and approximately $111,096 in Forest Improvement (FI) fees would be collected for FI projects. This is based on a stumpage rate of $16.44 per ton, multiplied by the estimated volume of 23,193 tons (3.74 MMbf). This stumpage rate was derived by comparing attributes of the proposed timber sale with the attributes and results of other DNRC timber sales recently advertised for bid. Costs related to the administration of the timber sale program are only tracked at the Land Office and Statewide level. DNRC does not track project-level costs for individual timber sales.

Costs, revenues, and estimates of return are estimates intended for relative comparison of alternatives. They are not intended to be used as absolute estimates of return.

Mills in Montana need 351 MMBF per year to maintain current production levels and industry infrastructure. Currently the Sustained yield and target harvest from Trust Lands is 56.9 MMbf, which represents approximately 16.4% of timber harvested in the state of Montana. This project would provide approximately 3.74 MMbf of timber towards the sustained yield target thus helping sustain current mill capacity.

Environmental Assessment Checklist Prepared By:

Name: Jeremy Akin
Title: Management Forester
Date: February 13, 2020

Finding

Alternative Selected
Upon Review of the Environmental Assessment and attachments, I find the Action Alternative, as proposed, meets the intent of the project objectives as stated in **Type and Purpose of Action**.

The lands involved in this project are held by the State of Montana in trust for the support of specific beneficiary institutions and DNRC is required by law to administer these trust lands to produce the largest measure of reasonable and legitimate return over the long run (Enabling Act of February 22, 1889; 1972 Montana Constitution, Article X Section 11; and, 77-1-212 MCA).

The Action Alternative complies with all pertinent environmental laws, the DNRC SFLMP and HCP, and is based upon a consensus of professional opinion on limits of acceptable environmental impact. We did not receive any comment on this project from the public during the scoping process. However, DNRC will assure existing and future recreation licensees are kept informed on the status of logging activities associated with this project. For these reasons and on behalf of DNRC I have selected the Action Alternative to be implemented on this project.

In summary, I find that the identified adverse impacts will be controlled, mitigated, or avoided by the design of the project to the extent that the impacts are not significant.

Significance of Potential Impacts
After a review of the scoping documents and comments, project file, Forest Management Rules, SFLMP and HCP checklists, and Department policies, standards, and guidelines, I find all the identified resource management concerns have been fully addressed in this Environmental Assessment and its attachments.

Specific project design features and various recommendations by the resource management specialists will be implemented to ensure that this project will fall within the limits of environmental change. Taken individually and cumulatively, the proposed activities are common practices, and no project activities are being conducted on important unique or fragile sites. I find there will be no significant impacts to the human environments as a result of implementing the Action Alternative.

Need for Further Environmental Analysis

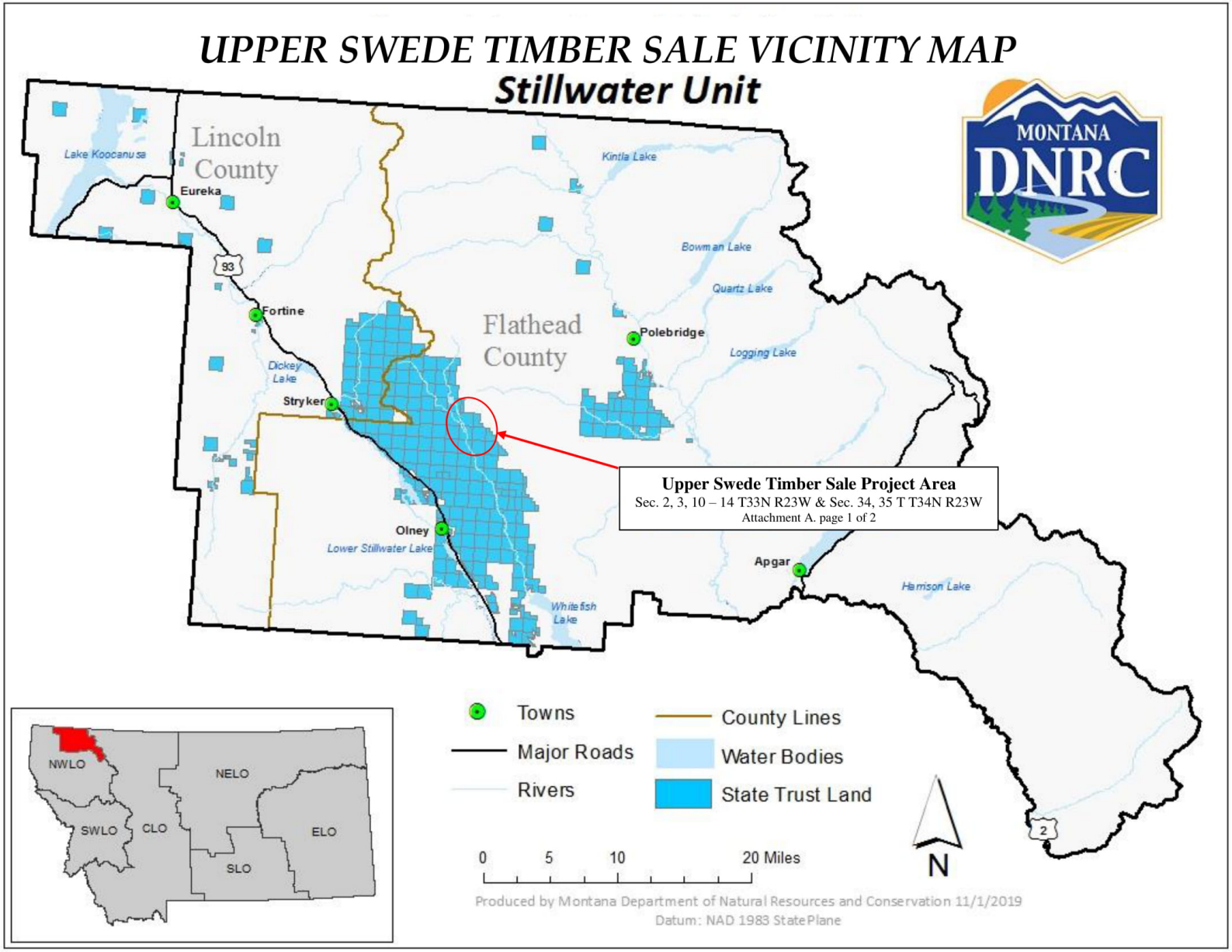
	EIS		More Detailed EA	X	No Further Analysis

Environmental Assessment Checklist Approved By:

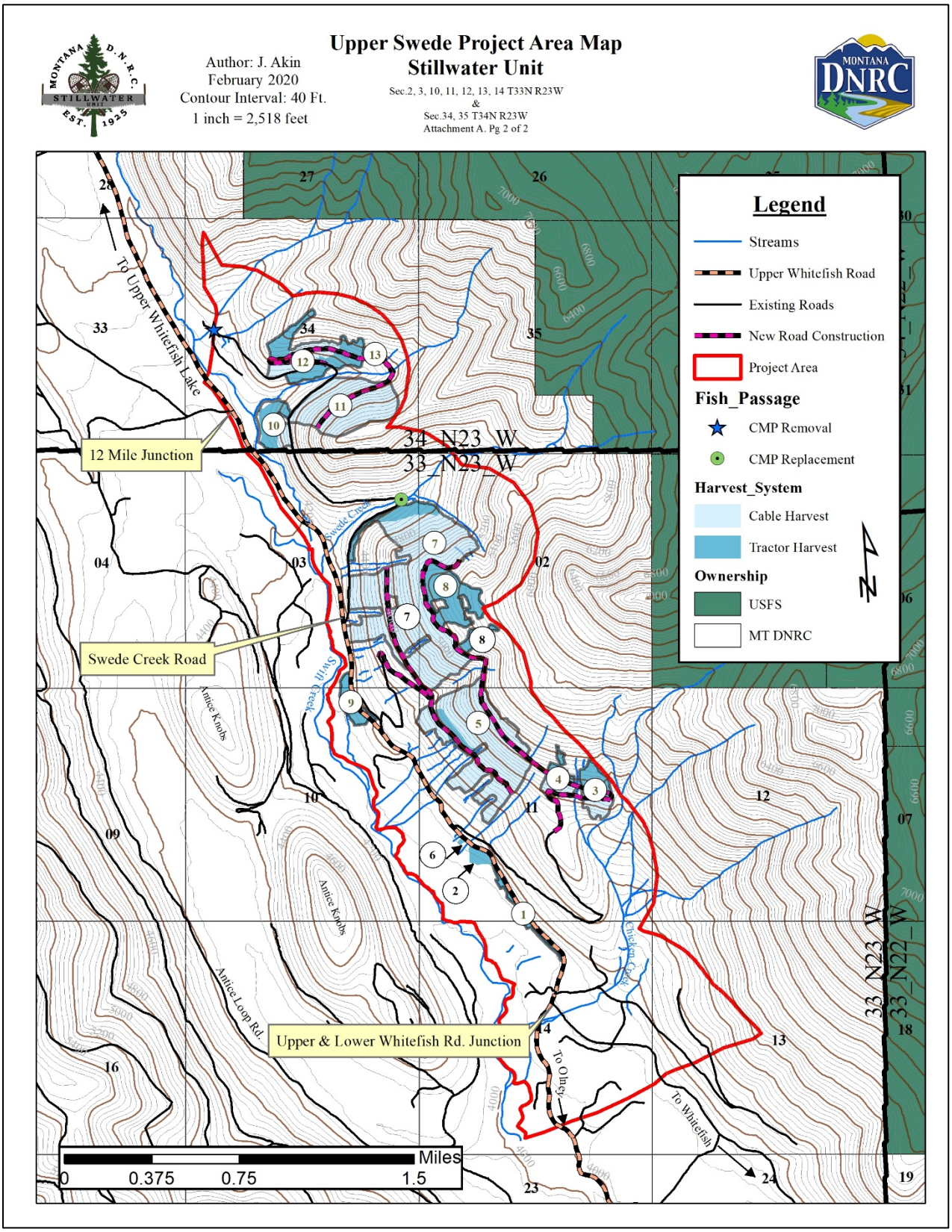
Name: Dave Ring
Title: Stillwater Unit Manager
Date: March 2, 2020
Signature: ***/s/ David A. Ring***

Attachment A - Maps

A-1: Upper Swede Timber Sale Vicinity Map



A-2: Upper Swede Timber Sale Project Area Map



Attachment B – Prescription Table

PRESCRIPTION TABLE

Unit number	Est. Acres & Total Vol.	Prescription	Particulars involved in unit(s)
1	4.6 acres/ 54 MBF	Seedtree	- Tractor Harvest - Hand-felling required - Remove all whitewoods (SAF, ES) - Retain 6-8 WL seedtrees per acre - Minimum of 4 snag recruits >21" DBH would be left where snags are not present. - Mechanical scarification. - Rely on natural regeneration.
2	3.7 acres/ 43 MBF	Seedtree	- Tractor Harvest - Retain 6-8 seedtrees per acre, favoring WL and DF. - Remove all whitewoods (SAF, ES) - Retain a minimum of 2 snag recruits >21" DBH and 2 largest snags available. - Class 1 RMZ harvest. (mark to cut) - Retain visual buffer along open roads. - Machine pile and scarify. - Plant WL/DF, interplant WWP.
3	16 acres/ 132 MBF	Seedtree	- Combination Tractor/Skyline Harvest - Retain 6-8 seedtrees per acre, favoring WL and DF. - Retain a minimum of 2 snag recruits >21" DBH and 2 largest snags where available. - Class 1 RMZ harvest and Class 2 SMZ harvest. - Machine pile and scarify on Tractor harvested areas, and broadcast burn/herbicide Skyline harvested areas. - Rely on natural regeneration.
4	10.9 acres/ 91 MBF	Seedtree	- Combination Tractor/Skyline Harvest - Retain 6-8 seedtrees per acre, favoring WL and DF. - Retain a minimum of 2 snag recruits >21" DBH and 2 largest snags where available. - Class 1 RMZ harvest. - Machine pile and scarify on Tractor harvested areas, and broadcast burn/herbicide Skyline harvested areas. - Rely on natural regeneration.

5	89 acres/ 969 MBF	Seedtree	- Combination Tractor/Skyline Harvest - Retain 6-8 seedtrees per acre, favoring WL and DF - Retain a minimum of 2 snag recruits >21" DBH and 2 largest snags where available. - Class 1 RMZ harvest and Class 2 SMZ harvest. - Machine pile and scarify on Tractor harvested areas, and broadcast burn/herbicide Skyline harvested areas. - Plant WL/DF and interplant WWP on lower elevations of unit. - Rely on natural regeneration at higher elevations.
6	.4 acres/ 3 MBF	Seedtree	- Tractor Harvest - Mark to cut w/ blue stripe at DBH. - Retain a minimum of 2 snag recruits >21" DBH and 2 largest snags where available. - Class 1 RMZ Harvest. - Machine pile and scarify. - Rely on natural regeneration.
7	145.5 acres/ 1.2 MMbf	Seedtree	- Combination Tractor/Skyline Harvest - Retain 6-8 seedtrees per acre favoring WL and DF - Retain a minimum of 2 snag recruits >21" DBH and 2 largest snags where available. - Class 2 SMZ harvest. - Excavated skid trail construction required. - Machine pile and scarify on Tractor harvested areas, and broadcast burn/herbicide Skyline harvested areas. - Plant WL/DF and interplant WWP on lower elevations of unit. - Rely on natural regeneration at higher elevations.
8	33.7 acres/ 231 MBF	Seedtree	- Tractor Harvest - Retain 6-8 seedtrees per acre, favoring WL and DF - Retain a minimum of 2 snag recruits >21" DBH and 2 largest snags where available. - Protect advanced regeneration. - Machine pile and scarify. - Rely on natural regeneration.

9	8.7 acres/ 107 MBF	Seedtree	- Tractor Harvest - Retain 6-8 seedtrees per acre, favoring WL and DF. - Retain a minimum of 2 snag recruits >21" DBH and 2 largest snags where available. - Retain visual screen along open roads. - ERZ harvest, directional hand–felling required. - Machine pile and scarify. - Plant WL/DF, interplant WWP.
10	15.6 acres/ 114 MBF	Seedtree	- Combination Tractor/Skyline Harvest - Retain 6-8 seedtrees per acre, favoring WL and DF - Retain a minimum of 2 snag recruits >21" DBH and 2 largest snags where available. - Class 1 RMZ harvest and Class 2 SMZ harvest. - Machine pile and scarify on Tractor harvested areas, and broadcast burn/herbicide Skyline harvested areas. - Plant WL/DF, interplant WWP.
11	51.3 acres/ 558 MBF	Seedtree	- Skyline Harvest - Retain 6-8 seedtrees per acre, favoring WL and DF - Retain a minimum of 2 snag recruits >21" DBH and 2 largest snags where available. - Retain visual screen along open roads. - Downhill yarding/shovel logging may be required. - Broadcast burn/herbicide - Rely on natural regeneration. - Plant WL/DF, interplant WWP.
12	39.5 acres/ 306 MBF	Seedtree	- Combination Tractor/Skyline Harvest - Retain 6-8 seedtrees per acre, favoring WL and DF. - Retain a minimum of 2 snag recruits >21" DBH and 2 largest snags where available - Retain visual screen along open roads. - Excavated skid trail construction required. - Machine pile and scarify on Tractor harvested areas, and broadcast burn/herbicide Skyline harvested areas. - Plant portions of unit with WL/DF and interplant WWP.

13	1 acre/ 14.47 MBF	Seedtree	- Tractor Harvest - Retain 6-8 seedtrees per acre, favoring WL and DF - Retain a minimum of 2 snag recruits >21" DBH and 2 largest snags where available. - Machine pile and scarify. - Rely on natural regeneration.

NOTES:

WL = Western larch
WWP = Western white pine
DF = Douglas-fir
LP = Lodgepole pine
ES = Engelmann spruce
SAF = Subalpine fir

MBF = Thousand board feet
DBH = Diameter at breast height
ERZ = Equipment restriction zone
SMZ = Streamside Management Zone
RMZ = Riparian Management Zone
FO = Forest Officer

Appendix A – Vegetation Analysis

Upper Swede Timber Sale – Vegetation Analysis

Analysis Prepared By:
Name: Jeremy Akin
Title: Management Forester, Montana DNRC

Introduction

The vegetation section describes present conditions and components of the forest as well as the anticipated effects of both the No Action and the Action Alternatives.

Issues

- Many forest cover types found in the project area do not match the DNRC's desired future condition (DFC) for those stands.
- Timber harvesting and road construction through old growth stands may affect the amount, quality, attribute level, and distribution within the project area as well as on the Stillwater Unit.
- Slow growth, decreased vigor, fading crowns and the occurrence of insects/disease (bark beetle/rot) is common throughout stands within the project area.
- Noxious weeds are present along open and closed roads within the project area. Further soil disturbance and logging equipment activity could increase the amount and distribution of noxious weeds in the project area.

Regulatory Framework

The following plans, rules, and practices have guided this project planning and/or will be implemented during project activities:

State Forest Land Management Plan (SFLMP)
DNRC developed the SFLMP to "provide field personnel with consistent policy, direction, and guidance for the management of state forested lands" (DNRC 1996: Executive Summary). The SFLMP provides the philosophical basis, technical rationale, and direction for DNRC's forest management program. The SFLMP is premised on the philosophy that the best way to produce long-term income for the trust beneficiaries is to manage intensively for healthy and biologically diverse forests. In the foreseeable future, timber management would continue to be the primary source of revenue and primary tool for achieving biodiversity objectives on DNRC forested state trust lands.

DNRC Forest Management Rules
DNRC Forest Management Rules (*ARM 36.11.401 through 456*) are the specific legal resource management standards and measures under which DNRC implements the SFLMP and subsequently its forest management program. The Forest Management Rules were adopted in March 2003 and provide the legal framework for DNRC project-level decisions and provide field personnel with consistent policy and direction for managing forested state trust lands. Project design considerations and mitigations developed for this project must comply with applicable Forest Management Rules.

Montana Best Management Practices (BMPs) for Forestry
Montana BMPs consist of forest stewardship practices that reduce forest management impacts to water quality and forest soils. The implementation of BMPs by DNRC is required under *ARM 36.11.422*. Key forestry BMP elements include: streamside management; road design and planning; timber harvesting and site preparation; stream crossing design and installation; winter logging; and hazardous substances storage, handling, and application.

Montana DNRC Forested Trust Lands Habitat Conservation Plan (HCP)
DNRC is managing the habitats of threatened and endangered species on this project by implementing the Montana DNRC Forested Trust Lands Habitat Conservation Plan (HCP) and the associated Incidental Take Permit that was issued by the United States Fish & Wildlife Service (USFWS) in February of 2012 under Section 10 of the Endangered Species Act. The HCP identifies specific conservation strategies for managing the habitats of grizzly bear, Canada lynx, and three fish species: bull trout, westslope cutthroat trout, and Columbia redband trout. This project complies with the HCP.

Analysis Areas

Direct and Secondary Effects Analysis Area

- Direct and indirect effects to old-growth acreage, cover type/age class, timber stand health (insect and disease conditions), forest fuels, and noxious weeds were conducted on the project area.
- The direct and indirect effects for cover types, age classes, and old-growth amounts/distribution considers conditions of the Stillwater Unit.

Cumulative Effects Analysis Area

- The cumulative effects analysis area for stand health, and noxious weeds is based on the Upper Swede project area.
- Cumulative effects for cover types, age class, and old growth distribution considers the conditions for the Stillwater Unit.

Existing Conditions

Standard Vegetative Community:

Active timber management has been taking place within the Upper Swede project area since the mid 1970's. The most recent harvests occurred in 2013, during the Swedish Chicken Timber Sale which implemented the SLFMP and associated Forest Management Rules. These rules direct the DNRC to promote biodiversity by taking a coarse-filter approach that favors an appropriate mix of stand structures and composition on state lands (ARM 36.11.404). This is evident in the mosaic of stand structures left behind from previous management activities. Approximately 14.5% of the 2,036-acre project area has seen some level of forest management activity in the last 50 years.

The Upper Swede project area ranges in elevation from 4,200 ft. to over 6,800 ft at its highest point. The lower elevation stands are predominantly mixed conifer and western larch cover types transitioning to more subalpine fir and western larch/Douglas-fir mix in the higher elevation. These stands are either single or multi-storied. Single storied stands are most likely to be found on west/south west exposures with more open understories and the multi-storied stands on northern exposures with heavier advanced regeneration and brush in the understory.
As you travel through the project area the following are commonly observed:

- Live crown ratios and tree vigor decreasing, resulting in loss of growth and individual/group mortality.
- Infections of various root diseases such as *Phaeolus schweinitzii* and *Armillaria ostoyae* are causing Douglas-fir mortality, as well as Pini Rot (*Phellinus pini*) in western larch.
- Endemic levels of insects and disease can be found, impacting a variety of tree species with Douglas-fir Beetle (*Dendroctonus pseudotsugae)* and Western Balsam Bark Beetle (*Dryocoetes confusus*) being most prevalent.

Current Stand Conditions for Cover Type and Age Classes:

Table V-1 – ***Current and appropriate cover type for the Upper Swede Project Area.***

Cover Type	Current Acres	Current Percent of Project Area	Desired Future Condition (DFC)	
			Acres	Percent
Subalpine fir	452	22%	10	.49%
Douglas-fir	76	4%	0.2	0.01%
Lodgepole pine	17.6	1%	9.1	0.4%
Mixed conifer	657	32%	36.3	1.8%
Western larch/Douglas-fir	554	27%	526.3	25.9%
Western white pine	213	10%	1426.7	70.1%
Non-stocked	39	2%	0	0%
Non-forest	27.4	1%	27.4	1%
Total:	2036	100	2036	100

Cover type refers to the dominant tree species that currently occupy a forested area.
***Data based on OCTOBER 2019 SLI*

On the project area level, data in **Table V-1:** ***Current and appropriate cover type for the Upper Swede Project Area.*** (above) indicates that the mixed conifer and subalpine fir cover types are currently overrepresented compared to DNRC's desired future conditions. These cover types are mainly comprised of shade-tolerant species, and trend toward more multi-storied stand structures. Also, the western white pine cover type is underrepresented, as shown above, primarily due to past white pine blister rust. These gaps in appropriate cover type can develop through natural disturbance regimes, past silvicultural practices, and successional trajectories.

As found in *ARM 36.11.405 Biodiversity – Desired Future Conditions*, the DNRC utilizes a site-specific computer model based on field data and species present to determine what are appropriate future conditions for individual stands. Cover type is the characteristic used to describe DFC within the DNRC. Field reconnaissance, consultation with DNRC silviculturist, soil type, and use of habitat type will further refine appropriate cover types and DFC obtained post-harvest.

One additional way to describe trends across the landscape other than cover type, is through age-class distributions. Comparing the entire Stillwater Unit's administrated area, based upon historical data, can provide a glimpse into the successional stages of the forest. **Table V-2:** ***Distribution of Age Classes*** (below) shows that Stillwater Unit currently has near historic levels of acres in the 0–to–39 year age-class (seedling/sapling stands), nearly twice the historic estimated percent of 40-to-99 year age-class, and a deficit in the 100-to-149 year age-class as well as the 150 + year age-class. These percentages are not static and change regularly dependent upon disturbance regimes, either natural or human caused.

Table V-2: ***Distribution of Age Classes***

Age Class	Historic Estimates of Percent on Stillwater Unit	Current Percent
0 - to - 39 years	22.8	20.4%
40 - to - 99 years	17.9	35.0%
100 - to - 149 years	24.7	17.5%
150 + years	32.8	26.8%
No age provided in SLI		trace

Using **Table V-3*: Age-Class distribution of current cover types on Stillwater Unit*** (below), we can compare age-class and cover type on the Stillwater Unit, illustrating current forest conditions.

Table V-3: ***Age-Class distribution of current cover types on Stillwater Unit***

Current Cover type	Age Class						Total Acres
		0 TO 39 YEARS	40 TO 99 YEARS	100 TO 149 YEARS	150 YEARS +	No Age	
	Number of Acres						
UNKNOWN		56.90	234.97				291.87
DF		242.37	1,953.56	1,537.37	1,602.94		5,336.23
ERROR_NSp		310.39					310.39
HW		39.22	234.96	85.89			360.07
LP	11.19	7,175.37	8,561.28	432.86	82.24		16,262.94
MC	314.65	7,441.89	12,115.04	6,776.00	9,988.41	11.31	36,647.29
NONSTKD		2,311.40					2,311.40
PP		675.33	361.94	241.31	117.80		1,396.38
SUBALP		3,163.98	12,714.24	5,593.33	10,232.70		31,704.25
SUBALP-NC			682.78	32.73	55.59		771.10
WL/DF	5.61	2,558.96	7,760.79	7,660.84	12,039.14		30,025.33
WWP		2,304.48	336.38	77.28	399.15		3,117.30
Total	**331.5**	**26,280.3**	**44,955.9**	**22,437.6**	34,517.96	**11.3**	**128,534.6**

**** Data based on OCTOBER, 2019 SLI . "ERROR_NSp" has unassigned cover type.**

Old Growth

DNRC uses the minimum criteria for number and age of large live trees and stand basal area as described by Green et al. (1992) to identify old growth stands on State trust lands. Green et al. described characteristic of old growth forests in Montana and provided minimum amounts of trees per acre of a given diameter at breast height (dbh), age, and basal area for each old growth type; DNRC classifies stands that meet or exceed those minimums as old growth. For this analysis, existing conditions and effects on old growth are presented according to this definition.

The Stillwater State Forest currently has 15,423.5 acres of old-growth, representing 12% of the Stillwater Unit, as shown below in **TABLE V-4: *Old growth acres by cover type on Stillwater Unit***.

TABLE V-4: ***Old growth acres by cover type on Stillwater Unit****

DOUGLAS-FIR	LODGEPOLE PINE	MIXED CONIFER	PONDEROSA PINE	SUBALPINE FIR	SUBALPINE FIR - NC	WESTERN LARCH/DOUGLAS-FIR	TOTAL
438.86	66.98	5,133.23	22.59	6,163.96	55.59	3,542.33	**15,423.55**

**** This information comes from October 2019 SLI , 2019 field reconnaissance, and accounts for harvest treatments in all current timber sale projects on Stillwater Unit. File located in G: Arcview_GIS_Layers\Stillwater_Forest_Data\SLI\Old growth\New Folder**

In the project area, there are 588.4 acres of old growth, representing 3.8% of Stillwater Unit's old growth. These acres have been field-verified as old growth according to DNRC procedures.

TABLE V-5: ***Old growth acres by cover type within the Upper Swede Project Area.***

DOUGLAS-FIR	LODGEPOLE PINE	MIXED CONIFER	SUBALPINE FIR	WESTERN LARCH/DOUGLAS-FIR	TOTAL
5.32	0.20	230.97	216.53	135.38	**588.40**

Noxious Weeds
Spotted knapweed (*Centaurea maculosa*), orange hawkweed (*Pilosella aurantiaca)*, St. John's Wort (*Hypericum perforatum)*, and oxeye daisy (*Leucanthemum vulgare*) are found in and around the proposed project area. Current occurrences are found mainly along existing roads. Incursions of noxious weeds into forested sites have not been observed.

Rare Plants
The following rare plants were identified within the Montana Natural Heritage Database to potentially occur inside the project area: whitebark pine (*Pinus albicaulis*), slim larkspur (*Delphinium depauperatum*), crested shieldfern (*Dryopteris cristata*), adder's tongue (*Ophioglossum pusillum*), and coville's rush (*Juncus covillei*).

Whitebark pine was not found in any proposed harvest units. Crested shieldfern, adder's tongue, and coville's rush were not found during field reconnaissance and generally grow in wetlands, fens, and riparian areas and these areas would not be harvested and are generally buffered by 50-foot buffers. Slim larkspur is found in moist meadows or riparian areas which dry by mid-summer. It is found with sagebrush in the lowlands and in subalpine and alpine meadows in the mountains. The project area does not have alpine meadows and was not found during reconnaissance.

If these plants are located during sale operations, the logging would be halted in those areas containing habitat for the species until consultation with a botanist and silviculturist occurs and an agreement to proceed is documented.

Environmental Effects

No Action Alternative: Direct and Secondary Effects and Cumulative Effects
The No-Action Alternative is used as a baseline for comparing the effects that the Action Alternative would have on the environment and is considered a possible alternative for selection. Under this alternative, no timber would be harvested and therefore no revenue would be generated for the Common Schools Trust at this time. Firewood gathering, recreational use, fire suppression, noxious-weed control, additional requests for permits and ongoing management requests may still

occur. Natural events, such as plant succession, tree mortality due to insects and diseases, windthrow, downed fuel accumulation, in-growth of ladder fuels, and wildfires would continue to occur. No change to cover type or age class would occur, however forest management in other areas trend toward DFC and younger age classes.

Action Alternative: Direct, Secondary, and Cumulative Effects

Standard Vegetative Community
Direct and Secondary to Cover Types and Age Classes

- The Action Alternative would reduce all current cover types found within the proposed harvest units; 205 of the 420 proposed harvest acres would be transitioned to a desired future condition of a western white pine cover type by implementing regeneration harvests and planting western white pine.
- 114.5 acres would be transitioned to a WL/DF cover type.
- 100.5 acres currently meet the desired future conditions and would do so post-harvest.
- All proposed harvest unit acres would receive seed tree prescriptions, in which age classes would remain unchanged from sawtimber (150-199 year age class) due to the method DNRC uses to classify age class. Specifically, stands that have greater than 10% crown cover in sawtimber-sized trees (at least 9" DBH) are classified as sawtimber stands, resulting in no change in age class, even in cutting units harvested with regeneration treatments that retain a sufficient number of sawtimber-sized trees to provide at least 10% canopy cover from those trees.

Cumulative
The cumulative effects, in combination with other ongoing and proposed harvests, would be trending towards increasing seral cover types and moving the Stillwater State Forest toward younger age classes as harvesting reduces the amount of older age classes.

Old Growth
Direct and Secondary effects to Old Growth Amounts and Distribution

- Under the Action Alternative, the proposed treatments would remove approximately 173 acres of old growth, and these stands would no longer meet the DNRC's old growth definition.
- Proposed harvest treatments would remove existing diseased and insect damaged trees from the old growth stands, reducing resource competition for the remaining trees.

Cumulative effects of the Action Alternative to Old Growth Amounts and Distribution
Cumulatively, the estimated amount of regeneration harvest treatments in old growth stands for proposed timber sale projects on the Stillwater State Forest is as follows; Upper Swede (173 acres), Beaver to Boyle (29 acres), Jim Junction (38.1 acres), West Coal (347.7 acres), and Molly-Wood (25.7 acres) totaling 613.5 acres. This would reduce the amount of old growth on the Stillwater Unit by .5%. The remaining amount of old growth on the Stillwater Unit would be reduced from 15,423.5 acres or 12% to 14,810 acres or 11.5%.

Noxious Weeds
Direct, Secondary, and Cumulative

- The Action Alternative proposes the operation of harvesting and yarding equipment, log trucks, and personal vehicles on existing roads as well as new roads. Additional mineral soil would be exposed through the operation of this equipment in the sale area and during the construction of landings and temporary roads, which may facilitate the spread of noxious weeds in the project area. Measures that would be implemented to reduce the establishment of additional weed populations include:
    - surface blading to remove weeds before the seed-set stage, when applicable, on the road system affected by the proposal.
    - cleaning all tracked and wheeled equipment prior to beginning project operations; the contract-administrating officer will inspect equipment periodically during project implementation,
    - applying herbicide.

  - promptly revegetating disturbed roadside sites by grass seeding the roads that have been used and closed.
  - Monitoring the area in coming years to help combat the further spread of weeds.
- The Action Alternative would expose mineral soil in the project area. If mitigation measures were not successful, additional populations of noxious weeds could be established, potentially requiring additional weed-management measures.

Cumulatively, weed populations would be monitored and herbicide treatments on haul roads would be scheduled through the Stillwater Units weed management program to maintain or reduce noxious weed occurrence over time.

Vegetation Mitigations

- Require all tracked or wheeled equipment to be cleaned of noxious weeds prior to beginning project operations.
- Control the spread of noxious weeds with pre – and – post herbicide treatments on established weed populations.
- Require prompt vegetation seeding of all disturbed roadside sites. Roads used and closed as part of this proposal would be reseeded and reshaped to prevent motorized use.

Vegetation References

DNRC 1996. State Forest Land Management Plan: final environmental impact statement (and appendixes). Montana Department of Natural Resources and Conservation, Forest Management Bureau, Missoula, Montana.

DNRC 2010. Montana Department of Natural Resources and Conservation Forested State Trust Lands Habitat Conservation Plan: Final EIS, Volume II, Forest Management Bureau, Missoula, Montana.

Green, P., J. Joy, D. Sirucek, W. Hann, A. Zack, and B. Naumann. 1992 (errata correct 02/05, 12/07, 10/08, 12/11). Old-growth forest types of the Northern Region. R-1 SES. Unpublished report on file at US Forest Service, Northern Region, Missoula, MT.

Montana Plant Species of Concern Report. Montana Natural Heritage Program. Retrieved on 12/30/2019, from http://mtnhp.org/SpeciesOfConcern/?AorP=p

Hagle, Susan. Gibson, K., Tunnock, S. 2003. A Field Guide to Disease and Insect Pests of Northern and Central Rocky Mountain Conifers. USDA Forest Service. Northern Region. Missoula, Montana.

Appendix B – Soils Analysis

Upper Swede Timber Sale – Soils Analysis

Analysis Prepared By:
Name: Marc Vessar
Title: Forest Hydrologist, Montana DNRC

Introduction

The following analysis will disclose anticipated effects to soil resources within the Upper Swede Timber Sale project area. Direct, secondary, and cumulative effects to soil resources of both the No-Action and Action alternatives will be analyzed.

DNRC strives to maintain soil productivity by limiting cumulative soil impacts to 15 percent or less of a harvest area, as noted in the State Forest Land Management Plan (SFLMP) (DNRC 1996). As a recommended goal, if existing detrimental soil effects exceed 15 percent of an area, proposed harvesting should minimize any additional impacts. Harvest proposals on areas with existing soil impacts more than 20 percent should avoid any additional impacts and include restoration treatments, as feasible, based on site-specific evaluation and plans.

Issues

- Timber harvesting activities may adversely affect soil resources due to increased compaction, displacement and erosion.
- Removal of both coarse and fine woody material off site during timber harvest operations can reduce nutrient pools required for future forest stands and can affect the long-term productivity of the site.

Regulatory Framework

The following plans, rules, and practices have guided project planning and/or will be implemented during project activities:

- The Administrative Rules for Forest Management (ARM 36.11.401 to 456) include several rules that guide conservation of soils resources. The Administrative Rules were generally adopted from recommendations in the SFLMP (DNRC 1996). Part of the project area is also covered by the Montana DNRC Forested Trust Lands Habitat Conservation Plan (HCP) (2012). The project was developed to be compliant with both the Administrative Rules and the HCP.
- DNRC strives to maintain soil productivity by limiting cumulative soil impacts to 15 percent or less of a harvest area, as noted in the SFLMP (DNRC 1996). As a recommended goal, if existing detrimental soil effects exceed 15 percent of an area, proposed harvesting should minimize any additional impacts. Harvest proposals on areas with existing soil impacts in excess of 20 percent should avoid any additional impacts and include restoration treatments, as feasible, based on site-specific evaluation and plans.

Analysis Areas

Direct, Secondary and Cumulative Effects Analysis Area

The analysis area will be the proposed harvest units and road locations. This analysis area encompasses all areas that could be impacted from soil disturbance associated with this project and cumulative impacts due to past activities.

Analysis Methods

Compaction, Displacement and Erosion

Methods for disclosing impacts include using general soil descriptions and the management limitations for each soil type. This analysis will qualitatively assess the risk of negative effects to soils from erosion, compaction, and displacement from each alternative, using insight from previously collected soils-monitoring data from over 90 DNRC post-harvest monitoring projects (DNRC 2011).

Nutrient Cycling and Soil Productivity

If the Action Alternative is selected, recommendations based upon scientific literature as required by *ARM 36.11.414 (2)* will assist in developing contract requirements and mitigation measures necessary to ensure post project levels of coarse woody debris (CWD) adequately meet the recommendations of relevant literature, primarily Graham et.al. (1994). Fine woody material will be addressed solely through contract language that minimizes removal (ARM 36.11.410).

Risk Communication

Effective risk management requires assessment of inherently uncertain events and circumstances, typically addressing two dimensions: how likely the effect is to occur (probability) and the magnitude the effect (impact) would be if it happened (Hillson and Hullett, 2004).

In terms of the risk that an impact may occur, a *low risk* of an impact means that the impact is unlikely to occur. A *moderate risk* of an impact means that the impact may or may not occur. A *high risk* of an impact means that the impact is likely to occur.

A *very low impact* means that the impact is unlikely to be detectable or measurable, and the impact is not likely to be detrimental to the resource. A *low impact* means that the impact is likely to be detectable or measurable, but the impact is not likely to be detrimental to the resource. A *moderate impact* means that the impact is likely to be detectable or measurable and the impact is likely to be moderately detrimental to the resource. A *high impact* means that the impact is likely to be detectable or measurable, and the impact is likely to be highly detrimental to the resource.

Existing Conditions

Geology

Stillwater State Forest, like much of northwest Montana, is dominated by bedrock consisting of metasedimentary rocks from the Proterozoic age. Rocks in this formation are generally comprised of argillites, quartzites, and siltites. Surface deposits of glacial till, outwash, and lacustrine sediments can be found throughout the area. Overlying these many of these sediments is a layer of loess that has been influenced by volcanic ash deposited and redeposited from Mount Mazama approximately 6,800 years ago (Martinson and Basko, 1998).

Physical Disturbance (Compaction, Displacement and Erosion)
Past monitoring on DNRC timber sales from 1988 to 2010 has shown an average of 12.2 percent soil impacts across all parent materials. Sales harvested prior to 1990 exhibited impacts of 16.8 percent; sales harvested post-1990 showed impacts averaging 7.3 percent of the harvest area. This provides a strong relationship to the implementation of Forestry Best Management Practices (BMPs) and the Streamside Management Zone (SMZ) law.

Stratifying the results by soil texture that are similar to the majority of the proposed harvesting shows an average of approximately 12.4 percent of the harvest areas impacted from erosion, displacement or severe compaction (DNRC 2011). Of the 21 sites with similar soil textures (silt loam and gravelly-silt loam), 3 were cable yarded while 18 were skidded using ground-based equipment. The cable yarded units averaged 4.5% impacts from erosion, displacement or severe compaction; the ground-based units averaged 13.7% impacts.

Cumulative effects from past and current forest management in the proposed harvest units are a result of skid trails and landings although very little of the proposed harvest area has been previously entered. While records show evidence of harvest dating as early as 1948 in the project area, the majority of the harvest occurred after 1963. Other forest product removals include fence posts and rails, firewood, and individual and commercial Christmas tree harvests throughout the last 70 years.

Table S3 – Soil Map Unit Description

Map Unit	Description	Acres	Analysis Area	Landtype Description	Compaction hazard	Erosion Hazard	Displacement Hazard
10-2	Fluvents Slopes 0-5%	6.1	1.4%	**Landform:** Stream bottoms along streams **Parent material:** alluvial deposits **Vegetation:** moist mixed forest type	H	M	M
14-2	Aquepts Slopes 0-5%	1.6	0.3%	**Landform:** Stream bottoms and moraines **Parent material:** lacustrine deposits **Vegetation:** moist mixed forest type	H	M	M
16	Fluvents Alluvial fans Slopes 5-25%	20.4	4.8%	**Landform:** Alluvial fans **Parent material:** alluvial deposits **Vegetation:** moist mixed forest type	H	M	M
21-8	Andic cryochrepts and medial-skeletal entic cryandepts cirque basins Slopes 20-40%	6.2	1.5%	**Landform:** Cirque basins **Parent material:** glacial till/metasedimentary rock **Vegetation:** upper subalpine forest	M	M	M
23-8	Andeptic cryoboralfs and Andic cryochrepts glaciated mtn slopes Slopes 20-40%	6.8	1.6%	**Landform:** Glaciated mtn ridges and slopes **Parent material:** glacial till/metasedimentary rock **Vegetation:** mixed forest type (moist/dry)	M	M	M
26C-7 26C-8 26C-9	Andeptic cryoboralfs moraines/glaciated mountain slopes Slopes 10-20%; 20-40%, and 40-60%	50.4	11.8%	**Landform**: Moraines and glaciated mtn slopes; **Parent material**: glacial till **Vegetation**: moist, mixed forest	M/H	M	M/H
28-7	Dystric eutrochrepts outwash substratum Slopes 0-20%	7.7	1.8%	**Landform:** Terraces **Parent material:** Glacial outwash **Vegetation:** dry, mixed forest	M	M	M

57-9	Andic cryochrepts glaciated mtn slopes Slopes 40-60%	25.2	5.9%	**Landform:** Glaciated mountain ridges **Parent material:** glacial till/metasedimentary rock **Vegetation:** lower subalpine forest	M	M	M
73	Andic cryochrepts and andeptic cryoboralfs glacial trough walls Slopes 60-90%	293.3	68.6%	**Landform:** Glacial trough walls **Parent material:** glacial till/metasedimentary rock **Vegetation:** lower subalpine forest and moist, mixed forest	M	M	H
78	Ochrepts rock outcrop complex Slopes 60-90%	9.8	2.3%	**Landform:** Glacial trough walls/structural breaklands **Parent material:** metasedimentary rock **Vegetation:** dry, mixed forest	M	M	M

Nutrient Cycling and Soil Productivity
Coarse and fine woody debris provide a crucial component in forested environments through nutrient cycling, microbial habitat, moisture retention and protection from mineral soil erosion. (Harmon et al. 1986). Fine woody debris, typically the branches and foliage, contain the majority of the macronutrients in forest stands. Harrington and Kirkland found higher levels of nitrogen, carbon and other important macronutrients on sites where debris was retained compared to sites where most of the debris is removed (Harrington and Kirkland 2012). While coarse woody debris decays at various rates due to local climatic conditions, the advanced stages of decay contain many nutrients and holds substantial amounts of moisture for vegetation during dry periods (Wicklow et. al. 1973). Forest management can affect the volumes of fine and coarse woody debris through timber harvesting and result in changes to the available nutrients for long term forest production. Recommendations for CWD by habitat type can be found in Managing Coarse Woody Debris in Forests of the Rocky Mountains (Graham et. al. 1994). Subalpine fir habitat types that dominate the project area are generally recommended to retain coarse woody debris in the range of 7 to 25 tons per acre to maintain forest productivity. Wetter habitat types tend to have higher amounts recommended while drier habitat types would be on the lower end of the scale. Subalpine fir/queen cup beadlily and subalpine fir/twinflower make up approximately 51 and 43 percent of the proposed harvest area, respectively.

Environmental Effects

No Action Alternative: Direct, Secondary, and Cumulative Effects
Implementation of the No-Action alternative would result in no soil resource impacts in the project area. Soil resource condition would remain similar to those described in the Existing Conditions sections of this environmental assessment.

Action Alternative: Direct, Secondary, and Cumulative Effects

Geology
Direct and Secondary & Cumulative
The geology would remain similar to those described in the Existing Conditions sections of this environmental assessment.

Physical Disturbance (Compaction, Displacement and Erosion)
Direct and Secondary
Considering data from the DNRC SOIL MONITORING REPORT (DNRC 2011), the implementation of Forestry BMPs has resulted in less risk of detrimental soil impacts from erosion, displacement, and severe compaction. While the report noted that the impacts were more likely on the fine-textured soils and steep slopes, reduced

soil productivity due to compaction and displacement can occur on coarser parent materials. Also, the greatest impacts occurred where harvesting implementation departed from BMPs by ground-based skidding on slopes of greater than 40 percent.

Comparing the soil type map, field reconnaissance notes, and topographic map features with the proposed harvest unit map, indicates that ground-based skidding would occur on slopes of up to 45 percent. A cumulative, estimated 0.4 mile of excavated skid trail would be constructed to facilitate yarding. Excavated skid trails constructed by this project would be fully recontoured and stabilized when yarding has been completed. The extent of expected impacts would likely be similar to those reported in the DNRC SOIL MONITORING REPORT (DNRC 2011), or approximately 13.7 percent of the harvest area for ground-based operations during summer conditions. Monitoring data shows that cable yarding averages approximately 4.5 percent impacts. Therefore, the impacts from this proposal are estimated to be approximately 7.1 percent (see Table S4).

In addition to impacts within harvest units, new road construction, including temporary roads, essentially removes land from forest production for several decades. The proposal would construct approximately 3.7 miles of new temporary road and an additional 1.2 miles of permanent road. At the close of the project, all temporary roads would have drainage structures removed. Although the road prism may remain on the landscape, usage of the road would not be feasible because a portion of the road would be recontoured to prevent use by all motorized vehicles. Additionally, approximately 0.64 miles of existing open road would have all five culverts removed and the road would be impassable to all vehicles. TABLE S4– DETRIMENTAL SOIL DISTURBANCE FOR THE ACTION ALTERNATIVE summarizes the expected impacts to soils within harvest units and for new road construction including temporary roads.

Although erosion would potentially result from this alternative, the magnitude, area and duration of erosion and other adverse impacts such as compaction and displacement would remain low. Therefore, a high risk of low direct and indirect impacts would be expected from the implementation of the Action Alternative.

Cumulative

As vegetation begins to establish on the impacted areas and freeze-thaw cycles occur, the area of reduced productivity due to skid trails and landings would decrease. Proposed harvest units that have been previously impacted by skid trails and landings would utilize existing trails to minimize additional areal extent of cumulative impacts. Per the SFLMP direction, areas with existing soil impacts more than 20 percent would require skid trail planning and include restoration treatments based on site-specific evaluation.

By implementing Forestry BMPs and adhering to recommended mitigation measures listed below, DNRC concludes that the risk of unacceptable adverse cumulative impacts from this project would be low.

Table S4 – Detrimental Soil Disturbance for the Action Alternative

Area of Analysis	Total Area (Acres)	Disturbance Rate (%)	Affected Area (Acres)
Ground Based Harvest Area (including landings)	119	13.7%	16.3
Cable Yarded Harvest Area (including landings)	301	4.5%	13.5
Total Cable and Ground Based	420	7.1%	29.8
Roads * (4.9 miles)	14.8	100%	14.8
*Acres in roads are calculated with a 25-foot impact width for the cutslope, fillslope and driving surface. This equates to approximately 3 acres per mile of road.			

Nutrient Cycling and Soil Productivity

Direct and Secondary

As required in the DNRC Timber Sale Contract, both fine and coarse woody debris would be retained to reduce potential impacts to forest productivity. Although, fine woody debris would be left on-site for nutrient retention, a moderate reduction in annual fine material contribution would result from this alternative for up to 20 years. Coarse woody debris would be left on-site to in volumes recommended to help maintain soil moisture and forest productivity, generally in the 12 to 24 tons per acre range for habitat types found in the harvest locations (Graham et al. 1994).

Because coarse woody debris would be left on site in amounts recommended by scientific literature, and fine debris removal would be maintained as much as practicable, a moderate risk of low direct or indirect impacts to nutrient cycling would be expected.

Cumulative

Coarse woody debris would be maintained at levels recommended by Graham et al (1994) to maintain long-term soil productivity. Although a short-term reduction in fine material would result from this alternative, contract clauses developed from mitigation measures listed below would be expected to minimize long-term impacts until acceptable stocking levels of vegetation is established. For these reasons, a low risk of low cumulative impacts to nutrient cycling and soil productivity would be expected from this alternative.

Soils Mitigations

1) Limit equipment operations to periods when soils are relatively dry, (less than 20 percent oven-dried weight), frozen, or snow-covered to in order to minimize soil compaction and rutting and maintain drainage features. Check soil moisture conditions prior to equipment start-up.

2) On ground-based units, especially on previously harvested areas, the logger and sale administrator would agree to a skidding plan prior to equipment operations. Skid-trail planning would identify which main trails to use and how many additional trails are needed. Trails that do not comply with BMPs (i.e. trails in draw bottoms) would not be used unless impacts can be adequately mitigated. Regardless of use, these trails may be closed with additional drainage installed, where needed, or grass-seeded to stabilize the site and control erosion.

3) Tractor skidding should be limited to slopes of less than 40 percent unless the operation can be completed without causing excessive displacement or erosion. Based on site review, short, steep slopes may require a combination of mitigation measures, such as adverse skidding to a ridge or winchline, and skidding from more moderate slopes of less than 40 percent.

4) Keep skid trails to 20 percent or less of the harvest unit acreage. Provide for drainage in skid trails and roads concurrently with operations.

5) Skyline corridors shall be spaced not less than 75 feet apart. In the case of ridges where fan-shaped settings are required, the minimum distance at the widest divergence will be 150 feet. Clearing width for corridors to accommodate yarding should not exceed 12 feet. Where skyline is required, harvest would be by log-length skidding. Leading end of the logs would be carried free of the ground at all times except during lateral yarding. Erosion control, such as slashing or retaining tops, would be required within cable skidding corridors where excessive soil disturbance may be of an extent to cause erosion. The contract administrator would monitor conditions and recommend erosion control as needed.

6) Slash disposal: Limit the combination of disturbance and scarification to 30 to 40 percent of the harvest units. No dozer piling on slopes over 35 percent; no excavator piling on slopes over 40 percent, unless the operation can be completed without causing excessive erosion. Consider lopping and scattering or jackpot burning on the steeper slopes. Consider disturbance incurred during skidding operations to, at least, partially provide scarification for regeneration.

7) Retain 12 to 24 tons of large woody debris and a feasible majority of all fine litter following harvesting operations. On units where whole tree harvesting is used, implement one of the following mitigations for nutrient cycling: 1) use in-woods processing equipment that leaves slash on site; 2) for whole-tree harvesting, return-skid slash and evenly distribute within the harvest area; or 3) cut tops from every third bundle of logs so that tops are dispersed as skidding progresses.

Soils References

DNRC, 1996. State Forest Land Management Plan Final Environmental Impact Statement. Montana Department of Natural Resources and Conservation, Forest Management Bureau. Missoula, MT.

DNRC 2011. DNRC update to the Compiled Monitoring Report. Includes data from 1988 through 2011. Unpublished. Prepared by J. Schmalenberg, Forest Management Bureau, Missoula, MT.

Graham, R.T., A.E. Harvey, M.F. Jurgensen, T.B. Jain, J.R. Tonn, and D. S. Page-Dumroese. 1994. *Managing Coarse Woody Debris in Forest of the Rocky Mountains.* USDA Forest Service Research Paper. INT-RP-447. 13 pp.

Harmon, M.E.; J.F. Franklin, and F. J Swanson. 1986. Ecology of coarse woody debris in temperate ecosystems. Advances in Ecological Research, Vol. 15. New York: Academic Press: 133-302.

Harrington, Timoth B.; Kirkland, John 2012. Logging debris matters: better soil, fewer invasive plants. Science Findings 145. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 6 p.

Hillson, D. A. & Hulett D. T. (2004) Assessing risk probability: Alternative approaches. Proceedings of PMI Global Congress 2004 EMEA, Prague, Czech Republic.

Martinson, A. H. and W. J. Basko. 1998. Soil Survey of Flathead National Forest Area, Montana. USDA Forest Service, Flathead National Forest, Kalispell, Montana.

Wicklow, M.C., W. B. Bolen, and W.C. Denison. 1973. Comparison of Soil micro-fungi in 40-year-old stands of pure alder, pure conifer and alder-conifer mixtures. Soil Biology and Biochemistry, 6:73-78.

Appendix C – Water & Fisheries Analysis

Upper Swede Timber Sale – Water Resources and Fisheries Analysis

Analysis Prepared By:
Name: Marc Vessar
Title: Forest Hydrologist, Montana DNRC

Introduction

The following analysis will disclose anticipated effects to water resources and fisheries within the Upper Swede Timber Sale project area. Direct, secondary, and cumulative effects to water resources of both the No-Action and Action alternatives will be analyzed.

Issues and Measurement Criteria

Issue: Timber harvesting and road construction has the potential to increase water yield, which, in turn, may affect erosive power, in-stream sediment production, and stream channel stability.

> *Measurement Criteria:* Annual water yield increase will serve as measure. Risk of adverse impacts will be based on channel condition, beneficial uses present and watershed thresholds. A qualitative risk assessment will assess potential impacts of peak flows.

Issue: Timber harvesting and road construction may increase sediment delivery into streams/lakes and affect water quality.

> *Measurement Criteria*: Risk assessment using DNRC road inventory sediment risk ratings for existing; erosion risk from the GEOLOGY AND SOILS ANALYSIS portion of the EA coupled with sediment travel distances found in relevant literature.

Issue: Timber harvesting activities may adversely affect water quality by reducing shade and increasing stream temperature.

> *Measurement Criteria:* Changes in riparian canopy due to the project proposal.

Issue: Fisheries resource issues raised internally include: the proposed actions may adversely affect fisheries habitat features, including channel forms, stream temperature and connectivity.

> *Measurement Criteria:* Changes to current connectivity conditions at road-stream crossing sites.
>
> Changes to stream temperature will be addressed by assessing the risk of stream shading within Class 1 Riparian Management Zones (RMZs).
>
> Channel form will be addressed by qualitatively assessing the risk of channel changes due to increased water yields and a reduction of recruitable woody debris.

Regulatory Framework

The following plans, rules, and practices have guided project planning and/or will be implemented during project activities:

Water Quality Standards
This portion of the Flathead River basin, including the Whitefish River and its tributaries, is classified as A-1 by the Montana Department of Environmental Quality (MDEQ), as stated in ARM 17.30.608. The water quality standards for protecting beneficial uses in A-1 classified watersheds are located in ARM 17.30.622. Water in A-1 classified waterways is suitable for drinking, culinary and food processing purposes (after conventional treatment), bathing, swimming and recreation, growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers, and agricultural and industrial water supply. State water quality regulations prohibit any increase in sediment above naturally occurring concentration in water classified A-1. Naturally occurring is defined as, "condition or materials present from runoff or percolation over which man has no control or from developed land where all reasonable land, soil and water conservation practices have been applied" [ARM 17.30.602 (17)]. Reasonable land, soil and water conservation practices include, "methods, measures or practices that protect present and reasonably anticipated beneficial uses…" [ARM 17.30.602 (21)]. The State of Montana has adopted Best Management Practices (BMPs) through its non-point source management plan (MDEQ, 2007) as the principle means of meeting the Water Quality Standards. These practices include, but are not limited to, structural and nonstructural controls as well as operation and maintenance procedures. Appropriate practices may be applied before, during, or after completion of activities that could create their own impacts.

Water Quality Limited Waterbodies
The streams in the project area are not considered impaired waterbodies and are not listed on the 2018 303(d) list. The 303(d) list is compiled by MDEQ as required by section 303(d) of the Federal Clean Water Act and the Environmental Protection Agency Water Quality Planning and Management Regulations (40 CFR, part 130). Under these laws, MDEQ is required to identify water bodies that do not fully meet water quality standards, and/or where beneficial uses are threatened or impaired.

Streamside Management Zone Law (SMZ)
All rules and regulations pertaining to the SMZ Law are to be followed. An SMZ width of 100 feet is required on Class 1 and 2 streams and lakes when the slope is greater than 35 percent. An SMZ width of 50 feet is required when the slope is less than 35 percent.

In order to implement practices within the SMZ that are generally prohibited, an alternative practice application must be submitted to a DNRC Public Assistance Forester for approval.

Forest Management Rules
In 2003, DNRC drafted Administrative Rules for Forest Management. The portion of those rules applicable to watershed and water resources include ARM 36.11.422 through 426 and 470 through 471.

Habitat Conservation Plan (HCP)
DNRC is managing the habitats of threatened and endangered species on this project by implementing the Montana DNRC Forested Trust Lands Habitat Conservation Plan (HCP) and the associated Incidental Take Permit that was issued by the United States Fish & Wildlife Service (USFWS) in February of 2012 under Section 10 of the Endangered Species Act. The HCP identifies specific conservation strategies for managing the habitats of grizzly bear, Canada lynx, and three fish species: bull trout, westslope cutthroat trout, and Columbia redband trout.

Fisheries
The US Fish and Wildlife Service has listed bull trout as 'threatened' under the Endangered Species Act. Both bull trout and westslope cutthroat trout are listed as S2 Montana Animal Species of Concern. Species classified as S2 are considered to be at risk due to very limited and/or potentially declining population numbers, range, and/or habitat, making the species vulnerable to global extinction or extirpation in the state (Montana Fish, Wildlife and Parks, Montana Natural Heritage Program, and Montana Chapter American Fisheries Society Rankings). DNRC has also identified bull trout and westslope cutthroat trout as sensitive species (ARM 36.11.436).

DNRC is a cooperator and signatory to the following relevant agreements: Restoration Plan for Bull Trout in the Clark Fork River Basin and the Kootenai River Basin, Montana (2000), Memorandum of Understanding (2005) for the Swan Valley Bull Trout Work Group, and Memorandum of Understanding and Conservation Agreement for Westslope Cutthroat Trout and Yellowstone Cutthroat Trout in Montana (2007). All 3 agreements contain land management conservation strategies or action items utilized by DNRC as decision-making tools.

Water Rights and Beneficial Uses
Water rights for surface water within the project area and within 3 miles downstream of the project area include industrial use for dust abatement.

Designated beneficial water uses within the project area include cold-water fisheries, aquatic life support, and recreational use in the streams, wetlands, and lakes in the surrounding areas.

Analysis Areas

Sediment Delivery
The analysis area for sediment delivery is the proposed harvest units and roads used for hauling. This includes upland sources of sediment that could result from this project. In addition, in-channel sources of sediment such as mass-wasting locations or excessive scour/deposition will be disclosed if found in project area streams.

Water Yield
The analysis area for annual water yield will include the East Fork Swift Creek and Swift Creek-Antice Creek watersheds. The size of the analysis area should result in meaningful measurement of potential impacts; therefore, this is selected as the appropriate scale of analysis due to the size of the project, versus the watershed size and the potential for impacts.

Woody Debris Recruitment
The direct/indirect and cumulative analysis area for woody debris recruitment is the RMZ of Class 1 streams in the project area.

Stream Temperature Increases
The analysis area for stream temperature increase will be identical to the analysis area for woody debris recruitment.

Connectivity (Fish Passage)
The analysis area for fish passage will be crossings on the proposed haul route within the project area.

Analysis Methods

Sediment Delivery
The methods applied to the project area to evaluate potential direct, indirect, and cumulative effects include a field review of potential sediment sources from haul routes. Stream crossings and roads were evaluated to determine existing sources of introduced sediment from existing and proposed roads.

Potential sediment delivery from harvest units will be evaluated from a risk assessment. This risk assessment will use the soil information provided in Attachment D: SOILS ANALYSIS and the results from soil monitoring on past DNRC timber sales.

Sediment sources from in-channel sources will be addressed qualitatively by identifying stream segments with atypical levels of instability and assessing the risk of adverse impacts from each alternative using the Risk Communication descriptions below.

Water Yield
Annual water yield will be disclosed as a cumulative effect in the *EXISTING CONDITIONS* portion of this report because the existing condition is a result of all past harvesting and associated activities. Annual water yield refers to the gross volume of water in a watershed that is contributed to a stream or other surface water feature over an entire year. This does not address peak flows or seasonal fluctuations in stream flow. In the *ENVIRONMENTAL EFFECTS* portion of this report, modeled water-yield increases as a result of this project will be disclosed as a direct effect. The cumulative water yield increase for each alternative will also be disclosed.

The annual water-yield increase for watersheds in the project area was estimated using the ECA (Equivalent Clearcut Acres) method, as outlined in Forest Hydrology, Part II (Haupt et al, 1974).

ECA is a function of total area roaded, harvested, or burned; percent of crown removed during harvesting or wildfire; and amount of vegetative recovery that has occurred in the harvested or burned areas. As live trees are removed, the water that would have otherwise evaporated and transpired, either saturates the soil, or is translated to runoff. This method also estimates the recovery of these increases as new trees revegetate the site and move toward preharvest water use.

In order to evaluate the potential effects of water-yield increases, a threshold of concern for each watershed was established per ARM 36.11.423. Thresholds were established based on evaluation of the acceptable risk level, resources value, and watershed sensitivity. Increased annual water yields above the threshold of concern may result in an increased risk of in-channel erosion and degradation of fisheries habitat and may have detrimental impacts on other downstream beneficial uses.

Woody Debris Recruitment
The analysis method for woody debris recruitment will evaluate the potential reduction in available woody debris and shading due to timber-harvesting activities in the riparian management zone (RMZ) of the project area.

Stream Temperature Increases
Stream temperature will be addressed by evaluating the risk of stream temperature increases due to reduced shading from existing vegetation.

Connectivity (Fish Passage)
Fish passage will be addressed by reviewing the current status of passage potential along the haul route and comparing it to the proposed change in the Action Alternative.

Risk Communication
In terms of the risk that an impact may occur, a *low risk* of an impact means that the impact is unlikely to occur. A *moderate risk* of an impact means that the impact may or may not (50/50) occur. A *high risk* of an impact means that the impact is likely to occur.

A *very low impact* means that the impact is unlikely to be detectable or measurable, and the impact is not likely to be detrimental to the resource. A *low impact* means that the impact is likely to be detectable or measurable, but the impact is not likely to be detrimental to the resource. A *moderate impact* means that the impact is likely to be detectable or measurable, and the impact is likely to be moderately detrimental to the resource. A *high impact* means that the impact is likely to be detectable or measurable, and the impact is likely to be highly detrimental to the resource.

Existing Conditions

General Description
Swift Creek is the main channel of a 49,244-acre watershed that contributes surface flow to Whitefish Lake. Annual precipitation in the watershed ranges from 20 inches at its lowest elevations to 70 inches near Stryker Peak. Average annual precipitation is approximately 48 inches per year. The elevation ranges from 3,000 feet above sea level at the mouth of the creek at Whitefish Lake to approximately 7,420 feet above sea level at the watershed divide. Ownership within the watershed is 80 percent State Trust Lands managed by DNRC, 19 percent federal lands managed by the USFS and the remaining 1 percent in private ownership including F.H. Stoltze Land and Lumber Company. The Swift Creek watershed is split into four, 6th hydrologic unit code (HUC) watersheds: Swift Creek-Hemlock Creek, Swift Creek-Antice Creek, West Fork Swift Creek and East Fork Swift Creek.

The main channel of this Class 1 fish-bearing stream flows at the base of several eroding Pleistocene banks along the middle and lower reaches of the stream (Watershed Consulting, LLC 2004).

<u>East Fork Swift Creek:</u>
Approximately 680 acres of the Upper Swede Timber Sale Project Area is located in the East Fork Swift Creek watershed which is a 6th-code watershed. This HUC encompasses approximately 11,082 acres of land that combines with the West Fork Swift Creek to form the main channel of Swift Creek. Average precipitation in this HUC is approximately 46 inches per year, mostly in the form of snow. Several small first and second order streams are tributary to this channel. Other streams in the watershed have discontinuous surface flow. Upper Whitefish Lake is in the middle of this watershed. Elevation ranges from approximately 4,200 feet at the confluence with West Fork Swift Creek to approximately 7,445 on the Whitefish Range near Diamond Peak. Ownership within the watershed is comprised DNRC-managed lands (53 percent), and USFS-managed lands (47 percent).

East Fork Swift Creek is a C4 channel type (Rosgen 1996) immediately above Upper Whitefish Lake. The stream is strongly influenced by beaver dams and has multiple channels. The floodplain in this portion of the stream is quite wide and several old relic channels were found during field reconnaissance in 2011. Stream stability is generally good throughout the DNRC managed lands, although some bank erosion was noted in the project area during 2001, 2009 and 2011.

Approximately 1.5 to 2 miles of East Fork Swift Creek is dry during a portion of the year. This is a natural condition due to geology of the watershed and a fault located in the valley bottom (USGS 1955).

Tributaries to East Fork Swift Creek are generally ‘A’ channels (Rosgen 1996) on the upper slopes and transition into ‘B’ channels on the lower slopes. Most of the tributaries are steep and much incised with little accessible fish habitat. The majority of these streams are intermittent, however a few of the tributaries are

small perennial, spring fed streams and are fish-bearing on the gentler lower slopes (generally less than 25 percent).

Swede Creek is the main named tributary delineated by USGS in the East Fork Swift Creek watershed. This analysis will continue to include Swede Creek with East Fork Swift; however the confluence of Swift is slightly downstream of the point where the east and west forks of Swift Creek combine.

The Swede Creek watershed is second-order drainage encompassing approximately 1,020 acres. Precipitation ranges from 46 to 60 inches per year, mostly in the form of snow. Swede Creek flows in a northeast-to-southwest direction to its confluence with Swift Creek a short distance downstream of the East Fork/West Fork confluence. Elevations in this watershed range from 4,180 feet at its confluence with Swift Creek to approximately 7,220 feet on the watershed divide. Ownership within the watershed is comprised of DNRC-managed lands (73 percent), and USFS-managed lands (27 percent).

Swede Creek has good to excellent channel stability with limited bank erosion. Most of the channel substrate is covered with moss through the project area. The moss is indicative of a stable channel with very little substrate movement.

Fish species present in East Fork Swift Creek include bull trout, eastern brook trout and westslope cutthroat trout. Recent electrofishing in Swede Creek found bull trout and eastern brook trout.

Swift Creek-Antice Creek:
The Swift Creek-Antice Creek watershed is approximately 6,829 acres and includes numerous first and second-order tributaries that flow from the east aspect of Stryker Ridge into Antice Creek and from the west aspect of the Whitefish Range toward Swift Creek. While most of the streams are unnamed, Antice Creek and Chicken Creek are named which flow into Swift Creek. Both of these streams are Class I fish-bearing streams. A description of the Antice Creek and its tributaries can be found in the Southeast Stryker Ridge Timber Sale Project EA (DNRC, 2010) located at http://leg.mt.gov/content/publications/mepa/2010/dnr0326_2010001.pdf . A description of Chicken Creek can be found in the Chicken-Antice Timber Sale Project Environmental Assessment (DNRC, 2008). Precipitation within the watershed ranges from 20 to 60 inches per year, mostly in the form of snow. Elevations range from approximately 4,000 feet at the Antice Creek-Swift Creek confluence to approximately 6,600 feet on Stryker Ridge. Ownership within the Swift Creek-Antice Creek watershed is 100 percent State Trust Lands managed by DNRC.

Water Quality
DNRC is striving to inventory all roads to identify sediment delivery risk and determine if Forestry BMPs are lacking. The project area, including haul roads were reviewed in 2018 and 2019. Two sites were identified as sediment sources; one is a high risk of sediment delivery near a Class 2 stream culvert with ditch water delivery and the second is an unvegetated cutslope that has potential to contribute to an ephemeral draw. The remainder of the existing roads that are proposed for use during this timber sale have been upgraded to meet BMPs and minimize the risk of sediment delivery to streams.

Harvest units proposed for harvesting as part of this project are located on landtypes with moderate erosion risk. Standard Forestry BMPs and mitigation measures are generally sufficient for minimizing erosion risk from these landtypes.

In-channel sources of sediment are primarily limited to a few constricted sites or outcurves. Many of the streams in the project area are very small and are spring influenced which leads to a more stable flow regime. No evidence of mass wasting was identified during field reconnaissance. with the exception of the Pleistocene banks along Swift Creek.

Water Quantity
Annual water yield increase (AWYI) was modelled for the two 6th-code HUCs in that intersect the project area. Table WR-1 displays the watershed name, existing annual water yield increase and the recommended threshold. Thresholds were set after reviewing the stability of streams in each watershed along with the beneficial uses and existing watershed conditions as required by ARM 36.11.24 (1f).

TABLE WR- 1: Existing Annual Water Yield Condition

Watershed	Acres	Existing ECA/Allowable ECA	Existing AWYI	Recommended AWYI Threshold
East Fork Swift	11,082	566/3048	2.4%	11%
Swift-Antice	6,829	1453/1878	9.2%	11%

Woody Debris Recruitment
Large woody debris recruitment to streams is important to maintain channel form and function and as a component of fish habitat. According to ARM 36.11.425, DNRC will establish a RMZ '…when forest management activities are proposed …on sites that are adjacent to fish bearing streams and lakes.' One reason for the RMZs is to retain adequate levels of large woody debris recruitment to the stream channel. Site potential tree height (SPTH) is the method used to identify RMZ width according to ARM 36.11.425 (5). Past analysis has looked at the site potential tree heights ($SPTH_{100}$) at 100 years in the Stillwater State Forest (DNRC 2005, DNRC 2009). The average $SPTH_{100}$ in the Stillwater State Forest has ranged from 87 feet in West Fork Swift Creek (DNRC 2005) to 111 feet in Swede Creek (USFWS and DNRC 2010). The RMZ width for this project will be 100 feet for all Class 1 streams.

Within the project area, approximately 203 acres is within 100 feet of Class 1 streams. A review of the 2017 NAIP layer (aerial photos) indicates that approximately 9 acres (4.4%) has been harvested or converted to roads.

Stream Temperature Increases
Water temperature data has been collected for varying numbers of years on streams in or near the project area since 2001. Streams with temperature data include East Fork Swift Creek, Swede Creek and main stem Swift Creek below the project area.

East Fork Swift has over eleven non-consecutive years of summer-season data from 2001 to 2018. The highest seven-day average temperature of 13.0 degrees Celsius was observed in 2003. Swede Creek has four years of data with the highest recorded seven-day average temperature of 7.2 degrees Celsius. The main stem Swift Creek near the lower end of the project area has over 12 years of data with the highest recorded seven-day average temperature of 13.9 degrees Celsius. These temperatures are conducive to beneficial uses including cold water fisheries.

Connectivity (Fish Passage)
A total of five stream crossing structures have been identified on fish-bearing streams along the proposed haul route. Of the five identified, one is a bridge and four are corrugated metal pipes (CMPs). Two of the CMP structures are located in the project area (Swede Creek and unnamed tributary to East Fork Swift Creek) and are considered fish barriers due to drop at the outlet. A third crossing structure --a CMP on Chicken Creek-- is suspected to restrict juvenile fish passage at high flows.

Environmental Effects

No Action Alternative: Direct, Secondary, and Cumulative Effects

Water Quality

Direct and Secondary

Under this alternative, no timber harvesting or related activities would occur. Water Quality would continue as described in the Existing Conditions.

Cumulative

No additional cumulative impacts to water quality would be expected. Sediment delivery sites from roads on the proposed haul routes would remain unchanged, as would the sediment sources described in Existing Conditions.

Water Quantity

Direct and Secondary

No increased risk of increases or reductions in annual water yield or ECA would result from this alternative.

Cumulative

No increase in water yield would be associated with this alternative. As vegetation continues toward a fully forested condition, annual water yields would also be expected to gradually decline.

Woody Debris Recruitment

No harvest in the RMZ would result from this alternative. Previously harvested stands within the RMZ would continue to revegetate and grow towards pre-harvest conditions.

Stream Temperature Increases

Stream temperature increases would not be affected by harvest under this alternative.

Connectivity (Fish Passage)

No improvements to fish passage are associated with this alternative.

Cumulative

No improvements to fish passage are associated with this alternative. The two sites that do not fully meet fish passage requirements would remain unchanged.

Action Alternative: Direct, Secondary, and Cumulative Effects

Water Quality

Direct and Secondary

As part of the timber sale requirements, roads that do not meet Forestry BMPs would be improved to minimize sediment delivery. Although much work has been done on the haul route over the last decade, one high-risk sediment site was identified during road inventory work during 2018. This site is an inboard ditch that should be relieved before a Class 2 stream crossing to minimize the risk of sediment transport into surface water.

Other improvements would include replacing or removing stream-road crossing structures that are improperly sized, restrict fish passage or are no longer deemed necessary. By implementing these upgrades on identified sites and maintaining BMPs on previously upgraded roads, the risk of sediment delivery would be minimized.

All CMP replacements/installations would be completed in a dewatered condition which would minimize the risk of sediment delivery during installation. Although forestry BMPs would be followed to minimize sediment

delivery, a high risk of a short-term increase in sediment would be expected during the installation process. The increase in sediment would be short-lived and would be expected to have a moderate risk of low impacts to beneficial uses present.

Approximately 2 acres of SMZ harvest within 50 feet of a Class 2 or Class 3 stream is proposed under this alternative. No SMZ harvest within 50 feet of a on Class 1 streams is proposed. During a review of BMP effectiveness, including stream buffer effectiveness, Raskin et al. (2006) found that 95 percent of erosion features (disturbed soil) greater than 10 meters (approximately 33 feet) from the stream did not deliver sediment. Their findings indicated that the main reasons stream buffers are effective include 1) keeping active erosion sites away from the stream, and 2) stream buffers may intercept and filter runoff from upland sites as long as the runoff is not concentrated in gullies or similar features (Raskin et.al. 2006).

Past monitoring of DNRC timber harvests has shown erosion on approximately 6 percent of the sites monitored, although no water-quality impacts from the erosion were found (DNRC 2011). These sites were harvested during the summer period, and the erosion was attributed to inadequate skid-trail drainage. Displacement was limited to main skid trails that occupy less than 2% of the harvest units. (DNRC 2011). By minimizing displacement, less erosion would likely occur compared to other harvest methods with more extensive disturbance (DNRC 2011).

Because harvesting within 50 feet of streams is limited to Class 2 and 3 SMZs and all Forestry BMPs would be followed, this alternative would be expected to have a low risk of low impacts from sediment delivery to streams from proposed harvest units.

Cumulative
Considering the risk of impacts to water quality from sediment originating in harvest units, roads and in-stream sources due to this harvest proposal, a moderate risk of low impacts to water quality would be expected from the implementation of this alternative.

Water Quantity
Direct and Secondary
Annual water yield increase (AWYI) was modelled for the three 6th-code HUCs in that intersect the project area. Table WR-2 displays the watershed name, proposed harvest acres, proposed ECA increase, proposed AWYI increase and the recommended threshold for each watershed. The modelled increases include clearing for road construction whether temporary or permanent.

TABLE WR- 2: Proposed Annual Water Yield Increases from Action Alternative

Watershed	Proposed Harvest Acres	Proposed ECA Increase	AWYI from Proposal	Recommended AWYI Threshold
East Fork Swift	163.6	152.9	0.6%	11%
Swift-Antice	259.0	249.0	1.6%	11%

Cumulative
Cumulative AWYI for each watershed includes all past, present and future proposed State actions. Table WR-3 displays the watershed name, cumulative ECA, allowable ECA, cumulative modelled AWYI, and the recommended threshold. The modelled increases include clearing for road construction whether temporary or permanent.

TABLE WR- 3: Cumulative Annual Water Yield Increases for Project Watersheds

Watershed	Cumulative ECA	Allowable ECA	Cumulative AWYI	Recommended AWYI Threshold
East Fork Swift	745	3048	3.0%	11%
Swift-Antice	1702	1878	10.8%	11%

Because the cumulative annual water yield increases would remain below the threshold of concern, a moderate risk of low impacts to adverse changes in channel form due to increase flows would be expected in these watersheds.

Woody Debris Recruitment
Direct and Secondary
Under this alternative, approximately 7 acres of RMZ along Class 1 streams would be harvested with up to 50% of the trees ≥ 8 inches diameter removed. This action would reduce the recruitable woody debris on approximately 3.4% of the Class 1 RMZ within the project area. No harvest would occur within 50 feet of a Class 1 stream. This would result in a low risk of low impacts to woody debris recruitment and would be expected to continue providing adequate woody debris recruitment to streams for maintaining their current form and functions.

Cumulative
Approximately 16 acres (7.9%) of Class 1 RMZ within the project area would have some level of harvest identifiable on an aerial photograph. Because much of the harvested RMZ area would remain stocked with sawtimber-size vegetation and recruitable woody debris would remain present along nearly all reaches of the Class 1 streams in the project area, this alternative would result in a low risk of low cumulative impacts to woody debris recruitment. Additionally, the implementation of this alternative would be expected to continue providing adequate woody debris recruitment to streams for maintaining their current form and functions.

Stream Temperature Increases
Direct and Secondary
Through implementation of the SMZ Law and Rules and Forest Management ARMs for RMZs along Class 1 streams, timber harvest within 100 feet of Class 1 streams in the project area would be limited to 3.4 percent of the total RMZ in the project area. This prescription is expected to result in a minimal loss of stream shading. The consequent impact to stream temperatures in the project area is also expected to be very low.

Cumulative
Due to the limited amount of shade-producing vegetation that would be removed, a low risk of cumulative temperature increases above naturally-occurring ranges would result from the implementation of this alternative. Therefore, beneficial uses, such as cold-water fisheries, would continue to benefit from water temperatures conducive to salmonids.

Connectivity (Fish Passage)
Direct, Secondary and Cumulative
As part of this alternative, two fish passage barriers would be improved. One site would have the crossing structure removed and the second site (Swede Creek) would be improved to simulate a natural open channel. The expected result of would be improved connectivity to habitat for westslope cutthroat trout and/or bull trout.

Water Resources Mitigations

Hydrologic related resource mitigations that would be implemented with the proposed Action Alternative include:

- Limit equipment operations to periods when soils are relatively dry, (less than 20 percent oven-dried weight), frozen, or snow-covered to in order to minimize soil compaction and rutting, and maintain drainage features. Check soil moisture conditions prior to equipment start-up.

- On ground-based units, especially on previously harvested areas, the logger and sale administrator would agree to a skidding plan prior to equipment operations. Skid-trail planning would identify which main trails to use and how many additional trails are needed. Trails that do not comply with BMPs (i.e. trails in draw bottoms) would not be used unless impacts can be adequately mitigated. Regardless of use, these trails may be closed with additional drainage installed, where needed, or grass-seeded to stabilize the site and control erosion.

- Tractor skidding should be limited to slopes of less than 40 percent unless the operation can be completed without causing excessive displacement or erosion. Based on site review, short, steep slopes may require a combination of mitigation measures, such as adverse skidding to a ridge or winchline, and skidding from more moderate slopes of less than 40 percent.

- Keep skid trails to 20 percent or less of the harvest unit acreage. Provide for drainage in skid trails and roads concurrently with operations.

- Slash disposal: Limit the combination of disturbance and scarification to 30 to 40 percent of the harvest units. No dozer piling on slopes over 35 percent; no excavator piling on slopes over 40 percent, unless the operation can be completed without causing excessive erosion. Consider lopping and scattering or jackpot burning on the steeper slopes. Consider disturbance incurred during skidding operations to, at least, partially provide scarification for regeneration.

- Follow all Forestry Best Management Practices for road construction and maintenance to minimize the risk of sediment delivery, including dewatering channels when installing or removing crossing structures.

Water Resources References

DNRC, 1996. State Forest Land Management Plan Final Environmental Impact Statement. Montana Department of Natural Resources and Conservation, Forest Management Bureau. Missoula, MT.

DNRC. 2005. West Fork Swift Creek Timber Sale Project Final Environmental Impact Statement. Montana Department of Natural Resources and Conservation, Olney, MT.

DNRC 2011. DNRC update to the Compiled Monitoring Report. Includes data from 1988 through 2011. Unpublished. Prepared by J. Schmalenberg, Forest Management Bureau, Missoula, MT.

DNRC, 2009. Swedish Chicken Timber Sale Project Environmental Assessment. Montana Department of Natural Resources and Conservation. Olney, MT.

DNRC, 2008. Chicken Antice Timber Sale Project Environmental Assessment. Montana Department of Natural Resources and Conservation. Olney, MT.

DNRC, 2010. Southeast Stryker Ridge Timber Sale Environmental Assessment. Montana Department of Natural Resources and Conservation. Olney, MT.

Haupt, H.F., et al., 1974. Forest Hydrology Part II Hydrologic Effects of Vegetation Manipulation. USDA Forest Service, Region 1. Missoula, Montana.

MDEQ, 2007. Montana Nonpoint Source Management Plan. Montana Department of Environmental Quality, Water Quality Planning Bureau, Watershed Protection Section. Helena, MT. 136 pages.

Raskin, Edward B., Casey J. Clishe, Andrew T. Loch, Johanna M. Bell. 2006. Effectiveness of Timber Harvest Practices for Controlling Sediment Related Water Quality Impacts. Journal of the American Water Resources Association 42(5), 1307–1327.

USFWS and DNRC. 2010. Montana Department of Natural Resources and Conservation Forested Trust Lands Habitat Conservation Plan, Final Environmental Impact Statement, Volumes I and II. U.S. Department of Interior, Fish and Wildlife Service, Region 6, Denver, Colorado, and Montana Department of Natural Resources and Conservation, Missoula, MT. September 2010.

Watershed Consulting, LLC 2004. Swift Creek Watershed: Existing Data Review. Montana Department of Environmental Quality Contract #202074.

Appendix D – Wildlife Analysis

Upper Swede Timber Sale – Wildlife Analysis

Analysis Prepared By:
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Title: Wildlife Biologist, Montana DNRC

Introduction

The following analysis will disclose the anticipated direct, secondary, and cumulative effects to wildlife associated with the No-Action and Action alternatives.

Issues

- *Mature forest cover and connectivity*. The proposed activities could decrease mature forested cover, which could reduce habitat connectivity and suitability for wildlife species associated with mature forests.
- *Old-growth forests*. The proposed activities could affect wildlife species associated with old-growth forests by reducing habitat availability and increasing fragmentation.
- *Canada lynx.* The proposed activities could reduce landscape connectivity and the availability of suitable Canada lynx habitat, reducing the capacity of the area to support Canada lynx.
- *Grizzly bears*. The proposed activities could affect grizzly bear cover, affect important habitat, and increase human access, which could adversely affect bears by displacing them from important habitat, and/or by increasing risk of human-caused bear mortality.
- *Fishers*. The proposed activities could reduce the availability and connectivity of suitable fisher habitat and increase human access, which could reduce fisher habitat suitability and increase trapping mortality.
- *Pileated woodpeckers.* The proposed activities could reduce tree density and alter the structure of mature forest stands, which could reduce habitat suitability for pileated woodpeckers.

Regulatory Framework

The following plans, rules, and practices have guided this project's planning and/or will be implemented during project activities: *DNRC Forest Management Rules, DNRC Forested Trust Lands Final Environmental Impact Statement and Habitat Conservation Plan (USFWS and DNRC 2010), the Endangered Species Act, the Migratory Bird Treaty Act,* and the *Bald and Golden Eagle Protection Act.*

Analysis Areas

Direct and Secondary Effects Analysis Area
The direct and secondary effects of the proposed activities on all species/issues were analyzed within the Project Area (*TABLE WI-1, FIGURE WI-1*).

Cumulative Effects Analysis Areas
The cumulative effects of the proposed activities on all species/issues were analyzed at a broad surrounding landscape scale that varies according to the issue or wildlife species being discussed. Cumulative effects analysis areas are named according to the size of the area and are summarized in *TABLE WI-1* and *FIGURE WI-1*. Cumulative effects analysis areas (CEAAs) include the Project Area as well as lands managed by the USFS. The USFS manages 10% and 16% of the Medium CEAA and Large CEAA, respectively. Both CEAAs are managed primarily for timber production and the elevation of the CEAAs ranges from 4,000 to 7,400 feet. Detailed descriptions of each analysis area are in the affected environment section for each issue or species evaluated (e.g., pileated woodpecker, etc.).

Table WI-1– Descriptions of wildlife analysis areas.

Analysis Area Name	Description	Total Acres	Issues/Species Analyzed
Project Area	Portions of Sections 34 and 35 T34N R23W; Sections 2, 3, 10, 11, 12, 13, and 14 T33N R23W east of Swift Creek	2,036	Direct & secondary effects for all issues/species
Medium CEAA	The Project Area and surrounding sections; defined by streams, ridgelines, and topographic features	9,432	Mature forest cover and connectivity, old-growth forests, pileated woodpeckers, fishers
Large CEAA	Primarily DNRC lands in the Stillwater State Forest bordered by high alpine ridges	32,201	Canada lynx, grizzly bears

Analysis Methods

Analysis methods are based on the DNRC State Forest Land Management Plan, which is designed to promote biodiversity. The primary basis for this analysis includes information obtained by: field visits, review of scientific literature, Montana Natural Heritage Program (MNHP) data queries, DNRC Stand Level Inventory (SLI) data analysis, aerial photograph analysis, and consultation with professionals. The coarse-filter wildlife analysis section includes analyses of the direct, secondary, and cumulative effects of the proposed alternatives on old-growth forest and the connectivity of mature forest habitats.

In the fine-filter analysis, individual species of concern are evaluated. These species include wildlife species federally listed under the Endangered Species Act, species listed as sensitive by DNRC, and species managed as big game by the Montana Department of Fish Wildlife and Parks (DFWP).

Cumulative effects analyses account for known past and current activities, as well as planned future agency actions. Timber sales that occurred on other ownerships are accounted for in analyses of aerial photographs. Proposed timber sales on other ownerships and recent DNRC timber sale projects (≤10 years) that could contribute to cumulative effects are summarized in the following table. Impacts of all completed and ongoing sales on wildlife habitat are accounted for in SLI data.

Table WI-2 – Recent projects and known proposed projects that could contribute to cumulative effects and the number of harvested acres that occur in each analysis area.

Sale Name	Agency	Harvest Year	Project Area	Medium CEAA	Large CEAA
Swift Divide	DNRC	2019-2023 (ongoing)			197
Antice Point North	DNRC	2019-2023 (ongoing)		61	226
Antice Central	DNRC	2018-2022 (ongoing)		276	276
Stryker Basin	DNRC	2017-2021 (ongoing)			572
Antice Knobs #2	DNRC	2017-2021 (ongoing)		302	302
Johnson's Yurt	DNRC	2017-2021 (ongoing)			239
Antice South	DNRC	2016-2020 (ongoing)		85	175
Lower Herrig	DNRC	2013-2018			254
Upper Whitefish	DNRC	2012-2016	18	18	183
Swedish Chicken	DNRC	2011-2014	206	206	265
SE Stryker Ridge	DNRC	2010-2014		299	362
Chicken Antice	DNRC	2009-2012	32	83	92
Grand Total % of Analysis Area			257 13%	1,331 14%	3,143 10%

Coarse Filter Wildlife Analysis

MATURE FOREST COVER AND CONNECTIVITY

Issue

The proposed activities could decrease mature forested cover, which could reduce habitat connectivity and suitability for wildlife species associated with mature forests.

Introduction

Mature forests characterized by large-diameter trees and dense canopy cover provide many wildlife species with food, shelter, breeding sites, and travel corridors. Historically, the spatial configuration of mature forested habitat in the western United States was shaped by natural disturbance, primarily wildfire, blowdown, and pest outbreaks. These events resulted in a mosaic-like spatial configuration of forest patches varying in age, species composition, and development. Spatial configuration, including patch size and connectivity of forested habitat, is important for many wildlife species. Patch size may affect the distribution of wildlife species that are attracted to or avoid forest edges. Additionally, connectivity of mature forested habitat may facilitate movements of wildlife species that avoid openings in canopy cover. For example, discontinuous mature forested habitat would negatively affect movements of fisher, which avoid large openings in canopy cover. Timber harvest, like wildfire and blowdown, is a disturbance event that often creates open patches of young, early-successional habitats. Forest

management considerations for wildlife species dependent on mature forested habitat include providing well-connected patches of habitat with ≥40% canopy cover.

Analysis Area
The analysis area for direct and secondary effects is the Project Area and the analysis area for cumulative effects is the 9,432-acre Medium CEAA as described in *TABLE W-1* and depicted in *FIGURE W-1*. The Medium CEAA is defined by geographic features and provides a reasonable analysis area to assess the impact of the proposed activities on wildlife species near the Project Area.

Measurement Criteria
Factors considered in the analysis include: 1) the degree of timber harvesting, 2) availability and patch size of mature forested habitat (≥40% canopy cover, trees >9 inches dbh average), 3) open and restricted road density, and 4) the availability of potential travel corridors. Mature forested habitat is defined here and in the remainder of the document as forest stands with ≥40% canopy cover comprised primarily of trees that are on average >9 inches dbh. Forested stands containing trees of at least this size and density were considered adequate for providing minimal conditions necessary to facilitate movements of wildlife species that benefit from well-connected mature forest conditions.

Affected Environment
The Project Area currently contains mature stands composed primarily of Douglas-fir and western larch stands with a huckleberry and beargrass understory (*TABLE WI-3, FIGURE WI-2*). Grand fir, subalpine fir, and Engelmann spruce are also present primarily in the midstory with few trees <20 feet tall in the understory. Most of the stands have not been logged before. The Project Area does not occur in any documented important area for habitat connectivity; however, Swift Creek located just west of the Project Area is a major riparian corridor and Chicken Creek and Swede Creek both lead to prominent saddles in the Whitefish Range that likely provide travel corridors. Overall, the connectivity of mature forests is high across the Project Area with habitat occurring in large patches. Portions of the Project Area have been harvested (13% in the past 10 years) and wetlands and meadows are also present, impacting connectivity. There are 2.1 miles/square mile of open and seasonally open roads present in the Project Area, which likely reduces connectivity for wildlife species that avoid roads.

The Medium CEAA consists primarily of DNRC lands (90% of Medium CEAA) and overall, mature forested habitat in the Medium CEAA is relatively well-connected (*TABLE WI-3*, *FIGURE WI-2*). Approximately 14% of the Medium CEAA has been impacted by timber harvest in the past 10 years, reducing connectivity. In the western portion of the CEAA, mature forested habitat is limited where high elevation (>6,000 feet) has limited tree growth. Open road density is relatively low in the Medium CEAA at 1.1 miles/square mile, with road density higher in low-elevation portions of the CEAA adjacent to Swift Creek and no roads present in the eastern high-elevation portion of the CEAA.

Table WI-3– Average patch size and acreage of mature forested habitat (≥40% canopy cover, >9 inches dbh) pre- and post-harvest in the Project Area and Medium CEAA for the Upper Swede Timber Sale. Percent of the total corresponding analysis area is in parentheses.

Mature Forest Attribute	Project Area		Medium CEAA	
	Existing	Post-Harvest	Existing	Post-Harvest
Acres of mature forest	1,306 (64%)	904 (44%)	4,580 (49%)	4,178 (44%)
Number of patches	6	10	16	19
Average patch size (acres)	217	90	286	220
Maximum patch size (acres)	4,466	4,011	1,221	770

Environmental Effects – Mature Forest Cover and Connectivity

No Action Alternative: Direct, Secondary, and Cumulative Effects

None of the proposed forest management activities would occur on DNRC lands. In the short-term, no changes to the amount, quality, or spatial arrangement of mature forested habitat would occur. In the long-term and in the absence of natural disturbance, the availability and connectivity of mature forested wildlife habitat may increase as stands age.

Action Alternative: Direct and Secondary Effects

The proposed activities would occur in 402 (31%) of the 1,306 acres of mature stands available in the Project Area (*TABLE WI-3, FIGURE WI-2*). These stands would be treated with a seed tree treatment which would retain 5-15% mature canopy cover post-harvest, removing mature forested habitat. The largest patch of mature forested habitat would be impacted and average patch size would be reduced by 127 acres (*TABLE WI*-3). Connectivity of upland mature canopy forest within the Project Area would be reduced. However, corridors would be retained between Swift Creek and higher elevation portions of the Project Area including a corridor north of Chicken Creek and corridors on the north end of the Project Area (*FIGURE WI-2*). Approximately 1.2 miles of road are proposed for construction and would be gated and only administrative use and non-motorized public would be permitted on these roads (except for snowmobiles). The impacts of constructing roads in this area were analyzed during the HCP process with USFWS (*USFWS and DNRC 2010*). Approximately 0.6 miles of road currently open to the public would be reclaimed and closed to all use. Post-harvest total road density would increase from 3.9 miles/square mile to 4.1 miles/square mile but open road density would decrease from 2.1 miles/square mile to 1.9 miles/square mile. Thus, since: 1) the abundance of mature forested habitat would decrease by 402 acres (31% of existing mature forest); 2) connectivity would be reduced but corridors would remain; and 3) 1.2 miles of roads closed to motorized public use would be constructed, but 0.6 of existing road open to the public would be reclaimed; moderate adverse direct or secondary effects to mature forested habitat abundance, suitability, or connectivity would be anticipated as a result of the Action Alternative.

Action Alternative: Cumulative Effects

The proposed activities would affect 402 acres (9%) of the 4,580 acres of mature forested habitat available in the Medium CEAA. Post-harvest these stands would not provide mature forested habitat for wildlife, causing a decrease in average patch size from 286 acres to 220 acres (*TABLE WI-3, FIGURE WI-2*). Reductions in the availability of suitable mature forested habitat would be additive to harvest activities that are proposed or ongoing in the Medium CEAA (*TABLE WI-2*), although the anticipated impacts of these timber sales were accounted for in patch size and connectivity analysis. The largest patch of mature forested habitat would be impacted and average patch size would be reduced by 66 acres (*TABLE WI*-3). Connectivity of upland mature forest would be reduced; however, corridors would remain between Stryker

Ridge, Swift Creek, and the Whitefish Divide. Approximately 1.2 miles of road restricted to motorized public use would be constructed and 0.6 miles of road open to the public would be reclaimed. Thus, since: 1) the abundance of mature forested habitat in the Medium CEAA would decrease by 402 acres (9% of existing mature forest); 2) mature forest fragmentation would increase; and 3) 1.2 miles of roads closed to motorized public use would be constructed, but 0.6 of existing road open to the public would be reclaimed; minor adverse cumulative effects to mature forested habitat abundance, suitability, or connectivity would be anticipated as a result of the Action Alternative.

OLD-GROWTH FORESTS

Issue
The proposed activities could affect wildlife species associated with old-growth forests by reducing habitat availability and increasing fragmentation.

Introduction
Old-growth forests are an important component of biological diversity. Old-growth forest stands typically contain various combinations of large old trees, abundant snags and downed logs, and multiple canopy layers, which are typically not found in young forests. These attributes provide structures used by a diversity of wildlife species. The diversity of species and the complexity of interactions between them can be different than in earlier successional stages (*Warren 1990*). Of the 48 old-growth associated species occurring in the Northern Rockies, about 60% may require stands larger than 80 acres (*Harger 1978*). Smaller patches may be unsuitable for wildlife species with large home ranges. Additionally, small, less-mobile species may be at greater risk of local extirpation in small patches/habitat islands. Timber harvest can affect the size, availability, and spatial juxtaposition of old-growth stands.

Analysis Area
The analysis area for direct and secondary effects is the Project Area and the analysis area for cumulative effects is the 9,432-acre Medium CEAA as described in *TABLE W-1* and depicted in *FIGURE W-1*. The Medium CEAA is defined by geographic features and provides a reasonable analysis area to assess the impact of the proposed activities on wildlife species near the Project Area.

Measurement Criteria
Old-growth forest stands were identified as described in the Vegetation Analysis. Factors considered in the analysis include: 1) the level of harvesting, 2) the abundance of old-growth, and 3) the abundance of patches >80 acres.

Affected Environment
The Project Area contains a high proportion of western larch and Douglas-fir old-growth stands (*TABLE WI-4; Green et al. 1992*). There are 2 old-growth patches >80 acres in the Project Area including a 204-acre patch located north of Chicken Creek and a 122-acre patch located north of a large avalanche chute (*FIGURE WI-2*). These old-growth stands have not been logged previously.

The Medium CEAA contains a high proportion of old-growth stands on DNRC-managed lands (*TABLE WI*-4) and an additional 168 acres of stands that have not been logged on USFS lands may also meet old-growth definitions (up to 29% of Medium CEAA). Overall, the availability of old-growth in the Medium CEAA is high. Old-growth stands are present throughout the CEAA and the largest patch is 1,454 acres and is located in the Antice Creek area.

Table WI-4– Average patch size and acreage of old-growth forests pre- and post-harvest in the Project Area and Medium CEAA for the Upper Swede Timber Sale. Percent of the total corresponding analysis area is in parentheses. Only includes stands on DNRC lands.

Old-growth Forest Attribute	Project Area		Medium CEAA	
	Existing	Post-Harvest	Existing	Post-Harvest
Acres of old-growth	588 (29%)	415 (20%)	2,550 (27%)	2,377 (25%)
Number of patches >80 acres	2	1	4	3
Number of patches	13	17	19	23
Average patch size (acres)	45	24	134	103
Maximum patch size (acres)	203	150	1,454	1,454

Environmental Effects – Old-growth Forests

No Action Alternative: Direct, Secondary, and Cumulative Effects

No changes to the amounts, quality, or spatial arrangement of old-growth would occur on DNRC lands under this Alternative. Thus, no direct, secondary, or cumulative effects associated with the abundance or fragmentation of old-growth forests would be anticipated as a result of the No-Action Alternative.

Action Alternative: Direct and Secondary Effects

Approximately 173 acres (29%) of existing old-growth would be treated with a seed tree treatment and post-harvest these stands would not meet old-growth definitions (*Green et al. 1992*). Average patch size would decrease by 21 acres, fragmenting old-growth stands and reducing habitat quality for wildlife. Most of the fragmentation would occur in the 122-acre stand located north of Swede Creek with this stand split into multiple small stands. The 204-acre stand would decrease to 150 acres and the 122-acre stand would decrease to 67 acres reducing the availability of large old-growth stands. Thus, since 1) the availability of old-growth would decrease by 173 acres (29% of existing old-growth); 2) fragmentation would decrease average patch size by 21 acres; 3) the abundance of old-growth patches >80 acres would decrease from 2 to 1 patches; and 4) post-harvest 20% of the Project Area would meet old-growth definitions; moderate adverse direct and secondary effects associated with the abundance or fragmentation of old-growth forests would be anticipated as a result of the Action Alternative.

Action Alternative: Cumulative Effects

Approximately 173 acres (7%) of the 821 old-growth acres in the Medium CEAA would be affected by the proposed activities. These stands would be treated with a seed tree and would not be considered old-growth post-harvest considering the low retention of large-diameter trees proposed. Average patch size would decrease by 31 acres with most of the fragmentation resulting from logging occurring in the northern portion of the Project Area. One of the patches >80 acres would be reduced from 107 acres to 56 acres, reducing habitat availability for species preferring large old-growth stands. Changes in structural attributes of old-growth would be additive to ongoing forest management activities in the Medium CEAA (*TABLE WI-2*), although impacts of these activities have been accounted for in old-growth availability and patch size analysis. Thus, since: 1) the availability of old-growth would decrease by 173 acres (7% of existing old-growth); 2) fragmentation would decrease average patch size by 31 acres; 3) the abundance of old-growth patches >80 acres would decrease from 4 to 3 patches; and 4) post-harvest 25% of the Medium CEAA would meet old-growth definitions; minor adverse cumulative

effects associated with the abundance or fragmentation of old-growth forests would be anticipated as a result of the Action Alternative.

Fine Filter Wildlife Analysis

In the fine-filter analysis, individual species of concern are evaluated. These species include those listed as threatened or endangered under the Endangered Species Act of 1973, species listed as sensitive by DNRC, and animals managed as big game by Montana DFWP. *TABLE WI-5* –provides an analysis of the anticipated effects for each species.

Table WI-5 –Anticipated effects of the Upper Swede Timber Sale on wildlife species.

Species/Habitat	[Y/N] Potential Impacts and Mitigation Measures N = Not Present or No Impact is Likely to Occur Y = Impacts May Occur (Explain Below)
Threatened and Endangered Species	
Grizzly bear *(Ursus arctos)* Habitat: Recovery areas, security from human activity	[**Y**] ***Detailed Analysis Provided Below.*** The Project Area is considered recovery zone habitat associated with the Northern Continental Divide Ecosystem (NCDE) (*USFWS 1993*).
Canada lynx (*Felix lynx)* Habitat: Subalpine fir habitat types, dense sapling, old forest, deep snow zone	[**Y**] ***Detailed Analysis Provided Below.*** The Project Area contains approximately 1,732 acres of suitable lynx habitat.
Sensitive Species	
Bald eagle *(Haliaeetus leucocephalus)* Habitat: Late-successional forest <1 mile from open water	[**Y**] Bald eagles nest on Upper Whitefish Lake located 1.5 miles north of the Project Area. However, the Project Area is not likely to be used frequently by the eagles considering the distance to the lake. Additionally, the haul route does not pass by the nest. Thus, negligible direct, secondary, or cumulative effects to bald eagles would be expected to occur as a result of the Action Alternative. No direct, secondary, or cumulative effects would be anticipated as a result of the No Action Alternative.
Black-backed woodpecker *(Picoides arcticus)* Habitat: Mature to old burned or beetle-infested forest	[**N**] No recently (<5 years) burned areas occur within 0.25 miles of the Project Area. Thus, no direct, secondary, or cumulative effects to black-backed woodpeckers would be expected to occur as a result of either alternative.
Coeur d'Alene salamander *(Plethodon idahoensis)* Habitat: Waterfall spray zones, talus near cascading streams	[**N**] No moist talus or streamside talus habitat occurs in the Project Area. Thus, no direct, secondary, or cumulative effects to Coeur d'Alene salamanders would be expected to occur as a result of either alternative.
Columbian sharp-tailed grouse *(Tympanuchus Phasianellus columbianus)* Habitat: Grassland, shrubland, riparian, agriculture	[**N**] No suitable grassland communities occur in the Project Area. Thus, no direct, secondary, or cumulative effects to Columbian sharp-tailed grouse would be expected to occur as a result of either alternative.
Common loon *(Gavia immer)* Habitat: Cold mountain lakes, nest in emergent vegetation	[**N**] No suitable lake habitat occurs within 500 feet of the Project Area. Thus, no direct, secondary, or cumulative effects to common loons would be expected to occur as a result of either alternative.
Fisher *(Martes pennanti)*	[**Y**] **Detailed Analysis Provided Below** – Approximately 1,152 acres of suitable fisher habitat occur within the Project Area.

Species/Habitat	[Y/N] Potential Impacts and Mitigation Measures N = Not Present or No Impact is Likely to Occur Y = Impacts May Occur (Explain Below)
Habitat: Dense mature to old forest less than 6,000 feet in elevation and riparian	
Flammulated owl *(Otus flammeolus)* Habitat: Late-successional ponderosa pine and Douglas-fir forest	[**N**] Suitable flammulated owl habitat does not occur in the Project Area. Thus, no direct, secondary, or cumulative effects to flammulated owls would be expected to occur as a result of either alternative.
Gray Wolf *(Canis lupus)* Habitat: Ample big game populations, security from human activities	[**Y**] Wolves may use habitat near the Project Area. Disturbance associated with timber sales at den and rendezvous locations can adversely affect wolves; however, timing restrictions would apply if den or rendezvous sites are documented (*ARM 33.11.430(1)(a)(b)*). Thus, negligible adverse direct, secondary, or cumulative effects to wolves would be anticipated as a result of the Action Alternative. No direct, secondary, or cumulative effects would be anticipated as a result of the No Action Alternative.
Harlequin duck *(Histrionicus histrionicus)* Habitat: White-water streams, boulder and cobble substrates	[**Y**] Potentially suitable stream habitat occurs along Swift Creek. However, there is no evidence of harlequin ducks breeding in the area (*MNHP data, December 19, 2019*) and harlequin ducks were not observed during recent brood surveys (DNRC, unpublished data). Logging would occur within 200 feet of Swift Creek, and if present nearby harlequin ducks could be displaced. However, considering the infrequency of sightings in the area and lack of evidence of breeding adverse impacts would be unlikely. Thus, negligible adverse direct, secondary, or cumulative effects to harlequin ducks would be anticipated as a result of the Action Alternative. No direct, secondary, or cumulative effects would be anticipated as a result of the No Action Alternative.
Northern bog lemming *(Synaptomys borealis)* Habitat: Sphagnum meadows, bogs, fens with thick moss mats	[**N**] No suitable wetlands occur within the Project Area. Thus, no direct, secondary, or cumulative effects to northern bog lemmings would be expected to occur as a result of either alternative.
Peregrine falcon *(Falco peregrinus)* Habitat: Cliff features near open foraging areas and/or wetlands	[**N**] Suitable nesting cliffs were not observed near the Project Area and peregrine eyries have not been reported in the area (*MNHP data, December 19, 2019*). Thus, no direct, secondary, or cumulative effects to peregrine falcons would be anticipated as a result of either alternative.
Pileated woodpecker *(Dryocopus pileatus)* Habitat: Late-successional ponderosa pine and larch-fir forest	[**Y**] **Detailed Analysis Provided Below –** Approximately 959 acres of pileated woodpecker habitat occur in the Project Area.
Townsend's big-eared bat *(Plecotus townsendii)* Habitat: Caves, caverns, old mines	[**N**] No suitable caves or mine tunnels are known to occur in the Project Area and observations have not been reported in the area (*MNHP data, December 19, 2019*). Thus, no direct, secondary or cumulative effects to Townsend's big-eared bats would be expected to occur as a result of either alternative.

Species/Habitat	[Y/N] Potential Impacts and Mitigation Measures N = Not Present or No Impact is Likely to Occur Y = Impacts May Occur (Explain Below)
Wolverine *(Gulo gulo)* Habitat: Alpine tundra and high-elevation boreal forests that maintain deep persistent snow into late spring	[**Y**] Suitable wolverine habitat exists within the proposed Project Area. The acres proposed for harvest coincide with areas that contain persistent snow cover per USFS data (*Copeland et al. 2010*) and wolverines have been documented on game cameras nearby. Minor short-term displacement associated with logging disturbance could occur if wolverines are in the area. Logging is not likely to occur during the wolverine denning season (February – May) given the difficulty of accessing the area and that grizzly bear timing restrictions begin in April. Given the large home range area wolverines occupy (average 150 plus square miles) and the long distances wolverines typically cover during their movements, the proposed activities are not expected to measurably affect use of the area by wolverines. Thus, negligible adverse direct, indirect, or cumulative effects to wolverines would be expected to occur as a result of the Action Alternative. No direct, secondary, or cumulative effects would be anticipated as a result of the No Action Alternative.
Big Game Species	
Elk **Whitetail** **Mule Deer**	[**Y**] The Project Area is located outside of areas considered big game winter range by DFWP (*2008*) so thermal cover is not a concern in this area. However, mule deer in particular may use the Project Area in the spring and late summer to access fawning grounds. Spring timing restrictions would apply from April 1 – June 15 in all harvest units, with some harvest units further restricted unitl June 30, protecting mule deer during the fawning period. Thus, negligible adverse direct, indirect, or cumulative effects to big game would be expected to occur as a result of the Action Alternative. No direct, secondary, or cumulative effects would be anticipated as a result of the No Action Alternative.

Threatened and Endangered Species

CANADA LYNX

Issue
The proposed activities could reduce landscape connectivity and the availability of suitable Canada lynx habitat, reducing the capacity of the area to support Canada lynx.

Introduction
Canada lynx are medium-size cats that prey primarily on snowshoe hares and they are federally listed as a threatened species (*Ruediger et al. 2000*). Lynx foraging habitat in western Montana consists of a mosaic of young coniferous stands and mature forested stands with high levels of canopy cover, which provide snowshoe hare habitat (*Squires et al. 2010, Squires et al. 2013*). Retaining habitat connectivity of both summer and winter lynx foraging habitat is important since winter corridors may provide local connectivity while summer corridors are more likely to facilitate long-distance dispersal (*Squires et al. 2013*). Forest management considerations for lynx include providing a mosaic of well-connected young and mature lynx habitat patches containing high horizontal cover.

Analysis Area
The analysis area for direct and secondary effects is the Project Area and the analysis area for cumulative effects is the 32,201-acre Large CEAA as described in *TABLE WI-1* and depicted in *FIGURE WI-1.* The Large CEAA approximates the size of a lynx home range and is defined according to geographic features (e.g., ridgelines), which are likely to influence movements of Canada lynx near the Project Area providing a reasonable analysis area for Canada lynx that could be influenced by project-related activities.

Measurement Criteria
Factors considered in the analysis include: 1) the level of harvesting, 2) the availability of suitable lynx habitat classes, and 3) landscape connectivity. Lynx habitat was subdivided into the following lynx habitat classes: 1) winter foraging, 2) summer foraging, 3) other suitable, and 4) temporary non-habitat. All habitat classes were identified according to DNRC's lynx habitat mapping protocols (*USFWS and DNRC 2010*). Suitable habitat is the sum of winter foraging, summer, foraging, and other suitable habitat. Other suitable lynx habitat is defined as habitat that has the potential to provide connectivity and lower quality foraging habitat but does not contain the necessary attributes to be classified as winter or summer foraging habitat classes. The temporary non-habitat category consists of forested stands that are not expected to be used by lynx until suitable horizontal cover develops. On non-DNRC lands, stands with ≥40% canopy cover provided by trees >9 inches dbh on average were considered to provide potential lynx habitat. This habitat definition provides a conservative estimate of suitable lynx because it excludes young, dense stands that can also serve as suitable habitat for lynx but are difficult to quantify using aerial photographs.

Existing Environment
The Project Area contains 1,732 acres of suitable lynx habitat (86% of the Project Area; *TABLE WI-6*). These stands are primarily western larch and Douglas-fir stands with grand fir in the understory. The remaining 304 acres in the Project Area consist primarily of stands that are suitable forest types, but do not contain sufficient structure to support lynx. Approximately 206 of these acres were logged in the DNRC Swedish Chicken Timber Sale (2011-2014). Forest types are generally favorable for lynx in and around the Project Area and suitable habitat is well connected.

The Large CEAA contains 22,469 acres of suitable lynx habitat (85% of the Large CEAA; *TABLE WI-6*) including 8,876 acres of stands on USFS lands that may provide suitable habitat. The Large CEAA contains cool moist forest types with grand fir and subalpine fir components, which is favorable for lynx. Suitable habitat is distributed throughout the CEAA and is well-connected. The remaining 9,732 acres in the Large CEAA that do not provide lynx habitat consist of 4,911 acres of stands on USFS that are not likely to provide suitable habitat since they are located at a high elevation (>6,000 feet), stands that were harvested in past 10 years (3,143 acres; 10% of the Large CEAA), 803 acres of stands that are not suitable forest types, and other non-lynx habitat such as lakes or meadows.

Table WI-6– Estimated acreage of lynx habitat that would remain in the Project Area and Large CEAA post-harvest. Values in parentheses refer to the percentage of the total potential lynx habitat that each lynx habitat class represents.

Lynx Habitat Category	Project Area		Large CEAA	
	Existing	Post-Harvest	Existing	Post-Harvest
Other Suitable (DNRC)	84 (14%)	84 (4%)	2,328 (9%)	2,328 (9%)
Summer Foraging (DNRC)	155 (8%)	153 (8%)	5,139 (19%)	5,137 (19%)
Winter Foraging (DNRC)	1,494 (74%)	1,081 (54%)	14,219 (54%)	13,806 (52%)
Temporary Non-habitat (DNRC)	276 (14%)	692 (34%)	4,017 (15%)	4,433 (17%)
Additional Potential Habitat[a] – non-DNRC Ownership	0 (0%)	0 (0%)	8,876 (82%)	8,876 (82%)
Grand Total - Suitable Lynx Habitat[b] (All Ownerships)	1,732 (86%)	1,317 (66%)	22,469 (85%)	22,054 (83%)

[a]Total potential lynx habitat describes all areas that contain appropriate habitat types for lynx (i.e., sum of summer forage, winter forage, other suitable, and temporary non-suitable lynx habitat classes).
[b]Total suitable lynx habitat describes all lynx habitat categories that contain structural attributes necessary for lynx use (i.e., sum of summer forage, winter forage, other suitable lynx habitat classes, potential habitat on non-DNRC lands).

Environmental Effects

No Action Alternative: Direct, Secondary, and Cumulative Effects on Canada Lynx

None of the proposed forest management activities would occur on DNRC lands. In the short-term, lynx habitat availability and connectivity would not change. In the long-term and in the absence of natural disturbance, winter foraging habitat availability would increase due to natural forest succession while summer foraging habitat availability would decrease due to the lack of young regenerating stands. Connectivity may also increase in the long-term due to increasing canopy cover over time.

Action Alternative: Direct and Secondary Effects on Canada Lynx

The proposed activities would affect 417 acres (24%) of the 1,732 acres of suitable lynx habitat available in the Project Area. Seed tree cuts proposed for these acres would cause habitat to become temporarily unsuitable for lynx use due to lack of canopy cover in the understory and overstory (*TABLE WI-6*). These stands may be suitable for lynx use again in 10-15 years after young trees have grown to a sufficient height. To ensure that forest structural attributes preferred by snowshoe hares remain following harvest, dense patches of advanced regeneration would be retained in lynx winter forage habitat. Additionally, coarse woody debris would be retained in accordance with DNRC Forest Management Rules (*ARM 36.11.414)* and retention of downed logs ≥15 inches diameter would be emphasized. Lynx habitat connectivity would be reduced between Swift Creek and the Whitefish Divide and would be additive to impacts that occurred during the Swedish Chicken Timber Sale (2011-2014); however, multiple corridors would be retained including corridors along Chicken Creek, a corridor along an unnamed drainage north of Chicken Creek, and a corridor north of Swede Creek. If present near the Project Area, lynx could be temporarily displaced by forest management activities for approximately 3 years. Thus, since: 1) lynx suitable habitat availability would be reduced by 417 acres (24%) of existing habitat in the Project Area; 2) patches of shade-tolerant trees would be retained where feasible in winter foraging habitat; and 3) landscape connectivity would be

reduced but multiple corridors would be retained; moderate adverse direct and secondary effects to Canada lynx associated with landscape connectivity and availability of suitable habitat would be anticipated as a result of the Action Alternative.

Action Alternative: Cumulative Effects on Canada Lynx
The proposed activities would affect 417 acres (2%) of the 22,469 acres of potentially suitable lynx habitat available in the Large CEAA. These acres are temporarily unsuitable for lynx use due to lack of canopy cover in the understory and overstory. Patches of shade tolerant trees and coarse woody debris would be retained emphasizing the retention of downed logs ≥15 inches diameter to provide important lynx and snowshoe hare habitat components. Connectivity between Swift Creek and the Whitefish Divide would be reduced in the area between Swede Creek and Chicken Creek, but travel corridors would be retained and travel would remain feasible. Changes to lynx habitat availability and connectivity would be additive to past, proposed, and ongoing projects (see *TABLE WI-2*). However, the impacts of past activities and anticipated impacts of ongoing activities have been accounted for in analysis of habitat structure. Lynx could be temporarily displaced by forest management activities associated with the Upper Swede Timber Sale and other ongoing timber sales for approximately 3 years. Thus, since: 1) lynx suitable habitat availability would be reduced by 417 acres (2% of potentially suitable lynx habitat in the Large CEAA); 2) patches of shade-tolerant trees would be retained where feasible in winter foraging habitat; 3) landscape connectivity would be reduced particularly between Swede and Chicken Creeks but habitat would remain well-connected overall; and 4) eight proposed and ongoing projects could occur concurrently impacting 7% of the CEAA and potentially displacing local lynx; moderate adverse cumulative effects to Canada lynx associated with landscape connectivity and suitable habitat type availability would be anticipated as a result of the Action Alternative.

GRIZZLY BEAR

Issue
The proposed activities could affect grizzly bear cover, affect important habitat, and increase human access, which could adversely affect bears by displacing them from important habitat, and/or by increasing risk of human-caused bear mortality.

Introduction
Grizzly bears are opportunistic omnivores that inhabit a variety of habitats in Montana. Preferred grizzly bear habitat includes avalanche chutes, fire-mediated shrub fields, and riparian areas, all of which provide seasonal food sources (*McLellan and Hovey 2001*). Grizzly bears are federally listed as a threatened species and primary threats are related to human-bear conflicts and long-term habitat loss associated with human development (*Mace and Waller 1997*). Forest management considerations for grizzly bears include minimizing potential for conflicts with humans, minimizing adverse effects to vegetation and cover, minimizing access and the construction of new roads, and reducing disturbance levels during the non-denning season, especially in the spring and fall when grizzly bears have important nutritional demands.

Analysis Area
The analysis area for direct and indirect effects is the Project Area and the analysis area for cumulative effects is the 32,201-acre Large CEAA as described in *TABLE WI-1* and depicted in *FIGURE WI-1*. The Large CEAA is defined by geographic features and approximates the home range size of a female grizzly bear in northwest Montana.

Measurement Criteria
Factors considered in the analysis included: 1) the degree of harvesting, 2) the availability of visual screening cover, 3) risk of displacement from important grizzly bear habitat including spring habitat and riparian habitat, 4) open and restricted road densities, and 5) impacts on security zones. Forest cover capable of hiding 90% of a grizzly bear at a distance of 200 feet was considered to provide visual screening cover. Visual screening was estimated by evaluating forest stand size class and the total crown density of all trees in the stand using GIS and SLI data. Seedlings/sapling stands were included in estimates of visual screening cover if they were >4 feet tall and contained ≥350 trees/acre. On non-DNRC lands the acreage of stands with ≥40% canopy cover provided by trees >9 inches dbh on average was queried to estimate the availability of visual screening cover. Open road densities were calculated using the simple linear calculation method (road length miles divided by area in square miles). Security zones are quiet areas where motorized use is prohibited during the non-denning period and no permanent road construction is permitted.

Existing Environment
The Project Area is grizzly bear recovery zone habitat associated with the NCDE (*USFWS 1993*) and grizzly bears are frequently observed in and around the Project Area. Approximately 1,363 acres (67%) in the Project Area possess cover capable of providing visual screening for grizzly bears, facilitating travel. Preferred bear habitat is present in the Project Area including avalanche chutes in the northern drainages which may provide early spring foraging opportunities for winter-kill carcasses as well as berry foraging opportunities in the summer and fall. There are also large huckleberry patches located in old timber cuts and riparian habitat associated with streams including Chicken and Swede creeks. Security zone habitat is not present in the Project Area, but it does border the Project Area to the west. Open and seasonally open road density is moderate in the Project Area at 2.1 miles per square mile, likely displacing bears or impacting temporal habitat use patterns near these roads.

The Large CEAA is recovery zone habitat associated with the NCDE. Approximately 21,699 acres (67%) of the Large CEAA are considered visual screening including 19,775 acres of visual screening on DNRC lands and an additional 1,924 acres on USFS lands. The remaining acres in the CEAA consist of 3,143 acres (10% of CEAA) of recently cut stands (<10 years), open areas associated with streams and meadows, and high-elevation habitat with limited timber growth, particularly in the northern portion of the CEAA near Link Mountain. The CEAA includes 4,279 acres of security zone habitat (13% of CEAA) located in the eastern portion of the analysis area near the Whitefish Range Divide. The CEAA contains many preferred bear habitat types including huckleberry patches, riparian areas, and avalanche chutes. Overall open and seasonally open road density is low at 0.8 miles/square mile.

<u>Environmental Effects- Grizzly Bears</u>

No Action Alternative: Direct, Secondary, and Cumulative Effects on Grizzly Bears
None of the proposed forest management activities would occur. In the short-term, no changes to grizzly bear habitat would be expected. Visual screening, risk of displacement, and open and restricted road density would not be affected. However, in the long-term and in the absence of natural disturbance, visual screening may increase as stands age increasing the availability of visual screening. Thus, no adverse direct, secondary or additional cumulative effects associated with grizzly bear displacement or human-caused bear mortality risk would be anticipated as a result of the No-Action Alternative.

Action Alternative: Direct and Secondary Effects on Grizzly Bears
Timber harvest would affect 388 acres (28%) of the 1,363 acres of visual screening available in the Project Area. After harvest, these acres would not provide hiding cover for 10-20 years due to low conifer density, although small patches of trees and shrubs would be retained. Open stands created by logging would likely have a greater availability of forage plants post-harvest, particularly huckleberries. However, logging would increase sight distances within proposed harvest units. To facilitate bear travel and use in these stands, all harvest units are designed so that no location is >600 feet to hiding cover. Some preferred bear habitat would be impacted, including 9 acres of riparian habitat associated with small streams. Overall accessibility of the area would increase slightly decreasing habitat quality and security for bears. Approximately 1.2 miles of permanent road would be built to access the proposed harvest units. Post-harvest, these roads would be closed behind gates and there would be no motorized access for the public and only seasonal access for commercial forest management and administrative use. The construction of roads in this area and impacts on bears were previously accounted for in USFWS and DNRC (*2010*). Approximately 0.6 miles of roads that are currently seasonally open to the public would be reclaimed, increasing security for grizzly bears in the northern portion of the Project Area which contains high-quality bear habitat including avalanche chutes and huckleberry foraging areas. Traffic would increase on 11.6 miles of road in the Project Area including 3.7 miles of temporary roads which would be closed post-harvest. If present nearby, grizzly bears could be displaced from preferred habitat by forest management activities for approximately 3 years. However, spring timing restrictions would be enforced from April 1 – June 15 across the entire Project Area and from April 1- June 30 in the Swede Creek area to provide security for grizzly bears in the spring. Security zone habitat would not be impacted and the duration of logging activities near the security zone would be minimized. Thus, since: 1) visual screening would be removed from 388 acres (28%) of existing screening; 2) motorized disturbance would increase on 11.6 miles of road during hauling and harvesting; 3) open and seasonally open road density would decrease by 0.2 miles/square mile, but total road density would increase by 0.2 miles/square mile, and 4) security zone habitat would not be directly impacted and the duration of nearby activities would be minimized; moderate adverse direct or indirect effects associated with grizzly bear displacement or human-caused bear mortality risk would be anticipated as a result of the Action Alternative.

Action Alternative: Cumulative Effects on Grizzly Bears
The proposed activities would affect 388 acres (2%) of the 21,699 acres of visual screening available in the Large CEAA. Logging would increase sight distances within proposed harvest units and post-harvest these acres would not provide visual screening for bears for 10-20 years. However, small patches of shrubs and conifers would be retained where feasible and units are designed so that no point in a harvest unit is >600 feet to hiding cover. Preferred bear habitat would be impacted including 9 acres of riparian habitat. Open roads would decrease by 0.6 miles while restricted roads (closed with a gate) would increase by 1.2 miles, decreasing motorized public access while also increasing the accessibility of the area to non-motorized public traffic. Traffic would also increase along 12.6 miles of roads in the CEAA including 3.7 miles of temporary road, which would be reclaimed post-harvest. Impacts to bear habitat would be additive to past, proposed, and ongoing projects (see *TABLE WI-2*). However, the impacts of past activities and the anticipated impacts of ongoing activities have been accounted for in analyses of stand structure. Grizzly bears could be temporarily displaced by forest management activities associated with the proposed Upper Swede Timber Sale and other ongoing projects (up to 2,406 acres of ongoing harvest; 7% of Large CEAA) for approximately 3 years. However, activities would be restricted from April 1 – June 15 in all harvest units and from April 1 – June 30 in harvest units located near Swede Creek. Thus, since: 1) visual screening would be removed from 388 acres (2% of existing screening); 2) motorized

disturbance would increase on 12.6 miles of road during hauling and harvesting; 3) open and seasonally open road density would decrease slightly (<0.1 miles/square mile), but total road density would increase slightly, 4) security zone habitat would not be directly impacted and the duration of nearby activities would be minimized, and 5) eight proposed and ongoing projects could occur concurrently impacting 7% of the CEAA and potentially displacing local bears; moderate adverse cumulative effects associated with grizzly bear displacement or human-caused bear mortality risk would be anticipated as a result of the Action Alternative.

Sensitive Species

FISHERS

Issue

The proposed activities could reduce the availability and connectivity of suitable fisher habitat and increase human access, which could reduce fisher habitat suitability and increase trapping mortality.

Introduction

In the Rocky Mountains, fishers prefer mesic late-successional forests with complex vertical and horizontal structure, large-diameter trees, and relatively dense canopies (*Raley et al. 2012, Schwartz et al. 2013*). Fishers generally avoid large openings, clearcuts, and ponderosa pine and lodgepole pine stands (*Schwartz et al. 2013*). Fishers prey upon snowshoe hares, ungulate carrion, porcupines, birds, and small mammals as well as seasonally available fruits and berries. Fisher resting and denning sites are found in cavities of live trees and snags, downed logs, brush piles, mistletoe brooms, squirrel and raptor nests, and holes in the ground. Forest-management considerations for fishers involve providing upland and riparian resting and denning habitat, maintaining a network of travel corridors, and reducing trapping risk associated with motorized access.

Analysis Area

The analysis area for direct and secondary effects is the Project Area and the analysis area for cumulative effects is the 9,432-acre Medium CEAA as described in *TABLE WI-1* and depicted in *FIGURE WI-1*. The Medium CEAA is centered on the Project Area and is defined according to geographic features and could support the home range of at least one fisher, providing a reasonable analysis area for fishers that could be influenced by project-related activities.

Measurement Criteria

Factors considered in the analysis include: 1) the degree of harvesting, 2) availability and structure of preferred fisher habitats (upland, riparian), 3) landscape connectivity, and 4) trapping risk. Fisher habitat classifications considered in the analysis include: 1) upland fisher habitat, and 2) riparian fisher habitat, which are defined according to proximity of forest stands to streams. Riparian fisher habitat is located within 100 feet of Class 1 streams or within 50 feet of Class 2 streams (*ARM 36.11.440(b)*). The remaining fisher habitat is considered upland fisher habitat. Habitat structure considered appropriate for fisher use includes stands with 40-100% total stocking density with appropriate mesic cover types. Potential fisher habitat (riparian, upland) on other ownerships was estimated by identifying mature forested habitat (≥40% cover, trees >9 inches dbh average) below 6,000 feet elevation in proximity to perennial and intermittent streams.

Existing Environment
Fisher habitat is present in the Project Area (*TABLE WI-7*). These stands consist of cool, moist Douglas-fir and western larch forest types and they are interspersed by subalpine fir stands and dry forest types on south-facing slopes (491 acres; 24% of Project Area) as well as stands that do not contain sufficient canopy cover including stands previously harvested in the DNRC Swedish Chicken Timber Sale (393 acres; 19% of Project Area). Connectivity is highest between Swede and Chicken creeks where forest types preferred by fishers are prevalent.

In the Medium CEAA, potential fisher habitat is located primarily around Antice Creek and between Swede and Chicken creeks (*TABLE WI-7*). Approximately 2,914 acres (30%) in the Medium CEAA are not forest types preferred by fishers such as subalpine fir and the remaining 2,632 acres (28%) do not contain sufficient structure or are non-forested areas including lakes and avalanche chutes. Overall, the connectivity of fisher habitat near the Project Area is moderate considering the availability of connected riparian habitat. Historical records of fishers using the CEAA are limited (*MNHP data, December 19, 2019*) and fisher use of the CEAA may be precluded by the deep unconsolidated snowpack that is common in the area.

Table WI-7 –Fisher Habitat in the Project Area and Medium CEAA and anticipated effects of the Upper Swede Timber Sale. Habitat estimates include potential habitat on non-DNRC ownership. Values in parentheses refer to the percentage that each fisher habitat type represents within the analysis area.

Fisher Habitat Attribute	Project Area		Medium CEAA	
	Existing	Post-Harvest	Existing	Post-Harvest
Fisher Habitat	1,152 (57%)	821 (40%)	3,886 (41%)	3,555 (38%)
Riparian Fisher Habitat	220 (11%)	215 (11%)	574 (6%)	569 (6%)
Fisher Habitat Harvest (% of available habitat)	331 (29%)		331 (9%)	

<u>Environmental Effects</u>

No Action Alternative: Direct, Secondary, and Cumulative Effects on Fishers
None of the proposed forest management activities would occur on DNRC lands. The level of motorized access would not change and no additional risk associated with trapping would be expected. In the short term, no changes to fisher habitat availability or connectivity would occur. In the long-term and in the absence of natural disturbance, fisher habitat suitability and connectivity may increase as stands age, the availability of large-diameter trees increases, and mature canopy cover increases.

Action Alternative: Direct and Secondary Effects on Fishers
The proposed activities would affect fisher habitat (*TABLE WI-7*). Approximately 331 acres (29%) of fisher habitat would be treated with a seed tree treatment and would not provide suitable fisher habitat post-harvest due to low retention of mature trees. The Action Alternative includes logging 5 acres (2%) of riparian fisher habitat in the Project Area. These acres also would not provide suitable fisher habitat post-harvest. Riparian stands proposed for harvest are located on short streams (<600 feet) or on one side of a stream and are anticipated to have a negligible impact on habitat connectivity for fishers. Overall connectivity of fisher habitat would be reduced, particularly adjacent to Swede Creek where the most acres of suitable fisher habitat would be impacted. However, corridors would remain between Swift Creek and the Whitefish Divide as well as along Swift Creek. The availability of some important habitat characteristics (i.e., snags, coarse woody debris) could be reduced by harvest activities; although retention of

dead material and live snag recruitment trees would meet DNRC Forest Management Rules (*ARM 36.11.411, ARM 26.11.414*). Open roads would decrease by 0.6 miles while restricted roads (closed with a gate, but open to snowmobiling) would increase by 1.2 miles, increasing accessibility of the area by snowmobile and increasing trapping risk. If present near the Project Area, fishers could be displaced by forest management activities approximately 3 years. Thus, since: 1) habitat availability would be reduced by 331 acres (29%), but some snags and coarse woody debris would be retained; 2) approximately 5 acres (2%) of riparian fisher habitat would be removed; 3) landscape connectivity would be reduced, but corridors would remain; and 5) 1.2 miles of new restricted roads would be constructed, increasing trapping risk; moderate adverse direct and secondary effects to fisher associated with habitat suitability and trapping risk would be anticipated as a result of the Action Alternative.

Action Alternative: Cumulative Effects on Fishers
Fisher habitat would be affected by the proposed activities (*TABLE WI-7*). Approximately 331 acres (9%) of fisher habitat including 5 acres of fisher riparian habitat would not be suitable for fisher use post-harvest due to low tree retention. The availability of some important habitat characteristics (i.e., snags, coarse woody debris) would be reduced by harvest activities; although retention of some dead material and live snag recruitment trees would be required to meet DNRC Forest Management Rules (*ARM 36.11.411, ARM 26.11.414*). Connectivity would be reduced overall, particularly near Swede Creek where most of the fisher habitat removal would occur. However, connectivity would be retained between Swift Creek and the Whitefish Divide. Trapping risk would also increase following the construction of 1.2 miles of gated roads. Impacts to fisher habitat would be additive to past, proposed, and ongoing projects (see *TABLE WI-2*). However, the impacts of past activities and the anticipated impacts of ongoing activities have been accounted for in analyses of stand structure. Fishers could be temporarily displaced by forest management activities associated with the proposed Upper Swede Timber Sale and other ongoing projects (up to 1,143 acres of ongoing harvest; 12% of the Medium CEAA) for approximately 3 years. Thus, since: 1) habitat availability would be reduced by 331 acres (9%), but some snags and coarse woody debris would be retained; 2) approximately 5 acres (<1%) of riparian fisher habitat would be removed; 3) landscape connectivity would be reduced, but corridors would remain; 4) 1.2 miles of new restricted roads would be constructed, increasing trapping risk; and 5) five proposed and ongoing projects could occur concurrently impacting 12% of the CEAA and potentially displacing fishers; moderate adverse cumulative effects to fisher associated with habitat suitability and trapping risk would be anticipated as a result of the Action Alternative.

PILEATED WOODPECKERS

Issue
The proposed activities could reduce tree density and alter the structure of mature forest stands, which could reduce habitat suitability for pileated woodpeckers.

Introduction
Pileated woodpeckers play an important role in mature forests by excavating large cavities that are often used in subsequent years by a variety of wildlife species for nesting and roosting. Pileated woodpeckers require mature forest stands with large-diameter (≥20-inch dbh) dead or defective trees for nesting and foraging and the density of pileated woodpeckers is positively correlated with the amount of dead and dying wood in a stand (*McClelland 1979*). Timber harvest may remove large-diameter trees necessary for nesting and fragmentation can make birds more vulnerable to predation as they travel between habitat patches (*Bull and Jackson 2011*). Forest management considerations for pileated woodpeckers include retaining dense

patches of old and mature coniferous forest with abundant large snags and coarse-woody debris for foraging, roosting, and nesting.

Analysis Area
The analysis area for direct and secondary effects is the Project Area and the analysis area for cumulative effects is the 9,432-acre Medium CEAA is defined according to geographic features as described in *TABLE WI-1* and depicted in *FIGURE WI-1*. This scale provides a sufficient area to support multiple pairs of pileated woodpeckers (*Bull and Jackson 2011*).

Measurement Criteria
Factors considered in the analysis include: 1) the degree of harvesting and 2) the structure of pileated woodpecker preferred habitat types. On DNRC-managed lands, sawtimber stands ≥100 years old within preferred pileated cover types (*ARM 36.11.403(58)*) with ≥40% canopy closure were considered potential pileated woodpecker habitat. On non-DNRC lands, mature forest stands (≥40% canopy cover, >9 inches dbh average) below 6,000 feet elevation were considered potential pileated woodpecker habitat.

Existing Environment
The Project Area contains 959 acres (47% of Project Area) of suitable pileated woodpecker habitat. This habitat is composed of Douglas-fir and western larch stands. Stands that are not considered pileated woodpecker habitat in the Project Area consist of 1,077 acres of stands that are appropriate forest types, but do not contain sufficient densities of mature trees. The remaining acres consist of stands that are typically not used by pileated woodpeckers such as subalpine fir. Pileated woodpeckers were observed during field visits and snags were available for nesting, particularly in upper elevations where stands have not been logged.

The Medium CEAA contains 2,746 acres (29% of Medium CEAA) of potential pileated woodpecker habitat scattered throughout the CEAA including 2,680 acres on DNRC lands and 65 acres on USFS lands. The remaining stands consist of forest types that are typically not used by pileated woodpeckers (3,398 acres; 36% Medium CEAA) as well as stands that are <100 years old or contain a low stocking density of mature trees. The largest habitat patches are in the Project Area. Open and seasonally open road density in the Medium CEAA is 1.1 miles/square mile, limiting firewood cutting in the area. In general snags are available for nesting and foraging in portions of the CEAA are located away from roads.

Environmental Effects

No Action Alternative: Direct, Secondary, and Cumulative Effects on Pileated Woodpeckers
None of the proposed forest management activities would occur on DNRC lands. In the short-term, no changes to pileated woodpecker habitat would be anticipated. However, in the long-term, and in the absence of natural disturbance, pileated woodpecker habitat availability and connectivity may increase due to natural succession and aging of timber stands.

Action Alternative: Direct and Secondary Effects on Pileated Woodpeckers
The proposed activities would occur in 369 acres (38%) of the 959 acres of pileated woodpecker habitat available in the Project Area. Seed tree treatments proposed for these acres reduce the canopy cover of mature trees to 5-15% causing the structure of these stands to become unsuitable for appreciable use by pileated woodpeckers. Snags would be removed by the proposed harvest, but at least 2 large snags and 2 large snag recruitment trees per acre (>21 inches dbh) would be retained and snags cut for safety reasons would be left in the

harvest unit (*ARM 36.11.411*). Disturbance associated with harvesting could adversely affect pileated woodpeckers on portions of the Project Area for approximately 3 years, should they be present in the Project Area. Thus, since: 1) forest structural changes would occur, but mitigation would include retention of snags and coarse woody debris (*ARM 36.11.411, ARM 36.11.414*); and 2) harvesting would reduce pileated woodpecker suitable habitat availability by 369 acres (38%); moderate adverse direct and secondary effects to pileated woodpecker habitat suitability in the Project Area would be anticipated as a result of the Action Alternative.

Action Alternative: Cumulative Effects on Pileated Woodpeckers
The proposed activities would occur in 369 acres (13%) of the 1,342 acres of potential pileated woodpecker habitat in the Medium CEAA. These acres would not provide suitable pileated woodpecker use post-harvest. Snags would be removed by the proposed harvest, but at least 2 large snags and 2 large snag recruitment trees per acre (>21 inches dbh) would be retained (*ARM 36.11.411*). Changes in pileated woodpecker habitat suitability would be additive to proposed and ongoing activities occurring in the Medium CEAA; however, the impacts of past activities and the anticipated impacts of ongoing activities have been accounted for in analyses of stand structure (see *TABLE WI-2*). Disturbance associated with the Upper Swede Timber Sale and additional ongoing timber sales could adversely affect pileated woodpeckers near the Project Area for up to 3 years. Thus, since: 1) structural changes would occur, but mitigations would include retention of snags and coarse woody debris; 2) harvesting would reduce pileated woodpecker suitable habitat availability by 369 acres (13%) within the Medium CEAA; and 3) five proposed and ongoing projects could occur concurrently impacting 12% of the CEAA; minor adverse cumulative effects to pileated woodpecker habitat suitability would be anticipated as a result of the Action Alternative.

Wildlife Mitigations

- If a threatened or endangered species is encountered, consult a DNRC biologist immediately. Similarly, if undocumented nesting raptors or wolf dens are encountered within ½ mile of the Project Area contact a DNRC biologist.
- Prohibit contractors and purchasers conducting contract operations from carrying firearms while on duty as per *ARM 36.11.444(2)* and *GB-PR2* (*USFWS and DNRC 2010)*.
- Contractors will adhere to food storage and sanitation requirements as described in the timber sale contract. Ensure that all attractants such as food, garbage, and petroleum products are stored in a bear-resistant manner.
- Restrict public access at all times on restricted roads that are opened for harvesting activities. Effectively close all restricted roads following harvest completion.
- Retain patches of advanced regeneration of shade-tolerant trees as per *LY-HB4* in all harvest units (*USFWS and DNRC 2010*).
- Prohibit motorized activities including commercial forest management from April 1-June 15 to provide seasonal security for grizzly bears as per *GB-NR3* (*USFWS and DNRC 2010*). Harvest units accessed from the Upper Swede Road have a longer timing restriction from April 1 – June 30.
- Retain visual screening along open roads to prevent human-wildlife conflict and increase security for bears and big game as per *GB-NR4* (*USFWS and DNRC 2010*).

- Within seed tree units, no point in the harvest unit can be >600 feet to hiding cover or a topographic break.
- Retain at least 2 snags and 2 snag recruits per acre that are ≥ 21 inches diameter or the next largest available size class, favoring western larch and Douglas-fir for retention. If snags are cut for safety concerns, they must be left in the harvest unit.
- Retain coarse-woody debris according to *ARM 36.11.414* and emphasize retention of 15-inch diameter downed logs aiming for at least one 20-foot-long section per acre.

Wildlife References

Bull, E. L., and J. A. Jackson. 2011. Pileated woodpecker (*Dryocopus pileatus*). *In* A. Poole, editor. The birds of North America online. Cornell Lab of Ornithology, Ithaca.

Copeland, J. P., K. S. McKelvey, K. B. Aubry, A. Landa, J. Persson, R. M. Inman, J. Krebs, E. Lofroth, H. Golden, J. R. Squires, A. Magoun, M. K. Schwartz, J. Wilmot, C. L. Copeland, R. E. Yates, I. Kojola, and R. May. 2010. The bioclimatic envelope of the wolverine (*Gulo gulo*): do climatic constraints limit its geographic distribution? Canadian Journal of Zoology 88:233-246.

DFWP. 2008. Maps of moose, elk, mule deer, and white-tailed deer distribution in Montana. *In* Individual GIS data layers. Available online at:

http://fwp.mt.gov/gisData/imageFiles/distributionElk.jpg
http://fwp.mt.gov/gisData/imageFiles/distributionMoose.jpg
http://fwp.mt.gov/gisData/imageFiles/distributionMuleDeer.jpg
http://fwp.mt.gov/gisData/imageFiles/distributionWhiteTailedDeer.jpg.

Green, P., J. Joy, D. Sirucek, W. Hann, A. Zack, and B. Naumann. 1992 Old-growth forest types of the northern region (errata corrected 02/05, 12/07, 10/08, 12/11). USDA Forest Service, Northern Region. Report R-1 SES.

Harger, R. 1978. Old-growth forests: managing for wildlife. Missoula, MT.

Mace, R. D., and J. S. Waller. 1997. Final report: grizzly bear ecology in the Swan Mountains, Montana. Montana Department of Fish, Wildlife and Parks.

McClelland, B. R. 1979. The pileated woodpecker in forests of the northern Rocky Mountains. Pages 283-299 *In* J. G. Dickson, R. N. Conner, R. R. Fleet, J. C. Kroll, and J. A. Jackson, editors. The role of insectivorous birds in forest ecosystems. Academic Press, New York.

McLellan, B. N., and F. W. Hovey. 2001. Habitats Selected by Grizzly Bears in a Multiple Use Landscape. The Journal of Wildlife Management 65:92-99.

Raley, C. M., E. C. Lofroth, R. L. Truex, J. S. Yaeger, and J. M. Higley. 2012. Habitat ecology of fishers in western North America: a new synthesis. *In* K. B. Aubry, W. J. Zielinski, M. G. Raphael, G. Proulx, and S. W. Buskirk, editors. Biology and Conservation of Martens, Sables, and Fishers: a New Synthesis. Cornell University Press, Ithaca, New York.

Ruediger, B., J. Claar, S. Gniadek, L. Lewis, B. Holt, S. Mighton, B. Naney, G. Patton, T. Rinaldi, and J. Trick. 2000. Canada Lynx Conservation Assessment and Strategy (Second Edition). USDA Forest Service, USDI Fish and Wildlife Service, Bureau Land Management, and National Park Service.

Schwartz, M. K., N. J. DeCesare, B. S. Jimenez, J. P. Copeland, and W. E. Melquist. 2013. Stand- and landscape-scale selection of large trees by fishers in the Rocky Mountains of Montana and Idaho. Forest Ecology and Management 305:103-111.

Squires, J. R., N. J. Decesare, J. A. Kolbe, and L. F. Ruggiero. 2010. Seasonal resource selection of Canada lynx in managed forests of the Northern Rocky Mountains. Journal of Wildlife Management 74:1648-1660.

Squires, J. R., N. J. DeCesare, L. E. Olson, J. A. Kolbe, M. Hebblewhite, and S. A. Parks. 2013. Combining resource selection and movement behavior to predict corridors for Canada lynx at their southern range periphery. Biological Conservation 157:187-195.

USFWS. 1993. Grizzly bear recovery plan. Report on file at Missoula, MT. 181pp.

USFWS, and DNRC. 2010. Montana Department of Natural Resources and Conservation Forested Trust Lands Habitat Conservation Plan, Final Environmental Impact Statement, Volumes I and II., U.S. Department of Interior, Fish and Wildlife Service, Region 6, Denver, Colorado and Montana Department of Natural Resources and Conservation, Missoula, MT.

Warren, N. M. 1990. Old-growth habitat and associated wildlife species in the Northern Rocky Mountains. USDA Forest Service, Northern Region, Missoula, MT.

Figure WI-1 –Wildlife analysis areas and harvest units for the proposed Upper Swede Timber Sale.

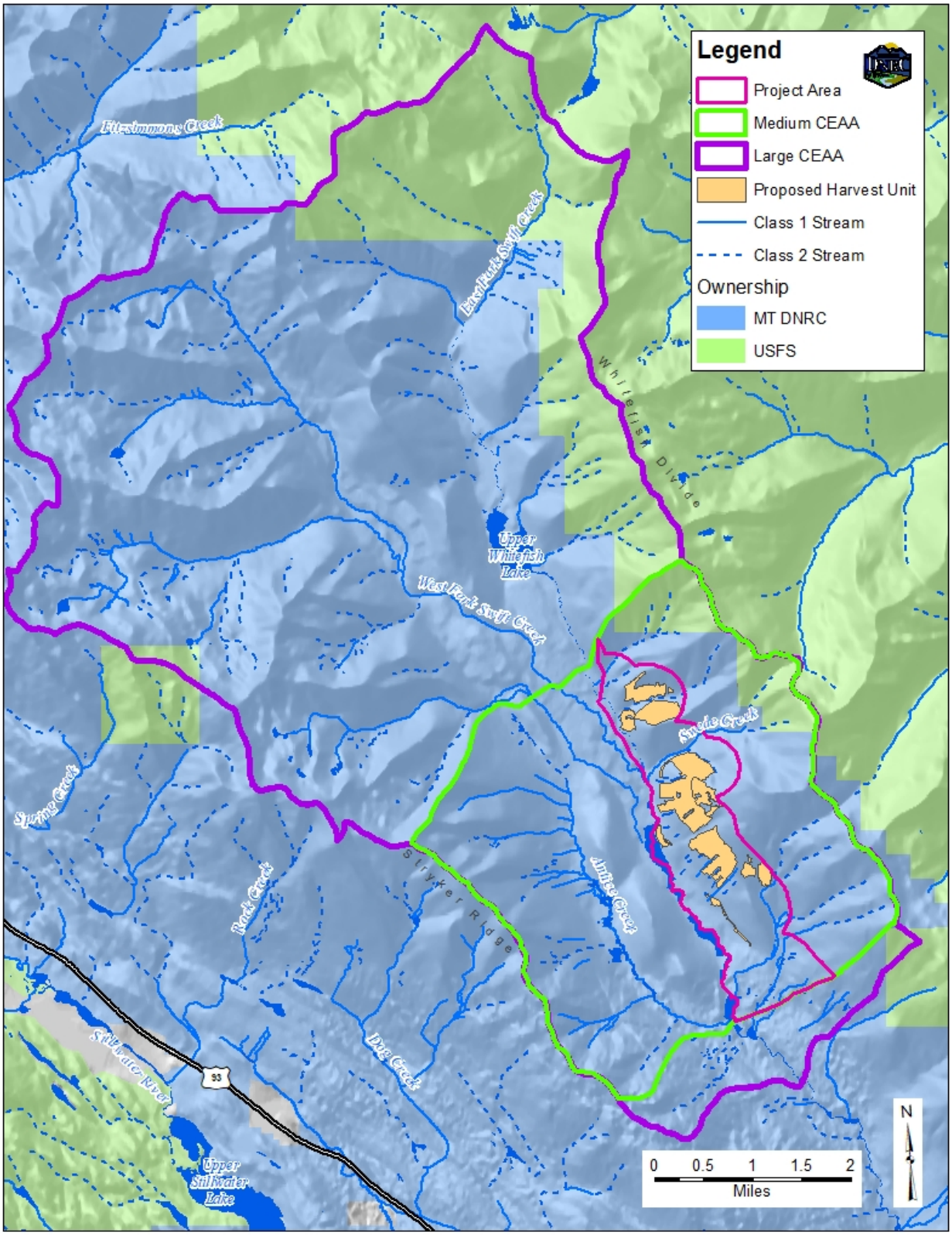
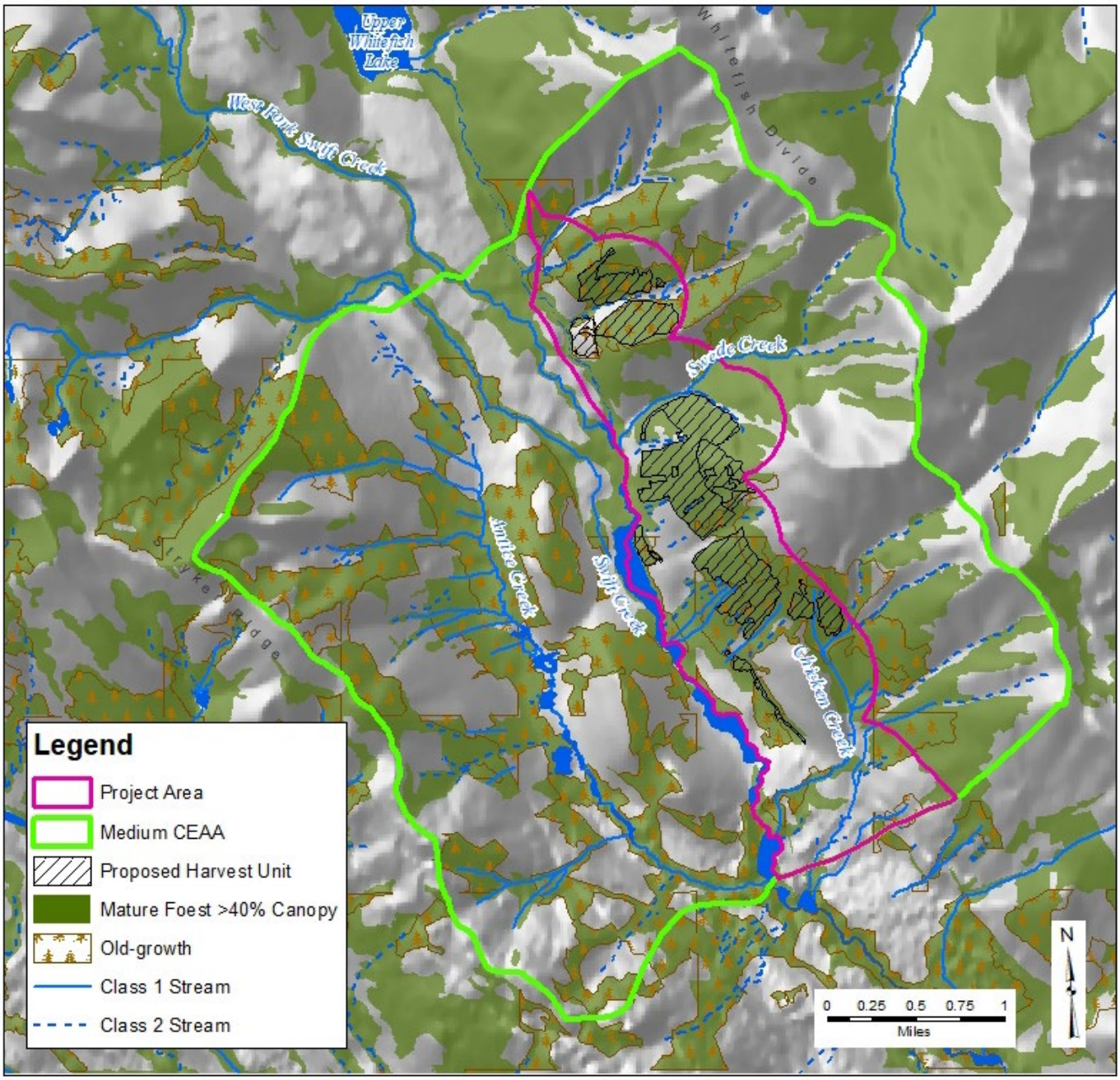
Figure WI-2 –Harvest units, mature canopy cover, and potential connectivity areas for the proposed Upper Swede Timber Sale.