term, whereas alternatives 2 and 3 would help to restore declining habitats while maintaining diverse habitat conditions across the landscape. As a result, habitat for migratory birds would be maintained or improved under all alternatives. Also, local populations of all species that currently utilize the project area are expected to be maintained. The action alternatives focus on habitat restoration, and include project design features that are expected to reduce impacts to migratory birds, therefore, all alternatives are in compliance with the Migratory Bird Treaty Act

Plants

Introduction

There are no threatened, endangered or proposed plant species known to occur on the Helena National Forest (USDI Fish and Wildlife Service 2011b). Therefore, this section is limited to analyzing Region 1(R1) sensitive species and their habitats.

Sensitive species are species identified by the Regional Forester for which population viability is currently of concern, as evidenced by significant current or predicted downward trends in population numbers or density, or by significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution (USDA Forest Service 2005). The Forest Service has established direction in Forest Service Manual 2600 – Wildlife, Fish, and Sensitive Plant Habitat Management (FSM 2600, USDA Forest Service 2005)) to guide habitat management for proposed, endangered, threatened, and sensitive plant species. This direction establishes the process, objectives, and standards for conducting a biological evaluation, and ensures that these species receive full consideration in the decision making process. The Botany Report and Biological Evaluation (Englebert 2012) incorporated all the information required for a biological evaluation.

Nine sensitive plant species are known to occur on or very near the Helena National Forest. An additional 12 species are suspected to occur on the Forest. Those 21 species are identified in table 117, along with the likelihood of occurrence. Whitebark pine (*Pinus albicaulis*) is the only sensitive species found in the project area. The species listed as 'possible' in the project area may have habitat within the project area. Only those listed as 'known to occur' or 'possible occurrence' are carried forward in this analysis. The remaining species do not have habitat in the project area and therefore no impacts to those species from this project are expected.

Table 117. Region 1 sensitive plant species that occur or may occur on the Helena National Forest

SPECIES **(FAMILY)** **COMMON NAME**	**KNOWN TO OCCUR ON HELENA NATIONAL FOREST**	**KNOWN TO OCCUR IN STONEWALL PROJECT AREA**	**LIKELIHOOD OF OCCURRENCE IN STONEWALL PROJECT AREA**
Amerorchis rotundifolia (Orchidaceae) Roundleaf orchid	No	No	**Possible** – Known from the Rocky Mtn. Front and the NW corner of Montana in spruce forests along seeps and streams
Aquilegia brevistyla (Ranunculaceae) Smallflower columbine	No	No	Unlikely – In Montana, it is known only from the Little Belt Mts in open woods and stream banks at mid-elevations in the montane zone.
Astragalus lackschewitzii (Fabaceae) Lackschewitz's milkvetch	No	No	Unlikely – Restricted to high elevation gravelly and rocky slopes and ridges, this species'

SPECIES **(FAMILY) COMMON NAME**	**KNOWN TO OCCUR ON HELENA NATIONAL FOREST**	**KNOWN TO OCCUR IN STONEWALL PROJECT AREA**	**LIKELIHOOD OF OCCURRENCE IN STONEWALL PROJECT AREA**
			habitat is not generally subject to human disturbance
Botrychium crenulatum (Ophioglossaceae) Scalloped moonwort	No	No	**Possible** – Known from the Beaverhead-Deerlodge National Forest and in western Montana, it generally occurs in wet habitats with high cover.
Botrychium paradoxum (Ophioglossaceae) Peculiar moonwort	Yes	No	**Possible** – This diminutive species is known from the Occidental Plateau, and near Irish Mine Hill. On the Helena NF populations are in sagebrush/rough fescue and rough fescue, however other populations have been documented from mesic meadows associated with spruce and lodgepole pine forests in montane and subalpine (MNHP 2007)
Cypripedium parviflorum (Orchidaceae) Lesser yellow lady's slipper	Yes	No	**Possible** -- Known from Divide landscape in fens, damp mossy woods, seepage area, and moist forest-meadow ecotone, in valleys & lower montane.
Cypripedium passerinum (Orchidaceae) Sparrow egg lady's slipper	No	No	**Possible** – This orchid is found in mossy, moist, or seepy places in coniferous forest; in northwestern Montana including Glacier NP.
Drosera anglica (Droseraceae) English sundew	Yes	No	Unlikely – Known from Indian Meadows, this species occurs with sphagnum moss in wet, organic soils of fens. Habitat is specialized.
Drosera linearis (Droseraceae) Slenderleaf sundew	Yes	No	Unlikely – Known from Indian Meadows, in wet, organic soil of nutrient-poor fens
Epipactis gigantea (Orchidaceae) Stream orchid	No	No	Unlikely – This species is associated with seeps and springs, often thermal.
Goodyera repens (Orchidaceae) Lesser rattlesnake plantain	No	No	Unlikely –In Montana, it is known from the Little Belt and Big Snowy Mts. in moist, montane forests with mossy understory.
Grindelia howellii (Asteraceae) Howell's gumweed	No	No	**Possible** –This species is an endemic known only from a cluster of sites northeast of Missoula, and a single county in Idaho.

SPECIES **(FAMILY)** **COMMON NAME**	**KNOWN TO OCCUR ON HELENA NATIONAL FOREST**	**KNOWN TO OCCUR IN STONEWALL PROJECT AREA**	**LIKELIHOOD OF OCCURRENCE IN STONEWALL PROJECT AREA**
Juncus hallii (Juncaceae) Hall's rush	Yes	No	**Possible**—Several populations occur on the Forest in the Big Belts and the Divide area. Moist to wet meadows,
Oxytropis podocarpa (Fabaceae) Stalkpod locoweed	No	No	Unlikely – Habitat for this species is in the alpine zone.
Phlox kelseyi var. *missoulensis (Phlox missoulensis)* (Polemoniaceae) Missoula phlox	Yes	No	**Possible** – It is known from east of the analysis area; habitat is rough fescue meadow, exposed, limestone-derived slopes in foothills and montane.
Pinus albicaulis (Pinaceae) Whitebark pine	Yes	Yes	**Known to occur**- This species is known to occur in almost all major mountain ranges of western and central Montana. In the project area it is known to be a component of several of the treatment units.
Polygonum douglasii ssp. *austinae* (Polygonaceae) Austin knotweed	Yes	No	Unlikely—This taxon is known from the Big Belts in open gravelly shale-derived soil of eroding slopes/banks or usually moist, barren shale slopes.
Saxifraga tempestiva (Saxifragaceae) Storm saxifrage	No	No	Unlikely – This species is a Montana endemic known only from vernally moist open sites and rock ledges at high elevations, west of Continental Divide.
Schoenoplectus subterminalis (Cyperaceae) Swaying bulrush	Yes	No	Unlikely – This species is known from Indian Meadows, and sites in the NW primarily west of Continental Divide in open water and boggy margins of ponds, lakes, and sloughs.
Thalictrum alpinum (Ranunculaceae) Alpine meadow-rue	No	No	Unlikely – In Montana, this species is known from sites in the SW corner, in moist alkaline meadows.
Veratrum californicum (Liliaceae) California false hellebore	No	No	Unlikely – In Montana it is known from 4 sites in Bitterroot Valley

Methodology

The Montana Natural Heritage Program (MTNHP) (2010) maintains a statewide database for sensitive species. Data from the MTNHP was applied to known sensitive plant populations in the project area.

Ground reconnaissance was conducted by Forest Service personnel in representative habitats within the project area. Field reconnaissance was conducted throughout the project area, with focus on moist and wetland habitats associated with timber harvest proposals. Those habitats support several sensitive species (USDA Forest Service 1998) and have the highest potential for sensitive plant populations. Wetlands throughout the project area were delineated and no sensitive plant populations were found. Field notes and GPS locations to represent specific field locations can be found in the project record.

Past surveys by the Montana Natural Heritage Program, botanical surveys from the Indian Meadows Research Natural Area as well as past surveys by Forest Service personnel were the focus for the current survey work (Olsen 2010).

In 2005, Cooper and others conducted inventories searching for sensitive vascular plants as well as riparian and wetland associated plant communities in the area of the Snow Talon fire and areas to the west of the fire, which included the Stonewall Project area. No sensitive plant populations were found in this survey. Those survey records can be found in the project record. Barton and Crispin (2002) completed surveys across the Helena National Forest in 2002. The purpose of the surveys was to locate sensitive plant populations in association with noxious weed populations, primarily along roadsides. Some of the roads in the project area were surveyed. No sensitive plant populations were found in this area during those surveys.

Whitebark pine was added to the Regional Forester's Sensitive Species List in 2011(Weldon 2011a), so was not included as a sensitive species in the previous surveys. Stand exam data for the project area indicate that it is present in several of the prescribed fire treatment units and it is also present in other units as an "occasional" component (Amell 2012, Milburn et al. 2009).

The methodology used in this analysis includes the best available science gathered from inventory data as well as several geospatial layers using known sensitive plant populations to predict sensitive plant habitat. The specific layers used include the Montana Natural Heritage Program data on sensitive species, the Helena National Forest Soil Survey, digital elevation models, information and experiences from past surveys, personal ground reconnaissance of the project area by Forest Service personnel along with field crew surveys in areas identified as potential habitat.

Assumptions

The following assumptions were used:

- Species on the Regional Forester's Sensitive Species List that occur on, or are suspected to occur on the Helena National Forest have been identified.
- Geospatial systems combined with habitat information, on-the-ground experience and past surveys is useful to screen areas of low probability of species occurrence.
- Reconnaissance of representative habitats is appropriate to determine the presence of sensitive plant populations.
- Known habitats need to be specifically identified and surveyed in the field.

Spatial and Temporal Context for Effects Analysis

Direct effects are those that occur at the same time and place of the proposed actions. Indirect effects are those effects that may occur along roads and stands adjacent to proposed treatments. The cumulative effects analysis area for sensitive plant species is the Stonewall Project area. For the herbaceous sensitive species this analysis is bounded in time by 10 years past and 10 years into the future, which allows for an adequate length of time to record vegetative changes. The analysis for whitebark pine however requires a

much greater temporal bounding; please see the Vegetation Section for details of the whitebark pine analysis.

Overview of Issues

Comments pertaining to disclosing the effects of project activities on plants were identified from public scoping as nonsignificant (40 CFR 1501.7), and are addressed by the analyses in this section. Please refer to volume 2, appendix A of this document for a complete listing of the issues and an explanation of how the agency determined their disposition.

Indicators

The following indicators were used to measure the differences between alternatives:

- For whitebark pine we looked at the total acres proposed for treatment in units in which whitebark pine has been identified.
- Because sensitive species habitat can be degraded by noxious weed infestations, we looked at the estimated acres of potential noxious weed infestation due to proposed activities.
- In addition, effects that cannot be easily quantified are described qualitatively. Impacts to sensitive plant species may be direct impacts, such as trampling, defoliation, and mechanical damage; or the impacts may be more indirect such as a change in the microclimate or a change in species composition, both of which may result in a loss of habitat. In general, direct impacts are short-term impacts, occurring immediately, while indirect impacts such as changes to the habitat occur over a longer timeframe.

Affected Environment

Existing Condition

Whitebark pine is the only sensitive species known to occur in the project area, and is carried forward in this analysis. None of the eight species identified as possibly occurring in the project area were located during survey work to date. Additional rationale for carrying these species forward in this analysis includes (Olsen 2010):

- Roundleaf orchid has not been found on the Helena National Forest, but is known from the Rocky Mountain Front, north of the Blackfoot landscape area. Habitat may exist in the wetter parts of the project area.
- Scalloped moonwort is known from the Beaverhead-Deerlodge National Forest, immediately adjacent to the Helena National Forest adjacent to the Divide landscape area. This species has not been found to date on the Helena National Forest. Habitat may exist in the project area for this species along stream bottoms, around seeps, on the edges of marshes, and in wet roadside swales.
- Peculiar moonwort is known from two populations on the Helena National Forest, both in the Divide landscape area. Habitat may occur in the project area in mesic meadows.
- Lesser yellow lady’s slipper was found at one location within the Helena National Forest boundary and at another location just outside the boundary. Neither population has been recently documented in additional sensitive plant surveys. The population occurs in the Divide landscape area. Habitat may occur in the project area in moist coniferous forests, seepage areas and moist ecotones between peatlands and upland forest.

- Sparrow egg lady's slipper has not been found on the Helena National Forest but is known from Glacier Park and northwest Montana. Habitat for this species is the same as that for lesser yellow lady's slipper.
- Howell's gumweed has not been found on the Helena Forest but is known from an area west of the Blackfoot landscape. It may have habitat in the project area in vernally moist, lightly disturbed soil adjacent to ponds and marshes, as well as similar human-created habitats such as roadsides.
- Hall's rush has 15 populations Forest-wide. The Montana Heritage database identifies eight populations on the Helena National Forest (three of the Heritage Program populations were again documented by Helena National Forest survey crews in 2009). Seven new populations were found by Helena National Forest survey crews in 2009. The populations occur in the Divide and Big Belts landscape areas. This plant may have habitat in the project area in wet to moist meadows.
- Missoula phlox has been found in each of the four landscape areas of the Forest. The Montana Heritage database identifies eight populations on the Helena National Forest. Three new populations were located in 2008 and three additional populations were found in 2009 while the Forest was validating a model which predicts sensitive plant habitat. Details for field survey areas and protocols are available in the project record. There may be habitat for this taxon in the project area along wind-swept ridges and forb-dominated meadows.

Species Unlikely to be Present

All species, except whitebark pine, were included during field surveys, but it was determined that 12 of those species are unlikely to occur in the project area (as indicated in table 117). Those 12 species are not carried forward in this analysis. The following is additional rationale for the elimination of those species (Olsen 2010):

- English sundew, slenderleaf sundew and swaying bulrush are known from the Indian Meadows Research Natural Area, which is in the combination boundary but would not be affected by the proposed treatments. These species are found in fens, which are very rare and specialized habitats. No other fens are known within the project area.
- Lackschewitz's milkvetch, stream orchid, stalkpod locoweed, storm saxifrage, and California false hellebore all have very specialized habitat that does not occur in the project area.
- Smallflower columbine, lesser rattlesnake plantain, and alpine meadow-rue are not likely to occur in the project area as the known populations are not from this area. These species have not been found on the Helena National Forest to date, but the species are searched for in any survey work.

Environmental Consequences

Effects Common to All Alternatives

Effects to herbaceous sensitive species from large, stand-replacing fire

If current management continues (alternative 1), a large stand-replacing fire is a potential reality (Kurtz 2009). The action alternatives cannot eliminate the potential for a large-scale fire; however, the activities proposed are designed to modify fire behavior to enhance community protection while creating conditions that allow the reestablishment of fire as a natural process on the landscape, thereby reducing the risk to resources in the project area. Thus, while the potential for wildfires is common to all three alternatives, there is less risk of effects to herbaceous sensitive species from wildfire under both the action alternatives.

The potential exists for wildfire to have short-term detrimental effects on herbaceous sensitive plant habitats, but long-term effects are not anticipated in most cases. However, there has been a dramatic increase of severe wildfires in the ponderosa pine type in recent decades where fuels have built up due to fire suppression (Agee and Skinner 2005). In these habitats there is potential for long-term damage to sensitive plant habitats (Menges and Dolan 1998, Pendergrass et al. 1999). Plant response to fire is a result of the interaction between severity of the fire and the individual plant species' inherent resistance to injury and ability to recover (Brown and Kapler Smith 2000). Mortality of herbaceous species is more dependent on the length of time plants are exposed to high heat, determined by the amount of duff and woody fuel consumed by the fire, than flame length and fire line intensity (Armour et al. 1984). The effect of wildfire on herbaceous sensitive plant habitats therefore would depend on the surface fuel conditions. The longer fuels build up on the forest floor, the greater the potential damage to herbaceous sensitive plant habitats.

After habitat loss, the spread of invasive species is considered the greatest threat to imperiled species in the United States (Sieg et al. 2003). Large stand-replacing fires are known to increase the risk of infestation by noxious weeds (D'Antonio 2000). Thus included with the potential for large-scale fire is the risk of noxious weed infestation. Of course, fires are not the only cause of weed infestations; any time the ground is disturbed (such as with the activities proposed under the action alternatives) there is the potential for infestation. Noxious weeds cause habitat degradation because they can out-compete desired plant species for water and nutrients. Drift from herbicides sprayed to help control weeds can also have detrimental effects to herbaceous sensitive plants. This risk is reduced by adhering to label instructions for applying specific herbicides, and by application of project design feature NOX-9 that requires a 100-foot buffer around sensitive plant species when applying herbicides. Within this buffer, only hand-pulling of weeds would be allowed (USDA Forest Service 2006c, d).

Effects specific to whitebark pine

Whitebark pine in the Northern Rocky Mountains depends on fire to maintain its dominance or presence on sites where it is a successional species (see the Vegetation section). Therefore if a large, stand-replacing fire occurs, whitebark pine may benefit because sites suitable for regeneration would be created. If, however, no seed source is nearby to facilitate the regeneration, such a fire could largely eliminate this sensitive species from the area. As is noted in the Vegetation section, the increases in fuel loads threaten the survival of even the largest and most fire-resistant whitebark pine trees.

Whitebark pine has been declining throughout major portions of its range for the last 50 years due to the effects of diseases, insects, and succession (Amell 2012). Although the action alternatives may reduce the effects from these threats they cannot eliminate the threats, therefore effects from diseases, insects and succession are common to all alternatives. Please see appendix B for a detailed discussion of these threats.

Effects Common to All Action Alternatives

The effects of ground disturbance on herbaceous sensitive plant populations would be similar in all action alternatives. There are no known occurrences of herbaceous sensitive species in the project area; however, if unknown occurrences are present those plants may be directly impacted by ground-disturbing activities. Effects from ground disturbance include the risk of noxious weed infestation as discussed earlier in the section *Effects Common to All Alternatives*, as well as direct impacts such as trampling, defoliation, soil and vegetation compaction and mechanical damage. These effects may be detrimental to individual plants as well as to the habitat for the sensitive plants. There is a project design feature in place that would reduce the risk of impacts by requiring appropriate mitigation if a population is located within the project area:

- If sensitive plant populations are located within the project area appropriate mitigation (e.g., site avoidance, avoid concentration of fuels on sites to be burned) would be followed upon consultation with a Forest Service botanist.

There are known occurrences of whitebark pine in the proposed treatment areas of both action alternatives. Those occurrences would be protected by the project design feature SILV-2 which is designed to protect whitebark pine individuals and enhance habitat for the species. Thus while there is the potential for individuals to be charred or physically damaged during the treatment, beneficial effects (in the form of habitat enhancement due to the removal of shade-tolerant species and creation of caching sites for Clark's nutcrackers) are expected in the long-term. The Vegetation section states that whitebark pine would increase in the short term with the increase extending into the long term under both action alternatives.

Alternative 1– No Action

Direct and Indirect Effects

There would be no direct effects to any of the sensitive species under alternative 1, since none of the proposed treatments would occur. Current management would continue. Alternative 1 does not propose activities to modify fire behavior to enhance community protection while creating conditions that allow the reestablishment of fire as a natural process on the landscape. Current management activities would not reduce potential for stand replacing wildfire events in the treated stands or help to break up the structure in the project area. Consequently, there is potential for indirect effects from wildfire as discussed earlier under *Effects Common to All Alternatives*.

Amell (2012) states in the Silviculture section that whitebark pine are expected to decline with the continuation of current management. Rather than reiterate that information, it is incorporated here by reference.

Irreversible/Irretrievable Commitments

There are no irreversible or irretrievable commitments that would affect sensitive plants under this alternative.

Cumulative Effects

There are policies in place that reduce or eliminate impacts from management activities on sensitive species (USDA Forest Service 2005). Therefore, the effects expected from this alternative when combined with the effects from the other management activities past and future, are not expected to contribute to change in status or viability of sensitive plants. In addition, cumulative effects are not expected to contribute to an increase in current or predicted downward trends in population numbers or habitat capability that would reduce the existing distribution of any of the R1 sensitive plant species discussed in this analysis, under this alternative. This conclusion applies the analysis indicators for direct and indirect effects (i.e. potential for direct physical impacts of trampling and defoliation, and potential for habitat degradation due to infestation of invasive species) from the proposed activities and adds them to expected effects from other management activities.

Cumulative effects from the following activities across the planning area are not anticipated:

- There is a roadside hazard tree removal project occurring on the main roads in this project area. The ground disturbance associated with that activity may increase the potential for habitat degradation from infestation of noxious weeds; however infestations would be monitored and treated per the Helena National Forest Noxious Weed Record of Decision (2006d).

- Livestock grazing within the analysis area would continue as identified in the Allotment Management Plans for the Stonewall, Keep Cool and Arrastra allotments. There are no known occurrences of sensitive species within these allotments. Known sensitive plant populations on the forest, outside the project area, have not shown adverse effects from grazing and would not be affected by fuel treatment activities from this project.
- Timber harvest and thinning (fuels reduction) has led to changes in forest composition, structure and fire frequency. There are no known sensitive plant species in the project area that occur in areas that have been harvested or thinned. There are areas outside the project area where known sensitive plant species occur within past harvest treatment areas, however, those occurrences would not be affected by treatment activities from this project.
- Motorized and nonmotorized recreational use has led to the development of nonsystem roads and trails, development of dispersed campsites, erosion, and vectoring of noxious weeds into areas not previously infested. These activities can lead to physical damage to plants and their habitats (biomass removal, vegetation compaction and ground disturbance). Vehicles and people help to spread noxious weeds by carrying weed seeds into new areas. These impacts are controllable through area closures and travel management.
- Road and trail construction and maintenance causes soil disturbance and erosion, fragmentation and destruction of habitat, and noxious weed invasion. It also increases the impacts from recreational activities by allowing improved access for those activities. Known sensitive plant locations outside the project area would not be affected by activities associated with proposed roadwork from this project. If any populations are discovered associated with ground disturbing activities, they would be protected. Populations would also be protected from herbicide application.
- Fire suppression has led to increased fuel loading, canopy closure, and higher intensity wildfire. Fire is a natural disturbance in the ecosystem. In some areas, habitat succession and fire could possibly create or improve habitat for select plant species by opening up meadows or reducing the litter accumulation and competition from other plants. In other areas, wildfires or controlled fires would create high ground temperatures that could sterilize the soil and eliminate fungal species that are necessary for the survival of others. Whitebark pine is dependent on fire to maintain its presence in the project area (Amell 2012). Fire exclusion has allowed an increase in competition from shade-tolerant species. Fire also tends to favor post-fire germination of nonnative species in environments where nonnatives are abundant and/or native species are stressed.
- Trends in climate change indicate the future precipitation levels will be lower and temperatures will be higher than the current long-term averages. Drier conditions are expected to be detrimental to riparian species that depend on moist habitats. Warmer temperatures are expected to result in a change in the distribution of plants as the elevation at which plants are found shifts upward. This shift appears to be greater for species found in mountain habitats (Lenoir et al. 2008). Modeling predicts a decline in whitebark pine due to global increase in temperature and more frequent summer droughts. However it's also predicted that there will be an expansion of whitebark pine due to more frequent fire return intervals resulting from global warming (Fryer 2002).
- Noxious weeds would continue to be treated as specified in the Helena National Forest Noxious Weed FEIS and Record of Decision (USDA Forest Service 2006d). While herbicides used in treating noxious weeds may be inherently harmful to herbaceous plants, the existing Forest program as many safeguards in place to prevent detrimental impacts to sensitive species.

The actions and effects described in this section can be both additive and interactive to each other and to the direct and indirect effects described above. As stated earlier, because current management direction is designed to eliminate or reduce negative cumulative impacts by protecting sensitive plants from direct and indirect impacts, the cumulative effects to all species discussed in this analysis are expected to be minimal.

Alternative 2 – Proposed Action

Project Design Features Common to All Action Alternatives

The Stonewall Vegetation Project has been designed with features that are intended to minimize or avoid potential adverse effects while meeting project objectives. In addition to the proposed action treatments described in this section, design features would be implemented where applicable. A description of the project design features relating to plants and other resources is displayed in table 9, chapter 2.

The specific design feature in table 9 pertaining to plants is BOT-1 that addresses all alternatives, all units

This analysis is based on the implementation of all design features. Project design features apply to both action alternatives. Design features that are applicable to sensitive plant species include not only those listed above, designed specifically to protect sensitive plant species but also those designed to protect other resources.

Direct and Indirect Effects

Because no herbaceous sensitive species are known to occur in the proposed treatment areas, direct effects to the herbaceous sensitive species are not expected.

Whitebark pine is known to occur in five units as shown in table 118. Please note the "Acres in Unit" does not reflect total acres of whitebark pine, but rather the total acres of the unit of which whitebark pine is a component. And while it is known that whitebark pine occurs in these units, it may also occur (as scattered individuals) in other units. These acres are used as a basis for comparing alternatives. Under Alternative 2, prescribed fire treatment is proposed on 2,557 acres, in which whitebark pine is a component of the species composition. As discussed under *Effects Common to All Action Alternatives*, those occurrences of whitebark pine would be protected by the project design feature SILV-2 (table 9, chapter 2). Under this alternative whitebark pine is expected to increase in the short term, with the increase extending into the long term (Amell 2012). Please see appendix B for details of effects to whitebark pine.

Table 118 Treatment units with whitebark pine present – Alternative 2

UNIT ID	ACRES IN UNIT	PROPOSED TREATMENT
76	123	prescribed fire
79	337	prescribed fire
82	776	prescribed fire
83	457	prescribed fire
88	864	prescribed fire
Total acres	**2,557**	

There is a potential for indirect effects from wildfire as discussed under *Effects Common to All Alternatives*. The risk of effects from wildfire (including the connected noxious weed infestation) is less under alternative 2 than under alternative 1, as the proposed actions are designed to meet the purpose and need by modifying fire behavior to enhance community protection while creating conditions that allow the reestablishment of fire as a natural process on the landscape. The proposed actions are meant to reduce potential for stand replacing wildfire events in the treated stands, as well as break up the structure in the project area. Reducing potential for stand-replacing events may reduce wildfire impacts to sensitive plants.

Potential habitat degradation due to noxious weed infestation as a result of ground disturbance is greater under alternative 2 than alternative 1. The Invasive Plants section identifies the potential for an additional 311 acres of potential weed infestation due to the proposed activities. This does not mean 311 acres of sensitive species habitat would be infested, but rather the risk of infestation of sensitive species habitat is greater under alternative 2 because of the potential increase of weeds in the area.

Irreversible and Irretrievable Commitments

There are no irreversible or irretrievable commitments that would affect sensitive plants under this alternative when project design features are applied.

Cumulative Effects

The cumulative actions and resulting cumulative effects as discussed under alternative 1 also apply to alternative 2. There would be no cumulative effects for this alternative as no known herbaceous plant populations would be affected, and there is a project design feature in place to protect whitebark pine. See also the discussion of cumulative effects due to indirect effects under alternative 1.

Alternative 3

Direct and Indirect Effects

Direct and indirect effects to sensitive species and their habitats under alternative 3 are expected to be the same as under alternative 2 except as follows:

- The risk of indirect effects from wildfire (including the connected effect of noxious weed infestation because of such fires) is greater under alternative 3 than alternative 2, because fewer acres are proposed for treatment, leaving a slightly greater potential for a large stand-replacing fire.
- Conversely, the risk of habitat degradation due to noxious weed infestation is less under alternative 3 than alternative 2 because ground disturbing activities would occur on fewer acres. Please see the Invasive Plants section for details of potential weed infestation due to proposed activities. Table 119 shows the comparison of potential weed infestation for all alternatives:

Table 119 Comparison of potential weed infestation due to proposed activities

ALTERNATIVE	ACRES OF POTENTIAL WEED INFESTATION DUE TO PROPOSED ACTIVITIES
1	0
2	311
3	233

- Four of the five units which have whitebark pine as a component would be treated with prescribed fire under alternative 3. There is no treatment proposed for Unit 76, so 123 fewer acres would be treated.

Irreversible/Irretrievable Commitments

There are no irreversible or irretrievable commitments that would affect sensitive plants under this alternative when project design features are applied.

Cumulative Effects

The cumulative actions and resulting cumulative effects as discussed under alternative 1 also apply to this alternative. There would be no cumulative effects for this alternative as no known herbaceous plant populations would be affected, and there is a project design feature in place to protect whitebark pine. Please see the discussion of cumulative effects earlier under alternative 1.

Summary of Effects

Alternative 1 would have no new soil disturbing activities that would disturb sensitive plant populations. However, alternative 1 does not propose activities that modify fire behavior to enhance community protection while creating conditions that allow the reestablishment of fire as a natural process on the landscape. Consequently, there remains a higher risk of a large, stand-replacing fire that could result in effects to herbaceous sensitive species habitat. The Vegetation section notes that under alternative 1 whitebark pine would not increase in the short term and would decline from present levels in the long term.

Alternative 2 has the highest level of soil disturbing activities with the highest level of potential to affect any unknown herbaceous sensitive plant populations. Nevertheless, alternative 2 addresses the purpose and need by proposing the greatest amount of acres of activities that modify fire behavior to enhance community protection while creating conditions that allow the reestablishment of fire as a natural process on the landscape. The proposed actions are meant to reduce potential for stand-replacing wildfire events in the treated stands, as well as break up the structure in the project area. Reducing potential for stand replacing events may reduce wildfire impacts to specific resources. The Vegetation section states that proposed activities under alternative 2 are consistent with recommendations for restoration of whitebark pine ecosystems, and that in the treated areas whitebark pine would increase in the short term with the increase extending into the long term.

Alternative 3 also proposes treatment activities that may disturb unknown occurrences of herbaceous sensitive plants (see description for alternative 2), however on fewer acres than alternative 2. The Vegetation section states that proposed activities under alternative 3 are consistent with recommendations for restoration of whitebark pine ecosystems and that in the treated areas whitebark pine would increase in the short term with the increase extending into the long term.

There are no known occurrences of herbaceous sensitive plants in the project area and there is a project design feature in place to protect whitebark pine; therefore, direct and indirect effects are limited. Cumulative effects are not expected to contribute to change in status or viability of sensitive plants, under any of the alternatives. No downward trend in population numbers or density, or downward trend in habitat capability that would reduce the existing distribution of any of the sensitive plant species discussed in this analysis, is expected under any of the alternatives.

Species-Specific Effects including Determination of Effects

Roundleaf orchid

This species is known from the Rocky Mountain Front and the northwest corner of Montana. Field surveys of potential wetlands within the analysis area did not locate any populations of this species. No other past surveys have located this species on the Helena National Forest. The habitat for this species is spruce forests along moist seeps and springs.

Direct, Indirect, and Cumulative Effects

Wetlands, seeps and springs would be protected from ground disturbance in the design features for this project (page 9); therefore, direct effects are not expected. However, when habitat is present for a species it is possible that unknown individuals are present, therefore, there is the remote chance, albeit very slight, that individuals could be directly affected. Indirect effects would be as described under *Effects Common to All Alternatives*. See *Cumulative Effects* section for alternative 1, and appendix C for specific cumulative effects.

Determination

Based on the analysis for alternatives 1, 2, and 3, detailed in this document, I determine that the activities proposed may impact individuals of roundleaf orchid but would not contribute toward a trend for federal listing or loss of viability. This determination is supported by the following rationale:

- None of the known occurrences of roundleaf orchid are within the project area and none would be impacted by this project.
- There may be habitat for roundleaf orchid in the project area and as a result there is a slight possibility that unknown individuals could be impacted
- There are project design features in place to protect this species' habitat.
- There is potential for indirect effects to habitat under all three alternatives. There are no activities associated with alternative 1; nevertheless, there is the possibility of habitat degradation due to the risk of large, stand-replacing fires and the associated habitat degradation from noxious weed infestation.

Scalloped moonwort

This species is known from the Beaverhead-Deerlodge National Forest, immediately adjacent to the Helena National Forest. This species has not been found to date in the project area through numerous surveys. This species is associated with wetland habitats.

Direct, Indirect, and Cumulative Effects

Wetlands, seeps and springs would be protected from ground disturbance in the design features for this project; therefore, direct effects are not expected. Indirect effects would be as described under *Effects Common to All Alternatives*. See *Cumulative Effects* section under alternative 1and appendix C for specific cumulative effects.

Determination

Based on the analysis for the three alternatives detailed earlier in this document, I determine that the activities proposed may impact individuals of scalloped moonwort but would not contribute toward a trend for federal listing or loss of viability. This determination is supported by the following rationale:

- None of the known occurrences of scalloped moonwort are within the project area and none would be impacted by this project.
- There may be habitat for scalloped moonwort in the project area and therefore. there is a slight possibility of unknown individuals that could be impacted
- There are project design features in place to protect this species' habitat.
- There is potential for indirect effects to habitat under all three alternatives. There are no activities associated with alternative 1; nevertheless, there is the possibility of habitat degradation due to the risk of large, stand-replacing fires and the associated habitat degradation from noxious weed infestation.

Peculiar moonwort

Peculiar moonwort is known from two populations on the Helena National Forest, both in the Divide landscape area. The habitat for this species on the Helena National Forest is open grassland and open grassland and sagebrush. This habitat does not occur in treatment areas; no populations are known to occur in the project area.

Direct, Indirect, and Cumulative Effects

No treatments are proposed in potential habitat, and there are no known occurrences of this species in the project area, therefore, no direct effects are expected. Indirect effects would be as described under *Effects Common to All Alternatives*. See *Cumulative Effects* section under alternative 1and appendix C for specific cumulative effects.

Determination

Based on the analysis for the three alternatives detailed earlier in this document, I determine that the activities proposed may impact individuals of peculiar moonwort but would not contribute toward a trend for federal listing or loss of viability. This determination is supported by the following rationale:

- None of the known occurrences of peculiar moonwort are within the project area and none would be impacted by this project.
- There may be habitat for peculiar moonwort in the project area and therefore there is a slight possibility of unknown individuals that could be impacted
- There are no activities proposed in this species' habitat.
- There is potential for indirect effects to habitat from surrounding activities. There are no activities associated with alternative 1; nevertheless, there is the possibility of habitat degradation due to the risk of large stand-replacing fires and the associated habitat degradation from noxious weed infestation.

Lesser yellow lady's slipper

Montana Natural Heritage Program has records showing an occurrence of this species just inside the Helena National Forest boundary, and an occurrence just outside the boundary. Neither population has been seen recently. Field surveys in 2009 of potential wetlands did not locate any populations of this species. No other past surveys have located this species on the Helena National Forest. No populations are known to occur in the analysis area. The habitat for this species is fens, damp mossy woods, seepage areas, and moist forest-meadow ecotone, in the valley and lower montane zones.

Direct, Indirect, and Cumulative Effects

Wetlands, seeps and springs would be protected from ground disturbance in the design features for this project; therefore, direct effects are not expected. Indirect effects would be as described under *Effects Common to All Alternatives*. See *Cumulative Effects* section under alternative 1and appendix C for specific cumulative effects.

Determination

Based on analysis for alternatives 1, 2, and 3 detailed in this document, I determine that the activities proposed may impact individuals of lesser yellow lady's slipper but would not contribute toward a trend for federal listing or loss of viability. This determination is supported by the following rationale:

- None of the known occurrences of lesser yellow lady's slipper are within the project area and none would be impacted by this project.

- There may be habitat for lesser yellow lady's slipper in the project area and therefore there is a slight possibility of unknown individuals that could be impacted
- There are project design features in place to protect this species' habitat.
- There is potential for indirect effects to habitat under all three alternatives. There are no activities associated with alternative 1; nevertheless, there is the possibility of habitat degradation due to the risk of large stand-replacing fires and the associated habitat degradation from noxious weed infestation.

Sparrow egg lady's slipper

Sparrow egg lady's slipper has not been found on the Helena National Forest but is known from Glacier National Park and northwest Montana. Field surveys in 2009 of potential wetlands did not locate any populations of this species. No other past surveys have located this species on the Helena National Forest. No populations are known to occur in the analysis area. The habitat for this species is mossy, moist or seepy places in coniferous forests.

Direct, Indirect, and Cumulative Effects

Wetlands, seeps and springs would be protected from ground disturbance in the design features for this project; therefore, direct effects are not expected. Indirect effects would be as described under *Effects Common to All Alternatives*. See *Cumulative Effects* section under alternative 1and appendix C for specific cumulative effects.

Determination

Based on the analysis for alternatives 1, 2, and 3 detailed in this document, I determine that the activities proposed may impact individuals of sparrow egg lady's slipper but would not contribute toward a trend for federal listing or loss of viability. This determination is supported by the following rationale:

- None of the known occurrences of sparrow egg lady's slipper are within the project area and none would be impacted by this project.
- There may be habitat for sparrow egg lady's slipper in the project area and therefore there is a slight possibility of unknown individuals that could be impacted
- There are project design features in place to protect this species' habitat.
- There is potential for indirect effects to habitat under all three alternatives. There are no activities associated with alternative 1; nevertheless, there is the possibility of habitat degradation due to the risk of large stand-replacing fires and the associated habitat degradation from noxious weed infestation.

Howell's gumweed

This species has not been found in the Helena National Forest to date. It is known from open roadsides in the western Blackfoot area. The Montana Natural Heritage Program was contracted by the Forest Service to survey known noxious weed populations across the Forest (Barton and Crispin 2002). They specifically searched for this species. It was not found during those surveys as well as in 2009 field surveys. Habitat is described as vernally moist, lightly disturbed soils adjacent to ponds and marshes, as well as roadsides and other disturbed areas.

Direct, Indirect, and Cumulative Effects

It is unlikely that this species would occur in heavily forested areas where management activities are proposed; therefore, direct effects are not expected. Indirect effects would be as described under *Effects*

Common to All Alternatives. See *Cumulative Effects* section under alternative 1and appendix C for specific cumulative effects.

Determination

Based on the analysis for alternatives 1, 2, and 3 detailed in this document, I determine that the activities proposed may impact individuals of Howell's gumweed but would not contribute toward a trend for federal listing or loss of viability. This determination is supported by the following rationale:

- None of the known occurrences of Howell's gumweed are within the project area and none would be impacted by this project.
- There may be habitat for Howell's gumweed in the project area and therefore there is a slight possibility of unknown individuals that could be impacted
- It is unlikely this species would occur in areas where management activities are proposed.
- There is potential for indirect effects to habitat from surrounding activities. There are no activities associated with alternative; nevertheless, there is the possibility of habitat degradation due to the risk of large stand-replacing fires and the associated habitat degradation from noxious weed infestation.

Hall's rush

This species has 15 populations Forestwide. The Montana Heritage database identifies eight populations on the Helena National Forest (three of the Heritage Program populations were located again by HNF crews). Seven new populations were found by Helena National Forest survey crews in 2009 (Bicker field surveys 2009). Habitat is wet to moist meadows.

Direct, Indirect, and Cumulative Effects

No treatments are proposed in potential habitat, and there are no known occurrences of this species in the project area; therefore, no direct effects are expected. Indirect effects would be as described under *Effects Common to All Alternatives*. See the *Cumulative Effects* section for alternative 1, and appendix C for specific cumulative effects.

Determination

Based on the analysis for alternatives 1, 2, and 3 detailed in this document, I determine that the activities proposed may impact individuals of Hall's rush but would not contribute toward a trend for federal listing or loss of viability. This determination is supported by the following rationale:

- None of the known occurrences of Hall's rush are within the project area and none would be impacted by this project.
- There may be habitat for Hall's rush in the project area; therefore, there is a slight possibility of unknown individuals that could be impacted
- There are no activities proposed in this species' habitat.
- There is potential for indirect effects to habitat from surrounding activities. There are no activities associated with alternative 1; nevertheless, there is the possibility of habitat degradation due to the risk of large, stand-replacing fires and the associated habitat degradation from noxious weed infestation.

Missoula phlox

This species is located in each of the four landscape areas of the Forest. The Montana Heritage database identifies eight populations on the Helena National Forest. The habitat for this species is open, exposed limestone-derived slopes in the foothills, to exposed ridges in the subalpine zone.

Direct, Indirect, and Cumulative Effects

No treatments are proposed in potential habitat, and there are no known occurrences of this species in the project area, therefore, no direct effects are expected. Indirect effects would be as described under *Effects Common to All Alternatives*. See the *Cumulative Effects* section under alternative 1, and appendix C for specific cumulative effects.

Determination

Based on the analysis for alternatives 1, 2, and 3 detailed in this document, I determine that the activities proposed may impact individuals of Missoula phlox but would not contribute toward a trend for federal listing or loss of viability. This determination is supported by the following rationale:

- None of the known occurrences of Missoula phlox are within the project area and none would be impacted by this project.
- There may be habitat for Missoula phlox in the project area; as a result, there is a slight possibility of unknown individuals that could be impacted
- There are no activities proposed in this species' habitat.
- There is potential for indirect effects to habitat from surrounding activities. There are no activities associated with alternative 1; nevertheless, there is the possibility of habitat degradation due to the risk of large stand-replacing fires and the associated habitat degradation from noxious weed infestation.

Whitebark pine

This species is a hardy conifer that tolerates poor soils, steep slopes, and windy exposures and is found at alpine tree line and subalpine elevations throughout its range (USDI Fish and Wildlife Service 2011a). It is known to occur in almost all major mountain ranges of western and central Montana. In the project area it is known to be a minor component in several of the treatment units. The Vegetation section contains additional information regarding this species; that information is incorporated here by reference,

Direct, Indirect, and Cumulative Effects

This species is known to occur as a minor component in treatment units 76, 79, 82, 83 and 88 (please see the Silviculture section for details). Those occurrences would be promoted by the project design feature SILV-2 which is designed to protect whitebark pine individuals and enhance habitat for the species. Thus, while there is the potential for individuals to be charred or physically damaged during the treatment, beneficial effects (in the form of habitat enhancement due to the removal of shade-tolerant species and creation of caching sites for Clark's nutcrackers) are expected in the long-term. Indirect effects would be as described under *Effects Common to All Alternatives*. The Vegetation section states that whitebark pine would not increase in the short term and would decline from present levels in the long term under alternative 1, and would increase in the short term, with the increase extending into the long term under alternatives 2 and 3. The proposed actions under both alternatives are consistent with recommendations for whitebark pine restoration (see appendix B). See *Cumulative Effects* sections for alternative 1, and appendix C for specific cumulative effects.

Determination

Based on the analysis for alternatives 1, 2, and 3, detailed in this document, I determine that the activities proposed may impact individuals of whitebark pine but would not contribute toward a trend for federal listing or loss of viability. This determination is supported by the following rationale:

- Whitebark pine is expected to decline within the project area under alternative 1 (Amell 2012). However, this project area makes up a very small portion of the range of the species, and a decline of the individuals in this project area cannot be determined to result in a trend towards federal listing or a loss of viability.
- Whitebark pine occurs as a minor component within some units that are proposed for prescribed burning under both action alternatives. Project design feature SILV-2 was designed to protect the species while incorporating activities to enhance the habitat. While some individuals may be impacted by these activities, overall a beneficial effect is expected in the long term.
- Amell (2012) states that the activities proposed by the action alternatives are consistent with recommendations for restoration of whitebark pine ecosystems and that in the treated areas whitebark pine would increase in the short term with the increase extending into the long term.

Summary of Determinations of Effects

Table 120. Summary of determination of effects

SPECIES **COMMON NAME (FAMILY)**	**DETERMINATION OF EFFECTS**		
	ALTERNATIVE 1	**ALTERNATIVE 2**	**ALTERNATIVE 3**
Amerorchis rotundifolia Roundleaf orchid (Orchidaceae)	MII[22]	MII	MII
Botrychium crenulatum Scalloped moonwort (Ophioglossaceae)	MII	MII	MII
Botrychium paradoxum *Peculiar moonwort* (Ophioglossaceae)	MII	MII	MII
Cypripedium parviflorum *Lesser yellow lady's slipper* (Orchidaceae)	MII	MII	MII
Cypripedium passerinum Sparrow egg lady's slipper (Orchidaceae)	MII	MII	MII
Grindelia howellii Howell's gumweed (Asteraceae)	MII	MII	MII
Juncus hallii Hall's rush (Juncaceae)	MII	MII	MII
Phlox kelseyi var. *missoulensis* Missoula phlox	MII	MII	MII

[22] May impact individuals or habitat, but will not likely contribute to a trend towards Federal listing or cause a loss of viability to the population or species.

SPECIES **COMMON NAME (FAMILY)**	**DETERMINATION OF EFFECTS**		
	ALTERNATIVE 1	**ALTERNATIVE 2**	**ALTERNATIVE 3**
(Polemoniaceae)			
Pinus albicaulis Whitebark pine (Pinaceae)	MII	MII	MII

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Whitebark pine is the only sensitive plant species that has been found to date in the project area. All alternatives are consistent with Regional direction, Forest Plan Standards and Guidelines and the *Endangered Species Act*. If any additional species of special concern were verified in the project area, appropriate measures would be taken.

Noxious Weeds

Introduction

This section addresses the effects of the proposed activities on noxious weeds within the Stonewall Project area. Noxious weed infestations are detrimental to native fauna and flora and present the greatest large-scale threat to native ecosystems that exist in the Nation's wild lands today (DiTomaso 2000; Lodge and Shrader-Frechette 2003; Lonsdale 1999; Mack et al. 2000; Pauchard et al. 2003). At high infestation levels, these effects are adverse due to the loss of native plant diversity, reduction of wildlife habitat and forage, increase in erosion and depletion of soil moisture and nutrient levels (DiTomaso 2000). There are approximately 564 acres of weeds mapped on National Forest System land within the Stonewall Project boundary. Figure 82 shows the general distribution of noxious weeds. These infestations are expected to spread, with the amount of spread increasing proportionally with the amount of ground disturbance.

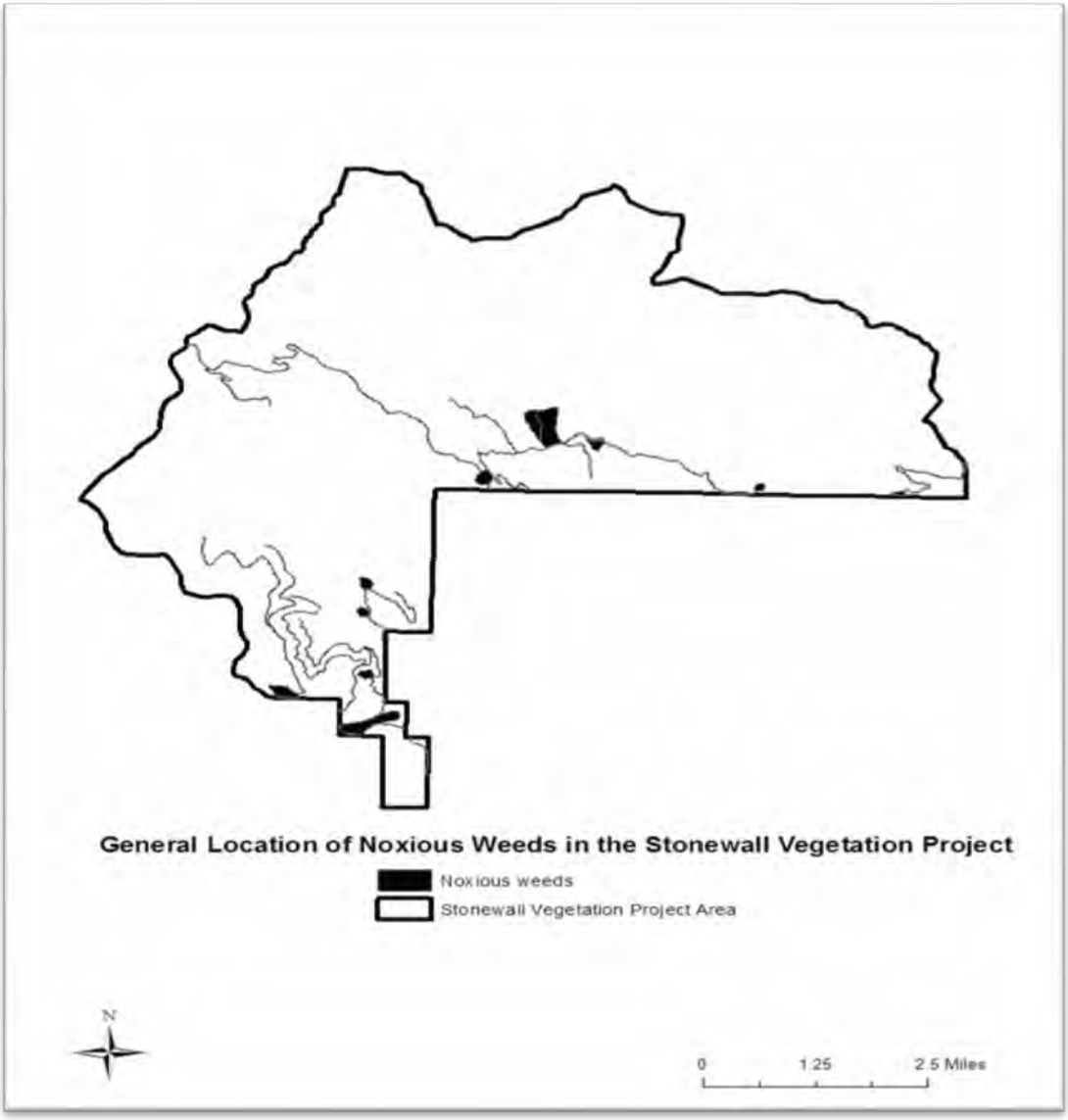

Figure 82. General location of noxious weeds in the Stonewall Vegetation Project area

Methodology

The methodology used in this analysis includes the best available data from the Helena National Forest Weeds Database and Geographic Information System (GIS) datasets. In addition, this analysis incorporates data collected by local Forest Service personnel during ground reconnaissance of the project area, and during vegetation monitoring of past vegetation treatments. Geographic Information Systems combine various datasets to help us understand relationships and the effects of travel routes on weeds and other flora, as well as influences from landform and landtypes.

Information Used

A GIS geodatabase (StonewallNEPA.gdb) contains numerous geospatial layers that provide the base data used in this analysis. This geodatabase is available in the project file located at the Helena National Forest or Lincoln Ranger District in Lincoln, Montana. Those layers include the known locations of weed infestations, watershed and stream information, and habitat types for risk assessment.

Assumptions

The following assumptions apply to this analysis:

- The analysis and decisions made in the record of decision for the Noxious Weed Treatment Project EIS are incorporated in noxious weed analysis and implementation on the Helena National Forest.
- Any soil disturbing activity with mechanized equipment has the potential to increase noxious weed invasion or spread.
- The expected rate of spread of noxious weeds is 14% per year, (Asher and Spurrier1998) without disturbance. The rate of spread could be even higher in areas affected by ground disturbing activities.
- Herbicide use in accordance with the requirements specified in the *Final Environmental Impact Statement: Helena National Forest Noxious Weed Treatment Project* and accompanying *Record of Decision (*USDA Forest Service 2006d) is appropriate for noxious weed management on infested lands.
- The Forest treats approximately one-third of its mapped weeds on an annual basis under its normal weed treatment program; therefore for this analysis it is assumed that one-third of the acres of weeds, would treated annually.
- The paragraphs below define mapped weed acres and weed treatment acres as used in this analysis.
    - **Mapped Weed Acres:** Mapped acres are reflected by polygons containing at least 1percent noxious weed cover. There are weeds outside those polygons that are too scattered to map, or are infestations that have not been discovered yet. The mapped acres are from the weeds layer in the Forest GIS database.
    - **Weed Treatment Acres:** Weed treatment acres for the purposes of this analysis are assumed to be the total polygon acres described above, to assess if any thresholds are being approached. Actual chemical application is reported to the State of Montana annually, as a requirement of a chemical applicator's/operator's license. Pesticide application is also recorded in the National Forest System FACTS database.

Spatial and Temporal Context for Cumulative Effects Analysis

The cumulative effects analysis area is the project area (figure 82). This geographic bounding was determined because activities beyond this boundary would have diminished effects. There are proposed haul routes identified that extend beyond this boundary, but expanding the analysis area to include those routes beyond the project area would result in an analysis of effects that is so subjective and conjectural that it would not contribute useful information. The analysis is bound in time by 10 years into the future, which allows for an adequate length of time to record vegetative changes. Effects associated with various actions are based on literature, known weed infestations and personal experience. Indicators, assumptions and method of analysis are the same as those described earlier.

Overview of Issues

The effects of project activities on noxious weeds were identified from public scoping as significant. Please refer to volume 2, appendix A of this document for a complete listing of the issues and an explanation of how the agency determined their disposition.

Weed Spread/Infestation: Proposed actions, including harvest disturbance and use of haul routes in areas with weeds present, may disturb landscapes allowing existing weed populations to expand or allowing additional species to become established.

Treatment of existing weed infestations would occur under the guidance of the Forestwide effort and treatments to prevent the spread of weeds is included in design features to reduce potential spread.

Issue Indicators

Indicators used to disclose the differences between the alternatives are:

- Predicted acres of invasive plants infestation due to the proposed treatments;
- Associated management cost for weed control activities.

Affected Environment

Existing Condition

Weeds have been expanding on the Helena National Forest for many years. A variety of factors contributed to the spread of noxious weeds. Noxious weeds are invasive by definition, and are able to spread without natural enemies, pathogens or ungulate grazing to keep them in check. Weeds favor disturbance caused by wildfire and ground disturbance of any kind. Increased public use across the Forest in the past few years due in part to off-road vehicle use and recreation displacement from wildfire, as well as travel plan closure areas, places more pressure on the remaining open areas.

Various methods of weed control are used on known weed infestations across the Helena National Forest (please see Appendix A in the Noxious Weeds Report (Englebert 2012a) for an estimate of costs for various control treatments). Herbicide application is the most common form of control used across the Forest. The Forest generally treats approximately 3,900 acres of weeds annually (averaging 2007 through 2009 as typical years). Although herbicide application has been the primary noxious weed treatment method, the Forest has also conducted a number of biological control agent releases and has established numerous insectaries across the Forest.

Partners and volunteers such as the Rocky Mountain Elk Foundation, Backcountry Horsemen, ATV groups, and Powell County and Lewis and Clark County participate with the Forest in weed treatment annually. The budget allocated for noxious weed treatment in 2009 was $335,000 with a target to treat approximately 3,000 acres. In addition, numerous grants and volunteer contributions assist the budget to help the Helena National Forest treat weeds.

Species information

Montana currently has 24 species on the statewide noxious weed list (Grubb et al. 2003). Five of those species are known to occur within the analysis areas: butter and eggs (*Linaria vulgaris*), Canada thistle (*Cirsium arvense*), houndstongue (*Cynoglossum officinale*), St. Johnswort (*Hypericum perforatum*) and spotted knapweed (*Centaurea maculosa*). Common mullein (*Verbascum thapsus*)is listed as a noxious weed by Lewis and Clark County. In addition to the known (mapped) infestations, it is likely that oxeye daisy (*Leucanthemum vulgare* also known as *Chrysanthemum leucanthemum*) and cheatgrass (*Bromus tectorum*) occur along roadways, especially near areas of recent disturbance. The State of Montana lists oxeye daisy as a noxious weed and cheatgrass as a regulated species. Noxious weed infestations throughout the project area range from areas of 5 to 10 individual weed plants to linear patches along roads and trails to large patches of greater than 20 acres. Infestation levels range from light (1 percent

canopy cover) to high (greater than 50% canopy cover). Table 121 shows the acres of weeds that are mapped in the project area. Infestation acres are rounded to the nearest acre.

Table 121. Mapped noxious weed infestation in the analysis areas

Noxious Weed Species (Scientific Name)	Project Area Infested Acres by Species
Butter and eggs – also known as yellow toadflax (*Linaria vulgaris*)	156
Canada thistle (*Cirsium arvense*)	118
Common mullein (*Verbascum thapsus*)	148
Houndstongue – also known as gypsyweed (*Cynoglossum officinale*)	126
St. Johnswort (*Hypericum perforatum*)	8
Spotted knapweed (*Centaurea maculosa*)	554
Total infested acres*	**564**

*Total infested acres do not equal the sum of all acres infested by a particular species. When a polygon is mapped and it contains multiple species, acres are recorded for each species.

Butter and eggs (*Linaria vulgaris*) is also known as yellow toadflax. It has been shown to readily establish on open and disturbed sites where competition from other plants is reduced (Zouhar 2003). Butter and eggs seeds may be dispersed by water, ants, birds, and rodents, but existing infestations appear to expand mainly by vegetative reproduction rather than by seed (Pauchard et al. 2003).

Canada thistle (*Cirsium arvense*) spreads primarily by adventitious root buds that may form new adventitious shoots that can develop along the root at any location (Zouhar 2001a). Canada thistle is present in much of the project area, generally associated with roadside disturbance or harvest disturbance. Its habitat is restricted to open areas of less than 10 percent canopy closure.

Cheatgrass (*Bromus tectorum*) is a serious weed that competes with native vegetation and fuels wildfire (Young et al. 1987). Cheatgrass has not been mapped on the Forest but is established along numerous roadsides and other areas of disturbance. Cheatgrass spread rapidly through sagebrush ranges following World War II and has been expanding its range ever since (Menalled et al. 2008). Cheatgrass is highly adaptable and has increased around the Helena National Forest over the past 30 years as evidenced by data collection (Olsen, personal observation). It is listed in Montana as a regulated plant.

Common mullein (*Verbascum thapsus*) is listed as a noxious weed in Lewis and Clark County. It has recently been mapped along roads in the project area. Gucker (2008) considers common mullein a short-lived member of disturbed communities whose abundance decreases with increased time since disturbance. Common mullein reproduces entirely by seed and has no means of vegetative regeneration. Its seed bank is very persistent, with seeds germinating after 100 years or more in the soil (Gucker 2008).

Houndstongue (*Cynoglossum officinale*) is also known as gypsyflower. This species is common along roads and in logged areas. Houndstongue is spread by large seeds that attach to animals or humans, as well as dispersed by wind (Zouhar 2002). A biennial or short-lived perennial, houndstongue reproduces

only by seed. It is relatively shade tolerant, although it thrives in full sunlight. This species is difficult to map as it may occur in small, scattered patches.

Oxeye daisy (*Leucanthemum vulgare* also known as *Chrysanthemum leucanthemum*) is not mapped in the project area, but quite likely occurs in small infestations, especially near areas of past disturbance. Besides reproducing vegetatively along a rhizome, oxeye daisy is a prolific seed producer. This plant is capable of taking over and modifying natural areas, pasture and rangeland and may increase soil erosion compared to native plant communities (Olson and Wallander 1999).

St. Johnswort (*Hypericum perforatum*) is quite limited in the project area. St. Johnswort is often treated as a grassland plant, but it is also common in many forested areas in North America. It may occur in open forests, natural clearings, or within forests where canopy cover has been reduced or removed by disturbances. In forested areas St. Johnswort is commonly associated with disturbances such as roads, logging, grazing and fire. St. Johnswort reproduces by seed and by sprouting from lateral roots and root crowns. Seeds can remain viable in the soils for several years (Zouhar 2004).

Spotted knapweed (*Centaurea maculosa* also known as *Centaurea stoebe* ssp. *micranthos* and *Centaurea biebersteinii*) has the largest extent of infestation within both the project area and the cumulative effects boundary. The species occurs along roadsides and throughout south-facing areas of past harvest, as well as in the natural grasslands. Spotted knapweed thrives in open areas with forest canopies of less than 20 percent. Spotted knapweed reproduces almost entirely from seed. Plants are also able to extend lateral shoots below the soil surface that form rosettes adjacent to the parent plant. This species has also been shown to have allelopathic properties, secreting toxins that suppress the growth of other plants, although resource competition is just as effective in its ability to dominate areas (Zouhar 2001).

Environmental Consequences

Project Design Features

The Stonewall Vegetation Project has been designed with features that are intended to minimize or avoid potential adverse effects while meeting project objectives. In addition to the proposed action treatments described in this section, design features would be implemented where applicable. A description of the project design features relating to noxious weeds and other resources is displayed in table 9, chapter 2.

The specific design features in table 9 pertaining to noxious weeds are NOX-1, NOX-2, NOX -3, NOX-4 NOX-5, NOX-6 and NOX-7.

This analysis is based on the implementation of all design features. Project design features apply to both action alternatives. Design features that are applicable to noxious weeds include not only those listed above, designed specifically to prevent noxious weed spread, but also those designed to protect other resources such as water and soil.

Effects Common to All Alternatives

The Forest treats approximately one-third of its mapped weeds on an annual basis under its normal weed treatment program (per the Helena National Forest Noxious Weed Treatment Project, USDA Forest Service1996). Therefore for this analysis it is assumed that one-third, or 188 acres of the 564 acres of weeds, would be treated annually. Herbicide treatment of these acres would have an average cost of about $30 per acre for easily accessible sites (up to 200 feet from a road and on slopes less than 40 percent) and $62 per acre for areas with more difficult terrain (farther than 200 feet from a road and on slopes greater than 40 percent). The cost of bio-control is included in these prices. An average cost of $50 per acre is used to calculate costs. Table 122 displays treatment type and cost to treat one-third of the acres in the

project area. This table does not include the cost of monitoring. This cost is not included in further analysis of the alternatives as it is assumed to be a baseline, independent of management actions, and common to all alternatives.

Table 122. Treatment type and cost to treat one-third of the currently infested acres - all alternatives

Treatment Type	Cost/Acre	Acres	Total Cost
Herbicide/Bio-control	$50.00	188	$9,400

Noxious weed infestations adversely affect native fauna and flora and present the greatest large-scale threat to native ecosystems that exist in the nation's wild lands today (DiTomaso 2000; Lodge and Shrader-Frechette 2003; Lonsdale 1999; Mack et al. 2000; Pauchard et al. 2003). At high infestation levels (canopy cover greater than or equal to 25 percent), noxious weeds cause a loss of native plant diversity, reduction of wildlife habitat and forage, increase in erosion, and depletion of soil moisture and nutrient levels (DiTomaso 2000). These effects are common to all alternatives and would vary depending on the level of infestation.

Weeds could potentially spread at a rate of 14 percent per year into dry forest areas as conifer species die and sunlight, nutrients, and moisture are more available to herbaceous plant species (Asher and Spurrier 1998). This is most important in ponderosa pine (*Pinus ponderosa*) forests, and lodgepole pine (*Pinus contorta*)/Douglas-fir (*Pseudotsuga menziesii*)/ponderosa pine mixed forests. The most susceptible forest habitat types would be dry habitat types that have existing infestations of noxious weeds because of the natural openness of such forest types.

Spotted knapweed, cheatgrass, Canada thistle, common mullein and houndstongue may spread rapidly with ground disturbance and may spread at a slower rate without disturbance (Young et al. 1987; Zouhar 2001, 2001a, 2002). Butter and eggs spreads readily without ground disturbance and very rapidly with disturbance (Zouhar 2003). The butter and eggs and oxeye daisy are of primary concern because they are difficult to control. Spotted knapweed is of primary concern across the analysis area because of the amount of infestation. New weed infestations, and spread of current infestations would occur under all alternatives, particularly along roadsides and areas of disturbance (Lonsdale 1999). The HNF Weed Treatment Project FEIS (USDA Forest Service 2006c) provides guidance and environmental requirements for weed control activities that would be applied to this area under any alternative. The Forest currently uses herbicides to treat approximately 30 percent of infestations annually. Roadsides would be treated annually, as they are a major vector for weed invasion. In addition to herbicide treatment, the noxious weed control program on the Forest has been successful in establishing insectaries. Biological control would be used in areas where the biological agents had optimal conditions for survival and expansion. In riparian areas, biological control would be emphasized where conditions for insect establishment are met.

A stand-replacing fire is a current risk in the Stonewall project area because of current fuels conditions (Kurtz 2009). Given the current conditions within the project area, and the dynamics associated with lodgepole and ponderosa pine mortality, untreated areas can be expected to experience uncharacteristically higher intensity fires that consume a considerable portion of duff and litter because of current density, stand structure, red-needled litter, and stand composition (Agee and Skinner 2005; Graham et al. 2004). This disturbance caused by wildfires would result in areas that are highly susceptible to weed invasions. For example, the Snowtalon fire occurred in an adjacent area in 2003. Much of that fire was stand-replacing. Yellow toadflax and spotted knapweed spread rapidly following the fire.

Herbicides and biocontrol were applied aggressively in the three years following the fire, with follow-up treatments since that time.

The data on response of weeds and changes in weed ecology because of climate change are limited. Weeds are genetically diverse and if resources such as light, water, nutrients, or carbon dioxide change within the environment, it is more likely there may be an expansion of weeds. However, very little is known regarding the impact of climate change on the reproductive success of invasive weeds and the potential consequences for their management (Ziska 2006).

Native plant diversity would be impacted by infestations of nonnative plants, especially noxious weeds. Noxious weeds dominate plant communities and tend to form monocultures that negatively influence native biological diversity. This weed competition to individual plants and plant communities can result in loss of species diversity and sensitive native plants. Native grasses used for domestic livestock and wild ungulates have been particularly susceptible to impacts from weeds (Beck 2001).

A review of the mechanisms underlying exotic plant invasions by Levine and others (2003) revealed that although numerous studies have been done examining the effects of invasive plants on community structure and diversity, few studies have examined the underlying processes (e.g. competition, allelopathy, production of flammable biomass, nutrient cycling) that cause the impact. It is well understood that community biodiversity decreases with exotic plant invasion, but the results of changes to soil community diversity, resource allocation, and soil water availability for example have not been examined (Levine et al. 2003).

Some studies have investigated effects on nutrient cycling on invaders that are nitrogen fixers for example, as available nitrogen in that case might be predictable (Vitousek and Walker 1989). Evans et al. (2001) found that cheatgrass invasion can significantly alter nutrient cycling through differences in litter quality and quantity. However, the consequences of altered nitrogen availability for community structure are poorly demonstrated and highly variable (Levine et al. 2003).

Studies of impacts to natural fire processes strongly support the expectation that invader impacts on disturbance regimes (ecosystem process) can strongly and possibly irreversibly affect community structure (Levine et al. 2003). Dramatic alterations of fire frequency in historic shrublands that are now dominated by cheatgrass have been demonstrated (D'Antonio 2000, Ehrenfeld et al. 2001). Other cases of exotic grass and shrub impacts include increasing fuel resulting in greater flame lengths, higher temperatures and greater heat release. In each case, the mechanism through which impact develops depends on whether the invader can out-compete the natives for resources. In most cases, the specific ecophysiological reasons for greater biomass production have not been identified. The effects of cheatgrass strongly support the prediction that invaders affecting disturbance processes have the greatest potential to create large impacts on ecosystems (Vitousek 1990).

Allelopathy is a biological phenomenon by which one organism produces biochemicals that influence the growth, survival and reproduction of other plants. Ridenour and Calloway (2001) showed that spotted knapweed reduced the root growth of Idaho fescue (*Festuca idahoensis*) by 50 percent, showing an adverse allelopathic effect. Additional studies on the effect of arbuscular mycorrhizae on interactions of spotted knapweed—Idaho fescue roots showed an enhancement of the competitive ability of spotted knapweed but direct effects of mycorrhizae were weak (Marler et al. 1999). Unanswered questions in the ecosystem-impacts literature include the degree to which the documented impacts result simply from the addition of new functional traits brought in by the invader, or alternatively the reduction or elimination of native species (e.g. Mack et al. 2001).

The use of herbicides may have positive or negative impacts on native plant diversity. Rice and others (1997) found in a detailed comparison of plant community composition over an eight-year period that plots treated with Tordon®, Transline®, and Curtail® were more similar to the potential natural communities than the no-spray controls (Mueggler and Stewart 1980). On the other hand, the side effects of weed management can vary as a function of local site conditions (Shea et al. 2005). Side effects of management actions include reducing vigor or abundance of native or desirable species, inhibiting overall productivity or diversity, shifting community structure and function, and altering physical conditions (D'Antonio et al. 2004, Hulme 2006, Louda et al. 1997). Therefore, effective weed management requires weighing the success of control measures (e.g., impacts on target weeds and recovery of native species) against the side effects of management actions. This necessitates a thorough understanding of how management tools interact with non-target system components as well as the target weed (Shea et al. 2005).

The *Helena National Forest Weed Treatment Project FEIS* (USDA Forest Service 2006c) provides guidance and environmental requirements for weed control and treatment activities that would apply to this area in any alternative. All personnel using herbicides are appropriately certified by the State of Montana and knowledgeable about the environmental guidelines and requirements of the Noxious Weed EIS.

Effects Common to All Action Alternatives

While the spread of noxious weeds would continue under all alternatives, the rate of spread could potentially be faster in areas proposed for treatments, particularly areas to be thinned and burned. Weed management would continue as in the past, however, activities proposed for the Stonewall Project add a layer of ground disturbance and therefore requires additional management for weeds. Areas of ground disturbance would be monitored for weed infestations and treated as appropriate, in accordance with the *Helena National Forest Weed Treatment Project FEIS* (USDA Forest Service 2006c) and Best Management Practices (BMPs) as specified in FSM 2080 (USDA Forest Service 2001), and the Forest Plan. Chemical weed treatment would be the primary treatment method in areas that are accessible by spray equipment. Biological control would apply in areas where the biological agents have optimal conditions for survival and expansion. In riparian areas, biological control would be emphasized where conditions for insect establishment are met. The effect of all treatment methods would be to control and contain existing and new infestations related to vegetation treatments.

The most susceptible habitat types within the project area are the dry habitat types that have existing infestation of noxious weeds. Included are habitat types dominated by Douglas-fir or ponderosa pine. Thinning and burning have been shown to increase the abundance of invasive species in a similar dry (ponderosa pine) forest type in western Montana. Removing the overstory can increase the availability of limiting resources and allow weeds to thrive (Dodson et al. 2008). Metlen and others (2006) found that understory diversity increased following burning, and the increase was in both native and non-native species. Slash burning can also create localized areas that are conducive to the propagation of noxious weeds. Within these dry forest habitat types there are proposed thinning and burning treatment units with existing populations of weeds. These weed populations would likely expand with disturbance, but there are project design features in place to help minimize the likelihood of expansion.

Harvest units in moist forest, subalpine fir (*Abies lasiocarpa*) habitat types that would have closed canopies have a lower probability of weed infestation, particularly spotted knapweed. This species does not tolerate shading (Zouhar 2001). Canada thistle and houndstongue tolerate more shade than spotted knapweed, but the spread of these species is closely associated with ground disturbing activities (Zouhar 2001a, 2002). The probability of weed expansion in these areas would be the lowest of the proposed treatment areas.

Ground disturbance increases susceptibility to weed invasion. The tractor-based treatments would create moderate ground disturbance on unfrozen ground. It is estimated that 10 percent of acres treated with tractor-based treatments on unfrozen ground in alternatives 2 and 3 may be susceptible to new weed infestation. This estimate is supported by a study in four Washington Douglas-fir forests, in which exotic species percent cover averaged 10 percent in the first year following overstory thinning treatments (Thysell and Carey 2001). Areas most susceptible are the regeneration and intermediate treatments in the open canopy cover where ground disturbance would occur. Specific effects are described in the sections for alternatives 2 and 3.

Ground-based logging operations over snow and on frozen ground would help minimize ground disturbance and noxious weed spread. Limiting logging activity to the dormant season on a frozen surface would greatly decrease the chance for weed spread from actively growing plants within the logged or haul area, or from soil containing weed seeds transported to the area on machinery. For this analysis, it is estimated that approximately 1 percent –5 percent (mid-point of 3 percent) of the treated acres may become infested with noxious weeds as a result of ground-based harvesting activities that occur during winter conditions. Past studies have shown a substantial decrease in soil surface disturbance resulting from logging when the activity occurs on frozen ground (McIver and Starr 2000). Limited ground disturbance would result in lower risk of increased weed infestations.

The prescribed fire treatment, which is mixed or low severity, as opposed to high severity associated with wildfires, would not require the use of heavy equipment, and therefore would not result in removal of top soil. It is estimated that as a result of the prescribed fire treatment, approximately 1 percent –5 percent (mid-point of 3 percent) of the treated acres may become infested with noxious weeds. Understory burn treatments have been shown to result in a much smaller increase in exotic species infestation than combined thinning and burning (Dodson et al. 2008).

The 2006 EIS for treating weeds on the Helena National Forest (USDA Forest Service 2006c) identified several 6th code HUCs in which herbicide application would be limited based on the amount of herbicide applied, the location of the application, the stream flow, and HUC area. These estimates are shown by HUC, and the rationale for that determination is from the coarse filter calculation to estimate possible concentrations of herbicide in stream waters, shown in in appendix B and appendix C respectfully of the Noxious Weed Report (Englebert 2012a)

Soil

Introduction

This section evaluates the soil conditions and discloses the potential direct, indirect and cumulative effects of the alternatives for the Stonewall Vegetation Project.

The Stonewall Project would comply with Region 1 Soil Quality Standards (R1 SQS (1999)) and the Helena National Forest Land and Resource Management Plan (1986) (Forest Plan) for long-term soil quality. The proposed silvicultural and fuel treatments proposed for each action alternative are not expected to adversely affect soil resources with the implementation of project design features as part of each alternative.

Methodology

We surveyed the majority of the proposed treatment units (58) during November of 2010 using the Forest Soil Disturbance Monitoring Protocol (Page-Dumroese et al. 2009). All units were traversed along randomly chosen transects to cover as much of the units as possible. Paced transects were used to measure

ground cover, coarse woody debris, slopes, detrimental soil conditions, and any other pertinent soil observations. Additionally, we took measures for soil texture, percent coarse fragments, and depth of organic material. Coarse woody debris transects were established using a modified Brown's line intercept method (Brown 1974).

For this analysis, we used the Water Erosion Prediction Project (WEPP) (Elliot et al. 2000) model to predict sediment movement in proposed burning and harvest units, and to assess erosion potential. WEPP models are accurate to within plus or minus 50 percent (ibid). We relied on literature reviews, field notes, geographic information system (GIS) data, Helena National Forest soil surveys (2001) and professional judgment to support reported conclusions.

In determining significant change in productivity, a 15 percent reduction in soil quality potential was the basis for setting threshold values. This 15 percent is the rationale for the R1 SQS and equates to the detrimental soil disturbance measured in the field. Monitoring on the Helena National Forest shows for traditional summer-based harvest activities in dry conditions, there is a 11.5 percent increase in DSD (9 percent from skid trails, 2.5 percent from landings); for winter-based harvest, there is a 5 percent increase in DSD (3 percent from skid trails, 2 percent from landings); for skyline harvest there is a 4-5 percent increase in DSD, and for pile burning, there is a 5 percent increase in DSD. These assumptions of increased DSD are incorporated into the project design features.

Data Assumption and Limitations

The existing and estimated values for detrimental soil disturbance are not absolute and best used to compare differences between alternatives. The calculation of 'percent of additional detrimental disturbance from a given activity' is an estimate, because detrimental disturbance is a combination of such factors as existing groundcover, soil texture, timing of operations and equipment used, as well as skill of the equipment operator, the amount of wood to be removed, and sale administration. The DSD estimates assume that Best Management Practices would be applied and that soil recovery occurs over time.

Scientific Uncertainty and Controversy

In order to manage forest vegetation, some level of soil disturbance inevitably occurs. Much of the public concern regarding soil disturbance is based on generalizations. Defining the threshold at which soil disturbance decreases site productivity has been the subject of much discussion and controversy. Powers (1990) cites that the rationale for the 15 percent limit of change in soil bulk density was largely based on the collective judgment of soil researchers, academics, and field practitioners, as well as the ability to detect change in productivity through then-current monitoring methods. Thus, the soil quality guidelines are set to detect a potential decline in soil quality. The 15 percent guideline was meant to serve as an indicator of potential soil quality issues in a unit, not a threshold that cannot be exceeded.

Ares and others (2005) state, *"generalizations about negative effects of harvest-related soil disturbance on tree growth may be in error because these impacts depend on their type and severity and on soil properties and climatic conditions."* The authors go on to point out that *"Many studies in the Pacific Northwest and elsewhere have addressed tree growth and soil response in logged sites using the 'after-the-effect' retrospective approach as described by Powers (1989), which may not allow to ascertain the original type, degree, and extent of disturbance. In addition tree growth may have been unknowingly and differentially affected by plant competition, disease, herbivory, and other factors. Tree growth impacts are often measured for short periods of time and this data is then incorrectly used to project long-term effects"* (Ares et al. 2005).

The North American Long-Term-Soil Quality Research Program (LTSP) is studying soil quality standards. The 5-year results were recently published (Page-Dumroese et al. 2006; Flemming et al. 2006; and Sanchez et al. 2006). The LTSP study is ongoing and provides the best available science to resource professionals. To date there has been no reduction in tree growth noted because of compaction or organic removal in plots with soils typical of the analysis area.

Analysis Area Temporal and Spatial Boundaries

Harvest or fuel treatment units are the analysis area for direct, indirect, and cumulative effects on soil quality (R1 Supplement 2500-99-1). Roads that would be built and then obliterated immediately following timber removal, skid roads, and landings within unit boundaries are included in the disturbance analysis. Roads that would be built and then obliterated immediately following timber removal outside of units were included in analysis of the unit they accessed. National Forest System roads and long-term specified roads are part of the Forest Transportation System and not considered for disturbance analysis. Soil cumulative effects analysis is limited to the “land area affected by a management activity” (USDA Forest Service 1999).

For the purpose of this analysis, short-term effects last from 1-50 years while long-term effects last from 50-100 years.

Overview of Issues

Comments pertaining to disclosing the effects of project activities on soils were identified from public scoping as nonsignificant (40 CFR 1501.7), and are addressed by the analyses in this section. Please refer to volume 2, appendix A of this document for a complete listing of the issues and an explanation of how the agency determined their disposition. Some comments indicated concern that roads built then obliterated immediately following timber removal, road reconstruction, and use of existing roads would adversely impact soils through compaction. See the Transportation section for information about roads and soil compaction.

Affected Environment

Existing Condition

Weather

Weather data for the project area is displayed in table 123 in this section. This data is from the Rock: Clime (Rocky Mountain Research Station Climate Generator). Most precipitation falls in the form of snow from November through March and as rain in May and June. Weather patterns are strongly influenced by the surrounding mountains as isolated summer thunderstorms are common. The reported climate is modeled for 4,976 feet in elevation, in the middle of the project area. We used the reported weather data for WEPP (Water Erosion Prediction Project) modeling.

Table 123. Annual weather data for the project area

MONTH	AVERAGE MAXIMUM TEMPERATURE (°F)	AVERAGE MINIMUM TEMPERATURE (°F)	PRECIPITATION (IN)	NUMBER OF WET DAYS
January	26	7	2.2	15
February	35	12	1.6	11
March	40	16	1.5	12
April	51	24	1.6	9

MONTH	AVERAGE MAXIMUM TEMPERATURE (°F)	AVERAGE MINIMUM TEMPERATURE (°F)	PRECIPITATION (IN)	NUMBER OF WET DAYS
May	60	32	2.5	10
June	68	38	2	11
July	78	40	1.2	7
August	78	39	1.5	8
September	67	33	1.4	8
October	54	27	1.3	8
November	37	19	1.6	13
December	28	11	2.2	15
Annual			**20.6**	**127**

Soil Characteristics

The project area is within moraine-influenced footslopes and headwater areas of the Upper Blackfoot River Watershed. The overall topography of the project area is heavily influenced by glacial activity including scouring of residual bedrock and deposition of till material in valley bottoms and gentle hillslopes. Table 124displays the characteristics for soils in the project units. These soil characteristics are defined by the Helena National Forest Soil Survey (USDA Forest Service and Natural Resource Conservation Service 2001). Approximately 21 percent of the soils are from glacial till, while the remaining 79 percent are from metasedimentary rock.

The glacial till material is coarse and unconsolidated, forming isolated wet areas that pose operational restrictions. The metasedimentary parent material does not have inherent management restrictions. Most of the soils in the project area are also skeletal in nature,[23] and several of the mapped units have a channery texture.[24] This suggested that the soils are resistant to compaction and resilient due to their coarse texture. However, approximately 44 percent of the area is mapped with a volcanic ashcap, which poses operational limitations due to the compaction potential in these areas. The ashcap soils have a compactable silt-loam texture over the skeletal subsoil. The ashcap soils have a higher water-holding capacity, which tends to extend the wet and productive period for soils into the dry season (Garrison-Johnston et al. 2007). In the project area, the ashcap layer is variable, mainly occurring in protected concavities.

[23] meaning that they consist of greater than 35 percent coarse fragments
[24] meaning they are dominated by flat fragments up to 6 inches in diameter.

Table 124. Soil characteristics and limitations for the Stonewall Vegetation project units

Soil Classification	Mus*	Parent Material	Surface Texture	Slope Range	Limitations	Acres
Typic Cryoboralfs	12A	Glacial Till	Stony Loam	10-25%	Wet Soils	1,103
Typic Cryoboralfs	13A	Glacial Till from Basalt and Metasedimentary rock	Cobbly Loam	10-25%	Wet Soils	477
Typic and Mollic Cryoboralfs	49	Metasedimentary	Cobbly Loam	25-50%	None	2,353
Argic Cryoborolls	49A	Metasedimentary	Loam	10-40%	None	11
Typic Cryoboralfs/Typic Cryochrepts Complex	49B	Metasedimentary	Channery Loam	40-60%	Volcanic Ashcap	2,371
Typic Cryochrepts	59	Metasedimentary	Channery Silt Loam	10-40%	Volcanic Ashcap	517
Andic Cryochrepts	59A	Metasedimentary	Loam	10-40%	Volcanic Ashcap	124
Typic Cryumbrepts	69	Metasedimentary, Granitics, and Basalt	Sandy Loam	10-40%	None	60
Typic Cryochrepts	79	Metasedimentary	Channery Loam	40-60%	Volcanic Ashcap	119
Cirqueland	80	Metasedimentary	Bedrock	40-60%+	None	236
Typic Ustochrepts	87	Metasedimentary and Basalt	Channery Loam	60-90%	None	512
Andic Cryochrepts	90	Metasedimentary and Basalt	Mixed Loess	60-90%	Volcanic Ashcap	458
Typic Cryochrepts/Typic Cryoboralfs Complex	790	Glacial Till and Metasedimentary Rock	Loam	25-40%	Volcanic Ashcap	172
Andic Cryochrepts/Rock Outcrop Complex	791	Glacial Till and Metasedimentary Rock	Loam	25-40%	Volcanic Ashcap	50

* Map Unit Symbol

The project area for the Stonewall Vegetation Project has a lengthy history of land management. There are active mining claims as well as signs of past mining, grazing, and timber harvest. The flatter portions of the project area have an existing network of skid trails and roads. The area borders private land on the south and southwest, making it easily accessible for dispersed uses such as camping and firewood gathering. Effects of past management activities for the project area were determined during field surveys. For a complete history of past management activities see appendix B.

In order to better formulate an existing condition that takes into account past management activities, indicators of soil quality were drawn from the North American Long-Term-Soil Quality Research Program (LTSP). The LTSP is a Forest Service program developed to meet the objectives of the National Forest Management Act (NMFA) to maintain forest productivity. The two main soil quality properties most influenced by timber extraction and indicative of soil (and forest) productivity are soil organic matter and soil porosity (Powers et al. 1998).

Soil Organic Matter

Soil organic matter (SOM) is one of the most important portions of the soil resource. Soil organic matter is crucial for water holding capacity in the soil. Although the project area receives a high amount of precipitation relative to other areas in western Montana, well-drained soils tend to dry early in the season and limit vegetation growth and soil biological activity. Soil organic matter functions similarly to the ashcap soils as it holds water longer and extends the growing season. Other important physical properties of SOM include aeration, drainage, and cation exchange (Jurgensen et al. 1997).

Soil organic matter is where most of the biological activity takes place; hence the "living" portion of the soil. This portion of the soil contains most of the essential nutrients and carbon stores. Soil organic matter accumulates over decades as plant material (leaf litter and woody debris) falls to the ground and decomposes, eventually forming humus and mixing with the mineral portion of the soils (Jurgensen et al. 1997). Page-Dumroese and Jurgensen (2006) noted that soils in Idaho and Montana have much higher percentages of their nutrient capacity in the SOM of the forest floor and topsoil.

These processes have a direct effect on site productivity, sustainability, and soil quality. Organic matter is the one main component of the soil resource that can be effectively managed to enhance soil quality. Maintaining, and where lacking, increasing SOM levels is critical for sustaining forest health and productivity (Jurgensen et al. 1997). Forest floor organic material includes undecomposed litter and more decomposed duff as well as woody material in various stages of decomposition.

Table 125, contains key soil parameters identified for units during field surveys. Total average depth of organic material (litter and duff) in the project units is included in table 125. Organic material depth ranges from 1 to 7 cm, with the majority of the units (36) having less than 3 cm of organic material. Most sites have a thicker layer of litter with little duff accumulation. Duff is the more desirable organic component in the complex humic material that supports cation exchange capacity and water holding capacity. The thin organic layer in the Stonewall Project area is likely due to the cold nature of the soils and slow decomposition rate as well as removal of the litter/duff layer due to people and activities in the area.

Coarse Woody Debris[25]

Coarse woody debris (CWD) is indicative of soil quality and resiliency. Physically, CWD protects exposed mineral soil from erosion and protects seedlings from grazing (Graham et al, 1994). Coarse woody debris also provides shade and when CWD decay has advanced, it can hold large amounts of water, making it important for dry season vegetation growth (Harvey et al. 1987).

From a chemical perspective, CWD releases several nutrients when it decays or burns, including sulphur, phosphorus, and nitrogen. This is especially true during advanced stages of decay (Graham et al. 1994). Coarse woody debris functions as a site for non-symbiotic nitrogen fixation in the absence of other nitrogen fixing plants (Jurgensen et al. 1997).

The soil biological environment is also enhanced by CWD. During advanced stages of decay, humus and woody material act as a site for the formation of ectomycorrhizal root tips. Ectomycorrhizae help woody plants take up water and nutrients and their fruiting bodies are crucial in the food chains of small rodents and predators (Graham et al. 1994).

The recommended amount of CWD for the project area is 5 to 20 tons per acre, outlined from Brown et al. (2003) and Graham et al. (1994) for maintaining soil quality while minimizing fuel hazards. Coarse

[25] generally defined as any woody residue larger than 3 inches in diameter (Graham et al. 1994)

woody debris amounts vary by unit in the project area (table 125). There are pockets with well over 100 tons per acre because of fallen trees killed by beetles

In spite of the benefits of CWD to soil quality, too much can degrade soil quality to an extent. As stated earlier, coarse woody debris is a crucial source of soil nutrients and biological activity, particularly in advanced stages of decay. Therefore, when CWD begins to accumulate in the absence of fire, nutrients begin to accumulate in CWD and are no longer available for plant uptake and soil biological activity (Hart et al. 2005). This is likely the case in some of the areas with higher amounts of CWD.

Ground Cover

Ground cover percentages for Stonewall units are in table 125 Soils in the project units should have a very small percentage of ground cover in the form of bare soil. The only naturally occurring bare soil should be associated with tip-up mounds in windthrow areas or recent wildfire areas. As established above, organic ground cover (CWD and litter) is a hotbed for biological activity. Bare soil is generally much less productive and in the project area is indicative of impaired soil conditions. As displayed in table 125, there are a few units with high percentages of bare soil but most are in the 0-5 percent range. Units 14 and 15 seem anomalous with the high percentages of bare soil (36 and 32 percent, respectively). However, both of these units, along with units 12 and 13 have piles of bare soil from past mining activity.

The remaining units have mixed distributions of wood, litter, and vegetation. As established previously, soil wood and litter are important for soil quality. If, however, the balance of these components as compared to the vegetative component begins to shift, there is a condition as described above where the majority of the plant-available nutrients are “locked up” in the litter and wood component and not available for vegetation uptake and cycling back into the soil system. This is obviously the case in units 26, 35, 63, and 65 and likely the case in units 1, 17, 19, 22, 32-34, 52-54, and 59.

Soil Porosity

Soil porosity is another important indicator of soil quality and the other main property addressed in the LTSP study. Soil porosity is directly affected by soil compaction and is primarily a physical change in the soil that directly affects soil chemical and biological properties.

Soil compaction occurs as a result of applied load, vibration, and pressure from equipment used for harvest activities and site preparation. Soil compaction breaks down surface aggregates, which leads to a decrease in macropore space with an increase in micropore space and volumetrically more soil as compared to air. This creates an increased bulk density (BD) and resistance to penetration in the soil (Gomez et al. 2002). This decrease in soil macropores can impede root penetration, water infiltration, and gas and nutrient exchange (Quesnel and Curran 2000). All of this in turn has the potential to decrease tree regeneration and growth.

Another effect of increased soil bulk density and decreased water infiltration rates is the potential to alter watershed hydrology and increase soil erosion rates. This occurs primarily because decreased water infiltration causes soils to become saturated much quicker and leads to increases in overland flow, which increases erosion and runoff in a watershed. Primary skid trails and landings show the most extensive and longest lasting of these effects. Working on frozen or dry ground helps soils resist increases in bulk density. Activities on wet soils are the most damaging, as the soil aggregates are more susceptible to compaction. The three primary field measurements taken to assess levels of soil porosity changes and resiliency to compaction are detrimental disturbance, texture, and percent coarse fragments.

The Region 1 technical guide for soil detrimental disturbance analysis (USDA Forest Service 2009) states, *“…new activities would be designed so that they do not create detrimental soil disturbance (DSD)*

on more than 15% of an activity area (R1 Supplement to FSM 2554.03). In other words, existing DSD plus the DSD predicted for proposed activities would not exceed 15% of a given activity area. In areas where more than 15% DSD exists from prior activities, the cumulative detrimental effects should not exceed the conditions prior to the planned activity and should move toward a net improvement in soil quality." This therefore sets the threshold value for DSD at 15 percent.

Existing detrimental soil disturbance for the field-surveyed units is in table 125 that follows. As can be seen, there is a variety of results. Units 12-15 had relatively high DSD results due primarily to the presence of previous mining activity in the units. With the exception of those four units, DSD was primarily associated with skid trails and landings from previous harvests.

Soils in the project area are fine-textured with high percentages of clay throughout (table 125). Although these soils also have high percentage of coarse textured sand, the clay portion can be highly compactable and sensitive to ground-based equipment, especially when wet. The percent coarse fragments column in table 125 displays a measure of rock content in the top 6 inches of mineral soil. Rock content is another indicator of the susceptibility of soil to compaction. Soils with over 35 percent coarse fragments are generally more resilient to compaction. Surveyed soils in the project area range from 13 to 70 percent coarse fragments. Only four units have less than 20 percent coarse fragments, which illustrates that most are fairly resilient. Regardless of the physical characteristics, moisture is an equally important factor in soil compaction. Dry soils are much less likely to compact than wet soils. Even soils with high rock content would compact when wet.

Table 125. Current conditions by unit in the Stonewall Vegetation Project

Unit	CWD (T/A)	Depth of Organic (cm)	Ground Cover Percentage					Current Detrimental Disturbance	Texture	Percent Coarse Fragments
			Bare Soil	Rock	Wood	Litter	Vegetation			
1	6	6	0	2	13	62	23	19	fi sa cl lo	15
3	0	3	2	0	2	3	94	6	sa cl	13
4	0	3	2	0	2	3	94	6	sa cl	13
5	13	3	3	3	10	13	70	3	cl lo	15
6	2	4	3	3	16	38	41	0	sa cl lo	30
7	2	4	3	3	16	38	41	0	sa cl lo	30
8	14	4	3	0	6	25	66	3	sa cl lo	36
9	12	6	0	0	7	27	67	0	sa cl lo	37
10	7	2	0	0	7	27	67	0	fi sa cl	43
11	4	3	0	0	2	30	68	8	cl lo	21
12*	3	3	7	2	2	53	37	18	sa cl lo	33
13*	9	3	4	0	0	35	61	7	sa cl lo	25
14*	0	1	36	0	0	15	49	30	sa cl	70
15*	4	2	32	13	2	42	12	22	sa cl	61
17	4	4	0	0	0	62	38	0	sa cl lo	33
18	0	2	0	2	0	7	92	5	sa cl	43
19	4	3	0	0	3	73	23	0	sa cl	38
20	12	3	0	0	0	27	73	2	sa cl	40
21	0	2	0	0	0	12	88	3	sa cl	33
22	13	4	3	3	13	49	31	0	sa cl lo	28

Unit	CWD (T/A)	Depth of Organic (cm)	Ground Cover Percentage					Current Detrimental Disturbance	Texture	Percent Coarse Fragments
			Bare Soil	Rock	Wood	Litter	Vegetation			
23	5	5	0	0	10	17	73	0	sa cl lo	36
24	7	3	3	3	7	10	77	0	sa cl	35
25	15	5	0	0	20	27	53	0	sa cl lo	33
26	6	5	4	0	9	67	20	0	sa cl lo	33
27	7	3	3	3	10	17	67	0	sa cl lo	30
28	5	5	0	0	20	13	67	0	sa cl lo	25
29	5	4	0	0	7	17	77	10	sa cl lo	34
30	9	3	2	0	4	20	73	0	cl lo	28
31	9	3	2	0	4	20	73	0	cl lo	28
32	6	3	5	5	7	56	28	0	sa cl lo	38
33	10	5	0	0	16	44	39	2	sa cl lo	41
34	13	6	0	0	30	40	30	0	sa cl lo	48
35	7	7	0	0	23	63	13	0	sa cl lo	31
36	18	5	3	0	3	20	73	0	sa cl lo	40
37	16	4	2	0	8	20	70	2	sa cl lo	32
38	16	4	2	0	8	20	70	2	sa cl lo	32
39	9	4	0	0	0	23	77	0	sa cl lo	38
40	18	3	0	0	10	35	55	2	cl sa	39
41	6	3	0	0	3	38	58	8	sa cl lo	51
42	12	3	2	0	2	37	60	2	sa cl	48
43	7	3	2	0	3	43	52	10	sa cl	45
44	6	1	0	0	0	43	57	0	sa cl lo	45
45	3	2	0	0	0	37	63	0	sa cl lo	48
46	3	3	1	0	1	27	71	13	sa cl lo	45
47	3	2	0	2	3	30	65	12	sa cl	41
48	0	3	2	2	0	22	75	12	sa cl	70
49	0	3	0	0	2	21	77	11	fi sa cl lo	28
51	0	2	2	0	0	15	83	15	sa cl	39
52	18	3	4	0	10	62	24	6	sa cl lo	24
53	17	7	0	0	27	40	33	10	sa cl lo	43
54	10	5	0	0	16	44	39	2	sa cl lo	41
55	25	3	3	0	10	13	73	0	sa cl lo	37
56	25	3	3	0	10	13	73	0	sa cl lo	37
59	1	3	7	0	3	57	33	27	sa cl lo	46
62	2	2	5	2	3	8	82	10	sa cl	33
63	0	2	5	0	0	75	20	10	sa cl	25
65	2	4	5	5	8	75	8	25	sa cl lo	34
72	0	4	0	0	0	15	85	12	sa cl lo	40
74	42	3	6	3	26	11	54	0	sa cl lo	29

*Units with past mining activity.

Summary of Current Conditions

The project area has a long management history that includes mining, grazing, and timber harvesting, which contributed to past ground disturbing activities that lead to the current conditions. The amount of detrimental soil disturbance in the units is mixed, but primarily is the result of past log landings and skid trails with the exception of four units that have residual effects from mining. The soils in the project area are generally coarse textured and resilient to compaction and erosion if operations take place during dry or frozen conditions. Ground cover is generally high in the project area and trending toward recovery where a thin organic layer exists. Coarse woody debris levels also vary across units but are mostly within forest standards. There are multiple areas and units where large amounts of CWD signal a build-up of "locked-up" nutrients that are not plant or soil available.

Environmental Consequences

Alternative 1 – No Action

No additional impacts to soil quality would occur. Existing areas with reduced soil quality would continue to recover through natural means (organic matter accumulation, freeze/thaw cycles, root penetration, etc.). There would be a gradual trend toward increased soil quality in units that currently have high detrimental disturbance. Coarse woody debris would slowly accumulate as stands age and begin to die. There would be no cumulative effects.

Direct Effects Common to Alternatives 2 and 3

For the action alternatives (alternatives 2 and 3), the same types of management activities are proposed (table 126). The measurable differences in alternatives are the extent and area of treatment. This section describes each of the proposed activities and the effects to the soil resource. The extent and mitigation measures specific to each alternative is further explained below.

Table 126. Acres of treatment and road miles for each action alternative

Treatments And Road Miles	Alternative 2 (Proposed Action) Acres	Alternative 3 Acres
Hand Treatments	6,541	5,001
Skyline Vegetation Treatments	663	364
Ground-based Vegetation Treatments	1,359	1,198
Total	**8,563**	**6,564**
Broadcast Burn	127	110
Burn Piles	146	94
Jackpot Burn	300	504
Low Severity Fire	449	326
Mixed Severity Fire	5,014	3,302
Site Prep Burn	180	171
Underburn	1,825	1,648
Total	**8,040**	**6,155**
Roads that would be built and then obliterated immediately following timber removal (miles)	2.6	0.4
Road Maintenance (miles)	45.6	43.8
Total	**48.2**	**44.2**

Ground-Based Vegetation Treatments

Ground-based harvesting includes conventional log skidders and feller-bunchers. Log skidders follow designated skidding routes, while the feller-bunchers operate across the unit area. The force from log-loaded machines can compact and displace soil, reducing soil aeration and infiltration capacity. Proper layout of the skid trail pattern can concentrate these impacts and keep detrimental disturbance within allowable limits (15 percent of each unit).

The planned ground-based harvest operation in Stonewall would follow old skid trails, resulting in an overlap of disturbance. The effects are therefore not necessarily additive. There is little data on the extent of overlap between new operations on old disturbance.

For comparison purposes, past monitoring on the Klamath National Forest showed that 69 percent of new skid trails reuse old skid trails (Laurent 2009). It was further assumed that main skid trails disturbed 10 percent of each unit. The assumption was made that 69 percent of the 10 percent (or 7 percent of each unit) would occur on pre-existing skid trails. Therefore, the assumption from this monitoring is that there would be 3 percent new detrimental disturbance added to the current amount from primary skid trails for units with existing skid trail networks.

The Flathead National Forest had a similar monitoring effort where they measured DSD before and after treatments. The results were mixed, with one unit showing less than 1 percent increase in DSD and another showing 5 percent increase (Archer 2011, personal communication). The average was 3 percent, just as in the Klamath National Forest monitoring.

The Helena National Forest has monitored and assumes that for summer tractor harvesting, there is 9 percent DSD from skid trails (Marr 2011b, personal communication). There has not been an attempt to quantify the additive effects of skid trails versus reuse of old skid trails on the Helena National Forest.

Regardless of the amount, it follows that current DSD is primarily from old skid trails and landings. When a unit has a high existing DSD percentage, there is more of an opportunity to reuse existing skid trails and therefore reduce the additive soil disturbance from the proposed operations. There is negative correlation between existing detrimental disturbance and the amount added to a unit following ground-based treatments. For example, ground-based harvest on an area with no prior mechanical harvest entry would result in 9 percent DSD. However, an area with 25 percent existing detrimental disturbance prior to ground-based harvest could conceivably result in no additional detrimental disturbance because all of the new skid trails are placed on old skid trails. For the current analysis, it was assumed that units with greater than 10 percent DSD would result in an additional 3 percent increase from primary skid trails.

Some compaction would occur in areas outside of main skid trails where machinery makes one or two passes but this increased compaction would not exceed threshold values as documented by Powers (2002). It is possible that in some of the units the combined current detrimental disturbance and projected detrimental disturbance from the activities would exceed 15 percent. These units are disclosed in the section that applies to the individual alternative. Rehabilitation of these units would include subsoiling and placing slash on areas with detrimental disturbance. If subsoiling is required, it would be done under dry soil conditions (dry down to 24 inches) with winged rippers to a depth of at least 18 inches.

Landings

Landings are central processing zones that are essential for logging operations. Landings are approximately 0.25 acre to 0.33 acre in size but are generally larger when accommodating whole-tree yarding. Existing landings would be reused where possible. Landings can produce erosion and sediment if not properly designed and maintained. Project design features provide for sufficient erosion control.

Monitoring on the Helena National Forest validates these assumptions and has found landings to average 0.25 acre in size and add 2.5 percent DSD to ground based operations (Marr 2011b, personal communication).

Skyline Vegetation Treatments

Cable harvesting would cause small amounts of soil displacement in the yarding corridors from dragging logs. The cable corridor can vary from 6 to 8 feet wide and would have an area in the center of the corridor that is down cut 9 to 12 inches. The spatial area in yarding corridors has been measured as varying between 3 and 8 percent depending upon the size of trees (Klock 1975). In accordance with monitoring on the Helena National Forest (Marr 2011b, personal communication), it is assumed that 5 percent additional disturbance would occur from cable logging corridors in the Stonewall project area. Skyline harvests do not include the addition of landings, as these are located on National Forest System roads in these units.

Hand Vegetation Treatments

Hand thinning and piling slash would maintain sufficient fine soil cover and would not cause additional ground disturbance.

Prescribed Burning

The risk from prescribed burning is that fire has the potential to create erosion possibilities by removing soil cover and the forest floor, both critical for soil functions. In low severity fire-treated areas, there would be enough forest floor retained to minimize any negative effects. Moderate burn prescriptions would be more severe but the mosaic nature of these burns should create a situation where there are firebreaks sufficient to reduce the erosion potential.

Burning should have a net positive impact by increasing the availability of nutrients for the soil and understory, thereby increasing forest productivity. Revegetation in forest openings would depend upon the seed source and remnant plant communities.

Using low and moderate severity fire would increase the available nutrient base for forest productivity based on studies in the Rocky Mountains (Gundale et al. 2005, DeLuca et al. 2006). The mosaic burn pattern would also ensure soil cover for moisture retention. Short-term nutrient flushes should occur for up to 3 years depending on the burn severity, with long-term nitrate increases up to 50 years (Deluca et al. 2006). Charcoal as a byproduct of fire, becomes functionally important as a stabilizer for soil chemistry against alkaloids that may impair soil nutrient processes, and as a soil conditioner for added water holding capacity and cation exchange sites (Deluca and Aplet 2008). Charcoal would also increase Nitrogen availability (Ball et al. 2010).

In reference to DSD, it is expected that for low severity prescriptions (including underburning), less than 2 percent would be severely burned and result in detrimental soil conditions from loss of groundcover. For the mixed or moderate burn severity prescriptions (including broadcast burns), it is anticipated there would be more severely burned area and hence 10 percent detrimentally disturbed soils (Marr 2011a).

Prescribed Pile Burning

Burning slash piles can have long-lasting negative, soil effects through direct consumption of soil ground cover, and removal of seed sources for revegetation. An indirect effect of pile burning is the potential for introducing invasive plants once native seed sources are removed. These effects are localized, and limited to areas where the slash piles are placed. This includes jackpot burning as these types of burns typically have similar effects as pile burning. Monitoring on the Helena National Forest found that these burns

affect less than 5 percent of units analyzed (USDA Forest Service 2005). It is assumed that units where pile and jackpot burns are prescribed would have 5 percent DSD resulting from these activities.

Coarse Woody Debris

Across all activities, coarse woody debris levels, as recommended previously, would be retained at 5-20 tons per acre or additional CWD would be left on site to meet these requirements. The prescribed underburning units were not surveyed for CWD. However, these higher elevation areas do not have an extensive management history and it is unlikely they are lacking in CWD. The underburning as described would create pockets of dead trees and some bare soil. This would provide recruitment for downed CWD on these openings in the long term.

Road Construction

Construction of roads that would be built and then obliterated immediately following timber removal creates detrimental soil disturbance by bulldozing the surface layer aside and exposing non-productive subsoil layers. Roads that would be built and then obliterated immediately following timber removal are assumed to be 25 feet wide. On flat to gentle slopes, soil disturbance can be minimal to shallow cuts (0.5 to 2 feet). On steeper slopes where cut and fill techniques are required, cuts can be 4 to 8 feet high. The fill material is deposited on top of the existing soil, thereby increasing soil depth, which in turn increases soil water holding capacity. Soil organic materials are also incorporated into the soil. Increased water holding capacity and organic matter has a positive effect on site productivity. The increased soil quality does not equal the soil quality lost in the cut portion of the road.

The road surface is compacted by equipment travel during the construction process as well as from log truck travel on the road. Building proposed roads built and then obliterated immediately following timber removal results in short-term degradation of soil hydrology and long-term reduction in soil biological function. Obliteration and reclamation efforts improve soil hydrologic function over leaving roads in place. For the short term, reclamation improves soil infiltration adequately to address erosion potential, though reclaimed soil would have infiltration rates lower than natural forest rates (Luce 1997; Foltz and Maillard 2003). For the long term, infiltration rates improve over time as freeze/thaw and plant roots improve soil porosity, though rates would likely remain lower than adjacent natural forest soil (Switalski et al. 2004). Soil biological function restores as forest floor and native plant communities return.

Indirect Effects Common to Alternatives 2 and 3

Noxious Weeds

An important indirect effect from harvest operations is the potential to spread and introduce noxious weeds. See the Noxious Weed section for a detailed list of weeds found in the area and their current range. Noxious weeds can have a detrimental effect on soil quality through competition for resources such as space, light, water, and nutrients; and through allelopathy.[26] Allelopathic weed species exude chemicals that can have a negative effect on native plant species. Canada thistle, spotted knapweed, and leafy spurge are known to be allelopathic (Foy and Inderjit 2001).

Though the potential exists for adverse impacts to soil quality because of noxious weeds infestation, the actual impact to long-term soil quality is minimal. Project design features would help to reduce the spread of noxious weeds. Units treated in the winter would help to reduce the spread of noxious weeds because weeds are dormant at this time decreasing the transport of viable seeds.

[26] Allelopathy is defined as “chemical interactions among and between plants that do not include positive effects” (Foy and Inderjit 2001).

Soil Erosion

Proposed activities for the action alternatives have the potential to expose mineral soil to overland flow and subsequent erosion. Potential erosion because of project implementation was modeled using Disturbed WEPP. The accuracy of all Disturbed WEPP predictions is plus or minus 50 percent (Elliot et al. 2000). WEPP is most appropriately used to compare alternatives. We selected Units 13, 23, and 84 for modeling because their location on soils with a high erosion hazard and long and sustained slopes represents each of the treatment types (tractor-13, skyline-23, and burn-84). These three units therefore represent the worst-case scenario for erosion potential.

We extrapolated inputs for WEPP modeling from the assumptions in the direct effects above. Specifically, it was assumed that conventional tractor harvesting would result in 12 percent decrease in ground cover, accounting for the detrimental disturbance percentage, moderate intensity prescribed burning would have a 10 percent decrease in ground cover, etc. Other WEPP inputs were gradient, slope length, soil texture, and rock percentage. These were estimated from Geographical Information Systems (GIS) data and soil mapping. All vegetation inputs were mature forest with the exception of the prescribed burning unit being low severity fire.

Table 127 demonstrates that the probability of erosion in the first year following harvest is 3percent for all units across all alternatives. There was no distinction made between alternatives 2 and 3 because they have the same prescriptions for the three units analyzed. The soil quality standards state that the tolerable soil loss rate is generally less than 1 to 2 tons per acre per year (USDA Forest Service 1999). None of the predicted erosion rates here exceeds these soil quality standards. These WEPP results do not take into account PDFs intended to reduce erosion potential. Therefore, it is unlikely that erosion would be an issue from either action alternative.

Table 127. WEPP modeling results for the Stonewall Project, erosion and sedimentation

ALTERNATIVE	UNIT	DRAINAGE	PROBABILITY OF EROSION‡	PROBABILITY OF SEDIMENTATION‡	AVERAGE EROSION RATE (TONS/ACRE)*	30-YEAR EROSION RATE (TONS/ACRE)**
No Action	13	Lincoln Gulch	3%	3%	0	0.134
Action	13	Lincoln Gulch	3%	3%	0.09	0.946
No Action	23	Lincoln Gulch	3%	3%	0	0.037
Action	23	Lincoln Gulch	3%	3%	0.03	0.746
No Action	84	Theodore Creek	3%	3%	0.01	0.359
Action	84	Theodore Creek	3%	3%	0.03	0.577

‡The probability of erosion or sedimentation for the no action alternative is the probability of erosion or sedimentation in any given year. For the proposed action, it is the probability of erosion or sedimentation the first year following harvest.

*There is an equal probability that the erosion rate could be greater than or less than the average value.

** The 30-year erosion rate represents the amount of erosion anticipated if there were a 30-year rainfall following implementation.

Cumulative Effects Common to Alternatives 2 and 3

Cumulative effects are activities that overlap spatially and temporally within the activity area. For the soils analysis, the unit is the activity area analyzed for cumulative effects (as defined in Forest Service Manual 2500, Supplement number 2500-99-1). Therefore, activities analyzed here would take place inside of units.

The cumulative effects for alternative 2 (the proposed action) and alternative 3 are included in appendix C and includes the cumulative effects of all the previously discussed direct effects in this section. The

detrimental disturbance analysis takes into account all proposed activities within a unit in the same fashion as a cumulative effects analysis. In the detrimental disturbance analysis, the spatial distribution of proposed activities and current conditions was taken into account.

Typical road maintenance and upgrading may have cumulative effects. This includes replacing and adding drainage structures, blading the road surface, brushing the sides of the roads, and placing additional surface material. This generally increases drainage and can decrease erosion off the road surface due to decreased overland flow. Road maintenance is ongoing and would extend beyond the life of this project. This project does not propose to change any road classifications but would utilize existing stored roads for access and vegetation removal. Roads that would be built and then obliterated immediately following timber removal are taken into account with the vegetation treatments. For more detail on the cumulative effects of roads, see the Hydrology Report (McNamara 2012).

There are no proposed changes to recreation management from the current project. There is currently motorized use that would continue throughout the project area. There is the potential to increase illegal off-road motorized use because forest stands would be opened up following the proposed activities. This is covered in more detail in the Recreation Report (Valentine 2012b).

Other recreational activities such as gathering of forest products, hunting, and hiking are likely to continue as they currently are. Effects from these activities are taken into account in the current conditions.

Recovery Rates

The expected recovery rates for proposed activities in the action alternatives are included in table 128. We based these estimates on a combination of published literature, monitoring reports from adjacent forests, field observations, and professional judgment. Recovery of roads that would be built and then obliterated immediately following timber removal is anticipated to be similar to summer tractor harvesting. Recovery depends upon the effectiveness of roots to penetrate compacted soil, leading to a return of porosity and drainage. Implementing the restoration project design features (PDF), described in would increase the recovery time for affected soils, particularly the placement of slash on heavily disturbed areas. Organic material amendments cannot be emphasized enough. In addition, contemporary timber harvest operations are less impactful than the historic operations monitored in the studies of table 128. It is therefore likely that recovery time from the proposed activities would be quicker than the best available science cited here.

Table 128. Expected recovery rates for proposed activities in the action alternatives

ACTIVITY	RECOVERY (YEARS)	REFERENCES
Summer Tractor Harvest	30−50	Froehlich et al. 1985; Bisbing et al. 2010
Winter Tractor Harvest	10−40	Lolo NF Monitoring (Archer 2008); Flathead NF Monitoring (Basko 2002)
Prescribed Burning	10	Auggie Soils Specialist Report (Archer 2009); Idaho Panhandle NF monitoring (Niehoff 2002)

Project Design Features

The Stonewall Vegetation Project has been designed with features that are intended to minimize or avoid potential adverse effects while meeting project objectives. In addition to the proposed action treatments described in this section, design features would be implemented where applicable. A description of the project design features relating to soil and other resources is displayed in table 9, chapter 2.

The specific design features listed under soil, watersheds and fisheries in table 9 pertaining to soil are S/WS/F-1 through S/WS/F-14.

This analysis is based on the implementation of all design features. Project design features apply to both action alternatives. Design features that are applicable to soil include not only those listed above, designed specifically to protect the soil, but also those designed to protect other resources such as water and fish.

Project Design Features and Restoration Effectiveness

Project design features and best management practices are effective at minimizing the amount of soil disturbance. For example, Han et al. (2006) found logging during dry months can reduce compaction effects in fine textured soils since soil strength is maximized when soil moisture is below field capacity. Harvesting when soils are dry also appears to limit the machinery impact to the wheel track (Williamson and Neilson 2000; Han et al. 2009).

On the Helena National Forest, soil quality monitoring results have previously demonstrated that conservation of soil resources has improved during implementation of forestry activities since adoption of BMPs in 1988. This is documented in the Helena National Forest Annual Monitoring Report Fiscal Year 2004 which reported: *"…forestry practices have generally become more effective in limiting the amount of area affected by detrimental soil disturbance to comply with the Forest Plan measure of soil variability (i.e. 20%) since adoption of forestry Best Management Practices (BMPs) in 1988. Six of the monitoring plots assessed areas harvested prior to adoption of BMPs in 1988. The mean value for aerial extent of moderate to severe soil disturbance on these 6 plots was 19%, and ranged from 8% to 26%. The remaining 4 monitoring plots assessed areas harvested after 1988 and adoption of BMPs. The mean value for aerial extent of moderate to severe soil disturbance on these 4 plots was 13%, and ranged from 5% to 17%"* (USDA Forest Service 2007, p. 80).

Key findings from additional BMP monitoring (USDA Forest Service 2003) for harvest units in the Maudlow-Toston sale area include:

- Adequate amounts of coarse woody material were retained in harvest units, as recommended by researchers (Graham et al. 1994).
- Region 1 soil quality standards (USDA Forest Service 1999) for limiting detrimental soil disturbance, such as compaction and displacement, were met in helicopter, skyline cable (both summer and winter logging), and winter tractor logging units.
- Roads that would be built and then obliterated immediately following timber removal and log landings have been successfully recontoured, with adequate amounts of woody material scattered across reclaimed areas, and then seeded.

The State of Montana and other land managers monitor the implementation and effectiveness of Montana Forestry BMPs within recent forest management activities. This effort is known as BMP Auditing. Results are provided in an annual report. The Montana State Audit found that *"across all ownerships, BMPs were*

properly applied 93% of the time and overall effectiveness of the implementation was 97%" (Montana DNRC 2006).

The effectiveness of soil rehabilitation treatments may be low, improving soil conditions by 30-50 percent (Luce 1997; Foltz and Maillard 2003). This implies that erosion control work is effective, and soil compaction has been alleviated; but biological and other physical soil processes are not returned to background levels. For roads built and then obliterated immediately following timber removal rehabilitation, or where slash is left on the skid trail, 50 percent effectiveness has been used. This acknowledges that biological and physical properties are improved beyond doing no restoration but not to background levels.

Application of slash and other organic materials on skid trails, burn piles, skyline corridors, and log landings helps restore areas denude of vegetation and topsoil to more natural conditions. These additional organic inputs aid biological processes and accelerate recovery. Road decommissioning research (Switalski et al. 2004; Kolka and Smidt 2004) is cited here for effectiveness of these practices. The added slash and other organic materials provide the benefits such as enhanced microbial activity, increased water holding capacity, and erosion control.

British Columbian monitoring of soil restoration showed that standard techniques such as those proposed in (decompacting, placing slash and duff, and seeding) can be effective in re-establishing vegetation and therefore alleviating negative soil effects (Bulmer 1997).

Alternative 2 – Proposed Action

Project Design Features

The Stonewall Vegetation Project has been designed with features that are intended to minimize or avoid potential adverse effects while meeting project objectives. In addition to the proposed action treatments described in this section, design features would be implemented where applicable. A description of the project design features relating to soil and other resources is displayed in table 9, chapter 2.

The specific design features listed under soil, watersheds and fisheries in table 9 pertaining to soil are S/WS/F-1 through S/WS/F-14.

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plots assessed areas harvested prior to adoption of BMPs in 1988. The mean value for aerial extent of moderate to severe soil disturbance on these 6 plots was 19%, and ranged from 8% to 26%. The remaining 4 monitoring plots assessed areas harvested after 1988 and adoption of BMPs. The mean value for aerial extent of moderate to severe soil disturbance on these 4 plots was 13%, and ranged from 5% to 17%" (USDA Forest Service 2007, p. 80).

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- Region 1 soil quality standards (USDA Forest Service 1999) for limiting detrimental soil disturbance, such as compaction and displacement, were met in helicopter, skyline cable (both summer and winter logging), and winter tractor logging units.
- Roads that would be built and then obliterated immediately following timber removal and log landings have been successfully recontoured, with adequate amounts of woody material scattered across reclaimed areas, and then seeded.

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This document details the primary effects from the proposed treatments. As stated earlier, the effects from each of the action alternatives are essentially the same with the exception of the degree of activities in each of the alternatives. As can be seen in table 126 alternative 2 proposes more overall treatment acres and more road miles utilized than alternative 3. Alternative 2 would have long- and short-term direct and indirect negative effects on forest soil quality. However, the project would meet the Region 1 Soil Quality Standards by implementing the project design features and restoration measures and help reduce negative impacts to soils.Anticipated detrimental disturbance for the proposed action by unit is shown in table 129. All units are expected to meet Region 1 Soil Quality Standards.

Table 129. Projected detrimental soil disturbance for the proposed action in the Stonewall Project

UNIT	ACRES	TREATMENT	CURRENT % DETRIMENTAL DISTURBANCE	PROJECTED % DETRIMENTAL DISTURBANCE FROM TREATMENTS	DETRIMENTAL DISTURBANCE % AFTER TREATMENTS	DETRIMENTAL DISTURBANCE % AFTER RESTORATION‡	ACTIONS TO MEET SOIL STANDARDS
1	96	SWD/SPB	19	8.1	27.1	17.0	Restoration/WL
2	146	LSF/<5ac	N/A	2.0	2.0		None
3	37	PCT/HP/BP	6	5.0	11.0		None
4	7	S/S/HP/BP	6	8.0	14.0		WL
5	18	S/S/HP/BP	3	8.0	11.0		WL
6	14	Imp Cut/UB	0	9.0	9.0		None
7	17	Imp Cut/UB	0	9.0	9.0		None
8	62	Imp Cut/UB	3	9.0	12.0		None
9	18	ST/S/HP/BP	0	10.5	10.5		WL
10	18	CLC/UB	0	9.3	9.3		WL
11	23	SWD/UB	8	9.2	17.2	12.6	Restoration/WL
12	80	SWD/UB	18	7.5	25.5	15.8	Restoration/WL
13	41	ST/JB	7	10.5	17.5	12.3	Restoration/WL
14*	11	PCT/HP/BP	30	5.0	35.0	30.0*	Restoration
15*	15	Imp Cut/UB	22	6.5	28.5	22.0*	Restoration
16	3	PCT/HP/BP	N/A	5.0	5.0		None
17	38	CLC/JB	0	10.5	10.5		WL
18	21	PCT/HP/BP	5	5.0	10.0		None
19	15	CLC/JB	0	10.5	10.5		WL
20	32	ST/JB	2	11.4	13.4		WL
21	6	PCT/HP/BP	3	8.9	11.9		None
22	30	SWD/SPB	0	9.0	9.0		None
23	29	Imp Cut/UB	0	9.0	9.0		None
24	5	Imp Cut/UB	0	9.0	9.0		None
25	29	ST/BB	0	9.0	9.0		None

UNIT	ACRES	TREATMENT	CURRENT % DETRIMENTAL DISTURBANCE	PROJECTED % DETRIMENTAL DISTURBANCE FROM TREATMENTS	DETRIMENTAL DISTURBANCE % AFTER TREATMENTS	DETRIMENTAL DISTURBANCE % AFTER RESTORATION‡	ACTIONS TO MEET SOIL STANDARDS
26	65	Imp Cut/UB	0	9.0	9.0		None
27	31	CLC/SPB	0	9.0	9.0		None
28	22	Imp Cut/UB	0	10.0	10.0		WL
29	25	SWD/S/HP/B	10	12.0	22.0	10.0	Restoration/WL
30	14	Imp Cut/UB	0	11.1	11.1		None
31	16	Imp Cut/UB	0	11.1	11.1		None
32	45	Imp Cut/UB	0	15.1	15.1		None
33	17	Imp Cut/JB	2	12.0	14.0		None
34	12	SWD/JB	0	12.0	12.0		None
35	24	CLC/BB	0	9.0	9.0		None
36	20	CLC/BB	0	9.0	9.0		None
37	8	CLC/BB	2	9.0	11.0		None
38	7	CLC/BB	2	13.5	15.5	14.3	Rip Landings
39	42	ST/UB	0	9.9	9.9		None
40	11	ST/UB	2	13.5	15.5	14.3	Rip Landings
41	12	SWD/UB	7	6.5	13.5		None
42	65	ST/UB	2	13.5	15.5	14.3	Rip Landings
43	104	ST/UB	10	7.5	17.5	7.8	Restoration/WL
44	97	Imp Cut/UB	0	10.3	10.3		None
45	38	Imp Cut/UB	0	10.8	10.8		WL
46	251	Imp Cut/UB	13	7.5	20.5	10.8	Restoration/WL
47	220	Imp Cut/UB	12	7.5	19.5	9.8	Restoration/WL
48	141	PCT/UB	12	2.0	14.0		Handthin
49	49	PCT/UB/PVT	11	2.0	13.0		Handthin
50	49	PCT	N/A	0.0	0.0		None
51	193	PCT/UB/PVT	15	2.0	17.0	16.0	Restoration/Handthin
52	22	CLC/BB	6	9.0	15.0		None

UNIT	ACRES	TREATMENT	CURRENT % DETRIMENTAL DISTURBANCE	PROJECTED % DETRIMENTAL DISTURBANCE FROM TREATMENTS	DETRIMENTAL DISTURBANCE % AFTER TREATMENTS	DETRIMENTAL DISTURBANCE % AFTER RESTORATION‡	ACTIONS TO MEET SOIL STANDARDS
53	17	SWD/JB	10	12.0	22.0	16.0	Restoration
54	20	Imp Cut/JB	2	12.0	14.0		None
55	29	Imp Cut/UB	0	12.5	12.5		None
56	17	CLC/BB	0	9.0	9.0		None
57	93	SWD/JB	N/A	10.5	10.5		WL
58	15	SWD/JB	N/A	10.5	10.5		WL
59	16	PCT	27	0.0	27.0		Handthin
60	25	PCT	N/A	0.0	0.0		None
61	34	PCT	N/A	0.0	0.0		None
62	37	PCT	10	3.0	13.0		WL
63	17	PCT	10	3.0	13.0		WL
64	30	PCT	N/A	0.0	0.0		None
65	25	PCT	25	0.0	25.0		Handthin
66	26	PCT	N/A	0.0	0.0		None
67	20	PCT	N/A	0.0	0.0		None
68	15	PCT	N/A	0.0	0.0		None
69	31	PCT	N/A	0.0	0.0		None
70	39	PCT	N/A	0.0	0.0		None
71	40	PCT	N/A	0.0	0.0		None
72	85	PCT	12	0.0	12.0		Handthin
73	33	PCT	N/A	0.0	0.0		None
74	23	CLC/SPB	0	13.5	13.5		None
75	148	PCT/UB	N/A	2.0	2.0		None
76	123	LSF/<10ac	N/A	2.0	2.0		None
77	709	MSF/<30ac	N/A	10.0	10.0		None
78	38	LSF/<5ac	N/A	2.0	2.0		None
79	337	MSF/<30ac	N/A	10.0	10.0		None

UNIT	ACRES	TREATMENT	CURRENT % DETRIMENTAL DISTURBANCE	PROJECTED % DETRIMENTAL DISTURBANCE FROM TREATMENTS	DETRIMENTAL DISTURBANCE % AFTER TREATMENTS	DETRIMENTAL DISTURBANCE % AFTER RESTORATION‡	ACTIONS TO MEET SOIL STANDARDS
80	326	MSF/<20ac	N/A	10.0	10.0		None
81	629	MSF/<30ac	N/A	10.0	10.0		None
82	776	MSF/<75ac	N/A	10.0	10.0		None
83	457	MSF/<75ac	N/A	10.0	10.0		None
84	831	MSF/<30ac	N/A	10.0	10.0		None
85	143	LSF/<5ac	N/A	2.0	2.0		None
86	47	MSF/<10ac	N/A	10.0	10.0		None
87	36	MSF/<5ac	N/A	10.0	10.0		None
88	865	MSF/<30ac	N/A	10.0	10.0		None

‡This value includes restoration detailed in PDFs S/WS/F 9-13 above with the assumption that they have 50% effectiveness in soil restoration (Luce, 1997). These values also assume that units with high existing detrimental disturbance (10%+) have an increase in 3% detrimental disturbance from skid trails due to overlap.

*Final detrimental disturbance values are assuming higher overlap and restoration due to preponderance of mining disturbance.

WL=Winter Logging

CLC/BB=Clearcut with Reserves/Broadcast Burn, **CLC/JB**=Clearcut with Reserves/Jackpot Burn, **CLC/SPB**=Clearcut with Reserves/Site Prep Burn, **CLC/UB**=Clearcut with Reserves/Underburn, **Imp Cut/JB**=Improvement Cut/Jackpot Burn, **Imp Cut/UB**=Improvement Cut/Underburn, **LSF/<5ac**=Low Severity Fire, Openings <5 acres, **LSF/<10ac**=Low Severity Fire, Openings <10 acres, **MSF/<5ac**=Moderate Severity Fire, Openings < 5 acres, **MSF/<10ac**= Moderate Severity Fire, Openings < 10 acres, **MSF/<20ac**=Moderate Severity Fire, Openings <20 acres, **MSF/<30ac**=Moderate Severity Fire, Openings <30 acres, **MSF/<75ac**=Moderate Severity Fire, Openings <75 acres, **PCT**=Precommercial Thin, **PCT/HP/BP**=Precommercial Thin/Handpiling/Burn Piles, **PCT/UB**=Precommercial Thin/Underburn, **PCT/UB/PVT**=Precommercial Thin/Underburn or Slash along Private, **S/S/HP/BP**=Sanitation/Slashing/Handpiles/Burnpiles, **ST/BB**=Seedtree with Reserves/Broadcast Burn, **ST/JB**=Seedtree with Reserves/Jackpot burn, **ST/S/HP/BP**=Seedtree with Reserves/Slashing/Handpiles/Burnpiles, **ST/UB**=Seedtree with Reserves/Underburn, **SWD/JB**=Shelterwood (Group) with Reserves/Jackpot burn, **SWD/S/HP/B**=Shelterwood (Group) with Reserves/Slashing/Handpile/Burn, **SWD/SPB**=Shelterwood with Reserves/Site Prep Burn, **SWD/UB**=Shelterwood with Reserves/Underburn

Units 14 and 15 currently have high detrimental disturbance (30 and 22 percent, respectively). These two units showed signs of past mining activities and have some of the highest bare ground percentages (36 and 32, respectively) as well as low coarse woody debris tonnage (0 and 4). Using the calculations described above, these two units have the potential to have a higher detrimental disturbance after restoration than they do currently. Region 1 Soil Quality Standards state that, *"In areas where more than 15% DSD exists from prior activities, the cumulative detrimental effects should not exceed the conditions prior to the planned activity and should move toward a net improvement in soil quality"* (USDA Forest Service 2009).

In these two units, there is an ample amount of area previously disturbed. Based on professional experience, it is highly likely that the projected disturbance from the proposed action would take place on current detrimental disturbance. This disturbed ground would then be restored and there would be a net decrease in detrimental disturbance. Also, in terms of net improvement, these units would have CWD levels increase to at least 5 tons per acre, many areas with bare soil would be covered with valuable organic material in the form of slash, and introduction of fire would help cycle nutrients locked up in biomass into the soil. These actions would all show a net improvement in soil quality trends within these units and hence meet Region 1 Soil Quality Standards.

Units 51 and 53 are also above the 15 percent threshold using the calculations in table 129. Both of these units are projected to have 16 percent detrimental disturbance after restoration by the calculations above. It should be noted that this is within the accepted range (+/- 5 percent) of accuracy for these measures (Page-Dumroese et al. 2009). The main disturbance that would push these units to the threshold is prescribed burning. Based on professional experience, it is possible to implement the prescribed burning in these units without exceeding thresholds. We would monitor these units for soil conditions following harvest and before burning. A soil scientist would be consulted prior to burning to ensure that soil moisture is high enough to not create excessive detrimental effects.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The planned actions for the Stonewall Vegetation Project adhere to the Forest Plan for the Helena National Forest, and the soil quality guidelines for maintaining soil quality from Region 1 with the implementation of design features.

Summary of Alternative 2

Alternative 2 (proposed action) has the most proposed treatment acres. This alternative has the most acreage that would potentially be detrimentally disturbed. However, this alternative also has the most acreage proposed for prescribed fire. Based on research and professional experience, the positive effects of reintroducing fire, as described in the sections previous, far outweigh negative potential from disturbing a larger acreage of land.

Alternative 3

The primary effects from the proposed treatments are detailed in this document. As stated earlier, the effects from each of the action alternatives are essentially the same with the exception of the degree of activities in each of the alternatives. As can be seen in table 130, alternative 3 proposes fewer treatment acres and less road miles utilized overall.Alternative 3 would have long- and short-term direct and indirect negative effects on forest soil quality. However, the project would meet Region 1 Soil Quality Standards by implementing the project design features and restoration measures and help reduce negative impacts to soils. Anticipated detrimental disturbance for alternative 3 is shown by unit in the following table. All units are expected to meet Region 1 Soil Quality Standards.

Table 130. Projected detrimental soil disturbance for alternative 3 in the Stonewall Project

UNIT	ACRES	TREATMENT	CURRENT % DETRIMENTAL DISTURBANCE	PROJECTED % DETRIMENTAL DISTURBANCE FROM TREATMENTS	DETRIMENTAL DISTURBANCE % AFTER TREATMENTS	DETRIMENTAL DISTURBANCE % AFTER RESTORATION‡	ACTIONS TO MEET SOIL STANDARDS
1	96	SWD/SPB	19.0	8.1	27.1	17.0	Restoration/WL
2	146	LSF/<5ac		2.0	2.0		None
3	37	PCT/HP/BP	6.0	5.0	11.0		None
4	7	S/S/HP/BP	6.0	8.0	14.0		WL
5	18	S/S/HP/BP	3.0	10.5	13.5		WL
6	14	Imp Cut/UB	0.0	6.5	6.5		None
7	17	Imp Cut/UB	0.0	6.5	6.5		None
8	62	Imp Cut/UB	3.0	6.5	9.5		None
9	18	ST/S/HP/BP	0.0	10.5	10.5		WL
10	18	CLC/UB	0.0	9.3	9.3		WL
11	23	SWD/UB	8.0	9.2	17.2	12.6	Restoration/WL
12	80	SWD/UB	18.0	7.5	25.5	15.8	Restoration/WL
13	41	ST/JB	7.0	10.5	17.5	12.3	Restoration/WL
14*	11	PCT/HP/BP	30.0	5.0	35.0	30.0*	Restoration
15*	15	Imp Cut/UB	22.0	6.5	28.5	22.0*	Restoration
16	3	PCT/HP/BP		5.0	5.0		None
17a	38	UB	0.0	2.0	2.0		None
19a	15	UB	0.0	2.0	2.0		None
20a	24	UB	2.0	2.0	4.0		None
22a	22	SWD/SPB	0.0	6.5	6.5		None
23	29	Imp Cut/UB	0.0	6.5	6.5		None
24	5	Imp Cut/UB	0.0	6.5	6.5		None
25	29	ST/BB	0.0	6.5	6.5		None
27	31	CLC/SPB	0.0	6.5	6.5		None
28	22	Imp Cut/UB	0.0	13.5	13.5		None

UNIT	ACRES	TREATMENT	CURRENT % DETRIMENTAL DISTURBANCE	PROJECTED % DETRIMENTAL DISTURBANCE FROM TREATMENTS	DETRIMENTAL DISTURBANCE % AFTER TREATMENTS	DETRIMENTAL DISTURBANCE % AFTER RESTORATION‡	ACTIONS TO MEET SOIL STANDARDS
29a	25	UB	10.0	2.0	12.0		None
30a	14	UB	0.0	2.0	2.0		None
31a	16	UB	0.0	2.0	2.0		None
32a	45	UB	0.0	2.0	2.0		None
34	12	SWD/JB	2.0	9.5	11.5		None
35	24	CLC/BB	0.0	6.5	6.5		None
36	20	CLC/BB	0.0	6.5	6.5		None
37	8	CLC/BB	2.0	6.5	8.5		None
38	7	CLC/BB	2.0	13.5	15.5	14.3	Rip Landings
39	26	ST/UB	0.0	6.5	6.5		None
40	11	ST/UB	2.0	13.5	15.5	14.3	Rip Landings
41	12	SWD/UB	7.0	6.5	13.5		None
42	65	ST/UB	2.0	13.5	15.5	14.3	Rip Landings
43	104	ST/UB	10.0	7.5	17.5	13.8	Restoration/WL
44a	97	UB	0.0	2.0	2.0		None
45a	38	UB	0.0	2.0	2.0		None
46a	223	UB	13.0	2.0	15.0		None
46b	27	Imp Cut/UB	13.0	7.5	20.5	10.8	Restoration/WL
47a	180	UB	12.0	2.0	14.0		None
47b	9	Imp Cut/UB	12.0	7.5	19.5	9.8	Restoration/WL
47c	31	Imp Cut/UB	12.0	7.5	19.5	9.8	Restoration/WL
48	141	PCT/UB	12.0	2.0	14.0		Handthin
50	49	PCT		0.0	0.0		None
51	193	PCT/UB/PVT	15.0	2.0	17.0	16.0	Restoration/Handthin
52	22	CLC/BB	6.0	6.5	12.5		None
53	17	SWD/JB	10.0	9.5	19.5	14.8	Restoration
57	93	SWD/JB		10.5	10.5		WL

UNIT	ACRES	TREATMENT	CURRENT % DETRIMENTAL DISTURBANCE	PROJECTED % DETRIMENTAL DISTURBANCE FROM TREATMENTS	DETRIMENTAL DISTURBANCE % AFTER TREATMENTS	DETRIMENTAL DISTURBANCE % AFTER RESTORATION‡	ACTIONS TO MEET SOIL STANDARDS
58	15	SWD/JB		10.5	10.5		WL
59	16	PCT	27.0	0.0	27.0		Handthin
61a	9	PCT/HP/UB		5.0	5.0		None
62	37	PCT	10.0	3.0	13.0		WL
63	17	PCT	10.0	3.0	13.0		WL
66	26	PCT		0.0	0.0		None
67	20	PCT		0.0	0.0		None
68	15	PCT		0.0	0.0		None
69	31	PCT		0.0	0.0		None
70	39	PCT		0.0	0.0		None
71	40	PCT		0.0	0.0		None
72	85	PCT	12.0	0.0	12.0		Handthin
73	33	PCT		0.0	0.0		None
74	23	CLC/SPB	0.0	13.5	13.5		None
75b	20	PCT/HP/UB		5.0	5.0		None
78	38	LSF/<5ac		2.0	2.0		None
79	337	MSF/<30ac		10.0	10.0		None
80a	326	JB		5.0	5.0		None
82	776	MSF/<75ac		10.0	10.0		None
83	457	MSF/<75ac		10.0	10.0		None
84	831	MSF/<30ac		10.0	10.0		None
85	143	LSF/<5ac		2.0	2.0		None
87	36	MSF/<5ac		10.0	10.0		None
88	865	MSF/<30ac		10.0	10.0		None

‡this value includes restoration detailed in PDFs S/WS/F 9-13 above with the assumption that they have 50% effectiveness in soil restoration (Luce, 1997). These values also assume that units with high existing detrimental disturbance (10%+) have an increase in 3% detrimental disturbance from skid trails due to overlap.
* Final detrimental disturbance values are assuming higher overlap and restoration due to preponderance of mining disturbance.

CLC/BB=Clearcut with Reserves/Broadcast Burn, **CLC/JB**=Clearcut with Reserves/Jackpot Burn, **CLC/SPB**=Clearcut with Reserves/Site Prep Burn, **CLC/UB**=Clearcut with Reserves/Underburn, **Imp Cut/JB**=Improvement Cut/Jackpot Burn, **Imp Cut/UB**=Improvement Cut/Underburn, **LSF/<5ac**=Low Severity Fire, Openings <5 acres, **LSF/<10ac**=Low Severity Fire, Openings <10 acres, **MSF/<5ac**=Moderate Severity Fire, Openings < 5 acres, **MSF/<10ac**= Moderate Severity Fire, Openings < 10 acres, **MSF/<20ac**=Moderate Severity Fire, Openings <20 acres, **MSF/<30ac**=Moderate Severity Fire, Openings <30 acres, **MSF/<75ac**=Moderate Severity Fire, Openings <75 acres, **PCT**=Precommercial Thin, **PCT/HP/BP**=Precommercial Thin/Handpiling/Burn Piles, **PCT/UB**=Precommercial Thin/Underburn, **PCT/UB/PVT**=Precommercial Thin/Underburn or Slash along Private, **S/S/HP/BP**=Sanitation/Slashing/Handpiles/Burnpiles, **ST/BB**=Seedtree with Reserves/Broadcast Burn, **ST/JB**=Seedtree with Reserves/Jackpot burn, **ST/S/HP/BP**=Seedtree with Reserves/Slashing/Handpiles/Burnpiles, **ST/UB**=Seedtree with Reserves/Underburn, **SWD/JB**=Shelterwood (Group) with Reserves/Jackpot burn, **SWD/S/HP/B**=Shelterwood (Group) with Reserves/Slashing/Handpile/Burn, **SWD/SPB**=Shelterwood with Reserves/Site Prep Burn, **SWD/UB**=Shelterwood with Reserves/Underburn

Alternative 3 is the same for detrimental disturbance in units 14, 15, and 51 as alternative 2 (see table 129 and discussion on pages 23 and 24). Calculations for alternative 3, however, do not include unit 53 (as seen in alternative 2) because unit 53 does not come above the 15 percent detrimental disturbance threshold in alternative 3 (table 130).

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternative 3 for the Stonewall Vegetation Project adheres to the Forest Plan for the Helena National Forest and the soil quality guidelines for maintaining soil quality from Region 1 with the implementation of design features.

Summary of Alternative 3

Alternative 3 has fewer proposed treatment acres than alternative 2, and therefore, has fewer acres that would potentially be detrimentally disturbed by prescribed fire. Based on research and professional experience, the positive effects of reintroducing fire, as described in the sections previous, far outweigh any negative potential from disturbing a larger acreage of land.

Units 51 and 53 in alternative 2 and unit 51 in alternative 3 would be checked for soil conditions before burning to ensure that soil moisture conditions are high enough to not create additional detrimental disturbance.

Hydrology

Introduction

This section addresses potential project-related and cumulative effects on water resources—specifically, water quality and quantity in the streams within and downstream of the project area, as well as riparian area and wetland condition and function within the project area. Project streams are tributaries to the Blackfoot River.

Existing water quality concerns in the project area are mainly related to sediment delivered from roadways. Undersized culverts on roads in the project area, while not affecting current water quality, are also a concern in that culvert failure during a large flow event would likely result in the entrainment and deposition of large volumes of sediment within stream channels. Sediment is of particular concern in the project watersheds because, although the streams flowing through the project area are not listed as water-quality impaired by the State, they flow to the Blackfoot River, which has a total maximum daily load (TMDL) developed for sediment (for the section downstream of the forest boundary). In an effort to improve watershed and stream water quality conditions in conjunction with the project, extensive road maintenance to meet the State Best Management Practices (BMP) is planned for roads used for the project. In addition, the action alternatives include about 0.4 to 2.6 miles of road that would be built then obliterated immediately following timber removal. Reducing sediment delivery from roads would help meet a target set by the Montana Department of Environmental Quality (DEQ) for the Blackfoot River sediment TMDL for sediment reduction in tributary watersheds (Montana DEQ 2004).

Methodology

Sediment delivery from roads at stream crossings was predicted using an erosion/sedimentation model called WEPP Road (Elliot et al.1999). The newly developed W3 version, a physically based erosion simulation model built on the fundamentals of hydrology, plant science, hydraulics, and erosion mechanics (Laflen et al. 2004), was exclusively designed to evaluate effects of forest projects on stream flows in Region 1 of the Forest Service.

Input data used to run this model were collected in the field in the sediment surveys identified in the next section. Sediment source areas were surveyed along all roads in project watersheds. The W3 WEPP model estimated an annual average sediment delivery to project streams under existing conditions, and then model runs were done assuming surfacing and drainage improvements were implemented at road stream crossings. The physical basis and performance of the WEPP models is discussed in the model documentation (Elliot et al. 1999, 2000) as well as several peer-reviewed papers (e.g., Larsen and MacDonald 2007; Laflen et al. 2004; Elliott 2004). In general, erosion prediction models have difficulty predicting sediment output with precision from a road, hillslope, or watershed at time-scales useful to land managers. This is due mainly to a high degree of variability in site characteristics and climate. An average erosion/sediment delivery rate prediction can encompass this variability to some degree, although this value becomes much more useful when combined with a predicted probability that erosion would occur. The WEPP models incorporate climate data tailored to the individual site using PRISM data (Daly et al. 2001) and simulates daily events for a number of years specified by the user (30 years in this analysis) to determine the probability of sediment leaving the unit. The model incorporates individual precipitation event characteristics and antecedent conditions as well as site characteristics into its prediction of average annual runoff, erosion, and sediment yield values.

The culvert risk analysis was based on field measurements of the culverts within the project area and flood frequency regression curves developed for the state of Montana (Parret and Johnson 2004). Many of the streams within the project area appear to lose water to the subsurface in the downstream sections; thus the predicted flows are probably conservative for culvert flow design.

An equivalent clearcut area (ECA) analysis was completed to evaluate water yield increases due to insect mortality, wildfires, and previous forest management actions. Water yield was also evaluated using the WEPP W3 model. The model was developed to replace the Universal Soil Loss Equation (USLE) and has been widely used in the United States and the world. WEPP requires four inputs, climate, topography, soil, and management (vegetation), and provides various types of outputs including water balance (surface runoff, subsurface flow, and evapotranspiration), soil detachment and deposition at points along the slope, sediment delivery, and vegetation growth.

Water yield increases occur as a result of changes in watershed evapotranspiration, and information used in the analysis is derived from a variety of sources including the timber stand data base, which gives us a reasonable estimate of the equivalent clearcut acres. Water yield increases presented for alternative 1 (current conditions) are relative to an undisturbed, fully-forested condition[27]. The Equivalent Clearcut Area analysis was also used to estimate the impact on water yield of project activities as well as past and present activities throughout the four 6th-field watersheds in the project area (USDA Forest Service 1978, 1980). Water quantity can be an issue as excess water yield may result in accelerated stream bank erosion resulting in habitat degradation and additional sedimentation. The use of water yield and potential impacts on a stream is consistent with EPA guidance for sediment Total Maximum Daily Loads (TMDLs). State water quality standards also recommend limits on water yield and related increased flow—activities increasing mean monthly flows above 15 percent can require an Authorization to Degrade (ARM 17.30.715). Activities resulting in flow increases of less than 15 percent are considered not significant and are not required to undergo review. The indicator used in this analysis is percent annual water yield

[27] Water yield analysis in this report uses, as a baseline, a watershed where mature forest exists and no fire or other vegetation removal has occurred in the recent past. Under natural conditions (or under conditions during which long-term flow records in the region were recorded), it is unlikely that the forests in watersheds in the study area would have been entirely intact over this interval, due to fires or insect infestations. Thus, this method of analysis is conservative—a more realistic baseline would likely consider part of a watershed to be deforested and/or recovering from disturbance at any given point in time. A natural channel would be adjusted to a marginally higher water yield than a conservative analysis would suggest.

increase. In keeping with state regulations and other EPA-approved water quality habitat restoration plans and sediment TMDLs, modeled water yield benchmark for non-TMDL streams is 10 percent and for TMDL streams 8 percent is used (e.g., Montana DEQ 2004).

Changes in water yield are difficult to predict at the landscape scale due to the high degree of complexity in the movement of water in mountainous forested environments. Even with exhaustive site data (i.e. transpiration rates, soil moisture and porosity, precipitation, stream flow, groundwater level and flow) available only in experimental settings, water yield estimates are approximate at best. The ECA model has been in use for several decades in the northern Rockies, and provides a reasonable estimation of the impacts of vegetation removal.

Numerous studies have been done on water yield and streamflow changes after forest harvest. In a review and summary of the short-term effects of forest harvest in the United States and other countries, Hibbert (1967) concluded that a "reduction of forest cover increased water yield," but the "response to treatment is highly variable, and for the most part, unpredictable." He also found that, in general, the increases in streamflow and water yield decreased over time as vegetation re-grew. In a later review, Bosch and Hewlett (1982) analyzed an additional 55 studies and concluded that increased streamflow is caused by a decrease in forest cover, and that the decrease correlated with the amount of the forest overstory canopy removed. Further, it was found that cutting conifers produced a greater increase in streamflow than cutting deciduous trees. The dense needles and branches of conifers intercept more water than hardwoods, and interception of precipitation occurs all year long. Conifers also actively photosynthesize for a longer period (Swank et al. 1988). Streamflow increases were highest in areas with greater amounts of mean annual precipitation, and were generally short lived as vegetation re-grew.

Physical riparian habitat was assessed as part of the sediment source survey described in the next section, using standard proper functioning condition (PFC) guidelines (Prichard 1998). Streams are considered to be in proper functioning condition when there is adequate vegetation, land form, or large woody debris present to dissipate stream energy associated with high water flows, filter sediment, capture bedload and aid floodplain development; improve flood-water retention and ground water recharge; develop root masses that stabilize stream banks; develop channel characteristics to provide habitat for beneficial uses; and support greater biodiversity (ibid). Streams rated as functional-at-risk are considered functional (see above), but an existing soil, water, or vegetation attribute makes them susceptible to degradation. A stream is considered nonfunctional when it is clear that there is not adequate vegetation, landform, or large woody debris to dissipate stream energy associated with high flows, thus leaving banks subject to accelerated erosion and worsening water quality (ibid).

Information Used

Data Sources

Sediment/Pollutant Source Survey – A sediment/pollutant source survey was completed for the project analysis. This consisted of a detailed, on-the-ground survey of the streams within the project area. Sediment and other pollutants were identified, described, photographed, and located using Global Positioning System (GPS) units. This information was entered in a database and sediment or other pollutant sources were plotted on maps of the drainages within the project area. The survey was done in an effort to assess the condition of streams within the project area as well as identify various pollution sources and causes.

Roads Sediment and Culvert Survey – A detailed roads sediment and culvert survey was also done for the project analysis. Roads within the area were surveyed in detail; sites where sediment was being transported to stream channels were evaluated and located with GPS units. Parameters measured at the

sites were those required by the WEPP-Roads model. Data included road design, dimensions, gradient, surface material, buffer dimensions, and overall disturbance width and length.

Roads Analysis Process – A roads analysis was undertaken for the Helena National Forest in 2004. The analysis examined roads in maintenance levels 1 through 5. The analysis includes drainage road densities, road mileage within riparian habitat conservation areas, mileage in wet areas, mileage across erosive and slide-prone soils, mileage within TMDL watersheds, and the number of road-stream interactions. Risk ratings were given to individual roads as well as watersheds on the forest as a result of this analysis

Data Queries from the Timber Stand Database – These queries assess past harvest activities and fire acreage by 6th-field watershed in the project area. This information was used in the analysis of water yield change.

GIS layers and Queries – Numerous GIS layers were used for spatial analysis including proposed harvest units, proposed and existing roads, 6th-field watershed boundaries and streams from the national hydrography dataset (NHD), Helena National Forest (HNF) landtypes, stream buffers and various intersections of these layers with the HNF soil resource inventory. This information was used in various analyses.

Soil Survey, Helena National Forest – The HNF Soil Survey provided data on soil types and characteristics for the study area. This information was used in modeling erosion and sedimentation.

Stonedry NFMA Analysis – The Stonedry NFMA analysis looked at a variety of data including recent water quality data, roads analysis, riparian stream characteristics for reference reaches, and past harvest and fire activity.

Information from past and proposed timber harvest on private property within the project area was also used in the analysis of water yield change.

Assumptions

Water Quality

The project would meet State water quality standards for streams if all reasonable land, soil, and water conservation practices are implemented and those practices “protect present and reasonably anticipate beneficial uses.” Of the beneficial uses designated for project area streams, the proposed activities could possibly affect salmonid habitat through increased delivery of fine sediment to streams. Other beneficial uses for project-area streams are unlikely to be affected by the proposed activities.

In streams with no previously identified water quality impairment, this analysis assumes beneficial uses are being fully met and would continue to be met if project activities do not cause an increase in sediment delivery, as predicted by modeling.

The effects of each alternative are based on the following assumptions related to water quality:

- The potential for sediment delivery from forested areas is highest in the first year following disturbance, and generally recovers to pre-disturbance conditions within three to five years.
- Road improvements (new drainage features, gravel application) may result in elevated erosion shortly after installation, but would remain effective in reducing sediment delivery over a period of at least three to five years.
- Obliteration of roads may result in elevated erosion during and shortly after work, but would become stable and cease to be sediment sources within one to two years following disturbance.

- Proposed roads to be built then obliterated immediately following timber removal would not develop sediment delivery points because they would be located in upland locations without hydrologic connection to any channels.

Water Quantity

Water yield from a watershed is typically defined as the total volume of water leaving the basin via surface flow over a specified length of time. Annual water yield fluctuates based on climatic variability and changes in land use patterns.

Most hydrologic impacts occur during periods of the peak stream flow in a watershed. Stream flow is defined as "the channelized flow of water at the earth's surface"; peak flow is defined as "the maximum flow rate that occurs within a specified period of time, usually on an annual or event basis." In the project area, peak flows occur as the snowpack melts in the spring. Occasionally, periods of high stream flow can be caused by rainstorms.

Snow melts from a watershed in a predictable pattern. Melt begins earlier in the season at lower elevations and proceeds upslope. Snow has generally disappeared from the lower elevations some time before the spring stream flows peak. During peak flow, snow is beginning to disappear from the mid-elevations and is actively melting at the higher elevations of a watershed.

After an area has been harvested, both winter snow accumulation and spring melt rates increase. This effect is less important at lower elevations, since the snow disappears before peak flow. At mid-elevations, the additional melt may or may not be important, depending on seasonal variations. Harvesting at high elevations would have the greatest impact and is, therefore, of most concern. The changes in snow accumulation and melt brought about by forest harvesting are reduced as new forests grow. This is commonly referred to as hydrologic recovery.

Second-growth forests are said to be hydrologically recovered when snowpack conditions approximate those prior to logging and, as a result, any impact on stream flow is minimized. The most important influence of vegetation on snow accumulation is the interception of snow by the forest canopy and the subsequent loss of this snow to the atmosphere. This interception effect is a result of the combination of tree height and canopy closure. The rate at which the snowpack melts is affected by the extent to which the snowpack is exposed to solar radiation, and like interception, is also controlled by the canopy. Consequently, canopy closure is one of the main stand characteristics affecting snow accumulation and melt.

The degree of canopy closure is determined by tree species, height, and stocking density. Since tree height data is readily available and is closely correlated with canopy closure, it is the variable used to evaluate hydrologic recovery.

Forest management practices and road construction may increase water yield by removing living trees from treated areas, thus reducing the amount of water removed from the watershed by transpiration and canopy interception, evaporation, and sublimation. Excess water yield can be of concern because it may result in accelerated stream bank erosion resulting in habitat degradation and additional sedimentation. Widespread tree mortality from natural causes, such as insects, disease or fire may similarly increase water yield. Removal of trees has a greater effect on the water balance than removal of smaller plants such as grasses, forbs, and many shrubs, because large trees are generally more deeply rooted and thus have access to groundwater for a longer period of time. Trees also transpire much more water per unit area of ground coverage than smaller plants. The effects of tree removal on water yield depend on many factors, the most important of which is the percent watershed area with tree removal/mortality. A statistically significant increase in stream flow is generally not measurable until at least 20 to 30 percent

of a watershed's forest cover is removed (MacDonald and Stednick 2003). Additionally, annual precipitation must generally exceed 18 to 20 inches in order for a measurable yield increase to occur even with greater forest cover removal (Bosch and Hewlett 1982; MacDonald 1987).

Many of the trees proposed for harvest under alternatives 2 and 3 would be dead or dying from insect infestation. Dead trees do not transpire and are thus not a substantial contributor to water loss in project sub-watersheds. Thus, removing these trees would have no measurable effect on the water balance in any watershed. The area of land proposed for clearing for roads to be built then obliterated immediately following timber removal is negligible at the 6th-HUC basin scale, and the majority of trees that would be removed to facilitate these roads are dead. Thus, road construction would have a minimal effect on overall water yield. Roads typically are compacted surfaces, however, that can create local flow increases that may lead to sedimentation if road drainage is connected to streams.

Road construction, however, can have a significant effect on sedimentation. The construction and maintenance of logging roads and landings exposes soil and increases the susceptibility to erosion and transport of sediment to streams (Kochenderfer et al. 1997; Swift 1985, 1988). The greatest input of sediment from roads generally occurs during construction and active log haul during timber harvest. Stream crossings, wetland crossings, and the approaches of roads to these areas are sources of the majority of sediment contribution to streams and wetlands (Swift 1988) especially where BMPs have not been properly applied (Stuart and Edwards 2006).

Physical Riparian Habitat

Proper functioning condition (PFC) is a qualitative method for assessing the condition of riparian areas (Prichard 1998). The term PFC is used to describe both the assessment process and a defined, on-the-ground condition of a riparian area. The on-the-ground condition termed PFC refers to the functional level of physical riparian processes. Proper functioning condition is a state of resiliency that allows a riparian area to maintain its integrity during high-flow events. This resiliency allows an area to produce desired values over time, such as fish habitat, neotropical bird habitat, forage, and dissipation of flood energy. Riparian areas that are not functioning properly cannot sustain these values. Proper functioning condition is used as the indicator of riparian area condition in this analysis.

Spatial and Temporal Scale of Analysis

The spatial scale of analysis of direct and indirect effects is the 6th-field hydrologic unit code (HUC). The individual 6th-field HUCs range in size from 7,552 acres for Lincoln Creek and11,617 acres for Beaver Creek, to 22,834 acres for Keep Cool Creek. This is an appropriate scale because the types of watershed impacts that are associated with forest management practices (increased sediment delivery and water yield) are generally discernible at the 6th-field HUC scale. Tools available for analysis of watershed impacts were also considered; a smaller scale of analysis would require significantly more data and effort without a commensurate increase in accuracy. The cumulative effects analysis covers the three 6th-field HUCs combined, and is approximately 42,003 acres in size. Cumulative effects from the project were considered along with other management activities and natural fires. Additionally, the mouth of the combined drainages is in the TMDL section of the Blackfoot River Headwaters, and thus is an appropriate point at which to assess cumulative effects.

The temporal bounding of the analysis for direct and indirect effects ranges from 1 to 5 years, referred to as "short-term" effects. Short-term increases in sediment delivery associated with construction activities (i.e. road improvements and decommissioning) would last as long as soil is disturbed or exposed in locations hydrologically connected to streams. Once the road surfaces have stabilized with aggregate or vegetation has re-established after obliteration, construction-related impacts would not be expected to persist (temporal scale of a few months to one year). After the completion of management activities on

treatment units, the potential for sediment delivery is highest in the first year following disturbance and generally recovers to pre-disturbance levels within five years. Therefore, discussion of direct and indirect effects related to treatment units has a temporal scale of five years.

As used in this analysis, "long-term" effects would be expected to last greater than 5 years (e.g. physical obliteration of closed roads). Beneficial effects of application of BMPS and design features may persist longer than the short-term.

Overview of Issues

Comments pertaining to disclosing the effects of project activities on hydrology were identified from public scoping as nonsignificant (40 CFR 1501.7), and are addressed by the analyses in this section. Please refer to volume 2, appendix A of this document for a complete listing of the issues and an explanation of how the agency determined their disposition. Comments indicated concern that roads built then obliterated immediately following timber removal, road reconstruction, and use of existing roads would adversely impact water quality. See the Transportation section for more information about roads.

Affected Environment

Introduction

This section describes the affected environment for water resources. Much of the information presented in this analysis comes directly from field examination of the Stonewall Project area, including a stream-by-stream sediment source survey and a road sediment and culvert survey. In addition, project units that have the potential to adversely affect water quality were examined in the field. Table 131 displays watershed information used in this analysis.

Table 131. Watersheds, stream miles, and acres of watershed area

SIXTH-HUC WATERSHED NAME	SIXTH-HUC WATERSHED NUMBER	STREAM MILES		AREA (ACRES)		PERCENT OF WATERSHED IN PROJECT AREA
		Watershed	Project Area	Watershed	Project Area	
Beaver Creek	170102030303	34	23	11,617	8846	76
Keep Cool Creek	170102030304	70	23	22,834	9270	41
Lincoln Creek	170102030305	21	13	7552	5777	77
Total		**125**	**59**	**42,003**	**25,898**	**57**

Lincoln Creek (170102030305)

The Lincoln Creek watershed is 7,552 acres in size and flows into the Blackfoot River about a mile downstream of the Forest boundary. This is a 1st-order drainage with 13 miles of streams on the Forest. Lincoln Creek appears to be a losing stream[28] near the Forest boundary. The average annual precipitation is 26 inches, with approximately 35-40 inches at upper elevations, and 15-20 inches at lower elevations; the wettest months are May and June. Historic land use activities in the drainage are predominantly

[28] A losing stream is one that typically loses flow at the edge of the valley because the water in the stream infiltrates to ground water

mining, forestry, and agriculture. Approximately 77 percent of this watershed is within the project boundary, and proposed treatment units occupy about 30 percent. There are no water quality listings in the Lincoln Creek watershed. Lincoln Creek exhibits a typical snowmelt-dominated hydrograph that can occasionally have multiple peaks during the spring due to rain events or warmer periods. The headwaters area consists of glaciated mountainous terrain while the lower portions of the watershed are comprised of mountain slopes and ridges and valley floor, all underlain by Proterozoic sedimentary rock. The stream bottoms run through compact loamy glacial till, moraines and glaciated mountain slopes in the upper portion of the watershed, and colluvial and alluvial flood plains and terraces and mountain slopes and ridges in the lower portion.

Beaver Creek (170102020303)

The Beaver Creek watershed is 11,617 acres in size and is a tributary to the Blackfoot River. The stream is connected to the Blackfoot River through a series of mostly beaver created ponds and lakes located mostly on private lands. This is a 2nd -order drainage with a mixture of 34 miles of intermittent and perennial streams. Theodore, Klondike, and Yukon Creek are mostly perennial headwater streams. Annual average precipitation for the watershed is about 31 inches from PRISM, with 35-40 inches in the upper elevations and about 15-20 inches at lower elevations. May and June are the wettest months. Beaver Creek exhibits a typical snowmelt-dominated hydrograph that can occasionally have multiple peaks during the spring due to rain events. Proterozoic sedimentary rock and Pleistocene glacial deposits underlie the Beaver Creek subwatershed. The predominant landforms are steep mountain slopes and ridges and valley floors. Historic land use activities in the drainage are predominantly mining and forestry. Approximately 76 percent of this watershed is within the project boundary, and about 17 percent is occupied by proposed treatment units. There are no streams in the Beaver Creek watershed with water-quality-limited segments (WQLS) on the Montana 303(d) list (DEQ 2008).

Keep Cool Creek (170102030304)

The Keep Cool Creek watershed is 22,834 acres in size and is a tributary to the Blackfoot River, which is located about half mile below the National Forest boundary. This second-order drainage exhibits a typical snowmelt-dominated hydrograph that can occasionally have multiple peaks during the spring due to rain events. The average annual precipitation is approximately 35-40 inches at higher elevations and 15-20 inches at lower; the wettest months are May and June. Annual average precipitation for the watershed is about 28 inches from PRISM. The drainage is characterized by steep mountainous terrain. The predominant landform is steep mountain slopes and ridges with the lower watershed consisting of alluvial flood plains and terraces. Proterozoic sedimentary rock and Pleistocene glacial deposits underlie the portion of the Keep Cool Creek 6th-HUC watershed covered by the project area. Historic land use activities in the drainage are predominantly forestry and mining. Approximately 41 percent of this watershed is within the project boundary, and proposed treatment units occupy about 16 percent. There are no water quality listings in the Keep Cool Creek watershed.

Water Quality

Project subwatersheds are in the Upper Blackfoot River Headwaters Total Maximum Daily Load planning area. The Blackfoot Headwaters TMDL for sediment was published by the Montana DEQ and cooperators in 2004. Attributes for each of the 6th-HUC watersheds covered by the project area are listed below. All of the project subwatersheds have large areas of beetle-killed trees.

Table 132. Summary of water quality impairments in project area 303(d)-listed streams

6TH-HUC WATERSHED	STREAM SEGMENT	LISTED IMPAIRMENTS
Blackfoot River—Little Moose Creek	Blackfoot River	Alteration in streamside vegetation, sedimentation, metals

Sedimentation

Roads Analysis Process

There are roughly 86 miles of National Forest System roads in the project area. This project includes up to 2.6 miles of roads to be built then obliterated immediately following timber removal. These proposed road segments are generally in upland locations and would likely not pose a risk for sediment delivery to streams.

The proposed road segment number 5, accessing units 10 and 11, crosses a small drainage of a headwater tributary basin to Lincoln Creek. This apparent crossing was reviewed in the field—there is an old abandoned irrigation ditch at this site, but no stream channel or evidence of overland flow. Flow may occur in the ditch during snowmelt. If the decision is made to construct this segment, then appropriate mitigations must be in place (adequate culvert, proper road drainage, and sediment fencing if appropriate) and the segment should be obliterated soon after the project ends, in order to minimize sediment impacts.

Many of the existing roads used to access the project area are known sources of sediment to streams, and were characterized as moderate-to high-risk in the HNF Roads Analysis Process. The use of these roads for project-related log hauling and other traffic would exacerbate their current sediment delivery. These roads present good opportunities for mitigation of potential sediment delivery from project activities in the form of road maintenance and improvements (e.g. gravel surfacing) and replacing undersized culverts. Mitigation measures sufficient to offset any project-related sediment delivery (from treatment units and haul routes) in the form of road BMPs and project design features have been incorporated into the project action alternatives.

Sedimentation from Roads

A detailed road sediment survey was conducted for the project area watersheds. The survey identified road segments that were hydrologically linked to stream channels and thus had the potential to deliver sediment to channels during runoff events. Road segments identified as such in the survey were modeled using the WEPP Roads model. The model's output consists of predicted annual average sediment yield from the road prism, in terms of tons per year, based on site-specific climate data and road characteristics.

The concept of an average annual sediment load is somewhat misleading in that sediment delivery varies widely from year to year. In WEPP, the average annual value is equivalent to a two-year-return-interval flow event; there is an equal probability that the sedimentation could be greater or less than this value.

Comprehensive sediment management begins by identifying the existing primary sources of sediment and developing a strategy that preferably minimizes or eliminates sources of sediment or the erosive action in the first place. This can be accomplished by first reviewing all existing road segments posing sediment delivery risk to the stream system, planning preventive measures that reduce or eliminate road-derived sediment, and then implementing those measures. Identification of primary sediment delivery sources to streams on many roads in the Stonewall Project Area has been accomplished and they are detailed in this analysis.

The next step involves evaluating all proposed road reconstruction and roads to be built then obliterated immediately following timber removal to determine the magnitude of potential risks to the stream system. Certainly roads in valley bottoms, roads paralleling streams and within 300 feet of the stream, and roads with live stream crossings generally pose the highest risk. Recommended action can vary from eliminating the road building to relocating or modifying the road design.

The sediment mitigation for the project area requires close coordination and support from engineering and watershed specialists in reducing sediment delivery by applying various BMP standards. Sediment mitigation measures have been developed for all alternatives to reach the goal of no net increase or preferably, a reduction in sediment delivery from current levels for the proposed project. Costs associated with erosion or sediment control measures should be included in the project area plan as well as an implementation schedule. Given the magnitude of other cumulative effects that may arise from ongoing and foreseeable activities, keeping sediment delivery below existing levels may be very difficult—especially during the first 1 to 3 years as the magnitude of ground disturbance required to bring roads up to standard may in itself result in some short-term sediment delivery.

Reducing sediment delivery below current levels over the long term would likely require that some roads be brought up to BMP standards—especially roads rated as high risk to watersheds and fisheries in the Helena National Forest Roads Analysis (map locations available in GIS data files), and in the project area where sediment source surveys have identified problem areas. BMP maintenance should emphasize surfacing of the roads near stream crossings with washed gravel, improved surface drainage of roads, improved cross drainage of roads, and providing for 100-year flood flows for culvert crossings. Upgrading culverts to ensure they have the capacity to pass 100-year flows reduces risk for culvert failure and subsequent loss of road fill material to streams. Culvert crossings of perennial streams in this project area may need to be upgraded to provide for 100-year flows as well as provide for fish passage.

Sedimentation from Stream Bank Erosion

Stream bank erosion was noted in the PFC survey. Streams were surveyed in the Beaver Creek and Keep Cool Creek watersheds. Areas of accelerated erosion were located on a map, described, and photographed. There are no areas with bank alteration over the standard specified in INFISH, which requires streambanks to be 80 percent stable.

Table 133. Road information for the project area by 6th-HUC watershed

6TH-HUC WATERSHED NAME	SYSTEM ROADS (MI)	SYSTEM ROAD DENSITY (MI/MI^2)	RAP* HIGH-RISK ROADS (MI)	RAP* MODERATE-RISK ROADS (MI)	ROAD SEDIMENT DELIVERY POINTS	CULVERTS (#)	FORDS (#)
Beaver Creek	33	1.8	9	16	14	13	0
Keep Cool Creek	36	1.0	2	9	24	19	2
Lincoln Creek	24	2.0	11	8	3	3	0
Total	**93**	**--**	**22**	**33**	**41**	**35**	**2**

*RAP: Helena National Forest Roads Analysis Process Report (USDA Forest Service 2004)

Sedimentation from Other Sources

In addition to accelerated stream bank erosion, other sources of sediment have been assessed in project watersheds. Other than the occasional elk wallow the only other notable sources of sediment are located downstream of Helena National Forest lands. Agriculture including cattle grazing, forestry, and mining occurs on private and State lands in project watersheds, and these activities may be a source of sediment to streams.

Stream Substrate Analysis

Sediment substrate analysis was done to determine cumulative sediment impacts in streams and to evaluate existing levels of fine sediment in stream substrates. Cumulatively, the impacts of disturbances (both natural and human related) throughout the watershed are reflected in the character of stream substrates. The percentage of fine sediment less than 6 mm diameter is used as a measure of condition. Use of sediment as a measure of risk to fisheries is appropriate for this project as it is generally accepted in watershed practice that the stream channel reflects the sum of land use activities; including natural disturbances in a watershed. Fine sediment (less than 0.25 inches diameter) levels for various streams within the project area are in table 134. Natural mean sediment levels from Helena National Forest reference cores from various drainages combined is about 32 percent with 0.66 percent (one standard deviation) of the overall range established near 10 percent each side of the mean). It is likely that reference drainages throughout the Helena National Forest may have mean sediment values of 28 to 30 percent rather than 32 percent. Specifically for streams sampled in roadless areas, sediment levels averaged 31.9 percent on the Helena National Forest. Consequently, for fisheries management goals, 32 percent likely represents a reasonable sediment level to maintain with an objective to reduce further toward the 28 to 30 percent range. As shown in table 134, several streams sampled within the project area have average sediment levels above the 32 percent level and three streams are above 40 percent.

Table 134. Summary of mean percent fines (less than 0.25 inches diameter) in select streams as an indicator of cumulative effects from past and ongoing activities by 6th-field HUC

6th Field HUC sub-watershed (name)	Stream(s) Sampled for Sediment Analysis	Mean Percent Fines in Spawning Habitat *	USEPA reference Standard (%) **	Roadless Area reference (%)
17010203 (Beaver Creek)	Beaver Creek	30.9	32.5	31.9
	Yukon Creek	34.2		
	Tributary to Yukon Creek	35.1		
	Theodore Creek	32.2		
	Klondike Creek	32.7		
17010203 (Stonewall/Park)	Stonewall Creek	31.6	32.5	31.9
	Park Creek	45.4		
17010203 (Lincoln Gulch)		Not sampled as no fishery present in most of the drainage	32.5	31.9
17010203 (Sucker/Liverpool)	Liverpool sw 1/4	42.7	32.5	31.9
	Liverpool nw ¼	25.4	32.5	31.9
	Sucker Creek	Not sampled	32.5	31.9
	Keep Cool Creek	47.2	32.5	31.9

** Reference standard developed from Helena National Forest Data in the Lake Helena Watershed

Water Yield

Past effects to the hydrology of forested areas in the project area was estimated using the equivalent clearcut area (ECA) methodology on lands managed by the Helena National Forest for existing conditions in the Lincoln Creek, Beaver Creek, and Keep Cool Creek watersheds. The current, pre-project existing condition water yield from project sub-watersheds is a result of forest clearing, past fires, insect mortality, forest roads and other activities. There are no stream gauges in project subwatersheds; as a result pre-project baseline stream flows cannot be reliably determined. Equivalent clearcut area can give a general estimate, based on the available literature, what the water yield increases from project activities may be. This estimate is based on comparable paired watershed studies completed in other parts of the intermountain west that investigated water yield effects of timber harvest and other fuels treatments.

Observed changes in the water yield after beetle kill or forest removal in snowmelt-dominated areas in the intermountain west are due to both a decrease in winter interception and a reduction in growing season soil moisture depletion (Potts 1984;Troendle 1987). In the upper part of project subwatersheds, precipitation accumulates over the winter as snow pack, with minimal melt over this accumulation period. When the snowpack begins to melt in spring, the meltwater first recharges the soil by replacing the water depleted during the previous growing season. Once soil moisture storage is filled, the excess meltwater is available to become streamflow. Paired watershed studies have shown that approximately 30 percent of the increase in water yield can be attributed to the decrease in interception and resultant increased amount of water contained in the snowpack. The reduced evapotranspiration during the previous summer also reduces the amount of meltwater needed for soil moisture recharge in the clearcut. This process accounts for approximately 50 percent of the increase in water yield. The remaining 20 percent of the observed increase in water yield results from the reduction in evapotranspiration losses during April and May (Troendle and King 1985). Primary sources of water yield increase for project subwatersheds include past timber harvest on Helena National Forest System lands and other land ownerships, as well as beetle-killed trees.

Riparian and Wetland Areas

Physical riparian habitat conditions were recorded for streams within the project area as part of the pollutant-source survey. For the most part, streams within the project area were rated to be in proper functioning condition (PFC) with the exceptions of one reach on Beaver Creek and three sites on Keep Cool Creek, which were rated functioning-at-risk. Other wetlands may exist within treatment unit boundaries, although none have been identified.

Table 135. Riparian condition and bank alteration information for the project area, by 6th-HUC watershed

6TH-HUC WATERSHED NAME	RIPARIAN CONDITION*			EXCEED	ALLOTMENT(S)
	PFC	FAR	NF	BANK ALT. STANDARDS	
	(# REACHES)	(# REACHES)	(# REACHES)	(# REACHES)	
Beaver Creek	2	1		None	Stonewall
Keep Cool Creek		3		None	Keep Cool-Liverpool

6TH-HUC WATERSHED NAME	RIPARIAN CONDITION*			EXCEED	ALLOTMENT(S)
	PFC	FAR	NF	BANK ALT. STANDARDS	
	(# REACHES)	(# REACHES)	(# REACHES)	(# REACHES)	
Lincoln Creek	not assessed				

Not every riparian reach was surveyed in 2009—numbers should be considered minimum values.
*PFC: Properly Functioning Condition, FAR: Functioning-At-Risk, NF: Non-Functioning

Environmental Consequences

Alternative 1 – No Action

Sedimentation from Roads

Road work proposed under the action alternatives would not occur under the no-action alternative.

Table 136. Estimated average annual sediment delivery from roads to stream channels for existing condition

Watershed	Sediment Delivered for Total Road Length (Tons)
Lincoln	1
Keep Cool	6
Beaver	4
Total	**11**

Since there would be no additional disturbance to roads under alternative 1, there would be no direct short-term (less than 5 years) or long-term (greater than 5 years) detrimental sediment effects to water quality. Roads would remain in their existing conditions. Project-related road maintenance work would not occur to existing roads. There would be no sediment or water quality impacts from ground disturbing activities such as landings, tractor harvesting, road reconstruction or building, or from increased haul traffic.

Indirectly, the existing road system would continue in the short and long term to risk sediment contribution to streams, currently modeled as 11 tons per year within the project watersheds (table 136). Although old, infrequently used roads would continue to revegetate, reducing the amount of sediment produced and possibly contributed to streams; all of these old roads would continue to have varying degrees of impact to watershed hydrology and water quality. Stream channel and road fill scour, channel aggradations, and risk of sediment contribution from failure of undersized stream crossings would persist until otherwise addressed.

The no-action alternative would likely not contribute to cumulative sediment-related effects to water quality. Existing trends in water quality would likely be maintained.

No mitigation would be required under the no action alternative.

The no-action alternative is consistent with Regulatory and Forest Plan direction and would maintain existing watershed conditions

Sedimentation from Streambank Erosion and Culverts

There would be no direct long-term or short-term effects to stream channels from streambank erosion and culverts under the no action alternative.

Indirectly, the presence of undersized culverts and their continued effects on stream channel stability at and near stream crossings would continue to be a resource concern. Undersized culverts are a long-term risk for sedimentation due to the possibility of failure. There are no conflicts with plans or policies with this alternative and no mitigation would be necessary. This alternative would meet Forest Plan and Regulatory guidance related to stream channels.

Sedimentation from Other Sources

There are several documented small sediment sources in the pollutant source survey, but these sites were determined to be minor sources of sediment to channels. There are no recent burns or other large-scale disturbances identified as sediment sources in the project area.

There is no vegetation manipulation proposed in the Stonewall Project area under alternative 1; consequently, there would be no water yield increase over watershed baseline as a result of this alternative.

Water Yield

Methods for determining the effects of vegetation removal on water yield have been developed for the Helena National Forest (Pfankuch 1973), and reviewed, and refined for USDA Forest Service Region 1. The methods developed were for areas with snowmelt-dominated runoff. The equivalent clear-cut area (ECA) model is a key component of these methods. The basis of the ECA analysis is that water yield increases when vegetation is removed, whether by natural disturbance such as fire, or by human disturbance. The project area harvest history was used to determine the existing, baseline ECA and runoff values on Forest Service lands in the project area by watershed. The GIS database for the Helena National Forest was queried to obtain all records of documented timber harvest. USGS HUC 6 watersheds were used to delineate the tributary watersheds.

The model was then re-run to estimate forest canopy and run-off changes after the proposed treatments are completed (see alternatives 2 and 3).

Table 137. Existing condition equivalent clearcut area (ECA) due to past alterations in vegetation cover in the project area

WATERSHED	EXISTING EQUIVALENT CLEARCUT AREA
Lincoln Creek	
Percent of Drainage Harvested:	16
Percent of Past Harvest Recovered:	31
Percent of Drainage as ECA:	7
Beaver Creek	
Percent of Drainage Harvested:	15
Percent of Past Harvest Recovered:	19

WATERSHED	EXISTING EQUIVALENT CLEARCUT AREA
Percent of Drainage as ECA:	4
Keep Cool Creek	
Percent of Drainage Harvested:	13
Percent of Past Harvest Recovered:	28
Percent of Drainage as ECA:	3

Peer-reviewed research has suggested that in areas such as the project area, roughly 20 to 30 percent of a watershed must be treated in order to begin to attain a statistically significant increase in streamflow (MacDonald and Stednick 2003). The percent area in ECA in the Lincoln Creek drainage under current conditions is about 7 percent, and Beaver Creek and Keep Cool Creek watersheds are 4 and 3 percent respectively. Minor streamflow increases may have occurred under existing conditions within the project area watersheds. However, in drier mountains such as the project area, research has suggested that streamflow increases are reduced in that remaining trees after treatment tend to make use of most additional water made available through the reduction in transpiration brought about by tree removal (MacDonald 1987). This same concept applies to both action alternatives to some degree, especially for thinning and salvage harvest of dead trees. Clearcut harvest may have the largest potential water yield increases.

Acres of vegetation removal from timber harvest, roads and fire are converted to ECAs to provide a common datum to compare activities based on the amount of cleared area. ECAs are calculated by summing the appropriate acreage, evaluating the percentage of crown removal then assigning a hydrologic recovery value based on stand age. National Forest System roads are not recovered hydrologically and therefore are assigned a recovery value of zero. For timber harvest there is a continuum of recovery values as the stand ages.

Water yield increase is greatest immediately following vegetation removal. In years subsequent to vegetation removal, the ECA (and water yield increase) declines, or “recovers” because of vegetation regrowth. The rate of regrowth and thus ECA recovery is based on evapotranspiration, snowfall accumulation related to patch dynamics, and the relationship between water yield and changes in vegetation interception. This regrowth relationship is expressed as a recovery curve.

There are limitations of ECA and water yield analysis. Removal of existing vegetation may demonstrate increases in water yield over existing conditions, however the ECA method does not account for the fact that fire suppression has resulted in overstocked forest conditions that may have actually been reducing water yield below “normal” levels. ECA analysis assumes that stands prior to harvest are fully stocked when in reality some stands at historic conditions were not fully stocked. In addition, this analysis does not accurately account for effects of vegetation removal on other land ownerships, which is a known activity, and it does not weight estimates based on elevation and aspect, which are known to influence water yield. ECA analysis is a relative index of change that might occur, not an absolute result. It is used in combination with other information to determine the effects that the proposed activities may have.

Another method used to estimate flow increases is the W3 module of the Water Erosion Prediction Project (WEPP) Model (Laflen 2004). The W3 module is designed to specifically estimate surface water yield from a project. It evaluates drainage and precipitation patterns, and the interactions with watershed soils. The model does not accurately predict flow increases due to groundwater inputs. It is difficult to predict the water yield from water that infiltrates deeply into bedrock layers, which are tied more to groundwater yield. As a result, flow and water yield estimates are focused on surface flow increases

Water yield increase values provided in this analysis are modeled approximations for the increase in runoff volume from vegetation removal. These values do not account for the effect the road system has on routing water and changes to the hydrograph. Although we did not model water yield impacts from roads, research has shown that roads can influence peak flows (Wemple and Jones 2003).

Riparian and Wetland Areas

The effects on physical riparian condition for the no action alternative would be similar to what is depicted in the affected environment. For the most part, streams within the project area were rated to be in proper functioning condition (PFC) with the exceptions of one reach on Beaver Creek and three sites on Keep Cool Creek, which were rated functioning-at-risk. No wetlands have been identified within the project boundaries.

Irreversible and Irretrievable Commitments

An irretrievable commitment represents a temporary loss of a resource that can be replaced over time. An irreversible commitment represents a total loss of a resource that cannot be replaced. An irretrievable commitment under the no action alternative would be continued erosion and sediment delivery from project area roads at existing levels, in the absence of road improvement work of the type specified in this project.

Cumulative Effects

Several past and present Federal and other ownership activities have affected and would continue to affect water quality, water yield, and riparian health and vigor in the cumulative effects analysis area for the foreseeable future. Federal and private roads and culverts constructed at road/stream crossings in the project area have affected streams and riparian areas. There are several sediment delivery points on existing roads as described previously, and culverts represent a permanent grade control in the stream channels where they reside. These existing roads also have several road/stream crossings. Culverts at road/stream crossings in the project area watersheds were analyzed for this analysis. Undersized culverts can affect the stream's ability to convey water and sediment, and represent an increased risk of failure and subsequent erosion and deposition of sediment into stream channels. Culverts directly interact with channels and can affect channel morphology and channel migration patterns, and local hydraulics that may influence the stream channel.

There has been past timber harvest activity in the analysis area. Land disturbed by prescribed burn and harvest activities with effective BMP application typically recovers within 5 years, based on observations of similar projects in the region. Dead trees cover a considerable area in the project area. Younger understory trees released by overstory tree mortality would eventually after a couple decades create a forest canopy and reduce evapotranspiration.

Continued grazing in riparian areas and cattle trailing along streams within grazing allotments would likely continue to contribute elevated sediment levels to streams in the watershed; although, adaptive management provisions in allotment management plans should be implemented where necessary to reduce livestock impacts. In the absence of other non-project related activities designed to reduce sediment delivery in the watershed, streams in several of the watersheds where treatment is planned would continue to receive sediment from anthropogenic sources near current rates.

In the past, mining has contributed sediment to stream channels in the watersheds. Additionally, abandoned mines can pose chronic or episodic water quality problems to forest streams.

The Stonewall project-area watersheds may be affected by large-scale tree mortality due to insect infestations. Large-scale loss of live trees may affect water yield by reducing the volume of water removed from a watershed by transpiration.

In addition, extensive tree mortality could remove the shade available and increase stream temperature in streams that cross the impacted stands. However, understory vegetation, generally unaffected by insect mortality, would continue to provide shade. Furthermore, understory and riparian vegetation exposed to increased levels of sunlight and moisture (due to overstory mortality or tree removal) can expand and provide additional shade (Gravelle and Link 2007). While an increase in incoming short-wave (solar) radiation is generally considered to be the dominant driver of stream temperature increase, numerous factors influence the extent to which a stream exposed to additional direct sunlight would have an increase in water temperature (Johnson 2004). Thus, the extent of water temperature changes resulting from overstory mortality is difficult to predict.

Alternatives 2 and 3

Alternative 2 treats 8,564 acres within the project area, and alternative 3 treats 6,564 acres. Treatment consists of a mixture of regeneration harvest, commercial thinning, non-commercial thinning, and low and mixed severity prescribed burns.

Project Design Features

The Stonewall Vegetation Project has been designed with features that are intended to minimize or avoid potential adverse effects while meeting project objectives. In addition to the proposed action treatments described in this section, design features would be implemented where applicable. A description of the project design features relating to hydrology and other resources is displayed in table 9, chapter 2.

The specific design features listed under soil, watersheds and fisheries in table 9 pertaining to hydrology are S/WS/F-18 through S/WS/F-26.

This analysis is based on the implementation of all design features. Project design features apply to all action alternatives. Design features that are applicable to hydrology include not only those listed above, designed specifically to protect water quality and water quantity, but also those designed to protect other resources.

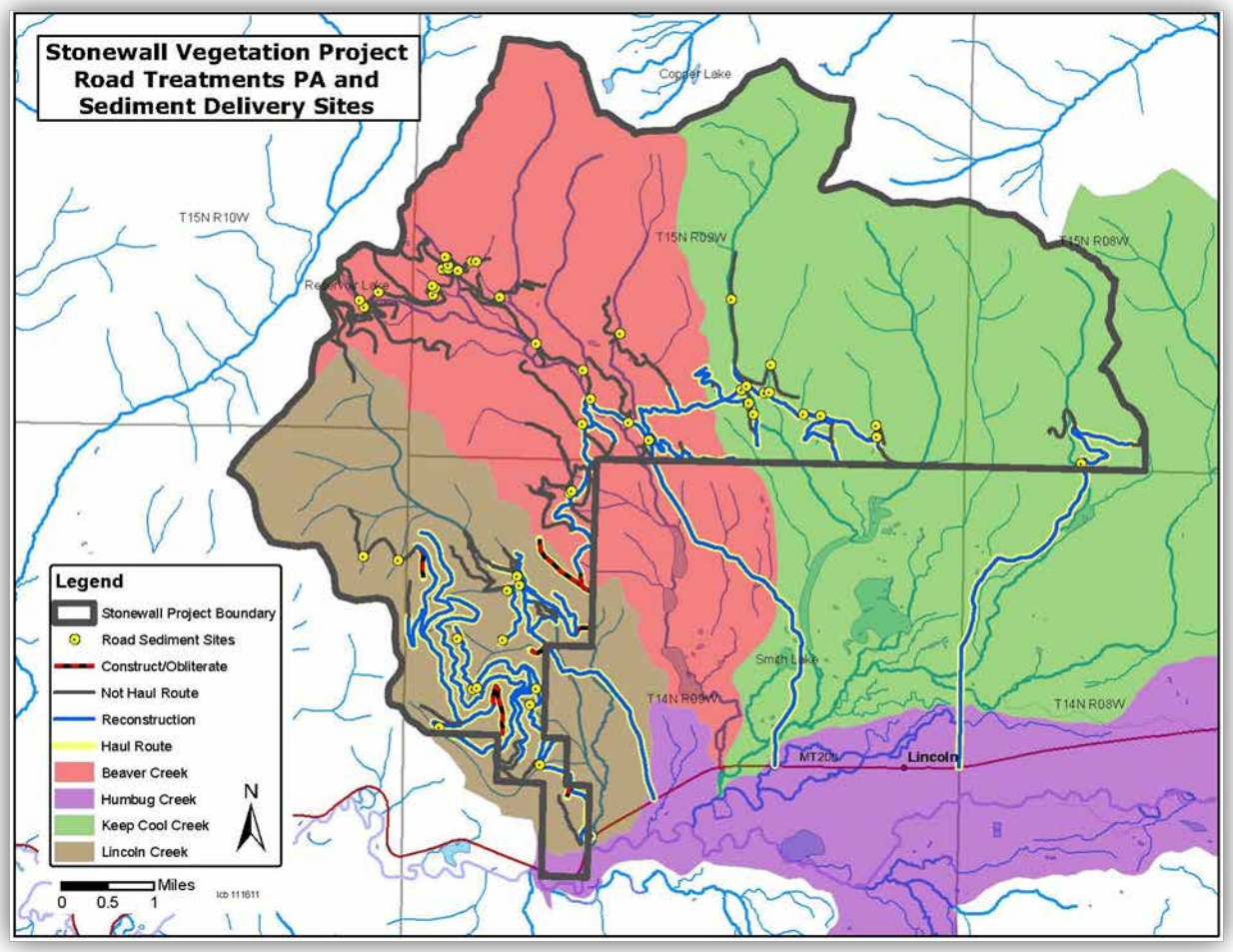

Figure 83. Sediment source areas and proposed road treatments for alternative 2- project watersheds

Effects Common to All Action Alternatives

Road maintenance and improvement best management practices (BMPs) would be applied to all roads used in the project, including application of aggregate at road/stream crossings and other sediment delivery points.

Sedimentation from Roads

WEPP Road models sediment delivery to streams mainly at road/stream crossings, often located at culvert crossings or bridges. Water concentrated on the road surface often flows down the road surface toward the low side of stream crossings, flows down the fill slope, and may enter the stream carrying sediment eroded from the road surface or fill slope. The model determines the amount of runoff that may occur from a road surface adjacent to a channel.

There should be a short-term (up to 5 years) reduction in sediment transport from roads in the project area resulting from road improvements planned in both alternatives (table 138). Forty-eight miles of road used for alternative 2 and 44 miles of road under alternative 3 would receive BMP maintenance. Project-related road improvements include surface grading, re-establishment of drainage features (grade dips and ditch-relief culverts), and application of sorted gravel at stream crossings and other sediment delivery points.

Table 138. Road obliteration and maintenance for project

ACTION ALTERNATIVE	ROADS BUILT FOR PROJECT USE THEN OBLITERATED (MILES)	ROAD MAINTENANCE (MILES)	TOTAL (MILES)
Alternative 2	2.6	45.6	48.2
Alternative 3	0.4	43.8	44.2

Table 139. Estimated average annual sediment delivery from roads to stream channels by sub-drainage for existing conditions and alternatives 2 and 3

WATERSHED	SEDIMENT DELIVERED FOR TOTAL ROAD LENGTH (TONS)	ALTERNATIVE 2&3 SEDIMENT DELIVERED FOR TOTAL ROAD LENGTH	PROJECT ROAD SEDIMENT AFTER BMPS MAINTENANCE
Lincoln	1	2	1
Keep Cool	6	18	5
Beaver	4	11	3
Total	**11**	**31**	**9**

There are about 2.6 miles of roads that would be built then obliterated immediately following timber removal (new and "new specified") planned in these alternatives. Most of these road segments are not predicted to convey sediment to stream channels, as they would be built in upland locations without surface hydrologic connection to any stream channel. The new roads would be obliterated immediately following timber removal. See the transportation report for more information regarding roads (Bielecki 2012).

The proposed new road number 1 (see project area map) crosses the drainage of a headwater tributary basin to Lincoln Creek. This apparent crossing was reviewed in the field—there is a vegetated old roadbed at this site, but no stream channel or evidence of overland flow. Channel features were observed roughly 60 feet below the roadbed. Sediment that appeared to be from the old roadbed was observed in this channel, indicating that in the past, this road probably contributed sediment to the uppermost reach of this intermittent stream. If restored, this road represents a potential source of sediment to the stream channel, and should be accounted for in estimates of sediment impacts of the project. If the decision is made to construct this segment, then appropriate mitigations must be in place (adequate culvert, proper road drainage, and sediment fencing if appropriate) and the segment should be obliterated soon after the project ends, in order to minimize sediment impacts.

The proposed new road number 5 crosses an intermittent channel and this road is a source of sediment to this stream. Efforts would be made in the construction of this new road to prevent sediment delivery to the channel (e.g. raised grade at crossing, sediment filters at drainage runouts) while the road is in place.

Many of the existing roads used to access the project area are known sources of sediment to streams, and were characterized as moderate-to high-risk in the Helena National Forest Roads Analysis Process (USDA Forest Service 2004). Project-related log hauling and other traffic would exacerbate sediment delivery: therefore, these roads present good opportunities for mitigation of potential sediment delivery from project activities, in the form of road improvements (e.g., gravel surfacing) and replacing undersized culverts.

All required State and Federal permits (e.g., SPA 124, CWA 402/404) would be obtained prior to construction of this new road.

The total reduction in average annual sediment transport from using BMPs for project haul roads was modeled to be roughly 2 tons less than the existing conditions under this alternative, based on proposed BMP maintenance and road improvements. For the road segments to be obliterated, the reduction in sediment delivery would be permanent. Without repeated maintenance, conditions on open roads would likely trend toward pre-project conditions over the next several years once the project is complete.

Sedimentation from Streambank Erosion and Culverts

Proper functioning condition surveys did not identify any areas of unstable stream banks in project watersheds. Unstable stream banks may exist in project watersheds. Where these features exist, sedimentation from accelerated stream bank erosion would continue to occur under these alternatives. Inadequately sized culverts may have a potential for increasing stream sedimentation. Some stream crossing culverts are undersized, and have the potential for removal during large flood events.

Sedimentation from Other Sources

The probability and volume of sediment delivered to stream channels from treatment units was estimated using the Disturbed WEPP model in project alternatives. Sedimentation and delivery of sediment probability reflects the variability in slope, soil type, and treatment type among units. The estimated sediment yield and probability are for the first year following treatment, and would likely return to pre-project (near zero) values within 5 years. See the soils report for more information on sediment sources in project units (Walters 2011).

Water Yield

The project-related and cumulative equivalent clearcut areas and estimated percent water yield increase that would result from proposed activities under the action alternatives are listed in table 140, and table 141. On other drainages within the Helena National Forest the State DEQ has suggested water yield thresholds of concern of 8 percent for TMDL streams and 10 percent for non-TMDL streams (Blackfoot Headwaters Planning Area: Water Quality and Habitat Restoration Plan and TMDL for Sediment, 2003).

Table 140. Equivalent clearcut area (ECA) by alternative

HUC 6 WATERSHED	EQUIVALENT CLEARCUT AREA		
	EXISTING	ALTERNATIVE 2	ALTERNATIVE 3
Lincoln Creek			
Percent of Drainage Harvested:	16	42	32
Percent of Past Harvest Recovered:	31	12	16
Percent of Drainage as ECA:	7	14	11
Beaver Creek			
Percent of Drainage Harvested:	15	29	25
Percent of Past Harvest Recovered:	19	10	11
Percent of Drainage as ECA:	4	5	5
Keep Cool Creek			
Percent of Drainage Harvested:	13	20	18
Percent of Past Harvest Recovered:	28	18	21
Percent of Drainage as ECA:	3	4	3

Table 141. Estimated percent water yield increase by action alternatives

WATERSHED	PERCENT WATER YIELD INCREASES	
	ALTERNATIVE 2	ALTERNATIVE 3
Lincoln Creek	4.9	3.85
Beaver Creek	1.75	1.75
Keep Cool Creek	1.40	1.05
Overall for Project Watersheds	2.13	1.75

This equivalent clearcut area analysis considered all past harvest and watershed disturbances, and the effects of reduction in forest canopy. Table 140 shows that for the proposed action, alternative 2, ECA values range from 4 percent in Keep Cool watershed, to 14 percent in the Lincoln Creek watershed. For alternative 2, for all project watersheds 23 percent of the project watersheds are in equivalent clearcut condition. For alternative 3, 19 percent of project watersheds would be in equivalent clearcut condition. In areas such as the Stonewall Project area, 20 to 30 percent of a watershed must be treated in order to begin to realize a statistically significant measureable increase in streamflow (MacDonald and Stednick 2003). Furthermore, in drier mountains such as the analysis area, research has suggested that remaining trees tend to make use of additional water made available through the reduction in transpiration brought about by tree removal (MacDonald and Stednick 2003), reducing the likelihood that predicted yield increases would be detectable in any of the study basins.

Given the number of acres that would be treated in the project watersheds under alternative 2 or 3, it is unlikely there would be a cumulative increase in water yield that would be detectable. The estimated water yield increase for project watersheds is below the DEQ-recommended threshold of 10 percent, and below the 15 percent stipulated in ARM 17.30.715. Streams emanating from project watersheds appear to lose flow as they move from steeper areas and encounter deep valley floor sediments. Considering the dry (losing stream) nature of the channels in the Stonewall Project area watersheds, the potential increase in water yield would be unlikely to cause any negative effects (i.e. accelerated bank erosion). In the event of an actual increase in water yield, the trout population could benefit from greater water availability.

Table 142. Percent estimated cumulative water yield increase over baseline conditions (%)

6TH-HUC WATERSHED	PERCENT CUMULATIVE WATER YIELD INCREASE OVER BASELINE		
	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
Lincoln Creek	0	4.9	3.8
Beaver Creek	0	1.8	1.8
Keep Cool Creek	0	1.4	1.0

The equivalent clearcut area (ECA) method was used to calculate potential water yield increase given cumulative impacts in the Lincoln, Beaver Creek, and Keep Cool Creek watersheds. Table 142 shows that results for the action alternatives suggests an increase of 4 to 5 percent in the Lincoln watershed, about 2 percent in the Beaver Creek watershed, and 1 to 1.5 percent in the Keep Cool Creek watershed, depending on alternative. The project, when combined with other recent, past and reasonably foreseeable actions was predicted to result in a theoretical combined increase in water yield from project watersheds of 2.1 percent at the confluence with the Blackfoot River. Given the dry/losing character of the stream channels in the project area, any change in water yield as a result of the project would be difficult to detect,

particularly considering that the majority of the ECA is from past or existing land use activities. Recent stream flow records at the nearby Helena National Forest Deep Creek monitoring site have not shown clear evidence of higher stream flow under the existing conditions. The small incremental potential increase posed by this project would likely not measurably change flow conditions. However, if a water yield increase were detectable, it would almost certainly be within acceptable limits for TMDL streams. In other drainages within the Helena National Forest, the State DEQ has suggested water yield thresholds of 8 percent for TMDL streams and 10 percent for non-TMDL streams (Montana DEQ 2004).

The W3 module of the Water Erosion Prediction Project (WEPP) Model was used to estimate unit discharges for different treatment types for the project. Results provide a rough estimate of potential flow increases. The model evaluates drainage and precipitation patterns, and the interactions with watershed soils. The model does not accurately predict flow increases due to groundwater inputs. It is difficult to predict the water yield from water that infiltrates deeply into bedrock layers that are tied more to groundwater yield. As a result, flow and water yield estimates are focused on surface flow increases. These estimates are based on the hydrology of headwater areas in each of the project watersheds, and are likely less than what was calculated in the model. None of these results exceeds Forest Plan standards.

Table 143. WEPP W3 module predicted flow increases for the project area

WATERSHED	RUNOFF (ACRE-FEET/YEAR)			
	ALTERNATIVE 2	ALTERNATIVE 3	AVERAGE ANNUAL SURFACE RUNOFF	PERCENT RUNOFF FROM PROJECT
Lincoln Creek	1,611	1,255	15,844	8
Beaver Creek	2,175	569	24,372	2
Keep Cool Creek	2,191	1,793	47,906	4

Riparian and Wetland Areas

For both action alternatives, riparian areas would have at least a 50-foot no-ignition buffer around ephemeral, intermittent, and perennial channels for slopes less than 35 percent, and a 100-foot buffer for slopes more than 35 percent. Additionally, the standard SMZ-law protection prohibits the operation of ground-disturbing equipment within riparian areas. Therefore, activities proposed under these alternatives would not adversely affect riparian areas. Streams within the project area would generally remain at proper functioning condition. The notable exceptions would be the functional-at-risk stream segments. These stream segments are expected to remain in that condition under this alternative.

No wetlands have been identified within the project area boundaries. If wetlands are identified during unit marking, they would be avoided by heavy equipment unless during winter conditions. Wetlands over one acre connected to stream channels would be protected by a no-harvest SMZ buffer. As noted above there would likely be small increases in water yield in project-area streams under this alternative. However, these minor changes are not expected to change the PFC ratings for any of the streams within the Stonewall Project area.

Irreversible/Irretrievable Commitments

An irretrievable commitment represents a temporary loss of a resource that can be replaced over time. An irreversible commitment represents a total loss of a resource that cannot be replaced. Any sediment delivery to streams resulting from implementation of this project would be an irretrievable commitment, in that the stream would recover from the influx of additional sediment over a period of years to decades. However, if all appropriate harvest and road BMPs are carefully and consistently applied, it is unlikely

that any irretrievable commitments would result from project implementation (Montana DNRC 2008). Furthermore, reductions in sediment delivery due to project road improvements were estimated to exceed the potential sediment delivery related to project activities.

Cumulative Effects

Past, present and reasonably foreseeable Federal and other ownership actions within the analysis area are described previously in the section for alternative 1, and can be found in volume 2, appendix C. These impacts include mining, wildfires, timber harvest, and recreation. The cumulative impact of alternatives 2 and 3 in concert with other impacts in the analysis area would be a net reduction in short-term and long-term sediment delivery to stream channels. The short-term reductions would come from road surfacing and drainage improvements. Long-term reductions would result from road obliteration. These reductions in sediment delivery would more than offset the low-probability of the predicted short-term increase from treatment unit erosion, as well as any sediment delivery associated with road improvements and obliteration.

Conclusions

The proposed project identifies two action alternatives. Alternative 2 treats 8,564 acres, and alternative 3 treats 6,564 acres with a range of harvest and burning prescriptions. Primary water resource concerns stemming from this project include potential sediment conveyance to streams from project treatment units, and potential increased water yield due to removal of vegetation. Field sediment surveys identified road segments that were capable of delivering sediment to ephemeral, intermittent, or perennial stream channels. The WEPP:Road model was used to predict the average annual sediment conveyance for each road segment, as well as the probability that sediment would be delivered from the road segment in a given year. The model was run for existing conditions as well as conditions under each action alternative. Under all project alternatives, overall reductions in sediment delivery to stream channels due to application of road BMPs and road obliteration are expected. Results suggest that under existing conditions, roughly 11 tons of sediment is delivered from roads to Lincoln, Beaver, and Keep Cool Creeks in an average year (table 139). With design features proposed in this project, sediment delivery from roads would remain one ton per year for Lincoln Creek, reduced by about one ton each for Beaver and Keep Cool Creeks. Overall sediment delivery reduction for alternatives 2 and 3 during the project is estimated to be about 2 tons. While road improvement and road obliteration activities may temporarily increase sediment delivery to stream channels, the design features proposed in this project would reduce sediment delivery to project area tributaries of the Blackfoot River over the long term (alternatives 2 and 3), leading to improved conditions in project watersheds.

The project has the potential to increase water yield in Lincoln Creek, Beaver Creek, and Keep Cool Creek. A water yield increase above 10 to 15 percent may be of concern in that the flow increase could accelerate bank erosion. Water yield increase is less likely to be an issue in the project area due in part to lower annual precipitation levels, to the dry/losing character of the streams in these watersheds, and to the relatively small footprint of the project. The Equivalent Clearcut Area (ECA) and the WEPP W3 method was used to calculate potential water yield increase given cumulative impacts in the Lincoln, Beaver Creek, and Keep Cool Creek watersheds. Results suggested an increase of up to 8 percent in the Lincoln watershed, 2 percent in the Beaver Creek watershed, and up to 4 percent in the Keep Cool Creek watershed, depending on alternative (table 142 and table 143) and analysis method. The project, when combined with other recent past and reasonably foreseeable actions was predicted to result in a theoretical combined increase in water yield from project watersheds of about 5 percent at the confluence with the Blackfoot River. These levels are within State DEQ recommendations for TMDL and non-TMDL streams elsewhere on the Helena NF. If predicted water yield increases did occur, the modest additional flow would likely improve stream temperature and in-stream physical habitat, rather than cause any

degradation. The project is unlikely to significantly affect the condition of riparian areas in the project area, given the 50- to 100-foot riparian no-ignition buffers in place for all action alternatives. The project is unlikely to affect the condition of any wetlands found in the project area, in that these areas would either be avoided entirely, or would be treated only by hand crews or by equipment during winter operating conditions.

In summary, the proposed project would have relatively minor impacts to water resources in the project watersheds under the action alternatives. Through implementation of design features and application of BMPs, the project alternatives would most likely reduce short- and long-term sediment delivery to stream channels, improving or maintaining water quality in the Blackfoot River headwaters watershed. Alternatives 2 and 3 would also reduce long-term sediment delivery through improving road BMPs at stream crossings. Water yield change due to proposed project activities is predicted to be at the margins of detectability and is not anticipated to have any deleterious effects on channel stability or water quality

Fisheries

Introduction

This section documents existing condition and environmental consequences to aquatic resources from the proposed Stonewall Vegetation Project, and also discusses the potential effects to Forest Service sensitive, management indicator species (MIS), and Endangered Species Act (ESA) listed aquatic species westslope cutthroat trout (*Oncorhynchus clarki lewsi*), bull trout (*Salvelinus confluentus*), and western pearlshell mussel *(Margaritifera falcata).*

Table 144. Analysis area species

SPECIES	SPECIES STATUS	PRESENT IN PROJECT AREA: HABITAT OR DETECTIONS
Fishes		
westslope cutthroat trout (*Oncorhynchus clarki lewsi*)	USFS Sensitive	Yes Habitat and Detections
bull trout (*Salvelinus confluentus*)	ESA Threatened	Yes
Invertebrates		
western pearlshell mussel *(Margaritifera falcata)*	USFS Sensitive	No

Overview of Issues

Comments pertaining to disclosing the effects of project activities on fisheries were identified from public scoping as nonsignificant (40 CFR 1501.7), and are addressed by the analyses in this section. Please refer to volume 2, appendix A of this document for a complete listing of the issues and an explanation of how the agency determined their disposition. Comments indicated concern that roads built then obliterated immediately following timber removal, road reconstruction, and use of existing roads would adversely impact fisheries. See the Transportation section for more information about roads.

Indicators

Indicators are defined to analyze data regarding the potential for increases to sediment delivery and changes to the timing of peak flows from project activities that may affect cutthroat trout habitat.

Change in stream habitat conditions for westslope cutthroat trout (MIS), bull trout and other aquatic species

12. Changes in stream function
    e. Change in sediment delivery to streams
    f. Change in fines by depth
    g. Change in the timing or increases in the magnitude of stream flows

Change in characteristics of riparian areas

13. Change in miles of motorized routes in RCAs
14. Acres of riparian treatments

Affected Environment

Introduction

This section presents existing conditions and trends for aquatic resources within the Stonewall Vegetation Project planning area. Information is organized under two major subsections: ***fish populations*** and ***fish habitat***. The first discusses the status and distribution of fish populations inhabiting the planning area; this includes discussions about nonnative and native fish populations. The second subsection provides an overview of fish habitat including land-use activities that influence trends in stream habitat conditions.

Analysis Area

The Stonewall Project area encompasses three sub-watersheds (tributaries) of the Blackfoot River watershed. Natural processes and land-use activities unique to each sub-watershed influence local fish populations and their habitats independently of other watershed units of the same scale. The geographic area of preference is the watershed scale delineated at the 6th field hydrologic unit code (HUC), namely Lincoln Gulch, Beaver Creek, and Keep Cool Creek. These boundaries are appropriate for addressing direct, indirect and cumulative effects upon fish populations occurring within each of these 6th field HUCs (sub-watersheds). The cumulative effects area, however, extends to mainstem Blackfoot River because it receives waters from the project planning area.

Existing Condition

Salmonid fishes present within the project area include westslope cutthroat trout, bull trout, brown trout, brook trout and mountain whitefish. Other fish species present include sculpins and suckers. Historically, most project area perennial streams suitable to support a fishery were likely occupied by various native fish. The introduction of nonnative salmonids, including brook, brown and rainbow trout, within portions of the Blackfoot River drainage, has changed the fish species composition somewhat in the project area. The current salmonid fish species composition within the project area is summarized by streams in table 145 that follows. The upper limits of salmonid fish distribution by species, as determined from sampling by Forest Service personnel, is depicted on fish distribution maps included in the project file, and reflected in geographic information system (GIS) maps included with this analysis (Fisheries Report Rief 2012).

Table 145. Fish species by stream in the Stonewall Project area

Stream	Salmonid Fish species present on forest based on sampling *	WCT genetic status	Comments
Lincoln Gulch Unnamed tributary NW ¼ S 20 T14N R9W Unnamed tributary SW ¼ S8 T14N R9W Unnamed tributary SW ¼ S9 T14N R9W	No fish on forest No fish, but does have perennial flow No fish; intermittent flows eb		Intermittent flows and extensive mining impacts limit fishery throughout much of the Lincoln Gulch drainage
Beaver Creek Theodore Creek Yukon Creek Klondike Cr Unnamed tributary to Yukon Creek	Wct, eb, bt, LL Wct,eb Wct, eb and bt Wct Wct	Genetically pure Assumed pure Assumed pure Assumed pure Assumed Pure	Bull trout are known to be present in Beaver Creek and Yukon Creek. The probability of bull trout to be present is low in other streams, but because habitat is suitable to support them bull trout are assumed present
Stonewall Cr	Wct	Genetically Pure	Probability of bull trout to be present is low on Forest but because habitat is suitable to support them bull trout are assumed present. Bull trout may be present off forest. Brook and brown trout present on nonfederal lands.
Park Creek	Wct	Genetically Pure	Probability of bull trout to be present is low on Forest but because habitat is suitable to support them bull trout are assumed present. Bull trout may be present off forest
Liverpool Creek	Wct	Genetically Pure	Probability of bull trout to be present is low on Forest but because habitat is suitable to support them, bull trout are assumed present. Bull trout may be present off forest
Sucker Creek	Wct	Assumed pure	Probability of bull trout to be present is low on Forest but because habitat is suitable to support them bull trout are assumed present. Bull trout may be present off forest
Keep Cool Creek	Wct and eb	Genetically pure	Bull trout are known to be present on nonfederal lands below the Forest.

* Fish Species: wct –westslope cutthroat trout, eb- eastern brook trout, LL-brown trout, bt- bull trout, wf-moutain whitefish

Threatened, Endangered and Sensitive Aquatic Species

Bull Trout

On July 10, 1998 bull trout (*Salvelinus confluentus*), were listed as Threatened within the Columbia River Basin by the U.S. Fish and Wildlife Service (USDI Fish and Wildlife Service 1998). Section 7(a) (2) of the Endangered Species Act (ESA) of 1973 as amended requires all federal agencies to review actions authorized, funded, or carried out by them to ensure such actions do not jeopardize the continued existence of listed species.

The distribution of bull trout is limited to drainages west of the continental divide on the Helena National Forest with the strongest populations being present in the Blackfoot River drainage. Bull trout are present in extremely low numbers within the Little Blackfoot River drainage. Table 145 lists the streams known currently to support bull trout in the project area.

The Inland Native Fish Strategy (USDA 1995), established priority drainages for bull trout, however, none are found within the project area. Importantly, special emphasis watersheds for bull trout were later designated throughout Region 1 of the Forest Service to supplement the INFISH priority watersheds, but none are found within the project area.

Designated critical habitat for bull trout includes reaches of the Blackfoot River and several tributaries in the Blackfoot drainage. All critical habitat for bull trout in the Blackfoot River is located downstream of the project area.

Under the Draft Recovery Plan (USDI Fish and Wildlife Service 2005), bull trout within various drainages are organized by core populations and then by local populations within those core population areas. It is important to note that there are no local populations of bull trout located currently within the project area, but it is likely that some bull trout from Beaver Creek contribute to the overall Blackfoot Core Population. The information on the bull trout core population that follows is based on information from the U.S. Fish and Wildlife Service as well as knowledge from local fishery biologists from the Forest Service, and Montana Fish, Wildlife, and Parks.

Blackfoot Core Bull Trout Population

Bull Trout in the Blackfoot River are included as a core population in the Draft Bull Trout Recovery Plan (2005). There are several local populations identified within the Blackfoot Core Bull Trout Population; including the North Fork of the Blackfoot River, Monture Creek, Landers Fork/Copper Creek, Cottonwood Creek, Belmont Creek, and Gold Creeks.

Based on redd counts and limited electro-fishing efforts, it is likely that there are somewhere between 400 to 500 adult bull trout between the 5 local populations. Additional adult bull trout are in numerous other streams throughout the core population area, and in some of the designated INFISH Priority Watersheds and Special Emphasis Watersheds, as well as in undesignated streams. The overall number of bull trout adults included in all of the streams throughout the Blackfoot drainage is probably less than 800 when combined with the adults in the local populations. Recent redd surveys suggest that four of the five Local Populations are declining somewhat while the Copper/Landers population is improving.

Bull trout may suffer from some competition with brown trout and predation in the main stem Blackfoot River, although there is no field documentation of this hypothesis. Both species occupy some of the same habitat and eat some of the same foods and both species are highly piscivorous. Consequently, the hypothesis seems reasonable. With temperatures in the main stem Blackfoot rising based on information

collected by the Montana Department of Fish, Wildlife and Parks over the last 10 years (Pierce et al. 2008, pp. 32 and 33); brown trout may be gaining some competitive edge over bull trout.

Interactions of bull trout with brook trout occur mostly in tributary streams rather than the main stem Blackfoot River. Brook trout are present in some of the local bull trout populations and many of the other streams in the Blackfoot River drainage, so there is some additional threat of decreased bull trout production due to hybridization. Additional discussion on aspects of bull trout biology and interactions with other species as a function of proposed project activities are addressed further in the biological assessment.

Westslope Cutthroat Trout

Westslope cutthroat trout (WCT) are a designated sensitive fish species by the Forest Service and are included as a management indicator species in the Helena Forest Plan. Westslope cutthroat trout are found within all the streams in the project area known to support a fishery with the exception of the tributary to Lincoln Gulch, which is known to support only brook trout. There is a strong WCT fluvial population functioning in the Blackfoot River drainage. Fluvial WCT may also be using the reaches of other streams in the project area below the Forest Service boundary. Several publications from the Montana Department of Fish, Wildlife and Parks between the mid-1990s and 2007 provide extensive discussions of WCT movements and life history in the Blackfoot drainage.

It is important to maintain viability of the westslope cutthroat trout conservation populations to reduce the risk of the species being listed under the Endangered Species Act (ESA). Currently, the WCT in the Blackfoot River are a conservation population, and with the exception of those above Nevada Creek Reservoir, function as a single meta-population. The population consists of both fluvial and resident components (Pierce et al. 1997, p. 73). Radio tracking of WCT indicates wide-ranging movements and use of various tributaries for spawning (Pierce et al. 2004, pp. 63-78).

The potential for loss of viability for the Blackfoot River WCT conservation population is presumed to be low due to the extensive distribution of WCT throughout the drainage, and the presence of a functioning fluvial population. However, nonnative fish especially brook trout and to some degree brown trout, are likely competing with and sometimes preying on WCT in portions of the Blackfoot River and selected tributaries.

Western pearlshell mussels

Western pearlshell mussels (*Margaritifera falcate*) may be one of the longest living freshwater invertebrates and animals. Specimens have been aged at greater than 90 years (Vannote and Minshall 1982). The western pearlshell mussel has an elongate shell, typically 2.5-4 inches long with a concave ventral edge. The interior shell has a purple to pink hue as the outside shell is dark brown to black. These mussels are found in cool, stable running, generally low to moderate gradient streams and rivers. Swift stream velocities can limit where mussels can occur in streams. They are most commonly found in stable gravel and pebble benthic substrate, but can occur in sand or gravel among cobble and boulders in moderate to higher gradient larger rivers. They usually occupy reaches of stream where the riparian zone is dominated by willows or alders.

The larval stage of this mussel (glochidia) briefly parasitizes a host fish, westslope cutthroat trout, by attaching to the gills. They fall off the host as a juvenile mussel. The larval parasitism on fish enables upstream transport to habitats otherwise difficult to reach by relatively immobile adult mussels. Western pearlshell glochidia are considered highly host specific (Bauer 1987) as they are typically restricted to salmonid fishes.

The western pearlshell mussel continues to experience significant range reductions over the last 100 years. The primary cause of stream habitat deterioration in Montana is high fine sediment load, related to agricultural practices, which is one of the most serious pollutants of streams systems. Excess fine sediment can degrade mussel habitats by decreasing substrate permeability. This has a smothering effect on juvenile mussels and limits successful recruitment (Stagliano 2010).

The Montana Natural Heritage database contains no records for this species in the project area, although they have been found in the Blackfoot River downstream of the project area. Habitats suitable for mussels are present in the project area where Westslope cutthroat trout are present. Based on this information, we believe pearlshell mussels may be present in the analysis area.

Aquatic Habitat

Streams currently known to support fisheries located within this analysis area include Beaver Creek, and tributaries to Beaver Creek which include Yukon Creek, Theodore Creek and Klondike Creek. Stonewall Creek also supports a fishery. The lower reaches of Beaver Creek and Stonewall Creek are located on private and State land. Both flow into the Keep Cool drainage within 3 miles above the confluence with the Blackfoot River.

Lincoln Gulch

Lincoln Gulch is a second-order tributary that enters the Blackfoot River at river mile (rm) 103.6. The upper 4.4 miles of Lincoln Gulch watershed is located on the Forest. Lincoln Gulch drains the eastern slopes of Black Mountain. The lower 2.6 miles flows through private agricultural land and a residential housing area. Lincoln Gulch shows impacts from mining, grazing and agricultural activities. In the headwater areas mining impacts and channelization are extensive. Fish surveys found brown trout and sculpin at mile 0.1. Surveys conducted higher in the watershed found no fish (Pierce and Podner 2006).

Beaver Creek

This stream forms near Reservoir Lake and is a third-order tributary to Keep Cool Creek, entering 0.7 miles upstream of the Keep Cool Creek confluence with the Blackfoot River (rm 105.2). Beaver Creek has a total of 20.1 stream miles of which 14.3 miles are perennial. In the Beaver Creek drainage on NFS land, past and present road construction, timber harvest and livestock grazing have influenced habitat conditions by increasing the sediment delivered to the stream. The lower reaches of Beaver Creek are located on private and State lands that support agricultural uses. There are some reaches where livestock grazing has negatively influenced bank stability (Peters 1990) and some isolated bank damage occurs from livestock grazing on the Forest. Bank trampling from livestock is limited in the higher reaches due to the inherent resistance of the stream channel type and the vegetation adjacent to the streambank. A water diversion is present just below the Forest boundary which partially dewaters the stream. This diversion was recently upgraded to provide fish passage. Beaver Creek maintains a moderate gradient originating at Reservoir Lake.

Fish habitat is in relatively good condition with good quality cover for fish present throughout the reaches evaluated. The amount of cover present is somewhat low on some of the reaches with quality pools estimated to be present at around 15 to 20 percent. Past beaver activity has been very important in the formation of habitat on selected reaches of stream downstream of Yukon Creek. Spawning gravels contain an average of 30.5 percent fines. Recreational fishing does occur on this stream within the Forest, but the intensity of fishing and the amount of harvest is unknown. Downstream of NFS lands, Beaver Creek is at least partially dewatered for irrigation and the stream gradient drops to near 1 percent in the vicinity of beaver activity (USDA 1995b).

Discharge was 10.7 cfs 0.50 mile above the mouth on August 31, 1989. Fine sediment levels in spawning gravels were found to average 33 percent in Beaver Creek with a range of 17 to 55 percent. In comparison, an unmanaged drainage of similar geology that had undergone high sediment delivery from fire averaged 27 percent with a range of 19 to 32 percent (Peters 1990).

Theodore Creek

The Theodore drainage shows past timber activity in the lower reaches. The lower reaches are located in the Stonewall allotment. This stream is a tributary to Beaver Creek that originates south of the Scapegoat Wilderness. The entire drainage lies within the Forest. Electro-fishing evaluations have shown that the lower reaches are dominated by cutthroat trout with a few brook trout also present. The upper reaches were found to support cutthroat trout exclusively. Fish distribution extends upstream into section 21 (T15N R9W). Abundance of salmonids over 6 inches in length was estimated at 160 per mile of stream while the maximum size obtained was around seven inches. It is likely that some of the cutthroat trout from Theodore Creek recruit downstream to Beaver Creek.

Habitat conditions on the reaches evaluated were very good in Theodore Creek. Much of the pool habitat in the stream is formed by large rubble cascades and woody debris. Spawning gravels were found to average 32.1 percent fines. Theodore Creek is too small to support much if any recreational fishing and no evidence of use by anglers was noted during survey evaluations (USDA Forest Service1995b).

Yukon Creek

This drainage is entirely within the Forest and is a tributary to Beaver Creek. The lower reaches show evidence of some timber harvest activity. The lowest reaches are within the Stonewall allotment. Yukon Creek is dominated by cutthroat with some brook trout present in the lower reaches. Abundance was estimated at 220 fish per mile of stream over 6 inches in length. Fish distribution extends upstream into section 17 with the headwater reaches likely supporting only cutthroat trout. This stream is important for providing recruitment of cutthroat trout to Beaver Creek. Walk-through evaluations indicate that habitat is in good condition. Some sediment delivery to the stream is still occurring at the upper culvert site which was constructed several years ago, however seeding the site has helped to mitigate the delivery.

Spawning substrates contain 34.2 percent fine sediment on the average. Yukon Creek is large enough to support some recreational fishing, but no evidence of fishing use was observed. In 1992, two instream pool structures were constructed to increase fish habitat capability (USDA Forest Service 1995b).

Unnamed Tributary to Yukon Creek

This stream is a tributary to Yukon Creek and is located entirely on the Forest. This drainage shows evidence of past timber harvest activity. Only the lowest reach containing the confluence with Yukon Creek is located in the Stonewall allotment. This is a very small stream that was found to support only cutthroat trout. Abundance of fish over 6 inches in length is 70 per mile of stream. The distribution of fish extends upstream in section 19 (T15N R9W). This stream probably provides for recruitment of cutthroat trout to Yukon and Beaver Creeks. Walk-through evaluations indicate that habitat is in relatively good condition. Spawning gravels measure 35.1 percent fines (USDA Forest Service1995b).

Klondike Creek

This drainage shows evidence of past timber harvest activity. The lower reaches are located within the Stonewall allotment. This stream is a tributary to Beaver Creek and is entirely located on the Forest. The stream is dominated by cutthroat trout with an occasional brook trout. Fish distribution likely extends upstream into section 20. The maximum size of fish obtained during sampling was just less than 7 inches in length. Abundance of fish over 6 inches in length was estimated at 120 per mile of stream. This stream

also provides recruitment of cutthroat to Beaver Creek. Walk-through evaluations indicate that habitat conditions are relatively good with numerous small pools formed by large rubble and woody debris. Spawning gravels averaged 32.7 percent fines. Klondike Creek is too small to support recreational fishing, but in an attempt to increase habitat capability eight instream pool structures were constructed in 1992 (USDA Forest Service 1995b).

Stonewall Creek

Stonewall Creek has a total stream length of 9.0 miles of which 3.8 miles are perennial. The Stonewall drainage shows evidence of past timber harvest in the middle reaches. A portion of the lower reaches is located in the Stonewall allotment. A small active patented mine is still under operation in the upper reaches. The lowest reaches are located on private ranch land and are likely to be dewatered before reaching the Blackfoot. In Stonewall Creek, fine sediment levels were found to average 31 percent with a range of 21 to 50 percent as compared to an undisturbed stream of similar geology having an average of 20 percent with a range of 11 to 26 percent. Other habitat parameters have not been measured. Cutthroat trout are common in the drainage (USDA Forest Service 1995b). On private land, Stonewall Creek shows effects from agricultural uses. Stonewall Creek flows through a large wetland on private land before its confluence with Keep Cool Creek.

Park Creek

Park Creek is a second-order tributary to Stonewall Creek. Park Creek has a total stream length of 6.1 miles, of which 2.9 miles are perennial. The headwaters and upper reaches of Park Creek are located on the Forest; the lower reaches are located on private land. The creek may be dewatered in the lower reaches. Spawning gravel quality has not been measured. Cutthroat trout have been determined to be genetically pure but are uncommon in Park Creek.

Liverpool Creek

The headwaters and upper reaches of Liverpool Creek are located on the Forest, and the lower reaches are located on private land. This drainage is located within the Keep Cool Liverpool allotment. The stream has been channelized by mining on the Forest. Eight drop-log structures have been built in the creek to provide much needed pool habitat. One downed tree was placed in the creek to provide for rearing habitat. A portion of the area mined has been reclaimed, but occasional suction dredging continues in the channel. Spawning gravels are common in the stream. Below the area mined spawning gravel quality measured 42.7 percent fines. Above the mined area spawning gravels measured 25.4 percent fines. Obviously, mining has had negative effects on the quality of spawning habitat in Liverpool Creek. Cutthroat trout are common both above and below the mined area (USDA Forest Service 1995b).

Sucker Creek

Sucker Creek has a total length of 3.0 miles, of which 2.5 miles are perennial. Only the headwaters of Sucker Creek are located on the Forest. The middle and lower reaches are located on private land. Timber harvest and road construction has taken place in the drainage. Sucker Creek drainage is located in the Keep Cool Liverpool allotment. Spawning gravel quality has not been measured. Cutthroat are rare, but presumed genetically pure in Sucker Creek (USDA Forest Service 1995b).

Keep Cool Creek

Keep Cool Creek is the largest spring creek in the Lincoln Valley. It forms north of Lincoln from both an alluvial groundwater aquifer and small basin-fed streams in its headwaters. It is joined at the mouth by Beaver Creek (mile 0.7) and Lincoln Spring Creek (mile 0.5) before entering the Blackfoot River at mile 105.2. The combined flow of this stream system provides a significant percentage of the upper Blackfoot River flow during low flow periods. Excessive livestock access to riparian areas has degraded portions of

Keep Cool Creek and its tributaries. Other mainstem fisheries-related impairments include channel alterations and irrigation practices.

Keep Cool Creek has a total length of 10.7 miles, of which 2.0 are perennial. The upper and middle reaches of Keep Cool Creek are located in the Helena Forest. The lower reaches are located in private land. The upper elevations of the drainage show evidence of timber sale activity and are heavily and roaded. The drainage is within the Keep Cool Liverpool allotment. Spawning gravels just above the Forest boundary measure 47.2 percent fines. Spawning gravels are common in this area; however, the flows become very low early in the season. Cutthroat trout are common in Keep Cool Creek (USDA Forest Service 1995b).

Recently, radio telemetry confirmed bull trout from the Blackfoot River use the lower portion of Keep Cool Creek (Pierce et al. 2004). Water temperature monitoring at two locations found maximum summer temperatures of 75.2 ^{o}F in upper Keep Cool (at the Sucker Creek road) compared to a high of 62 ^{o}F at the Beaver Creek Road. This cooling results from large inflows of groundwater between these two sites (Pierce et al. 2004).

Table 146 that follows, lists streams that support resident fish populations in the project area that have been sampled for sediment (less than 6.4 mm) by depth using McNeil core sampling methods to quantitatively establish estimates of fines in fish reproductive habitat.

Table 146. Summary of mean percent fines (<1/4 inch dia.) in spawning habitat of select streams as an indicator of cumulative effects from past and ongoing cumulative effects by 6th-field HUC

6th-Field HUC sub-watershed (name)	Stream(s) sampled for sediment analysis	Mean % fines in spawning habitat *	USEPA reference Standard (%) **	Roadless Area reference (%)
17010203 (Beaver Creek)	Beaver Creek	30.9	32.5	31.9
	Yukon Cr	34.2		
	Tributary to Yukon Cr	35.1		
	Theodore Cr	32.2		
	Klondike Cr	32.7		
17010203 (Stonewall/Park)	Stonewall Cr	31.6	32.5	31.9
	Park Cr	45.4		
17010203 (Lincoln Gulch)		Not sampled as no fishery present in most of the drainage	32.5	31.9
17010203 (Sucker/Liverpool)	Liverpool sw 1/4	42.7	32.5	31.9
	Liverpool nw 1/4	25.4		
	Sucker Cr	Not sampled		
	Keep Cool Cr	47.2		

*Averages for individual years are detailed in Fish Information for Stone Dry Watershed Analysis (Burns 2006).
** Reference standard developed from Helena National Forest Data in the Lake Helena Watershed

Summary of Fish Habitat

Fish habitat in the planning area is basically the product of interactions among underlying geologies, soils, topography, vegetation, climate and hydrology unique to the watershed (Meehan 1991, p. 5; Swanston 1991, p. 139). These drainage characteristics and processes remain fairly constant, setting up

conditions for optimum productivity of aquatic life forms (Meehan 1991, p. 5). When natural disturbance reshapes stream channels, the actual effects of such changes on aquatic organisms are often short term. In their natural context, accessory processes like fire, flood flows, insect infestations, and animal activities (e.g. beaver) operate on the stream system to produce improved habitat quality and productivity in the long term (Swanston 1991, p. 139-142).

Human land-use activities can disrupt the balance of these interactions producing persistent changes in habitat that can reduce natural fish production and population viability (Meehan 1991, pp. 1-6; Waters 1995, pp. 1, 17). The Stonewall Project area has historically implemented projects such as timber harvest, livestock grazing, mining, recreation and transportation. Cumulatively, these activities impair stream structure and function to varying degrees by increasing erosion and sedimentation, impacting water quality, altering flows, reducing vegetation cover, and destabilizing or degrading channels. Past and ongoing actions, including the transportation system that has been assessed for hydrologically connected sediment delivery sites and culvert crossings, cumulatively set the stage for existing conditions of sediment in fish reproductive habitat. Without mitigation or other corrective actions to protect and recover habitat, these factors suppress the natural fish production capabilities (carrying capacity) of streams (Hicks et al. 1991, pp. 484-485).

Environmental Consequences

Alternative 1

Direct and Indirect Effects

Under alternative 1 there would be no new road or ground based timber harvest to change the level of sediment delivered to streams. Sedimentation levels may change due to ongoing management. Taking “no action” to address motorized roads and trails in managed watersheds (like those in the project area) almost always results in the same or increased levels of sedimentation over time. Hydrologically linked roads, a significant unnatural source of chronic sedimentation, would remain untreated contributing 11 tons of sediment in excess annually within project watersheds. Although old, infrequently used roads would continue to revegetate, reducing the amount of sediment produced and possibly contributed to streams; all of these old roads would continue to have varying degrees of impact to watershed hydrology and water quality. Stream channel and road fill scour, channel aggradations, and risk of sediment contribution from failure of undersized stream crossings would persist until otherwise addressed.

No timber harvest is proposed under the no-action alternative, and therefore no change in the timing or magnitude of peak flows is expected. Alternatively, there would be no measures taken to promote change in function for any stream within the project area that is not currently at desired conditions.

Alternative 1 would fail to promote improvement in stream habitat conditions for Westslope cutthroat trout (MIS), bull trout or for other aquatic populations that exist in streams. Thus, certain aquatic populations would remain at lower densities than those in streams that are functioning properly and where habitat quality and quantity are nearer potential. Average fine sediments in trout spawning habitat would remain elevated in some of the project area streams (table 146) in contrast to approximately 33 percent average fine-sediment levels determined for reference streams across the Helena National Forest.

Alternative 1 would fail to promote improvement in riparian habitat conditions in the project area. Because there would be “no action” there would be no measures taken to change the function for any riparian area within the project area.

Alternatives 2 and 3

The Stonewall Vegetation Project has been designed with features that are intended to minimize or avoid potential adverse effects while meeting project objectives. In addition to the proposed action treatments described in this section, design features would be implemented where applicable. A description of the project design features relating to fisheries and other resources is displayed in table 9, chapter 2.

The specific design features listed under soil, watersheds and fisheries in table 9 pertaining to hydrology are S/WS/F-15, S/WS/F-16, and S/WS/F-17.

This analysis is based on the implementation of all design features. Project design features apply to all action alternatives. Design features that are applicable to fisheries include not only those listed above, designed specifically to protect fish and fish habitat, but also those designed to protect other resources such as soils and water quality/quantity.

Effects Common to All Action Alternatives

Roads

Road maintenance and improvement best management practices (BMPs) would be applied to all roads used in the project, including application of aggregate at road/stream crossings and other sediment delivery points. Project design features apply to all action alternatives (table 9).

There would be a short-term (5-7 years) reduction in sediment transport from roads in the project area resulting from road improvements planned in this alternative. Forty-eight miles of road proposed for hauling in alternative 2 and 44 miles of road proposed for hauling under alternative 3 would receive BMP maintenance (table 138 in the Hydrology Section). Project-related road improvements include surface grading, re-establishment of drainage features (grade dips and ditch-relief culverts), and application of gravel at stream crossings and other sediment delivery points. Sediment levels would increase during the project as a result of ground disturbance during maintenance and when culverts are installed (table 139 in the Hydrology Section). There are about 2.6 miles of road that would be built then obliterated immediately following timber removal (new and “new specified”) planned in these alternatives. Most of these road segments are not predicted to convey sediment to stream channels, as they would be built in upland locations without surface hydrologic connection to any stream channel. After the project there would be an overall decrease in sediment sources from roads (table 139 in the Hydrology Section).

The proposed new road to be built then obliterated number 4, which would provide access to units 20 and 21, crosses the drainage of a headwater tributary basin to Lincoln Creek (chapter 2). This crossing was reviewed in the field—there is a vegetated old roadbed at this site, but no stream channel or evidence of overland flow. Channel features were observed roughly 60 feet below the roadbed. Sediment that appeared to be from the old roadbed was observed in this channel, indicating that in the past, this road probably contributed sediment to the uppermost reach of this intermittent stream. If restored, this road represents a potential source of sediment to the stream channel, and should be accounted for in estimates of sediment impacts of the project. If the decision is made to construct this segment, then appropriate mitigations must be in place (adequate culvert, proper road drainage, and sediment fencing if appropriate) and the segment should be obliterated soon after the project ends, in order to minimize sediment impacts.

The proposed new road to be built then obliterated number 5, which is between units 10 and 11, crosses an intermittent channel and is a source of sediment to this stream (chapter 2). Efforts would be made in the construction of this new road (e.g. raised grade at crossing, sediment filters at drainage runouts) to prevent sediment delivery to the channel while the road is in place.

The total reduction in average annual sediment transport from using BMPs for project haul roads was modeled to be roughly 2 tons less than the existing conditions under this alternative, based on proposed BMP upgrades and road improvements. The long-term benefits from decreased annual sediment loads would outweigh the short-term increases during road maintenance activities. For the road segments to be obliterated, the reduction in sediment delivery would be permanent.

BMPS

INFISH (USDA Forest Service 1995) standards would need to be met. A key component of INFISH for this project includes measures to address roads that have high risk for sediment delivery to surface waters, see the Transportation Report (Bielecki 2012) and Hydrology Report (McNamara 2012) in the project file for specific roads and BMP details.

Riparian Areas

Additional measures to reduce risk for negative effects to native fisheries entail restrictions on removal of trees from riparian habitat conservation areas to ensure the potential for woody debris recruitment, pool formation and floodplain function is maintained (table 9)

As provided for with INFISH standard RA-2, trees to be removed as part of salvage, that are not needed for woody debris recruitment or floodplain needs, can be removed. “Green commercial trees within the RHCA that have not been attacked by beetles and are not otherwise at risk of dying in the immediate future cannot be removed unless site-specific rationale discussing why it would be beneficial to fish and watershed is developed for each specific unit. Log landings should not be located in RHCAs.”

Category 1 - Fish bearing streams: The RHCA width is 300 feet on either side of the stream or the 100-year floodplain whichever is greater.

Category 2 - Perennial streams not supporting fish: The RHCA is 150 feet on either side of the stream.

Category 3 - Lakes or wetlands greater than one acre: The RHCA is a minimum of 150 feet but can be larger and extend to the outer limits of riparian vegetation, the extent of seasonally saturated soil, the extent of highly unstable areas, or the distance equal to the height of one site-potential tree.

Category 4 - The project area is not within INFISH priority drainage: For seasonally flowing or intermittent streams, wetlands less than 1 acre, landslides and landslide prone areas, the RHCA boundary is one-half site potential tree from the edges of the stream channel, wetland or landslide, landslide prone area or a 50-foot slope distance, whichever is greatest.

For both action alternatives, riparian areas would have at least a 50-foot no ignition buffer around ephemeral, intermittent, and perennial channels for slopes less than 35 percent, and a 100-foot buffer for slopes more than 35 percent. Fire would be allowed to back into INFISH buffers. Alternatives 2 and 3 would allow for dead trees to be removed from RHCAs. These trees are not providing shade to the stream and not in a position (across the road) to become woody debris. Removal of dead trees and allowing fire to back into RHCAs would allow riparian shrubs and trees to reestablish. Roads to be built and then obliterated are short segments that would be temporary in nature and not likely to change the character or function or the RHCAs. Therefore, activities proposed under these alternatives would not adversely affect riparian areas. Streams within the project area would generally remain at proper functioning condition.

Fish

Trout use redds (nests dug by fish in streambed gravels) in flowing waters for their reproductive strategy. When excessive sediment accrues to spawning and rearing sites, trout embryo and fry success decline below natural rates. Additionally, other trout life history elements such as juvenile survival, growth, and

adult survival also can be at risk if excess sediment reduces cobble spaces in riffle areas and pool volumes. Everest et al.1987, p. 133 concluded that salmonid species can cope with the natural variability in sediments, but their populations can be reduced substantially by persistent sedimentation that exceeds the natural levels under which they evolved. Average fine sediments in trout spawning habitat within project area streams may show short-term increases in fines at depth. In the long term, stream channels would show measurable decreases in the levels of fines as project area roads would deliver roughly 2 tons less sediment per year.

Given the number of acres that would be treated in the project watersheds under alternatives 2 or 3, it is unlikely there would be a cumulative increase in water yield that would be detectable. The estimated water yield increase for project watersheds is below the DEQ-recommended threshold of 10 percent. Streams emanating from project watersheds appear to lose flow as they move from steeper areas and encounter deep valley floor sediments. Considering the dry (losing stream) nature of the channels in the Stonewall Project area watersheds, the potential increase in water yield would be unlikely to cause any negative effects (i.e., accelerated bank erosion).

Therefore, this vegetation treatment proposal may result in short-term impacts to fisheries resources from road maintenance treatments. The project incorporates special design elements that reduce sedimentation risk by incorporating RHCA buffers and use of low-severity burns. Most importantly, long-term sediment reduction (improvement) in trout reproductive habitat is predicted due to road BMP measures and culvert upgrades that also reduce flood hazard risks at these critical road/stream intersections.

Cumulative Effects

A list of past, present and reasonably foreseeable future activities is available in appendix C. Management activities that are most likely to influence aquatic species abundance, distribution and possibly persistence of populations are discussed in this section.

Livestock grazing: This affects aquatic species because it alters stream morphology and vegetative conditions in the uplands and riparian areas. This changes the capabilities of hydrologic processes and stream morphology changes, reducing stream function. The result is a reduction and simplification in habitats.

Irrigation diversions: The effects on aquatic species occur through the loss of instream flows and possibly temperature increases and loss of individuals in irrigation ditches. In some cases, diversion may benefit WCT because it is limiting upstream movement of nonnative species that would hybridize and/or compete with them.

Noxious weed treatment: Beneficial effects are expected from reversing trends in vegetative conditions. Potential negative effects if herbicides contact individuals directly. Risk is low for this; the HNF weed treatments provide mitigations to reduce risks of introduction of herbicide into streams and other water bodies. We expect the balance of effects related to this management to be beneficial.

Mining: Historic mining has had major affects to water quality and stream function in the project area, but there are no known water quality or stream channel conditions caused by historic mining that would be affected by the proposed activities. Placer operations have altered the physical function of some stream channels through the removal of stream gravels and channelization. Suction dredge mining operations are proposed or on-going at this time.

Prescribed burning: This has some risk of increasing short term sediment delivery because of the temporary loss of vegetative cover that occurs. This, however, is effectively mitigated in most situations through the application of treatment buffers around streams and other water bodies. Benefit would occur

through longer-term improved vegetation cover in riparian and uplands, which would reduce sediment delivery.

Dispersed recreation: This is common across the analysis area and would continue – and probably increase – in the future. Effects to aquatic species are likely minor. Even though most dispersed camping and other activities occur in close proximity to water, the length of streams disturbed is relatively small. Sediment delivery from dispersed recreation can occur but it is limited enough in scope in most cases to keep it from being a notable concern relative to aquatic populations. Angling probably results in a limited amount of mortality, even though state regulations prohibit anglers from keeping bull trout from streams in the analysis area.

Range improvements: These are expected to help with livestock distribution, decreasing impacts to streams, and so limiting negative effects on stream channel morphology and stream function.

Road and trail construction and maintenance: To support timber removal Alternative 2 proposes approximately 2.6 miles of roads to be built then obliterated immediately following timber removal; alternative 3 proposes 0.4 mile. No permanent roads or trails are proposed. Required maintenance on roads for the project would reduce sources of sedimentation in the long term by 2 tons per year that are negatively affecting aquatic species and habitat.

Hazard Tree Removal: This activity is limited to certain road and trail corridors and recreation sites. Effects to aquatic populations are likely minor.

Alternative 1 (no action) would not promote a change in existing conditions within the analysis area. While this alternative meets the Forest Plan direction of “no measurable effect”, it does nothing to help ensure movement toward desired conditions. Because many streams are currently nonfunctioning or functioning at risk, alternative 1, when considered with other current, past and reasonably foreseeable actions could work cumulatively with the management activities/natural events discussed above to limit the potential to achieve healthy population densities in certain populations.

Alternatives 2 and 3 would promote improvement in stream conditions through long-term reductions in sediment delivery and physical impacts to stream channels, which would promote positive shifts in stream function across the analysis area. Therefore, the effects of the Stonewall Vegetation Project proposed actions when considered cumulatively with other past, present and reasonably foreseeable actions should promote the attainment of better habitat conditions, and more abundant and resilient aquatic populations.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

Alternatives 2 and 3 comply with the Helena National Forest Plan, and other State and local laws, regulations, policies and plans.

Other Relevant Mandatory Disclosures

There are no other relevant mandatory disclosures for the aquatic resources in the Stonewall Vegetation Project

Species Determinations

The Biological Effects Determination for westslope cutthroat trout and western pearlshell mussel, if implementing alternative 2 or 3 is: **May impact individuals or habitat, but will not likely contribute to a trend toward federal listing or loss of viability to the population or species**.

The Biological Analysis Determinations for bull trout and bull trout critical habitat is: **May effect, not likely to adversely affect.**

WCT Population Viability at the Project Level:

Westslope cutthroat trout are the fish "management indicator species" for the Helena National Forest. They represent a measure of the effects of management activities on habitat with the objective of ensuring population viability (Forest Plan p. II-17). Westslope cutthroat trout are found in Stonewall planning area, and therefore, serve as the proxy population for viability analysis in fulfillment of the NFMA viability requirement.

This analysis uses a practical approach outlined in Ruggiero et al. (1994) and Region 1 guidance (Draft 01/30/2004) in conjunction with criteria established by Rieman et al. (1993). Simply put, "…an analysis of population viability is about birth, death, immigration, and emigration rates and how environmental or ecological factors affect these rates over time" (Ruggiero et al. 1994, p. 366). In this exercise, select habitat attributes considered both ecologically significant to fish and sensitive to land management disturbances are borrowed from Overton et al. 1995, p. 1), and Region 1 guidance (USDA Forest Service Draft 1/30/2004).

Table 147 displays these habitat attributes and which ones are affected by this proposal. Projections of change in any habitat attribute provide an indication whether negative effects to species or habitat is occurring.

Table 147. WCT habitat variables from Overton and Region 1 guidance that may be influenced by proposed management in the Stonewall Project area

HABITAT FEATURE	EFFECTS OF ACTION			COMMENTS
	MAINTAIN	DEGRADE	IMPROVE	
Bank Stability	X			Special guidance within stream buffers, SMZ regulations
Bank Undercut	X			Special guidance within stream buffers, SMZ regulations
Water temperature	X			Special guidance within stream buffers, SMZ regulations
Width-to-depth ratio	X			Special guidance within stream buffers, SMZ regulations
Width-to-maximum depth ratio	X			
Substrate composition		X	X	Degrade yr-1; improve yr 3+
Large woody debris (LWD)	X			Special guidance within stream buffers, SMZ regulations
Pool frequency	X			Special guidance within stream buffers, SMZ regulations
Invasive species	X			

Sediment in stream substrates was described being the attribute most responsive to disturbance from this project. Other attributes of fish habitat (bank stability, temperature, LWD, etc.) were excluded from further consideration due to specific project design elements—300-foot stream buffers in conjunction with state SMZs and low-severity burn prescriptions that restrict disturbance from important stream corridors.

Research has shown how increasing and decreasing levels of sediment in trout reproductive habitat affect trout embryo and fry survival rates negatively or positively respectively. When fine sediments elevate beyond natural levels in trout spawning habitat, the reproductive quality of that habitat diminishes resulting in a corresponding decrease in fry production. Mathematical equations to estimate existing and predicted embryo survival as a function of changes in sediment suggest success rate of hybrid WCT fry survival for this stream drops to 57 percent (from 62 percent) in year-one, and then improves to 78 percent after year-three as a result of sediment source reduction treatments to road # 423 and 423-D1. Estimates of changes in the rates of embryo survival are not necessarily accurate, but are meant to help determine the amount of changes in sediment yield upon WCT populations in question.

This analysis, therefore, predicts a short-term change in substrate composition risks, some minor downward trend in incubation and fry emergence success (birth rate) to the population before recovering to an improved trend over baseline after 3 years. WCT recruitment is likely more than adequate to offset minor short-term sediment increases near the populations in Beaver Creek and Keep Cool Creek.

In the long term, treating hydrologically connected roads helps recover gravel quality slightly over baseline conditions. Therefore, there is some minimal risk to viability for this WCT population in the short-term with a long-term trend of maintaining reproductive habitat within the acceptable range of variation (32.7% ±9.9%).

Recreation

Introduction

This analysis describes the existing recreation activities, settings and opportunities within the Stonewall Vegetation Project area, and describes the potential effects to recreation from proposed activities. Portions of the Stonewall Project area are within the Bear-Marshall-Scapegoat-Swan and Lincoln Gulch Inventoried Roadless Areas (IRAs). The potential effects to roadless and wilderness characteristics of the IRAs and unroaded lands contiguous to the IRAs are in a separate section beginning on page 596.

Overview of Issues

Comments pertaining to disclosing the effects of project activities on recreation were identified from public scoping as nonsignificant (40 CFR 1501.7), and are addressed by the analyses in this section. Please refer to volume 2, appendix A of this document for a complete listing of the issues and an explanation of how the agency determined their disposition.

Indicators

Indicators are defined to analyze data regarding the potential for impacts of vegetation treatments and prescribed fire on recreation opportunities within the project area, and the impacts of prescribed fire on trail conditions within the project area

- Loss of recreation opportunity, displacement of users, or a change in recreation experience due to vegetation treatments/prescribed fire activities (i.e. temporary closure of areas/visitors avoiding the

area during the vegetation treatments/prescribed fire, or changes in scenery following the vegetation treatments/prescribed fire that affect the recreation setting)

- **Measure: Life of the project**

· Increased trail maintenance needs following prescribed fire (i.e. increased erosion due to runoff or fallen trees)

- **Measure: Miles of trail affected**

Methodology

An interdisciplinary team meeting and field tour of the proposed project area was attended in Lincoln, Montana by specialists on September 20-24, 2010.

Analysis was accomplished using ArcMap and relevant Geographic Information System (GIS) data layers from the Helena National Forest, Lincoln Ranger District, including trails, roads, recreation sites, inventoried roadless areas, summer and winter ROS classes, winter use, and management areas. Online visitor information provided by the Helena National Forest and other local organizations provided an overview of the recreation opportunities and trends within the analysis area. A review of existing law, regulation and policy relevant to recreation resources within the project area was completed and are referenced where appropriate.

Spatial and Temporal Context for Effects Analysis

The potential direct and indirect effects to recreation resources were considered within the Stonewall Project area boundary. The direct effects would be short term and temporary, occurring during project implementation. The longer-term indirect effects would relate to ecosystem restoration, changes in visual qualities, and other items within the project area that would influence the recreation setting.

Cumulative Effects Process

Cumulative effects to recreation within the Stonewall Project area boundary would relate to other administrative or Forest management activities occurring within or immediately adjacent to the project area. Cumulative impacts would result if other activities take place during implementation of the Stonewall Vegetation Project or until vegetation growth obscures the visible stumps from the vegetation treatment activities and prescribed fire, approximately 3-5 years. A complete list of past, present and reasonably foreseeable activities is in appendix C.

Affected Environment

Existing Condition

The Forest

Fire suppression and moist growing conditions through much of this century resulted in a loss of open forest conditions and seral species (aspen, ponderosa pine and western larch). This has created a uniform landscape comprised of dense forests susceptible to insect and wildfire mortality (Douglas-fir and lodgepole pine). In addition, a large-scale mountain pine beetle epidemic has killed most of the mature lodgepole pine and ponderosa pine. These conditions are elevating fuel levels, which poses a wildfire threat to nearby homes and communities in the wildland urban interface (WUI).

Recreation

The project area provides access to a variety of recreation opportunities. While hunting and snowmobiling are the predominate recreation activities, other recreation uses include: camping, fishing, driving for

pleasure, off highway vehicle (OHV) travel and horseback riding, hiking, firewood gathering, berry picking, cross-country skiing and wildlife viewing. The following recreation facilities are located within the project area: Dry Creek Trailhead, Arrastra Creek Trailhead and Pine Grove dispersed camping area and trailhead. The Lincoln Ranger District receives most recreation use during the fall hunting season. Winter and summer visitation is slightly lower, and spring is the least used period.

The National Visitor Use Monitoring Results from data collected in 2008 indicate that the Helena National Forest serves a mostly local client base with nearly 70 percent of visitor use coming from people who live within 50 miles of the Forest. A majority of this is day use. Approximately 60 percent of Forest visitors listed the following as their main recreation activities on the Forest: hunting, hiking/walking, cross-country skiing, viewing natural features, snowmobiling, and driving for pleasure (USDA Forest Service 2009).

The Lincoln Ranger District issues special Use Permits for special events and commercial outfitters and guides. Several commercial outfitters are authorized to operate within the Bob Marshall Wilderness Complex; these outfitters likely pass through the project area to access the Scapegoat Wilderness area during their operations.

The southern boundary of the Scapegoat Wilderness is approximately 3 miles north of the Stonewall project area. The Scapegoat Wilderness is part of the Bob Marshall Wilderness Complex. It is referred to as "The Crown Jewel of the National Wilderness Preservation System" and is a very popular place to visit for people from all parts of the country (USDA Forest Service 1986, FEIS Appendix C-29). The Arrastra Creek and Dry Creek trailheads are popular access points for the Scapegoat Wilderness and heavily used during the fall hunting season.

The project area is also within the area known as the Southwest Crown of the Continent. The Crown of the Continent at a landscape level is an area that links the Canadian Rockies with the Greater Yellowstone Ecosystem and the Selway-Bitteroot Wilderness areas to the south.

The Southwestern Crown Collaborative (2010) describes this area as *"…one of the most biologically diverse and intact landscapes in the western United States. The Crown has been described as one of the premier mountain regions of the world and contains many of the largest remaining blocks of roadless lands in the contiguous US. The presence of expansive open space in the Southwestern Crown provides an abundance of outdoor recreational opportunities, from hunting and fishing to hiking and snowmobiling. Public access to streams, lakes, and private and public lands is highly valued."*

Roads and Trails

The primary motorized access into the project area is National Forest System Road #4106, Beaver Creek Road. It provides access to the Dry Creek Trailhead, Arrastra Creek Trailhead and Pine Grove dispersed camping area and trailhead, Huckleberry Pass, and serves as an important snowmobile trail. The road is popular with local residents who want to harvest huckleberries and firewood. Additional National Forest System roads that provide motorized access into the project area are Lincoln Gulch Road #626, Lone Point Road #1824, Lincoln Ditch Road #4043, and Park Creek Road #607.

Other access into the project area is on designated National Forest System trails including Dry Creek Trail #483, Porcupine Basin Trail #488, Arrastra Creek Trail #482, Stonewall/Copper Creek Trail #485, Stonewall Mountain Trail #418, and Stonewall Trail #417. The last three trails identified are open to motorized travel. Table 148 displays information for other motorized and nonmotorized trails as well as

groomed[29] and ungroomed snowmobile trails within the project area. The entire project area is currently open for snowmobile use in the winter.

Table 148. Stonewall Project area trails

Forest Trail Name	Miles within Stonewall Project Area	Trail Type
Stonewall/Copper Creek Trail #485	1.5 miles	Forest System Trail – motorized & nonmotorized
Stonewall Mountain Trail #418	2.5 miles	Forest System Trail – motorized & nonmotorized
Stonewall Trail #417	3 miles	Forest System Trail – motorized & nonmotorized
Snowmobile Trails	**Miles within Stonewall Project Area**	**Trail type (groomed/ungroomed)**
Route 2, Beaver-Dry Creek Trail	7 miles	Groomed
Route 1, Sucker Creek Road	1 mile	Groomed
Stonewall Mountain Trail	3 miles	Ungroomed
Trail near Reservoir Lake	1 mile	Ungroomed

The Lincoln Ranger District is currently developing the *Blackfoot Travel Plan (non-winter)* that would designate motorized public access routes on a Motor Vehicle Use Map and the *Blackfoot-North Divide Winter Travel Plan* that would provide for a variety of motorized and nonmotorized winter recreational opportunities. The plans are under analysis and being developed in accordance with 36 CFR 212, Subpart B, *Designation of Roads, Trails, and Areas for Motor Vehicle Use.*

Recreation Opportunity Spectrum

The Forest Service uses the Recreation Opportunity Spectrum (ROS) to inventory and describe the range of recreation opportunities available based on the following characteristics of an area: physical (characteristics of the land and facilities), social (interactions and contact with others), and managerial (services and controls provided). The recreational settings are described on a continuum ranging from Primitive to Urban. The Summer ROS classes within the Stonewall Project area include Semi-Primitive Motorized (SPM) and Roaded Modified (RM) (figure 84). The Winter ROS classes within the Stonewall project area include Semi-Primitive Motorized (SPM), Roaded Natural (RN), and Roaded Modified (RM) (figure 85). The Helena Forest Plan includes the following ROS Class definitions:

Semi-Primitive - A classification of recreation opportunity spectrum that characterizes a predominately natural or natural appearing environment of a moderate to large size. Concentration of users is low, but there is often evidence of other area users. The area is managed in such a way that minimum onsite controls and restrictions may be present, but subtle. In areas designated as **Semi-Primitive Motorized**, motorized use may occur on primitive roads and motorized trails.

Roaded Natural - A classification of the recreation opportunity spectrum where timber harvest or other surface-use practices are evident. Motorized vehicles are permitted on all parts of the road system (USDA Forest Service 1986).

[29] The groomed trails are as indicated on the Lincoln Area Snowmobile Trails Map compiled by the Ponderosa Snow Warriors Snowmobile Club (available in the project record)

Roaded Modified - A subclass of **Roaded Natural** that has typically been defined as areas exhibiting evidence of Forest management activities that are dominant on the landscape (USDA Forest Service 2003).

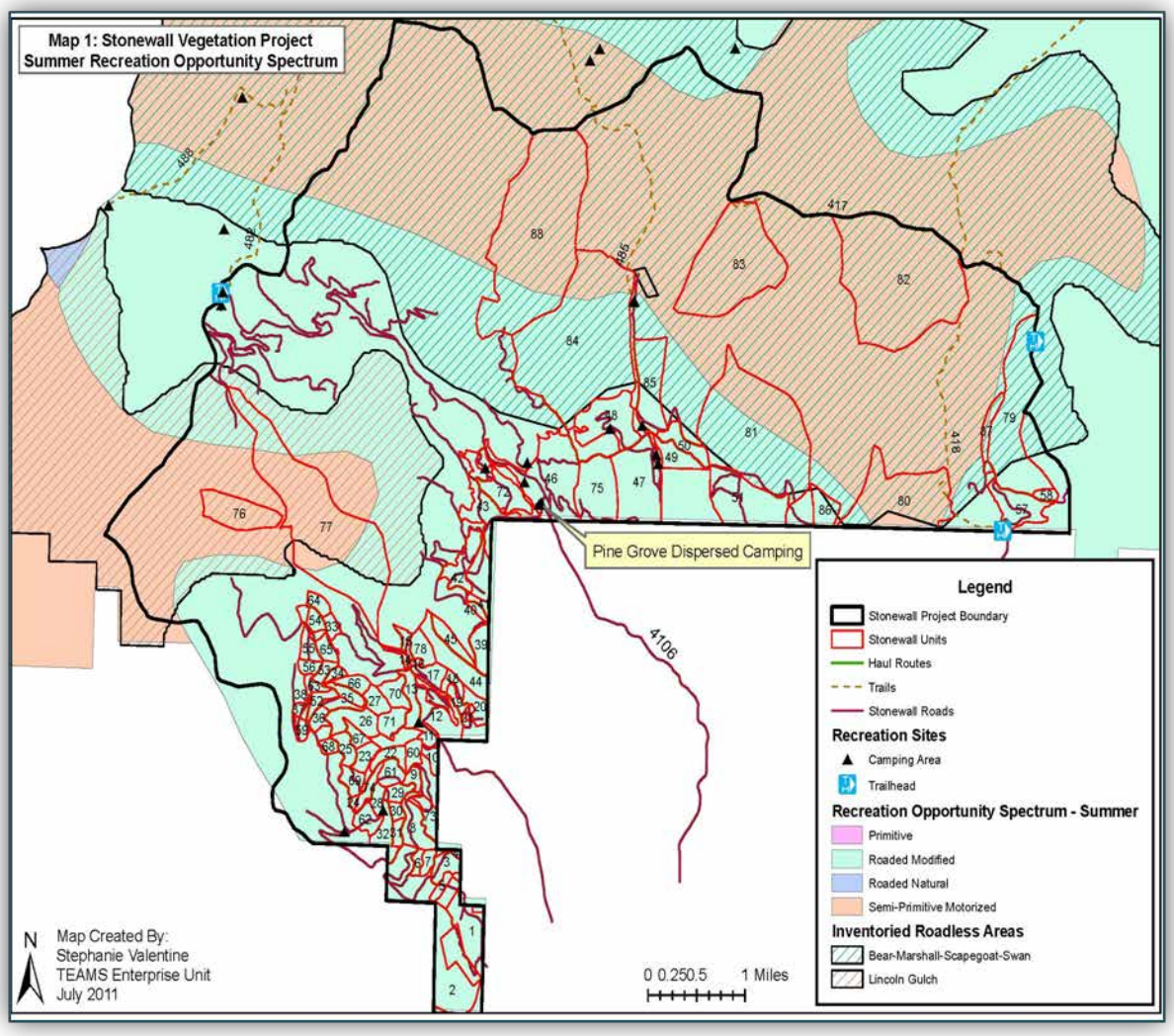

Figure 84. Summer Recreation Opportunity Spectrum

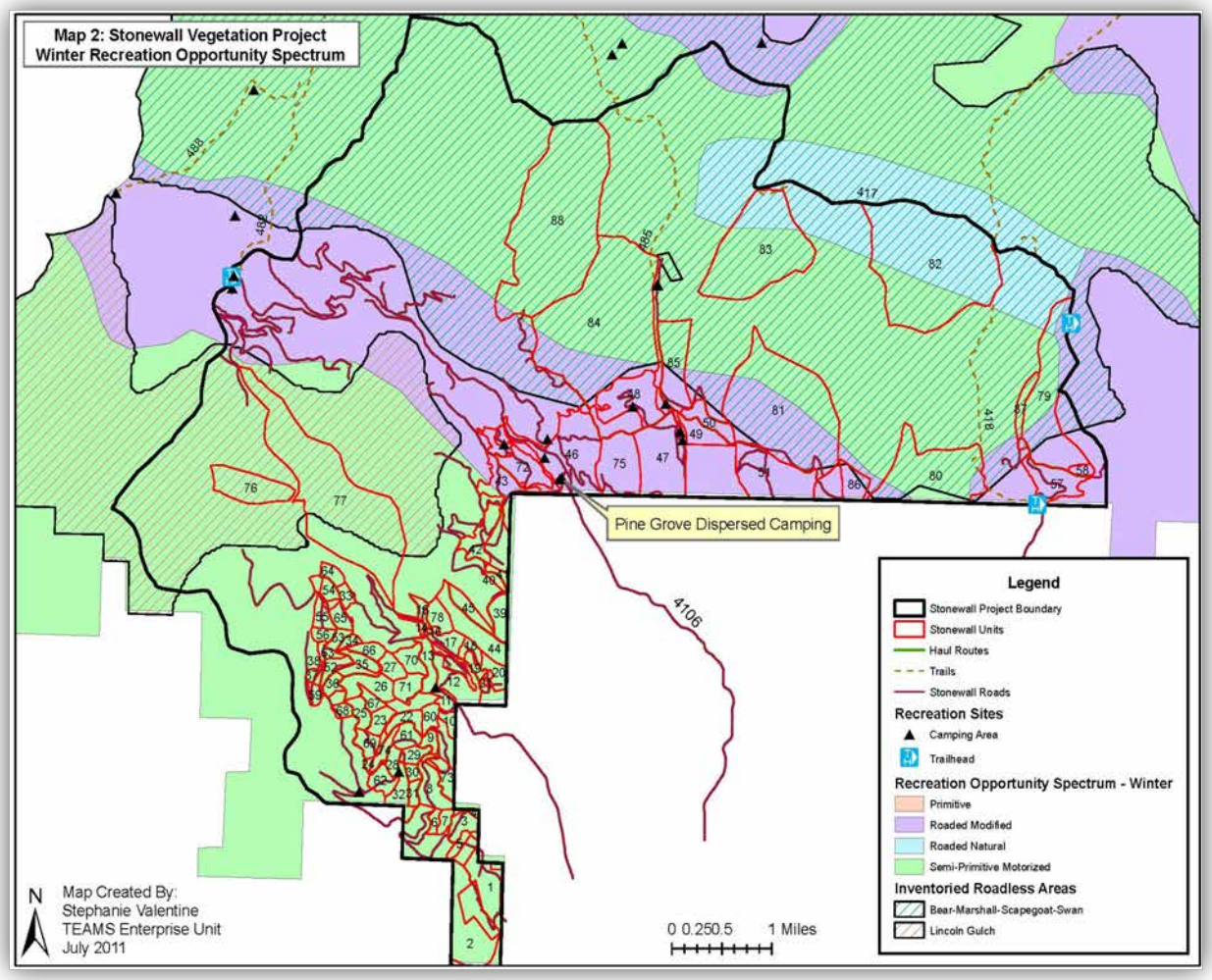

Figure 85. Winter Recreation Opportunity Spectrum

Environmental Consequences

Alternative 1 – No Action

Direct and Indirect Effects

If the no-action alternative is chosen, there would be no direct effects from proposed activities to recreation resources. However, the risk of severe wildfire would remain because the ecosystem restoration and fuel reduction project would not occur. In the long term, this may result in indirect effects to recreation resources, potentially resulting in changes to the recreation setting or scenic quality of the project area. The beetle killed, dead and dying trees would eventually fall to the ground making cross-country foot travel more difficult for hunting and hiking. In the long-term, this may result in displaced users as trees fall across trails and folks find other places to hunt, hike and walk. The effects to the recreation resource would continue over the next 10 to 15 years as dead trees fall to the ground and vegetation begins to reestablish.

Cumulative Effects

There are no known cumulative effects to recreation resources from alternative 1.

Irreversible and Irretrievable Commitments of Resources

Alternative 1 would have no irreversible and irretrievable commitments of resources relevant to the recreation resources within the project area.

Alternative 2 – Proposed Action

Project Design Features

The Stonewall Vegetation Project has been designed with features that are intended to minimize or avoid potential adverse effects while meeting project objectives. In addition to the proposed action treatments described in this section, design features would be implemented where applicable. A description of the project design features relating to recreation and other resources is displayed in table 9, chapter 2.

The specific design features listed in table 9 pertaining to recreation are REC-1 through REC-8.

This analysis is based on the implementation of all design features. Project design features apply to all action alternatives.

Direct and Indirect Effects

Activities from the proposed vegetation treatments including regeneration harvest, intermediate harvest, precommercial thinning, and prescribed burning may directly affect recreation activities and experience in the project area. The vegetation treatments may require temporary road or trail closures or limited access to the immediate area to protect public safety. In addition, visitors may choose to avoid areas during the harvesting, hauling, or prescribed burning activities. These effects would be both temporary and short term. The project design features, listed in table 9 in chapter 2, limit hauling logs during hunting season and on weekends and holidays (see table 9, Rec-1 and Rec-2) and would minimize impacts to the majority of recreational users. Public notification at trailheads, on the Forest website and in the local media would allow adequate notice for those planning trips into the area to adjust their plans (See table 9, Rec-3). Commercial outfitters operating in the area during project implementation may also be directly affected by limited access or trail closures. The public notification efforts would allow them to adjust their schedules.

The proposed vegetation treatments may indirectly affect the recreation setting within the project area by changing the scenic qualities within the treatment areas. The harvest activities would reduce stand density, and the cut tree stumps would remain visible to visitors passing through the project area. The prescribed burning activities would create blackened areas on the landscape. These effects would be short term.

The long-term benefits of the proposed action, including a more diverse, resilient and sustainable forest ecosystem, and reduction in the risk of negative impacts from severe wildfire or insects and disease, have the potential to indirectly benefit recreation by helping to maintain the settings and opportunities currently valued by the public for recreation within the project area. Studies suggest that less intense fires may have beneficial economic effects on outdoor recreation, whereas intense fires may have detrimental effects (Vaux, Gardner and Mills 1984).

Regeneration Harvest, Intermediate Harvest, Precommercial Thinning

The direct impacts to recreation from the harvest activities would be to the sights and sounds of equipment including chainsaws, feller bunchers, and cable logging equipment within the harvest units, and log truck traffic on the haul routes. Indirect affects to recreation would result from changes to the scenery following the harvest activities

Removal of beetle-killed trees would reduce the amount of standing dead trees that would eventually fall. The harvest activities would reduce safety concerns and make cross-country travel by foot easier for dispersed recreational activities such as hunting and hiking.

The Pine Grove dispersed camping area and trailhead is located within unit 46, which is proposed for intermediate harvest to restore open habitat, leaving a mature forest and the largest trees behind. After treatment, trees would be spaced 20 to 40 feet apart. This would result in short-term affects to recreation opportunities during the harvest activities, but the more open forest conditions would likely enhance opportunities for dispersed camping in the long term. A proposed haul route would also pass through this dispersed camping area. Project design features are in place to minimize impacts to the dispersed camping opportunities. They include prioritizing treatments adjacent to the dispersed camping area to limit the amount of time the area may be closed to the public, not permitting hauling on weekends and holidays, providing public notification of treatment schedules and protecting recreation facilities (See table 9, REC-2, 3, 5, 6, 7 and 8).

Several of the groomed snowmobile routes have been identified as haul routes for the harvest activities. Approximately 3 miles of Route 2 - Beaver-Dry Creek Trail (along Roads 4106 and 607), approximately 4 miles of Route 2A – Beaver Trail (not on Forest System land, along Road 4106) and approximately 4 miles of Route 1 – Sucker Creek Road Trail (along Road 1800, 3 miles, not on Forest System land), would be used as haul routes. Route 2 passes through units 46, 47 and 51 and runs along the borders of units 75, 48, 49, and 50 proposed for intermediate harvest or precommercial thinning. The 1-mile segment of Route 1 on Forest System land is located within unit 57 where the mountain pine beetle has caused high mortality. This unit is proposed for regeneration harvest that would leave behind live trees to provide shelter and seed, and establish a new stand of young trees. The Forest would coordinate with local snowmobile groups to identify alternative routes if winter operations would affect the use of the groomed trails (See table 9, REC-4).

Skid trails left by ground-based harvest and removal methods may open access to areas for off highway vehicles where vegetation previously prevented access. Design features are in place to minimize the appearance of skid trails where they intersect with existing roads and trails to reduce the likelihood of unauthorized motorized use (See table 2, Fuel-3). The ongoing *Blackfoot Travel Plan (non-winter)* and the *Blackfoot – North Divide Winter Travel Plan*, when completed, would designate public motorized access and motorized and nonmotorized recreational opportunities on the Lincoln Ranger District. The Stonewall Vegetation Project proposed action would not change any motorized route designations. The entire project area is currently open to cross-country travel by snowmobiles; the creation of more open forest conditions that would result from implementation of the proposed action could enhance the opportunities for snowmobiling within the project area. Cross-country travel by snowmobiles within the Stonewall Project area would be evaluated in the winter travel planning process.

Following the vegetation treatments, opportunities for firewood gathering would be enhanced (see table 9, FUEL-1). Huckleberries may see an increase in regeneration, therefore, picking opportunities may be fewer in the short term following treatments, but enhanced in the long term as plants start to reestablish (see the Wildlife Specialist Report (Reitz 2012) for additional information).

Prescribed Burning

The direct impacts to recreation from the prescribed burning activities during project implementation would be the sights and sounds of people and equipment, including chainsaws and vehicles, and smoke in the air. Smoke in the air during the prescribed burns may have a direct affect to the quality of the recreation experience within the project area and in the adjacent dispersed camping areas by temporarily reducing air quality and visibility. Coordination with the Montana Airshed Group to ensure compliance

with the Clean Air Act would minimize this impact (see table 9 AIR-1 and additional discussion in the Air Quality Report (USDA Forest Service 2012g).

Indirect affects to recreation would result from changes to the scenery following the prescribed burning activities.

There is potential for prescribed fire to affect Forest System trails by causing increased runoff and erosion or debris on the trails. There may be an increased incidence of burnt trees falling across the trails for several years following the prescribed burns. The Stonewall Mountain Trail #418 runs along the eastern boundary of units 80 and 82. The Stonewall Trail #417 runs along the northern boundary of the project area and units 82 and 83. The Stonewall/Copper Creek Trail #485 runs along the western boundary of unit 85 and passes through the eastern edge of unit 84. All of these units are proposed for prescribed burning activities. The designated National Forest System trails on the Lincoln Ranger District receive regular maintenance. Specific trail maintenance requirements would be addressed as needed based on trail conditions.

The proposed prescribed fire activity would include construction of hand fire lines. The fire lines may open access for OHVs where vegetation previously prevented access. Design features are in place to minimize the appearance of fire lines where they intersect with existing trails to reduce the likelihood of unauthorized use (see table 9, FUEL-3). The ongoing Blackfoot winter and summer travel plans discussed previously, when completed would guide motorized access on the Lincoln Ranger District. The proposed action would not change any motorized route or area designations.

Recreation Opportunity Spectrum

A majority of the proposed treatment units fall within the summer and winter ROS classes of Roaded Modified, while the only treatment proposed within the Semi-Primitive Motorized ROS class is hand slashing of small diameter trees and prescribed fire. The proposed harvest and prescribed burning activities, including the short-term disturbance, would be consistent with Roaded Natural and Roaded Modified ROS classes where timber harvest or other surface use practices are evident. The proposed hand slashing of small diameter trees and prescribed fire would maintain a predominately natural or natural appearing environment and would be consistent with Semi-Primitive Motorized ROS class (see page 5). There are no anticipated long-term effects on recreation opportunities or settings for the Stonewall Project area under alternative 2. Table 149 that follows shows the units and treatments proposed with potential impacts to specific recreation resources:

Table 149. Alternative 2 – proposed treatments and potentially impacted recreation resources

Unit Number	Alternative 2 – Proposed Action Treatment Description	Potentially Impacted Recreation Resource
46	Description Group 1 - Intermediate Harvest to Promote Mature Open Forests; Prescribed Fire - Underburn	Pine Grove Dispersed Camping & groomed snowmobile route (2)
47	Description Group 1 - Intermediate Harvest to Promote Mature Open Forests; Prescribed Fire - Underburn	Groomed snowmobile route (2)
48	Description Group 2 - Intermediate Harvest to Thin Young Forests; Underburn	Groomed snowmobile route (2)
49	Description Group 2 - Intermediate Harvest to Thin Young Forests; Underburn or slash treatment along private	Groomed snowmobile route (2)
50	Description Group 2 - Intermediate Harvest to Thin Young Forests; No fuels treatment	Groomed snowmobile route (2)
51	Description Group 2 - Intermediate Harvest to Thin	Groomed snowmobile route (2)

Unit Number	Alternative 2 – Proposed Action Treatment Description	Potentially Impacted Recreation Resource
	Young Forests; Underburn or slash treatment along private	
57	Description Group 3 - Regeneration Harvest in Areas of High Mortality Retaining Seed and Shelter Trees; Jackpot Burn	Groomed snowmobile route (1), adjacent to trailhead #418, Stonewall Mountain Trail
75	Description Group 2 - Intermediate Harvest to Thin Young Forests; Underburn	Groomed snowmobile route (2)
80	Description Group 7 - Mixed Severity Fire to Create Mortality Patches up to 5, 10, or 20 Acres	Trail #418, Stonewall Mountain Trail
82	Description Group 8 - Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Trail #417 - Stonewall Trail , #418 - Stonewall Mountain Trail
83	Description Group 8 - Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Trail #417 - Stonewall Trail
84	Description Group 8 - Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Trail #485 - Stonewall/Copper Creek Trail
85	Description Group 6 - Low Severity Prescribed Fire to Create Mortality Patches 5 to 10 Acres	Trail #485 - Stonewall/Copper Creek Trail

Irreversible and Irretrievable Commitment of Resources

In alternative 2, proposed action, there would be no irreversible and irretrievable commitment of resources relevant to the recreation resources within the project area.

Alternative 3

The activities proposed in alternative 3 differ from those of alternative 2 - proposed action, relevant to the analysis of recreation resources. The relevant changes include fewer units proposed for intermediate harvest and fewer units proposed for prescribed fire and hand slashing of small diameter trees within inventoried roadless areas (IRAs). Alternative 3 has no activities planned within the Lincoln Gulch IRA or in the unroaded area contiguous to this IRA. In addition, alternative 3 proposes fewer units for treatment in the Bear-Marshall-Scapegoat-Swan IRA.

The relevant unit changes in alternative 3 are as follows:

Units 46 and 47 change from intermediate harvest with underburn treatments in Group 1 for alternative 2, to units 46a and 47a in a new group, Group 10 for alternative 3. Treatments would be designed in a mosaic pattern to maintain cover and forage for wildlife while promoting ponderosa pine and aspen, and reducing ladder fuels. Portions of the stand would be thinned to reduce understory competition from around large ponderosa pine trees, thin heavily stocked groups of trees on sites historically dominated by ponderosa pine, and remove conifer competition from within and around quaking aspen.

Units 49 and 75 proposed for intermediate harvest are removed. Units 76 and 77 proposed for prescribed fire are removed from the Lincoln Gulch IRA and the unroaded area contiguous to the IRA. The mixed severity prescribed fire proposed for unit 80 changes to unit 80a, jackpot burn. Units 81 and 86 proposed for mixed severity prescribed fire are removed from the Bear-Marshall-Scapegoat-Swan IRA and the unroaded area contiguous to the IRA.

Direct and Indirect Effects

Regeneration Harvests, Intermediate Harvests, Precommercial Thinning

The Pine Grove dispersed camping area and trailhead is located within unit 46a proposed for intermediate harvest with jackpot burning in alternative 3. There would be short-term impacts to recreation opportunities during these activities, but the more open forest conditions would likely enhance opportunities for dispersed camping in the long term. A proposed haul route would also pass through this dispersed camping area. Project design features are in place to minimize impacts to the dispersed camping opportunities. They include prioritizing treatments adjacent to the dispersed camping area to limit the amount of time the area may be closed to the public, not permitting hauling on weekends, providing public notification of treatment schedules and protecting recreation facilities (see table 9, REC-2, 3, 5, 6, 7 and 8).

Several of the groomed snowmobile routes have been identified as haul routes for the harvest activities. Approximately 3 miles of Route 2 - Beaver-Dry Creek Trail (along Roads 4106 and 607), approximately 4 miles of Route 2A – Beaver Trail (not on Forest System land, along Road 4106) and approximately 4 miles of Route 1 – Sucker Creek Road Trail (along Road 1800, 3 miles, not on Forest System land), would be used as haul routes. Route 2 passes through units 46a, 47a and 51 and runs along the borders of units 48, and 50 proposed for intermediate harvest or precommercial thinning. Alternative 3 would have slightly less potential to impact Route 2, since two of the units proposed for treatment (75 and 49) were removed from consideration in this alternative. The 1-mile segment of Route 1 on Forest System land is located within unit 57 where the mountain pine beetle has caused high mortality. This unit, proposed for regeneration harvest, would leave behind live trees to provide shelter and seed to establish a new stand of young trees. The Forest would coordinate with local snowmobile groups to identify alternative routes if winter operations would affect the use of the groomed trails (See table 9, REC-4).

Prescribed Burning

Alternative 3 proposes fewer acres of prescribed burning; therefore, the potential impacts of noise from people and equipment would be less than those described in alternative 2. Smoke in the air during the prescribed burns may have a direct affect to the quality of the recreation experience within the project area and in the adjacent dispersed camping areas by temporarily reducing air quality and visibility. Coordination with the Montana Airshed Group to ensure compliance with the Clean Air Act would minimize this affect (see table 9, AIR-1 and additional discussion in the Air Quality section).

Indirect affects to recreation would result from changes to the scenery following the prescribed burning activities, but fewer changes can be expected in this alternative compared to alternative 2 because fewer acres are proposed for treatment.

There is potential for prescribed fire to affect Forest System trails by causing increased runoff and erosion or debris on the trails. There may be an increased incidence of burnt trees falling across the trails for several years following the prescribed burns. The Stonewall Mountain Trail #418 runs along the eastern boundary of units 80a and 82. The Stonewall Trail #417 runs along the northern boundary of the project area and units 82 and 83. The Stonewall/Copper Creek Trail #485 runs along the western boundary of unit 85 and passes through the eastern edge of unit 84. All of these units are proposed for prescribed burning activities. The designated National Forest System trails on the Lincoln Ranger District receive regular maintenance. Specific trail maintenance requirements would be addressed as needed based on trail conditions.

Recreation Opportunity Spectrum

A majority of the proposed treatment units fall within the summer and winter Recreation Opportunity Spectrum classes of Roaded Modified, while the only treatment proposed within the Semi-Primitive Motorized ROS class is hand slashing of small diameter trees and prescribed fire. The proposed harvest and prescribed burning activities, including the short-term disturbance, would be consistent with Roaded Natural and Roaded Modified ROS classes where timber harvest or other surface-use practices are evident. The proposed hand slashing of small diameter trees and prescribed fire would maintain a predominately natural or natural appearing environment and would be consistent with Semi-Primitive Motorized ROS class (p.5). There are no anticipated long-term effects on recreation opportunities or settings for the Stonewall Project area under alternative 3.

Table 150 that follows shows the units and treatments proposed with potential impacts to specific recreation resources:

Table 150. Alternative 3 – proposed treatment and potentially impacted recreation resources

Unit Number	Alternative 3 –Treatment Description	Potentially Impacted Recreation Resource
46a	Description Group 10 – Intermediate Harvest – Improvement Cut; Jackpot burn, Handpiling, Burn Piles	Pine Grove Dispersed Camping & groomed snowmobile route (2)
47a	Description Group 10 - Intermediate Harvest to Thin Young Forests; Low Severity Prescribed Fire	Groomed snowmobile route (2)
48	Description Group 2 - Intermediate Harvest to Thin Young Forests; Underburn	Groomed snowmobile route (2)
50	Description Group 2 - Intermediate Harvest to Thin Young Forests; No fuels treatment	Groomed snowmobile route (2)
51	Description Group 2 - Intermediate Harvest to Thin Young Forests; Underburn or slash treatment along private	Groomed snowmobile route (2)
57	Description Group 3 - Regeneration Harvest in Areas of High Mortality Retaining Seed and Shelter Trees; Jackpot Burn	Groomed snowmobile route (1), adjacent to trailhead #418 - Stonewall Mountain Trail
80a	Description Group 9 - Low Severity Prescribed Fire	Trail #418 - Stonewall Mountain Trail
82	Description Group 8 - Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Trail #417 - Stonewall Trail, #418 - Stonewall Mountain Trail
83	Description Group 8 - Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Trail #417 - Stonewall Trail
84	Description Group 8 - Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Trail #485 - Stonewall/Copper Creek Trail
85	Description Group 6 - Low Severity Prescribed Fire to Create Mortality Patches 5 to 10 Acres	Trail #485 - Stonewall/Copper Creek Trail

Irreversible and Irretrievable Commitments of Resources

In alternative 3, there would be no irreversible and irretrievable commitment of resources relevant to the recreation resources within the project area.

Cumulative Effects Common to All Action Alternatives

Cumulative effects to recreation within the Stonewall Project area boundary would relate to other administrative or Forest management activities occurring within or immediately adjacent to the project area. Cumulative impacts would result if other activities take place during implementation of the

Stonewall Vegetation project or until vegetation growth obscures the visible stumps from the vegetation treatment activities and prescribed fire, approximately 3-5 years.

The effects of past actions within the Stonewall Project area are incorporated into the description of the existing condition. The present and reasonably foreseeable future actions within the project area have been reviewed for potential cumulative effects when the direct or indirect effects of the alternatives are added to them. The projects occurring within the spatial and temporal boundaries described in this analysis for recreation resources cumulative effects analysis are considered here.

Since there would be no direct or indirect effect to the ROS classes, there would be no cumulative effects to the ROS classes within the project area.

Recreational activities such as hunting, camping, hiking, OHV travel on primitive roads, and snowmobiling and cross-country skiing in the winter would continue within the analysis area. Other ongoing and reasonably foreseeable activities that would be occurring within the analysis area include hazard tree removal, weed treatments, road and trail maintenance, commercial guided recreation and special events, firewood cutting and continued use of grazing allotments. All of these activities, when added to the activities proposed in the Stonewall Vegetation Project have the potential to cumulatively affect the recreation experience within the project area. The primary impacts would be due to the increased presence of people, vehicles and associated noise that would directly affect the ability of recreational visitors to enjoy their desired experience, and may lead to the short-term displacement of visitors who choose to avoid the area during implementation of the various activities.

The longer-term impacts of ongoing and reasonably foreseeable activities, such as hazard tree removal and weed treatments, when added to the activities proposed in the Stonewall Vegetation project, have the potential to cumulatively impact the recreation setting by causing changes to the scenic qualities within the project area and creating a setting where resource modifications and utilization practices are evident, but harmonize with the natural environment as indicated in a Roaded Natural ROS setting (p.5). Most of these effects would be beneficial because they would increase the resiliency of forest conditions, and reduce the risk of potential negative impacts from severe wildfire, therefore, maintaining the recreation settings currently valued by the public.

A complete list of past, present and reasonably foreseeable future activities in the project area is in appendix C.

Summary of Effects of All Alternatives

Alternative 1, no action would have no direct or cumulative effects to recreation resources. The purpose and need for the Stonewall Vegetation Project *"…improving the mix of vegetation and structure across the landscape so that it is diverse, resilient, and sustainable to wildfire and insects; modifying fire behavior to enhance community protection while creating conditions that allow the reestablishment of fire as a natural process on the landscape; enhancing and restoring aspen, western larch and ponderosa pine species and habitats; utilizing the economic value of trees through removal; and integrating restoration with socioeconomic considerations"* would not be addressed. Potential long-term indirect effects to recreation resources would be due to the ongoing risk of severe wildfire that could lead to changes in the recreation settings, visual qualities and naturalness within the roadless expanse.

Alternative 2, proposed action would have short-term direct effects to recreation resources during project implementation such as limited access to specific areas and increased presence of people and noise within the project area. Project design features are in place to limit potential affects (table 9). The proposed treatments would address the purpose and need for the Stonewall Vegetation Project, resulting in a more diverse, resilient and sustainable Forest ecosystem with reduction in risk of negative impacts from severe

wildfire. The long-term indirect effects to recreation would be generally beneficial and help to maintain the existing recreation settings and scenic qualities within the project area.

Cumulative effects to recreation resources would generally be short term, occurring during project implementation, and would relate to an increased presence of people, vehicles and the associated noise that may affect the recreation experience. Longer-term cumulative effects would impact the Pine Grove dispersed camping area, such as hazard tree removal and fence construction for a riparian exclosure, in addition to the actions proposed in the Stonewall Vegetation Project. These effects would remain until vegetation growth obscures the visible stumps from the vegetation treatment activities, approximately 3-5 years, but would remain consistent with Roaded Natural ROS class (p.5).

The effects of alternative 3 relative to recreation resources would be similar to those described for alternative 2, but the impacts would occur on fewer acres. There would be no affects to the Lincoln Gulch IRA and fewer acres treated within the Bear-Marshall-Scapegoat-Swan IRA (see the Inventoried Roadless Area Report (Valentine 2012a) for additional analysis).

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The proposed alternatives are consistent with the following:

- Helena National Forest Plan 1986, Recreation Standards for Management Areas: M-1, T-1, T-2, T-3, T-4, and W-1.

Forest Service Manual (FSM) 2300 – Recreation, Wilderness and Related Resource Management, guides management of recreation and wilderness resources on National Forest System lands.

Inventoried Roadless Areas

Introduction

This analysis describes the existing condition in portions of the Bear-Marshall-Scapegoat-Swan (BMSS) and Lincoln Gulch Inventoried Roadless Areas (IRAs) that are within the Stonewall Vegetation Project area. In addition, this roadless analysis describes the potential effects from the proposed activities identified in the alternatives of the Stonewall Project to the roadless area characteristics and wilderness attributes of the Inventoried Roadless Areas, as well as the unroaded lands contiguous to them. Additional detailed information is contained in the Inventoried Roadless Area report (Valentine 2012a), incorporated by reference.

Overview of Issues Addressed

During the public scoping process, five comments were received regarding IRAs. The comments were identified as nonsignificant (40 CFR 1501.7). Specific responses to the comments and explanations of how the comments were addressed either in the analysis or through project design features, are included in this DEIS in Appendix A – Public Involvement.

The following issue is relevant to the roadless resources within the analysis area and is addressed by the analysis in this section:

- Prescribed fire activities may affect roadless area characteristics within the project area.

Indicators

Indicators are defined to analyze data regarding the potential for impacts to the roadless resource from project activities that may affect roadless characteristics and wilderness attributes. Impacts to the roadless area characteristics as described in 36 CFR 294.11 – Roadless Area Conservation, Final Rule and wilderness attributes of roadless areas as described in Forest Service Handbook (FSH) 1909.12 (72.1) – Wilderness Evaluation.

Measure: Acres affected and duration of the impact

Roadless Analysis Background and Direction

Classification of roadless areas began with the Roadless Area Review and Evaluation (RARE) study in 1973 and the subsequent RARE II study in 1978. The 1983 Helena Forest Plan included evaluation of 23 roadless areas (USDA Forest Service 1986c, FEIS ROD). This met the direction in 36 CFR 219.17 regarding evaluation of roadless areas, and was in compliance with a 1982 decision of the Ninth Circuit Court that found RARE II study to be inadequate. As a result of this evaluation, the Forest Plan provides management direction for 79,200 acres of undeveloped area outside of Wilderness to remain undeveloped, and the remaining 203,900 acres of undeveloped areas were assigned to other resource management goals (USDA Forest Service 1986b, c). The two IRAs within the Stonewall Project area (Bear-Marshall-Scapegoat-Swan and Lincoln Gulch) were among those areas assigned to other resource management goals, as described in the Affected Environment section of this section.

On Jan 12, 2001, the Roadless Area Conservation Rule was published (36 CFR 294); the rule became effective on March 13, 2001. The 2001 rule prohibited road construction, road reconstruction and timber cutting, sale and removal in inventoried roadless areas with some exceptions. On July 13, 2003, the 2001 Roadless Rule was enjoined by U.S. District Court Judge Brimmer in Wyoming, after which the Forest Service established Interim Directives for the management of roadless areas.

In May 2005, the 2005 State Petitions Rule was established, which allowed governors to petition for individual, state-specific rules to manage IRAs in national forests and grasslands in their states. In October 2006, Judge Laporte (Northern District Court of California) set aside the State Petitions Rule and reinstated the 2001 Roadless Rule (*California ex rel. Lockyer v USDA).* In December 2008, the Court limited its injunction to states within the Ninth Circuit and New Mexico (excluding Idaho). In August 2009, the 9th Circuit Court of Appeals affirmed the Northern District Court of California's opinions.

On Jan 12, 2007, the state of Wyoming again challenged the 2001 Roadless rule in Wyoming. On August 12, 2008 in the District Court of Wyoming, Judge Brimmer issued a ruling enjoining the 2001 Roadless Rule for the second time *(Wyoming v. USDA).* This opinion was appealed to the 10th Circuit Court of appeals.

On May 28, 2009, Secretary of Agriculture Tom Vilsack issued Memorandum 1042-154, which reserves "to the Secretary the authority to approve or disapprove road construction or reconstruction and the cutting, sale, or removal of timber in those areas identified in the set of inventoried roadless area maps contained in Forest Service Roadless Area Conservation, Final Environmental Impact Statement, Volume 2, dated November 2000." The Secretary's Memorandum 1042-154 is intended to assure careful evaluation of actions in inventoried roadless areas while long-term roadless policy is developed and relevant court cases move forward.

On August 3, 2009, the Forest Service received re-delegation of authority from the Secretary to authorize

- Approval of any necessary timber cutting or removal or any road construction/reconstruction in emergency situations involving wildfire suppression, search and rescue operations, or other imminent threats to public health or safety in Inventoried Roadless Areas. The local line officer is delegated authority to make these decisions.
- Approval of any timber cutting, sale, or removal in inventoried roadless areas incidental to the implementation of an existing special use authorization. Road construction/ reconstruction are not authorized through this re-delegation without further project specific review. The local line officer is delegated authority to make these decisions.

On October 16, 2009, the Secretary re-delegated authority to the Forest Service for the cutting, sale, or removal of generally small diameter timber when needed for one of the following purposes:

- To improve threatened, endangered, or sensitive species habitat
  a. To maintain or restore the characteristics of ecosystem composition and structure, such as to reduce the risk of uncharacteristic wildfire effects within the range of variability that would be expected to occur under natural disturbance regimes of the current climatic period
  b. For administrative and personal use, as provided for in Title 36, Code of Federal Regulations 223, where personal use includes activities such as Christmas trees and firewood cutting and where administrative use includes providing materials for activities such as construction of trails, footbridges, and fences

On May 28, 2010 and again on May 30, 2011, Secretary Thomas J. Vilsack renewed his reservation of final decision authority over certain forest management and road construction projects in inventoried roadless areas. The new Secretary's Memorandum 1042-155 and 1042-156 include the same re-delegations of authority to the Forest Service as described above.

On October 21, 2011, the United States Court of Appeals for the Tenth Circuit decided *Wyoming v. USDA* and found the Forest Service's adoption of the 2001 Roadless Area Conservation Rule (Roadless Rule) does not violate Federal law. The Tenth Circuit ordered the District of Wyoming Court to vacate its earlier ruling and lift its nationwide injunction of the Roadless Rule. Pending action by the District Court to vacate the permanent injunction, the Forest Service continued to follow the direction in the letter dated August 18, 2008 signed by the Deputy Chief for NFS (see Holtrop 2008) and the direction provided in the Secretary's Memo 1042-156, described in Pena (2011).

On March 2, 2012, Judge Brimmer (Wyoming) lifted his injunction on the 2001 Roadless Rule. Lifting the injunction paves the way for implementation of the 2001 Roadless Rule nationwide, and in Region 1 (except for Idaho) provides much needed consistency regarding the management of Inventoried Roadless Areas.

On May 30, 2012, the Secretary's Memorandum 1042-156 requiring review and approval of certain activities in Roadless Areas expired. In order to provide a smooth transition, the Chief is requiring review of certain activities (see Chiefs Letter dated May 31, 2012, and the associated attachments describing the Review Process, and Talking Points. Some activities will require review by the Chief and others by the Regional Forester. In Region 1, the Regional Forester review process has been delegated to Deputy Regional Forester Jane Cottrell, per the Regional Forester's letter dated June 8, 2012.

The Chief's letter dated May 31, 2012 implements the following process for review of certain activities in Roadless Areas:

Except as noted below, the Chief will review all projects involving road construction or reconstruction and the cutting, sale, or removal of timber in those areas identified in the set of inventoried roadless area

maps contained in the Forest Service Roadless Area Conservation, Final Environmental Impact Statement Volume 2 dated November 2000.

Regional Foresters will review the following activities:

a. Any necessary timber cutting or removal or any road construction or road reconstruction in emergency situations involving wildfire suppression, search and rescue operations, or other imminent threats to public health and safety in inventoried roadless areas.
b. Timber cutting, sale, or removal in inventoried roadless areas incidental to the implementation of an existing special use authorization. Road construction or road reconstruction is not authorized through this re-delegation without further project specific review.
c. The cutting, sale, or removal of generally small diameter timber when needed for one of the following purposes:
    1) To improve threatened, endangered, proposed, or sensitive species habitat;
    2) To maintain or restore the characteristics of ecosystem composition and structure, such as to reduce the risk of uncharacteristic wildfire effects within the range of variability that would be expected to occur under natural disturbance regimes of the current climatic period; or,
    3) For the administrative and personal use, as provided for in 36 CFR 223, where personal use includes activities such as Christmas tree and firewood cutting and where administrative use includes providing materials for activities such as construction of trails, footbridges, and fences.

The activities proposed within the Stonewall project fall within the activities requiring Regional Forester review, as explained in c. 2, above. To fulfill this requirement, a briefing paper was prepared for the Regional Forester dated November 30, 2009 that included a project description and maps. On February 13, 2012, the Regional Roadless Coordinator reviewed and commented on the Draft Roadless Resource Specialist Report. Additional discussion regarding compliance with the 2001 roadless rule is included in the “Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans” section.

Methodology

An interdisciplinary team meeting and field tour of the proposed project area was attended in Lincoln, Montana by specialists on September 20-24, 2010.

Analysis was accomplished using ArcMap and relevant Geographic Information System (GIS) data layers from the Helena National Forest, Lincoln Ranger District, including trails, roads, recreation sites, inventoried roadless areas, summer and winter ROS classes, winter use, and management areas. On-line visitor information provided by the Helena National Forest and other local organizations was used as an overview of the roadless values and wilderness attributes within the analysis area. A review of existing law, regulation and policy relevant to roadless resources within the project area was conducted and relevant section of the Forest Plan and Forest Service Handbooks are referenced.

Roadless Analysis Methodology

The purpose of the analysis on the roadless resource is to disclose potential effects to roadless area characteristics and wilderness attributes from the Stonewall Project proposed activities, and determine if, or to what extent these effects might influence future consideration for wilderness recommendations. This analysis focuses on the potential effects of project activities on roadless characteristics as defined in 36 CFR 294.11 – Roadless Area Conservation, Final Rule and wilderness attributes as defined in the Forest Service Handbook (FSH) 1909.12 (72.1).

Roadless area characteristics, as defined in 36 CFR 294.11 – Roadless Area Conservation, Final Rule and evaluated in this analysis include the following:

- High quality or undisturbed soil, water, and air
- Sources of public drinking water
- Diversity of plants and animal communities
- Habitat for threatened, endangered, proposed, candidate, and sensitive species, and for those species dependent on large, undisturbed areas of land
- Primitive, semi-primitive nonmotorized and semi-primitive motorized classes of dispersed recreation
- Reference landscapes
- Natural appearing landscapes with high scenic quality
- Traditional cultural properties and sacred sites
- Other locally identified unique characteristics

Wilderness attributes, as defined at FSH 1909.12 (72.1) and evaluated in this analysis include the following:

Natural – The extent to which long-term ecological processes are intact and operating

Undeveloped – The degree to which the impacts documented in natural integrity are apparent to most visitors

Outstanding opportunities for solitude or primitive unconfined recreation – Solitude is a personal, subjective value defined as the isolation from sights, sounds, and presence of others and from developments and evidence of humans. Primitive recreation is characterized by meeting nature on its own terms, without comfort and convenience of facilities.

Special features and values – Unique ecological, geographical, scenic, and historical features of an area

Manageability – The ability to manage an area for wilderness consideration and maintain wilderness attributes

The following table shows the crosswalk between the wilderness attributes identified in Forest Service Handbook 1909.12 and the 1964 Wilderness Act; and the roadless area characteristics defined in the 2001 Roadless Area Conservation Rule (36 CFR 294.11).

Table 151. Wilderness attributes and roadless area characteristics crosswalk

WILDERNESS ATTRIBUTES	ROADLESS AREA CHARACTERISTICS
Natural Ecological systems are substantially free from the effects of modern civilization and generally appear to have been affected primarily by forces of nature	High quality or undisturbed soil, water, and air; Sources of public drinking water: Diversity of plant and animal communities; Habitat for threatened, endangered, proposed, candidate, and sensitive species and for those species dependent on large, undisturbed areas of land; Reference landscapes
Undeveloped Degree to which the area is without permanent improvements or human habitation	Natural appearing landscapes with high scenic quality
Outstanding Opportunities for Solitude or Primitive and Unconfined Recreation Solitude: opportunity to experience isolation from the sights, sounds, and presence of others from the developments and evidence of humans Primitive and unconfined recreation: opportunity to experience isolation from the evidence of humans, to feel a part of nature, to have a vastness of scale, and a degree of challenge and risk while using outdoor skills	Primitive, semi-primitive non-motorized and semi-primitive motorized classes of dispersed recreation
Special Features and Values Capability of the area to provide other values such as those with geologic, scientific, educational, scenic, historical, or cultural significance	Traditional cultural properties and sacred sites; and Other locally identified unique characteristics.
Manageability The ability of the Forest Service to manage an area to meet size criteria and the elements of wilderness	No criteria

Spatial and Temporal Context for Effects Analysis

The potential direct and indirect effects to roadless resources were considered within the Stonewall Project Area boundary. The direct effects would be short term and temporary, occurring during project implementation. The long-term indirect effects would be related to ecosystem restoration, changes in visual qualities, and other items within the project area that would influence several of the areas roadless characteristics.

Cumulative Effects Process

Cumulative effects to roadless resources were considered within the entire 866,330-acre Bear-Marshall-Scapegoat-Swan IRA that is managed by the Helena, Flathead, Lolo, and Lewis and Clark National Forests, the entire 17,261-acre Lincoln Gulch IRA that is managed by the Helena National Forest and

unroaded lands contiguous to these IRAs. Potential cumulative effects to roadless resources would be related to other activities occurring within the roadless expanse that have the potential to impact roadless area characteristics or wilderness attributes. Cumulative impacts to roadless resources would result if other activities take place during implementation of the Stonewall Vegetation project, or until vegetation growth obscures the visible stumps from the hand slashing of small diameter trees and hand firelines, approximately 3-5 years.

Connected Actions, Past, Present, and Foreseeable Activities Relevant to Cumulative Effects Analysis

The effects of past actions within the Stonewall Project area are incorporated into the description of the existing conditions. A list of past, present and foreseeable actions relevant to the cumulative effects analysis for roadless resources within the Stonewall analysis area is in volume 2, appendix C. Actions that overlap the roadless areas include:

Helena National Forest, Lincoln Ranger District:

- Helena National Forest Roadside Hazard Tree Removal
- Blackfoot North Divide Winter Travel Planning
- Blackfoot Travel Plan (non-winter)
- Alice Creek Wildlife Enhancement Project
- Dry Creek Prescribed Fire
- Southwest Crown Weed Treatments
- Grazing Allotments (ongoing)

Flathead National Forest, Spotted Bear Ranger District:

- Soldier Addition II EA
- Spotted Bear River Project

Lewis and Clark National Forest, Rocky Mountain Ranger District:

- Benchmark Fuels EA
- Rocky Mountain Ranger District Travel Plan EIS, Badger Two Medicine Area
- Rocky Mountain Ranger District Travel Plan EIS, Birch Creek South Area

Lolo National Forest

- Dick Creek Fuels
- Swan Face Prescribed Burn

Affected Environment

Existing Condition

Fire suppression and moist growing conditions through much of this century resulted in a loss of open forest conditions and seral species (aspen, ponderosa pine and western larch). This has created a uniform

landscape comprised of dense forests susceptible to insect and wildfire mortality (Douglas-fir and lodgepole pine). In addition, a large-scale mountain pine beetle epidemic has killed most of the mature lodgepole pine and ponderosa pine. These conditions are elevating fuel levels, which poses a wildfire threat to nearby homes and communities in the wildland urban interface (WUI).

Inventoried Roadless Areas

The Stonewall Vegetation Project boundary encompasses portions of two IRAs, the Bear-Marshall-Scapegoat-Swan IRA (#A1485) and the Lincoln Gulch IRA (#1601). The portion of the BMSS IRA managed by the Lincoln Ranger District of the Helena National Forest is 53,995 acres in size and the project area overlaps with 12,254 acres. The Lincoln Gulch IRA is 8,246 acres in size and the project area overlaps with 3,193 acres (table 152 and figure 86).

Table 152. Inventoried Roadless Area Acreage

Name of IRA	Total Acres in IRA*	Total Acres in IRA managed by the Lincoln Ranger District	Acres of IRA within the Stonewall Project Boundary	Percent of total IRA acres within the Stonewall Project Boundary
Bear-Marshall-Scapegoat-Swan	866,330	*53,995	12,254	1.4
Lincoln Gulch	17,261	17,261	3,193	18.5
Totals	**883,591**	**71,256**	**15,447**	**1.7**

*Portion of the Bear-Marshall-Scapegoat-Swan IRA managed by the Helena National Forest, Lincoln Ranger District. Total acreage of the Bear-Marshall-Scapegoat-Swan IRA managed by the Flathead, Helena, Lolo and Lewis and Clark National Forests is 866,330 acres (USDA Forest Service 1986, FEIS Appendix C-3).

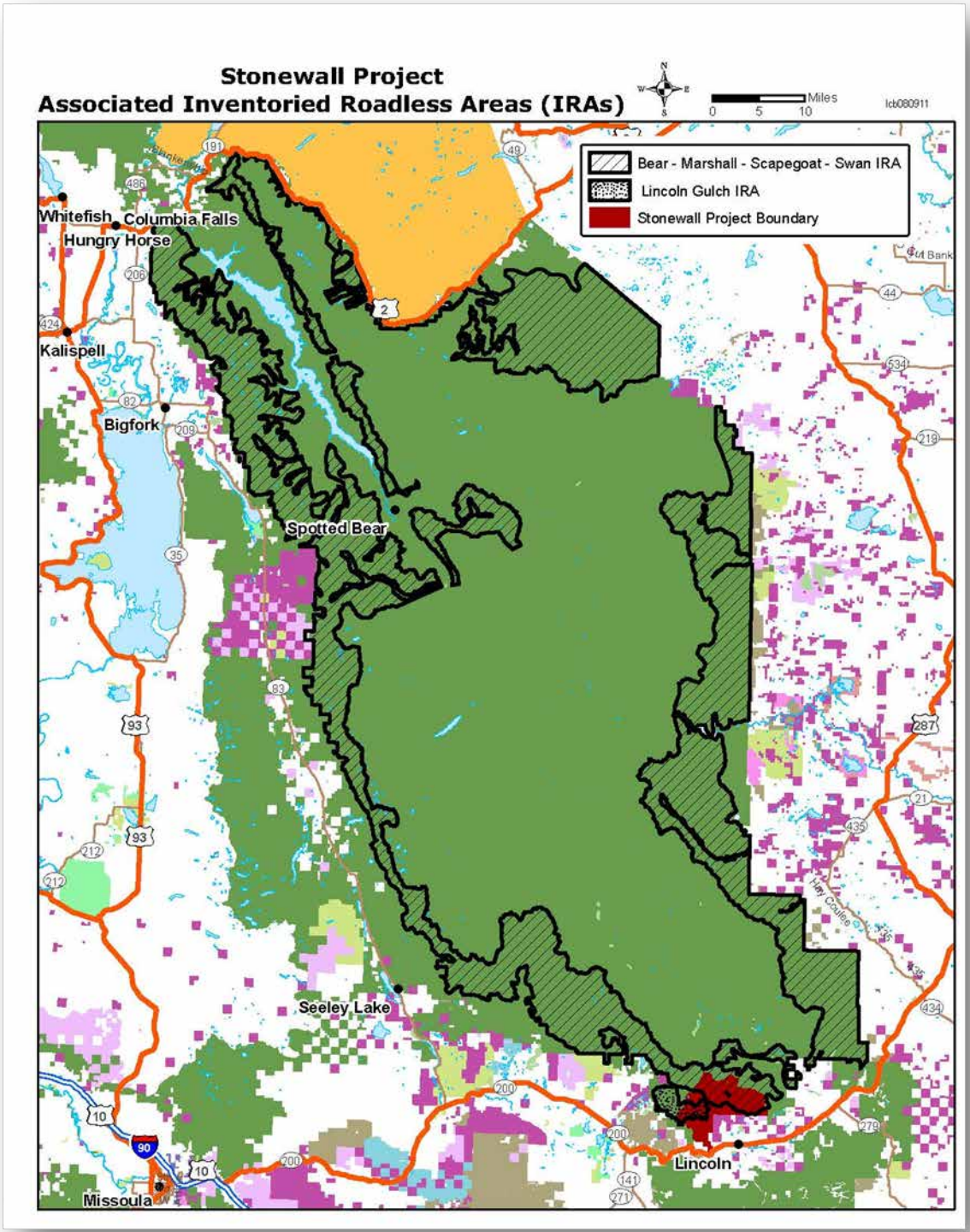

Figure 86. Associated inventoried roadless areas

The Helena National Forest Plan established Forestwide multiple-use goals, objectives, and management area requirements as well as management area prescriptions. Roadless areas are well distributed throughout the Forest and managed to provide semi-primitive recreation opportunities (USDA Forest Service 1986a). The analysis of roadless lands, documented in Appendix C of the FEIS for the Forest Plan, described each roadless area, the resources and values considered, the range of alternative land uses studied, and the effects of management under each alternative (USDA Forest Service 1986b). As a result of the analysis, some roadless areas were recommended for inclusion in the National Wilderness Preservation System and others were assigned various nonwilderness prescriptions. The portion of the BMSS IRA that is within the project area is assigned primarily to Management Area (MA) M1 and W1 with small areas of T1, T3, and T4 along the southern edge of the IRA. The portion of the Lincoln Gulch IRA that is within the project area is assigned primarily to MA T3 with small areas of W1, T1, T2, and M1 (figure 87).

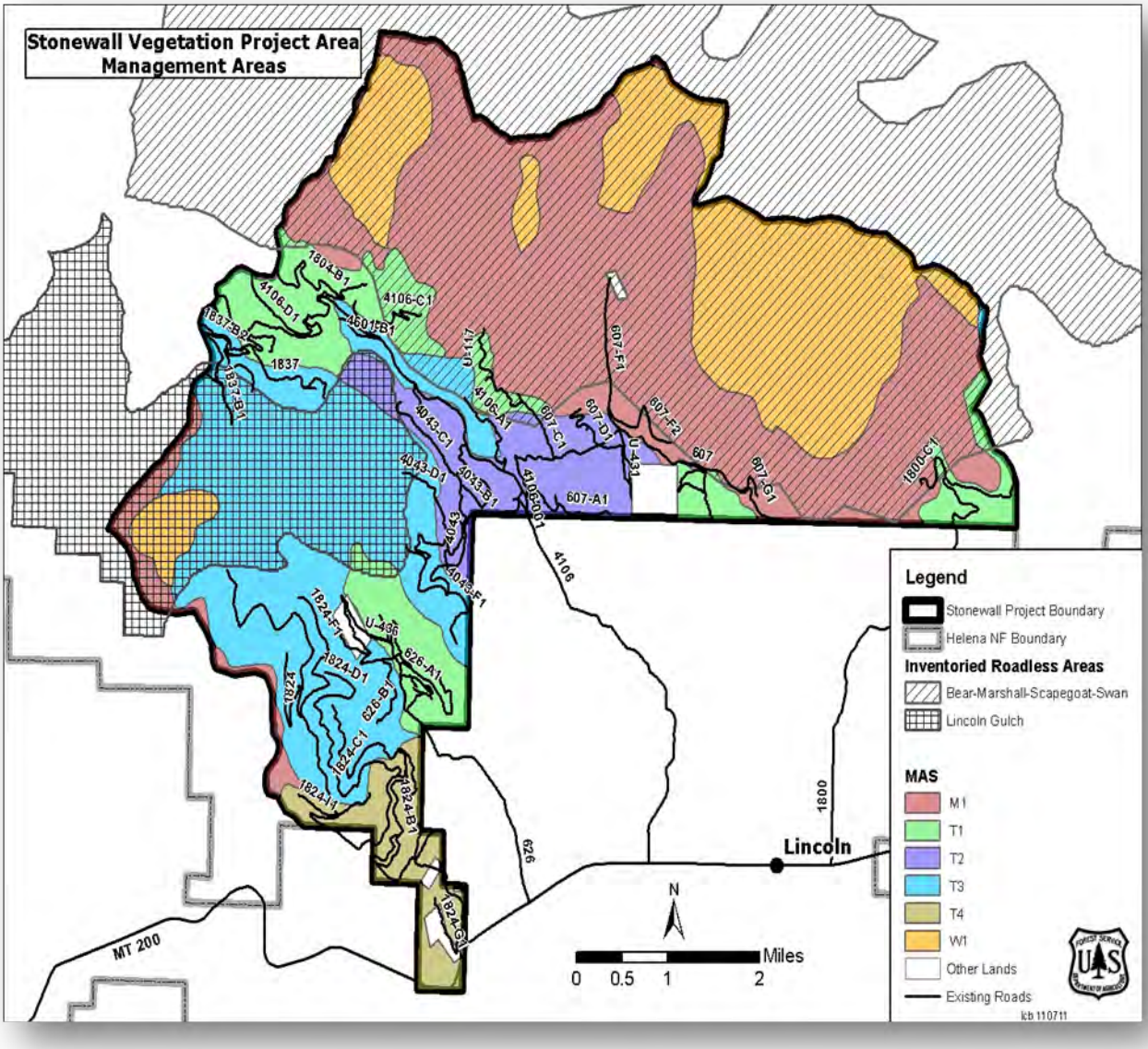

Figure 87. Management areas in the inventoried roadless areas

Bear-Marshall-Scapegoat-Swan IRA

The Bear-Marshall-Scapegoat-Swan Inventoried Roadless Area is located in the Northern Continental Divide Ecosystem. This roadless area surrounds the Bob Marshall, Great Bear and Scapegoat wilderness areas. It also contains portions of the Swan Mountain Range north of the Bob Marshall Wilderness.

The Flathead, Helena, Lolo and Lewis and Clark National Forests manage this large roadless area, which provides habitat for many wildlife species including, grizzly bear and black bear, cougar, lynx, fisher, marten, elk, whitetail deer and mule deer, wolf, moose, mountain goat, and bighorn sheep. The higher elevations provide important summer range habitat for big game species.

The Bear-Marshall-Scapegoat-Swan Inventoried Roadless Area is especially important to many members of the public because of its proximity to other wilderness areas, providing the opportunities for expansive hiking backpacking, hunting, cross-country skiing and equestrian travel. Livestock grazing, motorized recreation, timber harvesting, and oil and gas development represent other uses (USDA Forest Service 1986b, FEIS Appendix C3 – C5).Access to the Scapegoat Wilderness from the south requires travel through the Stonewall portion of this roadless area.

Roadless Area Characteristics

The roadless area encompasses 12 different locations; the Stonewall Mountain area, managed by the Lincoln Ranger District, is located along the southern boundary of the Scapegoat Wilderness. Most of the area west of Stonewall Mountain and Copper Creek is very steep and rocky. The area east of Stonewall Mountain to Copper Creek is steep and well-timbered on north facing slopes. It contains open growing stands of timber with small grassland parks on south and west facing slopes. Elevations range from 4,900 feet in the Blackfoot Valley to 9,411 feet on Red Mountain

Snowmobilers use the Stonewall Mountain Trail to travel to the Upper Copper Creek Basin and use the Alice Creek/ Lewis and Clark Pass area. Most of the drainage bottoms have access trails with the Reservoir Lake Trail in Arrastra Creek receiving the most use (USDA Forest Service 1986b, FEIS Appendix C10-C-11).

Wilderness Attributes

Following is a list of the specific Wilderness Attributes defined in Forest Service Handbook (FSH) 1909.12 (72.1) – Wilderness Evaluation. The Roadless Area Characteristics defined in 36 CFR 294.11 – Roadless Area Conservation, Final Rule are also incorporated into the following descriptions: Wilderness Attributes and Roadless Area Characteristics Crosswalk in the Roadless Analysis Methodology section.

The descriptive paragraphs that follow are from the analysis of roadless lands conducted by the Helena National Forest in 1986 during development of the Forest Plan. Following those paragraphs are descriptions of activities and changes that have occurred since the Forest Plan was developed.

Natural – The extent to which long-term ecological processes are intact and operating

Most of the plant and animal species that existed in this roadless area when the Lewis and Clark Expedition passed south of here nearly 200 years ago are still present. Most mammal species present then are still present now; however, some are considered threatened or endangered. The integrity of the fisheries has been altered by the stocking of grayling and rainbow trout, however, many miles of unaltered cutthroat streams remain. Some invasive plant species, such as spotted knapweed, leafy spurge, thistle, and clover have been introduced accidentally into the area through livestock use. These species are mainly along the trails. Off-trail, the plant community has changed little except for successional changes

and those brought about by naturally occurring fires. To the untrained eye, the natural appearance of this area is high (USDA Forest Service 1986b, FEIS Appendix C-11).

Fire suppression and moist growing conditions through much of this century resulted in a loss of open forest conditions and seral species (aspen, ponderosa pine and western larch). This has created a uniform landscape comprised of dense forests susceptible to insect and wildfire mortality (Douglas-fir and lodgepole pine). In addition, a large-scale mountain pine beetle epidemic has killed most of the mature lodgepole pine and ponderosa pine.

These vegetative changes have impacted fish and wildlife habitat, and spotted knapweed is present within the IRA, however, the IRA generally continues to provide high quality soil, water and air; diversity of plant and animal communities; and habitat for threatened, endangered, proposed, candidate, and sensitive species, and for those species dependent on large, undisturbed areas of land. See additional discussion of the roadless resources in volume 2, appendix D of this DEIS, Stonewall Roadless Characteristics Worksheet and in specific resource sections.

Undeveloped – The degree to which development and uses are apparent to most visitors

Human activities in some areas are evident, although most impacts are concentrated along road corridors and the exterior boundaries. In other areas, the only disruptions are trails, which access the adjacent Wilderness areas (USDA Forest Service 1986b, FEIS Appendix C-11). There is some evidence of non-energy mineral mining exploration that occurred in the Cotter Basin, Copper Camp, Alice Creek and Stonewall Creek areas. Most of this activity lies on the fringes of the area. There are old roads associated with these activities and evidence of past earth moving activities is present. Some clearcuts are in the Alice Creek, Beaver Creek, and Arrastra Creek Drainages, along the edge of the roadless area. Silver King Lookout is the only Forest Service maintained structure in the area. One special use cabin is located in the Alice Creek drainage, as well as fences used for controlling livestock. Seismic exploration has occurred here in recent years (USDA Forest Service 1986b, FEIS Appendix C-21).

Since the 1986 analysis of roadless lands, The Helena National Forest, consistent with Forest Plan direction, has continued harvest and fuels activities within the Bear-Marshall-Scapegoat-Swan IRA, as shown in table 153 that follows. These activities have contributed to some evidence of human access within the IRA; however, the IRA has generally retains the undeveloped characteristics described above.

Table 153. Past harvest and fuel activities since 1986 in the portion of the Bear-Marshall-Scapegoat-Swan IRA managed by the Helena National Forest

Activity	Acres within IRA
Prescribed Burning	5,869
Wildfire	433
Fuels Treatment (yarding, rearranging, piling)	1,587
Thinning (hazardous fuels reduction)	1,551
Range Improvement	871
Timber Harvest (stand clearcut, shelterwood establishment cut, single tree selection cut, sanitation salvage, precommercial thin)	271
Reforestation Needs Created by Fire	1,203
Reforestation/Planting/Regeneration activities	1,657
TOTAL	**13,309**

*Data from “SWCumEffectsPastHarFuActivitiesIRAs_080911.xlsx” Acres rounded for display

Outstanding opportunities for solitude or primitive unconfined recreation – Solitude is a personal, subjective value defined as the isolation from sights, sounds, and presence of others and from developments and evidence of humans. Primitive recreation is characterized by meeting nature on its own terms, without comfort and convenience of facilities.

In general, the BMSS IRA possesses high opportunities for solitude because of its size and the influence of the adjacent Bob Marshall, Great Bear and Scapegoat wilderness areas. Much of it contains highly dissected topography that easily screens people from one another in a short distance. Some portions are influenced by adjacent roads and other developments.

The Stonewall area possesses very high opportunities for solitude. Screening of the more developed areas occurs over most of the area. Sounds of vehicles, chainsaws, and logging activity are screened from most of the area due to the topography and lay of the terrain.

The area offers high opportunities for primitive recreation. A variety of topography challenges the visitor with its high mountaintops and steep valleys. The large size of the area offers the opportunity to get away from the man-influenced environment and experience excellent primitive recreation activities such as fishing, camping, hunting, backpacking, hiking, and horseback riding. People nationwide are attracted by the outstanding hunting and backcountry experiences here and in the adjacent wildernesses (USDA Forest Service 1986b, FEIS Appendix C11-12).

The Stonewall area offers a variety of topographic features to challenge the visitor. The high peaks, steep slopes, flat valley bottoms, and numerous streams, offer a different primitive recreation experience to visitors (USDA Forest Service 1986b, FEIS Appendix C-21).

Recreational activities such as hunting, camping, hiking, off-highway vehicle (OHV) travel on primitive roads, and snowmobiling and cross-country skiing in the winter continue to be the primary recreation activities occurring within the IRA. Recreational use of the area has increased over time along with the corresponding increase in population and popularity of outdoor recreational activities. Implementation of various forest management activities and the associated increased presence of people, vehicles and associated noise over the years may have temporarily affected the opportunities for solitude and primitive and unconfined recreation.

The IRA continues to provide outstanding opportunities for solitude and primitive recreation. The area has become highly valued due to its proximity to the Bob Marshall Wilderness Complex, and its location within the Southwest Crown of the Continent, an area that links the Canadian Rockies with the Greater Yellowstone Ecosystem and the Selway-Bitteroot Wilderness areas to the south.

Special features and values – Unique ecological, geographical, scenic, and historical features of an area

The Stonewall area is also noted for other features. Red Mountain is the highest peak from Lincoln to Glacier National Park, rising 9,411 feet above sea level. It is one of the few sites in the United States where limber pine and whitebark pine grow together.

The Red Mountain Research Natural Area (RNA) is located approximately 3 miles north of the Stonewall Project area.

The Lewis and Clark Trail passes up Alice Creek over Lewis and Clark Pass. This is of historical interest to many Forest users.

The area also supports a small herd of Rocky Mountain goats near Red Mountain (USDA Forest Service 1986b, FEIS Appendix C-22).

Manageability – The ability to manage an area for wilderness consideration and maintain wilderness attributes.

Because this area surrounds the Bob Marshall, Great Bear and Scapegoat Wilderness Complex, it consists of several long, narrow segments that are usually separated by road corridors. The boundary along the adjacent wilderness areas are usually well defined by high ridges and major topographic features. Other boundaries parallel existing roads or land survey lines which are sometimes difficult to identify (USDA Forest Service 1986b, FEIS Appendix C-12).

The Stonewall area is large enough and the topography is such that any person visiting the area would gain the feeling that they are in a natural area free from human activities and development. The high peaks afford the viewer with vistas of part of the Scapegoat Wilderness mountain ranges and many of the major drainages in the district. Some distant roads and timber harvesting areas can be seen from these high points (USDA Forest Service 1986b, FEIS Appendix C21).

Lincoln Gulch IRA – Roadless Area Characteristics and Wilderness Attributes

The Lincoln Gulch IRA is located approximately 6 miles northwest of Lincoln, MT. The area includes the Ward Creek, Arrastra Creek, and Lincoln Gulch drainages. The terrain is characterized by very steep and timbered slopes. Arrastra Creek, the major drainage, runs northeast to southwest and roughly divides the area in half. The elevation ranges from 4,800 feet on the west side near Patterson Prairie to 7,432 feet on the summit of Black Mountain. The steep terrain confines most use to ridgetops and stream bottoms (USDA Forest Service 1986b, FEIS Appendix C-55).

Wildlife species include elk, mule deer, whitetail deer, black bear, cougar, grizzly bear, wolverine, lynx, bobcat, coyote, other furbearers, numerous grouse species, and several nongame animals and birds. Deer and elk winter range is located along the southwest boundary (USDA Forest Service 1986b, FEIS Appendix C-55).

Recreation use of the area revolves around big game hunting. There are no lakes or major attractions, such as high mountain peaks, to attract large numbers of recreationists (USDA Forest Service 1986b, FEIS Appendix C-55).

Natural – The extent to which long-term ecological processes are intact and operating

Most of the area has had little human influence. The naturalness of the area is similar to that described above for the Bear-Marshall-Scapegoat-Swan IRA, with the exception of trail related impacts, since there are no trails within the Lincoln Gulch IRA.

Undeveloped – The degree to which development and uses are apparent to most visitors

The only disturbance within the area has been from scattered mining activity. The mining activity includes a ditch used for placer mining, which winds through the eastern finger of the area and terminates just south of the area at the old Lincoln Town site. The ditch was built at the turn of the century and has since been reclaimed by nature (USDA Forest Service 1986b, FEIS Appendix C-56).

There are several clearcuts adjacent to the area in the Lincoln Gulch and Beaver Creek drainages. An old logging road, which is no longer drivable, follows the bottom of Arrastra Creek about 200 yards into the area (USDA Forest Service 1986b, FEIS Appendix C-56).

Based on a recent review of management activities implemented by the Helena National Forest, no harvest or fuels activities have been conducted within the Lincoln Gulch IRA. Ongoing activities in the area include noxious weed treatments and livestock grazing. The area remains undeveloped.

Outstanding opportunities for solitude or primitive unconfined recreation – Solitude is a personal, subjective value defined as the isolation from sights, sounds, and presence of others and from developments and evidence of humans. Primitive recreation is characterized by meeting nature on its own terms, without comfort and convenience of facilities.

Even though this area is relatively small, it has a very high opportunity for solitude, due to rugged terrain that secludes the visitor from most outside disturbance. Occasional sounds of motorized vehicles or chainsaws can be heard. These sounds are associated with mining, logging, and hunting. The mining and logging would affect the area from spring breakup in May until early winter. Human activity is well dispersed throughout the area because there are no major attractions such as lakes to draw recreation use (USDA Forest Service 1986b, FEIS Appendix C-56).

This area provides excellent primitive recreation opportunities. Because of the heavy timber and lack of trails, there is no motorized access into the area. Hunting and hiking are the main recreation uses. Horseback riding is limited due to topography and vegetative cover. The Lone-Point-Black Mountain ridge provides most of the horseback riding opportunity in this area (USDA Forest Service 1986b, FEIS Appendix C-56).

Hunting and hiking continue to be the primary recreation activities within the IRA. Recreational use of the area has increased over time along with the corresponding increase in population and popularity of outdoor recreational activities. Very few Forest management activities have been implemented and the IRA continues to provide outstanding opportunities for solitude and primitive recreation.

Special features and values – Unique ecological, geographical, scenic, and historical features of an area.

Elk are abundant within this area and it has historically been a productive and primitive hunting area. Lincoln Gulch provides a large big game security area and the rugged terrain gives a hunter a unique challenge (USDA Forest Service 1986b, FEIS Appendix C-57).

Manageability – The ability to manage an area for wilderness consideration and maintain wilderness attributes.

The entire area is on National Forest System land. There are presently no grazing permits or developments in the area. Conflicts might arise between wilderness use and mining or oil and gas exploration (USDA Forest Service 1986b, FEIS Appendix C-57).

Other Unroaded Areas

Geographical Information System (GIS) information was used to assess the Stonewall Project area to determine the extent of other unroaded areas located outside of the inventoried roadless areas. A majority of the project area outside of the IRAs is within 1/8- mile of existing roads. Unroaded areas exist adjacent to the southern boundary of the Lincoln Gulch IRA (two areas approximately 400-600 acres in size, intersected by unit 77), adjacent to the southern boundary of the Bear-Marshall-Scapegoat-Swan IRA (several areas approximately 80-200 acres in size, intersected by units 79 and 86), and adjacent to the Forest boundary along the southern boundary of the project area (an area approximately 300 acres in size, intersected by units 46, 47, and 75). The unroaded lands adjacent to the IRAs have similar roadless characteristics and wilderness attributes as those described above and are considered in this analysis. The

small area along the southern project boundary does not meet the inventory criteria in FSH 1909.12 71.1 and is not considered further in this analysis (USDA Forest Service 2010a).

Environmental Consequences

Alternative 1 – No Action Alternative

Direct and Indirect Effects

If the no action alternative is chosen, the proposed regeneration harvests, intermediate harvests, precommercial thinning and prescribed burning would not be implemented within the project area. There would be no direct effects from proposed activities to roadless resources.

However, there would be a chance of an indirect effect under alternative 1, as the ecosystem restoration and fuel reduction project would not occur, and the risk of severe wildfire would remain. In the long term, this may result in indirect effects to roadless resources potentially resulting in changes to the recreation setting or scenic quality of the project area.

An effect to wilderness attributes from taking no action would be to Naturalness (the extent to which long-term ecological processes are intact and operating). Fire would not be reintroduced into this fire-adapted ecosystem, fire suppression efforts would continue and the risk of large, severe wildfires would remain. This may detract from the characteristic of "naturalness" throughout the area, since conditions would not allow the reestablishment of fire as a natural process on the landscape.

Cumulative Effects

There are no known cumulative effects to roadless resources from the no action alternative.

Irreversible and Irretrievable Commitments of Resources

In the no action alternative, there would be no irreversible and irretrievable commitments of resources relevant to the roadless resources within the project area.

Alternative 2 – Proposed Action

Under alternative 2, 8,562 acres are proposed for treatment. The proposed actions, outside of the IRAs, include using both commercial and noncommercial treatments to achieve the desired condition. These actions would include: regeneration harvests, intermediate harvests, precommercial thinnings, and prescribed burning. Implementing the proposed action could include the use of chainsaws, feller bunchers, and cable logging equipment. Approximately 2.5 miles of road would be built for project use then obliterated immediately following timber removal. Post treatment activities would include underburning, site preparation burning, jackpot burning, hand piling/ burning, tree planting, and monitoring of natural regeneration.

The only action proposed within the two IRAs (BMSS and Lincoln Gulch) is prescribed fire and the associated hand slashing of small diameter trees. Commercial harvest and road construction would not occur in the two roadless areas.

Project Design Features

The Stonewall Vegetation Project has been designed with features that are intended to minimize or avoid potential adverse effects while meeting project objectives. In addition to the proposed action treatments described in this section, design features would be implemented where applicable. A description of the project design features is displayed in table 9, chapter 2. The FUEL-3 project design feature is relevant to

minimizing unauthorized motorized use associated with proposed activities within roadless areas. This analysis is based on the implementation of all design features. Project design features apply to all action alternatives.

Direct and Indirect Effects – Roadless Resources

The activities proposed within the IRAs include construction of fire-lines, hand slashing of small diameter trees and prescribed fire.

Table 154 shows the units and treatments proposed within the roadless expanse:

Table 154. Alternative 2 - Proposed treatment within inventoried roadless areas

UNIT NUMBER	ALTERNATIVE 2 – PROPOSED ACTION – TREATMENT DESCRIPTION	ROADLESS AREA
76	123 acres, Description Group 6 – Low Severity Prescribed Fire to Create Mortality Patches 5 to 10 Acres	Lincoln Gulch IRA
77	541 acres, Description Group 8 – Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Lincoln Gulch IRA and unroaded lands contiguous to the IRA
79	257 acres, Description Group 8 – Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Bear-Marshall-Scapegoat-Swan IRA and unroaded lands contiguous to the IRA
80	280 acres, Description Group 7 – Mixed Severity Fire to Create Mortality Patches up to 5, 10, or 20 Acres	Bear-Marshall-Scapegoat-Swan IRA, Trail #418
81	607 acres, Description Group 8 – Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Bear-Marshall-Scapegoat-Swan IRA
82	776 acres, Description Group 8 – Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Bear-Marshall-Scapegoat-Swan IRA, Trail #417,418
83	457 acres, Description Group 8 – Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Bear-Marshall-Scapegoat-Swan IRA, Trail #417
84	806 acres, Description Group 8 – Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Bear-Marshall-Scapegoat-Swan IRA, Trail #485
85	87 acres, Description Group 6 – Low Severity Prescribed Fire to Create Mortality Patches 5 to 10 Acres	Bear-Marshall-Scapegoat-Swan IRA, Trail #485
86	10 acres, Description Group 7 – Mixed Severity Fire to Create Mortality Patches up to 5, 10, or 20 Acres	Bear-Marshall-Scapegoat-Swan IRA and unroaded lands contiguous to the IRA

UNIT NUMBER	ALTERNATIVE 2 – PROPOSED ACTION – TREATMENT DESCRIPTION	ROADLESS AREA
87	36 acres, Description Group 7 – Mixed Severity Fire to Create Mortality Patches up to 5, 10, or 20 Acres	Bear-Marshall-Scapegoat-Swan IRA
88	865 acres, Description Group 8 – Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Bear-Marshall-Scapegoat-Swan IRA

Effects to Roadless Area Characteristics and Wilderness Attributes for IRAs and Contiguous Unroaded Lands

Roadless Areas: The Bear-Marshall-Scapegoat-Swan Inventoried Roadless Area (IRA) is 866,330 acres and managed by the Helena, Lewis and Clark, Lolo and Flathead National Forests. The portion of the Bear-Marshall-Scapegoat-Swan IRA managed by the Lincoln Ranger District of the Helena National Forest covers 53,995 acres, and the Stonewall Vegetation Project area overlaps with 12,254 acres. The Lincoln Gulch IRA covers 8,246 acres, and the Stonewall Vegetation Project area overlaps with 3,193 acres.

Natural – Reintroducing fire into this fire adapted ecosystem would begin reversing the trends caused from past fire suppression and reduce the risk of large, severe wildfires. This would enhance the characteristic of "naturalness" throughout the area, by establishing forest characteristics that would have been more typical of this area if fire had been allowed to play its natural role in landscape processes.

Management-ignited prescribed fire, however, is a form of "modern human control or manipulation" and would to some extent affect the "untrammeled" and natural character within the roadless areas. There is disagreement about whether the effects of additional management actions such as prescribed fire (i.e. trammeling) to correct the effects of previous management actions such as the suppression of natural fire (i.e.: trammeling) is appropriate (Yung, undated).

The proposed action would enhance or help to maintain the roadless resources including high quality soil, water and air; diversity of plant and animal communities; and habitat for threatened, endangered, proposed, candidate, and sensitive species, and for those species dependent on large, undisturbed areas of land.

Undeveloped – There would be little evidence that the fires were initiated as a management tool versus natural ignition. The fire hand lines would create a linear disturbance within the roadless area. Stumps from the hand slashing of small diameter trees may remain visible for several seasons following the prescribed fire, which may detract from the undeveloped character for visitors traveling through the roadless area. There are also concerns that the hand lines could encourage unauthorized motorized use. Design features are in place to obliterate fire handlines adjacent to or that intersect existing roads and trails to reduce the potential for unauthorized motorized use (see project design feature: FUEL-3). Blackened trees from the prescribed burning would be noticeable; however, fire is a natural process and should not affect the roadless integrity.

The proposed prescribed fire would help ensure the forest maintains a visual appearance characteristic of a wildfire within its natural regime as opposed to an unnaturally intense wildfire, thereby enhancing or helping to maintain the roadless characteristic of natural appearing landscapes with high scenic integrity. The creation of openings in the forest from low and mixed severity prescribed fire ranging from 5 to 75

acres in size would create a visually appealing mosaic in the landscape, enhancing the overall existing landscape character.

Outstanding opportunities for solitude or primitive unconfined recreation – There may be short-term effects to "solitude" within the project area during project implementation due to the presence of Forest personnel managing the prescribed fire and noise associated with the use of chainsaws for the hand slashing of small diameter trees. The proposed activities would not affect opportunities for "primitive and unconfined type of recreation." See additional discussion of the roadless resources in Attachment 1: Stonewall Roadless Characteristics Worksheet.

Special features and values – The proposed action would not affect the special features or values of the BMSS IRA because there are no special features within the Stonewall project area. The proposed action would maintain the productive and primitive Elk hunting opportunities within the Lincoln Gulch IRA for approximately15-20 years and enhance these opportunities in the long term. Hand lines within sites could alter historic and prehistoric sites.

Manageability – Overall, the effects to wilderness character within the IRAs would be minor and short term. The proposed action would not affect the suitability of the area for designation as Wilderness pursuant to the Wilderness Act of 1964.

Table D-1 in volume 2, appendix D displays effects to roadless characteristics.

Irreversible and Irretrievable Commitments of Resources

In alternative 2, proposed action, there would be no irreversible and irretrievable commitments of resources relevant to the roadless resources within the project area.

Alternative 3

The actions proposed in alternative 3 differ from those of alternative 2 - proposed action, relevant to the analysis of roadless resources. The relevant changes include fewer units proposed for prescribed fire and hand slashing of small diameter trees within the IRAs. Alternative 3 has no activities planned within the Lincoln Gulch IRA or in the unroaded lands contiguous to this IRA and proposes fewer units for treatment in the BMSS IRA.

The relevant unit changes in alternative 3 are:

Units 76 and 77 proposed for prescribed fire are removed from the Lincoln Gulch IRA and the unroaded lands contiguous to the IRA. The mixed severity prescribed fire proposed for unit 80 is changed to unit 80a, Jackpot burn; and units 81 and 86 of mixed severity prescribed fire are removed from the Bear-Marshall-Scapegoat-Swan IRA and the unroaded lands contiguous to the IRA.

Direct and Indirect Effects

Alternative 3 proposes construction of fire handlines, hand slashing of small diameter trees and prescribed fire within the Bear-Marshall-Scapegoat-Swan IRA and unroaded lands contiguous to the IRA. There are no actions proposed within the Lincoln Gulch IRA or the unroaded lands contiguous to the IRA in alternative 3. Table 155 shows the units and treatments proposed within the roadless expanse:

Table 155. Alternative 3 - proposed treatment within inventoried roadless areas

Unit Number	Alternative 3 – Treatment Description	Roadless Area
79	257 acres, Description Group 8 – Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Bear-Marshall-Scapegoat-Swan IRA and unroaded area contiguous to the IRA
80a	280 acres, Description Group 9 – Low Severity Prescribed Fire	Bear-Marshall-Scapegoat-Swan IRA, Trail #418
82	776 acres, Description Group 8 – Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Bear-Marshall-Scapegoat-Swan IRA, Trail #417,418
83	457 acres, Description Group 8 – Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Bear-Marshall-Scapegoat-Swan IRA, Trail #417
84	806 acres, Description Group 8 – Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Bear-Marshall-Scapegoat-Swan IRA, Trail #485
85	87 acres, Description Group 6 – Low Severity Prescribed Fire to Create Mortality Patches 5 to 10 Acres	Bear-Marshall-Scapegoat-Swan IRA, Trail #485
87	36 acres, Description Group 7 – Mixed Severity Fire to Create Mortality Patches up to 5, 10, or 20 Acres	Bear-Marshall-Scapegoat-Swan IRA
88	865 acres, Description Group 8 – Mixed Severity Fire to Create Mortality Patches up to 30 or 75 Acres	Bear-Marshall-Scapegoat-Swan IRA

Effects to Roadless Area Characteristics and Wilderness Attributes for IRAs and Contiguous Unroaded Lands

Alternative 3 does not propose any treatment within the Lincoln Gulch IRA or unroaded lands contiguous to the IRA, therefore, the impacts would be the same as described in alternative 1- no action.

The impacts from alternative 3 on the BMSS IRA and unroaded lands contiguous to the IRA would be the same as described in alternative 2, proposed action, but would occur on fewer acres due to the elimination of the mixed severity prescribed fire in units 81 and 86.

Irreversible and Irretrievable Commitments of Resources

In alternative 3, there would be no irreversible and irretrievable commitments of resources relevant to the roadless resources within the project area.

Cumulative Effects Common to All Action Alternatives

Cumulative effects to roadless resources were considered within the entire 866,330-acre BMSS IRA that is managed by the Helena, Flathead, Lolo, and Lewis and Clark National Forests, the entire 17,261 acre Lincoln Gulch IRA and the unroaded lands contiguous to the IRAs. Potential cumulative effects to roadless resources are related to other activities occurring within the roadless expanse that have the potential to impact roadless area characteristics or wilderness attributes. Cumulative impacts to roadless resources would result if other activities take place during implementation of the Stonewall Vegetation project, or until vegetation growth obscures the visible stumps from the hand slashing of small diameter trees and hand firelines, approximately 3-5 years.

Past harvest and fuel activities (1954-2010) have been conducted on approximately 74,972 acres across the 866,330 acre BMSS IRA that is managed by four National Forests (37,288 on the Flathead NF; 13,888 on the Helena NF; 17,767 on the Lewis and Clark NF; and, 6,029 on the Lolo NF), or 8.6 percent of the total IRA acreage (see volume 2, appendix C, table C-6).

Recreational activities such as hunting, camping, hiking, off-highway vehicle (OHV) travel on primitive roads, and snowmobiling and cross-country skiing in the winter would continue within the analysis area. Other ongoing and reasonably foreseeable activities that would be occurring within the analysis area include hazard tree removal, weed treatments, trail maintenance, commercial guided recreation, and ongoing use of grazing allotments. All of these activities, when added to the activities proposed in the Stonewall Vegetation Project have the potential to cumulatively affect the roadless values and wilderness attributes within the analysis area. The primary effects would be due to the increased presence of people, vehicles and associated noise that would directly affect solitude and opportunities for primitive and unconfined recreation.

The long-term impacts of other ongoing and reasonably foreseeable activities, such as noxious weed treatment and hazard tree removal, when added to the activities proposed in the Stonewall Vegetation Project, have the potential to cumulatively impact the natural and undeveloped characteristics by causing changes to the scenic qualities within the project area and creating a setting where "resource modifications and utilization practices are evident, but harmonize with the natural environment" as indicated in a Roaded Natural ROS setting. Most of these effects would be beneficial because they would increase the resiliency of forest conditions and reduce the risk of potential negative impacts from severe wildfire, therefore, maintaining the roadless and wilderness qualities that are currently valued by the public. A list of past, present and foreseeable actions relevant to the cumulative effects analysis for roadless resources within the Stonewall analysis area is in volume 2, appendix C, table C-7.

Summary of Effects for All Alternatives

Alternative 1, no action would have no direct or cumulative effects to roadless resources. The purpose and need for the Stonewall Vegetation Project "… *improving the mix of vegetation and structure across the landscape so that it is diverse, resilient, and sustainable to wildfire and insects; modifying fire behavior to enhance community protection while creating conditions that allow the reestablishment of fire as a natural process on the landscape; enhancing and restoring aspen, western larch and ponderosa pine species and habitats; utilizing the economic value of trees through removal; and integrating restoration with socioeconomic considerations"* would not be addressed. Potential long-term indirect effects to roadless resources would be due to the ongoing risk of severe wildfire that could lead to changes in the recreation settings, visual qualities and naturalness within the roadless expanse.

In alternative 2, prescribed fire is proposed within IRAs to promote ecological restoration of a mix of vegetation composition and structure across the landscape. Prescribed fire is proposed on 4,182 acres (about 0.5 percent) within the Bear Marshall Scapegoat Swan IRA and on 664 acres (about 3.8 percent) within the Lincoln Gulch IRA. The proposed action would have short-term direct impacts to roadless resources during project implementation such as increased presence of people and noise within the project area. Project design features are in place to limit potential effects. The proposed treatments would address the purpose and need for the Stonewall Vegetation Project, resulting in a more diverse, resilient and sustainable forest ecosystem with a reduction in risk of negative impacts from severe wildfire. The long-term indirect effects from alternative 2 to roadless resources would be generally beneficial and help to maintain the existing recreation settings and scenic qualities within the project area.

Impacts would be stable or improving for a majority of roadless area characteristics and wilderness attributes with short-term impacts to the undeveloped character from the hand slashing of small diameter

trees and construction of hand fire lines, short-term impacts to solitude during project implementation, and potential adverse effects to cultural resources.

Cumulative effects to roadless resources would generally be short term and related to an increased presence of people, vehicles and the associated noise that may affect solitude.

In alternative 3, prescribed fire is proposed within the Bear Marshall Scapegoat Swan IRA to promote ecological restoration of a mix of vegetation composition and structure across the landscape. Prescribed fire is proposed on 3,565 acres (about 0.4 percent) within the Bear Marshall Scapegoat Swan IRA. The Lincoln Gulch IRA would not be treated. The effects of alternative 3 relative to roadless resources would be similar to those described for alternative 2, but the impacts would occur on fewer acres. There would be no impacts to the Lincoln Gulch IRA and fewer acres treated within the BMSS IRA.

The alternative comparison summary in chapter 2 provides a comparison of effects from project activities by alternative for roadless resources.

Cumulatively there may be short-term impacts to solitude and undeveloped character with long-term benefits to naturalness throughout the IRA. Additional management activities within the IRA including travel planning, weed treatments and livestock grazing would also occur. These activities are compatible with the management of roadless resources and may cumulatively represent short-term impacts to solitude throughout the IRA due to the presence of people.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

The proposed alternatives are consistent with the following:

- Helena National Forest Plan 1986, Management Goals for Management Areas: M-1, T-1, T-2, T-3, T-4, and W-1.
- Forest Service Handbook (FSH) 1909.12 (72.1) – Wilderness Evaluation, that provides definitions for the wilderness attributes of Inventoried Roadless Areas.
- 36 CFR 294.11 – Roadless Area Conservation, Final Rule and related Secretary's Memorandum 1042-155 and 1042-156.
- Forest Service Manual (FSM) 2300 – Recreation, Wilderness and Related Resource Management, guides management of recreation and wilderness resources on National Forest System lands.

As of March 2, 2012, the 2001 Roadless Rule is in full effect after Judge Brimmer (Wyoming) lifted his injunction on the Rule (see the "Roadless Analysis Background and Direction" section in the Inventoried Roadless Area section), The Stonewall project complies with the 2001 Roadless rule, as follows:

d. The cutting, sale, or removal of generally small diameter timber is needed for one of the following purposes and would maintain or improve one or more of the roadless area characteristics as defined in § 294.11. To maintain or restore the characteristics of ecosystem composition and structure, such as to reduce the risk of uncharacteristic wildfire effects, within the range of variability that would be expected to occur under natural disturbance regimes of the current climatic period (36 CFR 294.13(b)(1)(ii)).
e. The cutting, sale, or removal of timber is incidental to the implementation of a management activity not otherwise prohibited by this subpart (36 CFR 294.13(b)(2)).

The cutting of generally small diameter timber is needed to implement the proposed prescribed fire treatments. Consistent with 36 CFR 294.13(b)(1)(ii), prescribed fire is proposed within the Inventoried Roadless Areas (IRA) to promote ecological restoration of a mix of vegetation composition and structure across the landscape. The proposed actions would enhance or help to maintain the roadless characteristics, as defined in 36 CFR 294.11, including high quality soil, water and air; diversity of plant and animal

communities; and habitat for threatened, endangered, proposed, candidate, and sensitive species, and for those species dependent on large, undisturbed areas of land, and natural appearing landscapes with high scenic quality.

Consistent with 36 CFR 294.13 (b)(2), the cutting of generally small diameter timber is incidental to the implementation of the proposed prescribed fire, a management activity that is not otherwise prohibited by the Roadless Rule.

Scenery

Introduction

The Forest Plan uses Visual Quality Objectives (VQOs) when setting objectives to manage the viewed landscape. The VQOs were determined using the Visual Management System (VMS) framework found in Agricultural Handbook (AH) 462, "National Forest Landscape Management Volume 2, Chapter 1, The Visual Management System". Components of VMS used when analyzing effects from management activity on the visual resource are discussed in the Methodology section of this analysis. All VMS components referred to in this analysis are defined in the Glossary section. The Visuals Report (Bonnett 2012) was completed to determine compliance with the direction found in the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans.

Overview of Issues Addressed

Comments pertaining to disclosing the effects of project activities on the visual resource were identified from public scoping as nonsignificant (40 CFR 1501.7), and are addressed by the analyses in this section. Please refer to volume 2, appendix A for a complete listing of the issues and an explanation of how the agency determined their disposition.

Indicators

Indicators are defined to analyze data regarding the potential for impacts to scenery from project activities.

- A landscape analyses should be completed to show the changes that would occur from the proposed actions. What are the visual impacts?
  - **Measure:** Effects to visual resources analyzed and VQO forest plan compliance disclosed.
- A feathering of Timber harvest along the existing straight line harvested areas would benefit the existing visual condition. Property lines adjoining private inholdings, state and BLM lands should be considered for this type of timber harvest also.
  - **Measure:** Design features incorporated to reduce the appearance of lines in units adjoining private inholdings, state and BLM lands to meet the visual quality objectives.

The public also submitted comments to consider effects of activities on the Continental Divide National Scenic Trail (CDNST) corridor. The CDNST lies outside the project area and no activities are proposed within a 5-mile distance of the CDNST. Additional comments from the public included the visual benefits of dead trees verses clearcuts as a personal preference and that smoke from burning reduces visibility and diminishes the appreciation for scenic vistas. Assumptions for viewing preferences were based on information in Forest Service handbooks and considered in this analysis. Smoke, reducing visibility within a viewshed, is short term, lasting only the duration of the burn. Therefore, the effect is considered minimal.

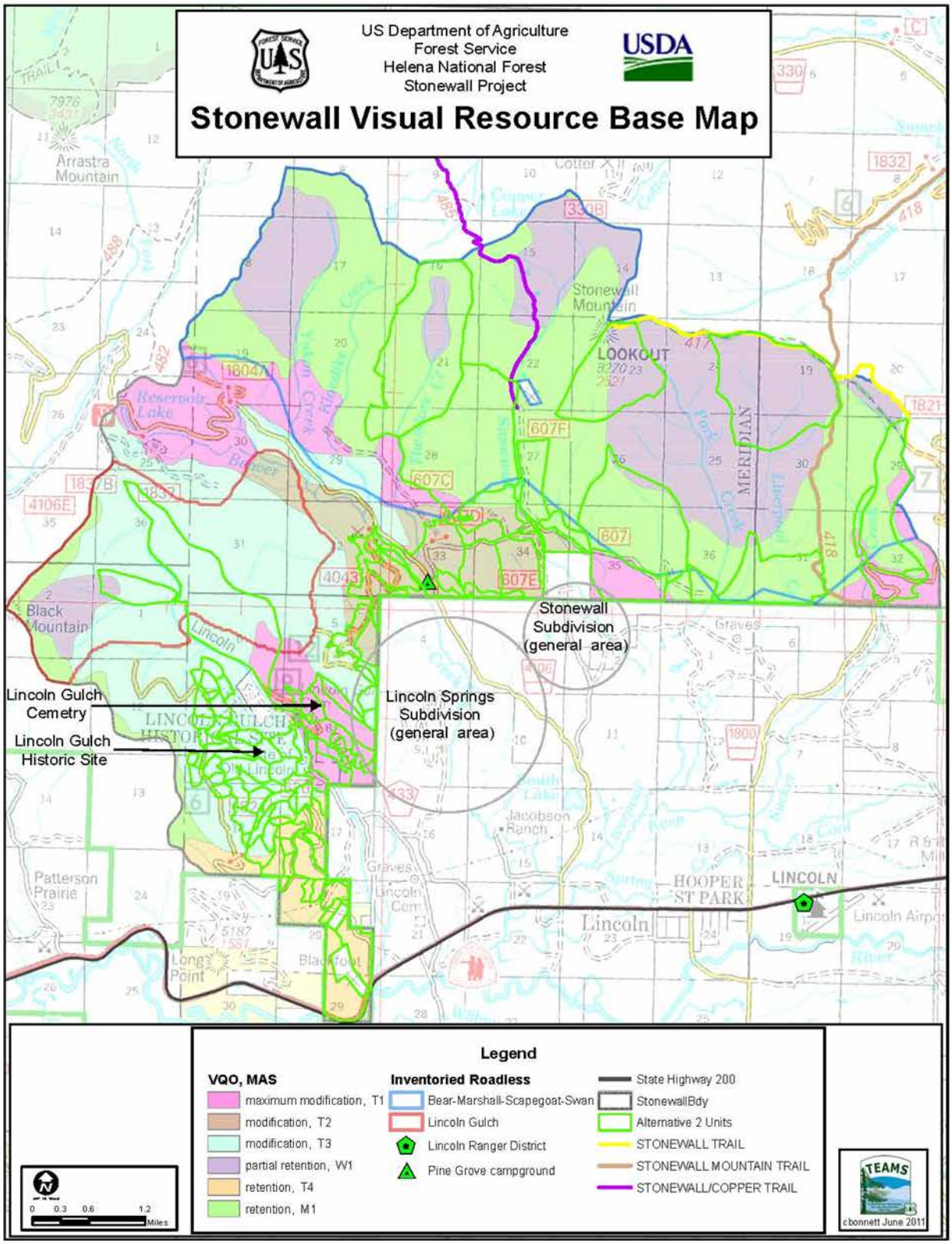

Figure 88. Stonewall Project visual resource

Methodology

The Forest used the Visual Management System (VMS) framework to develop their Visual Quality Objectives (VQOs). The VQOs are used as standards and guidelines when managing the visual resource. The VQO refers to "degree of acceptable alteration of the characteristic landscape" (USDA Forest Service 1974, p. 46). Acceptable alteration is analyzed qualitatively using "degree of alteration" and "duration of impact" components from the "Visual Management System" (USDA Forest Service 1974, p. 28 and 30). In addition, degree of acceptable alteration is determined through the use of other agency handbooks, and professional experience and judgment based on expected outcomes of similar activities elsewhere on the Forest. The current insect conditions (mountain pine beetle epidemic and high levels of western spruce budworm) found in the project area allow the opportunity for the rehabilitation management goal to be used when managing the visual resource (USDA Forest Service 1974, p. 28 and 40). A detailed description of the method used when evaluating the visual resource to disclose effects and determine Forest Plan compliance follows. This methodology was developed under consultation with and approved by the Forest landscape architect.

Seen area was determined per Forest Plan direction. The Forest Plan and information from the Forest landscape architect were used to identify sensitive travel routes, use areas, and water bodies used when determining seen area. The term sensitive area is used throughout this document when referring to sensitive travel routes, use areas, and water bodies. Forest Geographical Information System (GIS) layers and the Helena National Forest America's Great Outdoors Montana 2006 map were used to locate these sensitive areas on a map used for field reconnaissance. All sensitive areas considered when determining seen area are listed in Table 156.

ArcMap GIS was used to display distance zones (foreground, middleground, and background) from sensitive areas when determining seen area. Distance zones of foreground, middleground, and background, are defined in the Glossary section. In addition, views from private lands were considered when determining project seen area. When evaluating effects the most restrictive distance was assigned to a unit if the unit was viewed in more than one distance zone. Table 156 also shows the expected viewed distance zones and seen areas from the sensitive areas. Also, topographic relief displayed on field maps was used to assist in determining seen area during field reconnaissance. Views of the project area were photo documented and are displayed in this section.

The Forest Plan adopted VQO acres for the project area were determined using the Forest VQO GIS layer in conjunction with addition direction per management area found in the Forest Plan. These VQOs are shown on figure 88. GIS analysis was used to determine VQO acres viewed within the project seen area.

Effects from management activities are disclosed. Anticipated changes in the unit's attributes (basic vegetation patterns, rock formations, and water forms) elements (line, form, color, and texture) were considered when determining direct and indirect effects of viewed management activity (USDA Forest Service 1974, p. 8). This information was then used to determine Forest Plan VQO compliance. Cumulative effects were described in terms of changes in the characteristic landscape attributes (basic vegetation patterns, rock formations, and water forms). Existing viewed disturbances were documented to be used in the appropriate sections in the Affected Environment and Environmental Consequences sections of this analysis. Viewed management activities were analyzed to determine Forest Plan compliance. Distance zones were used when describing the viewed landscape being evaluated (USDA Forest Service 1974, p. 7). Management area direction listed under the Forest Plan and Other Relevant Laws, Regulations, Policies and Plans section was considered for compliance.

Whether the activity stayed within the "degree of alteration" and "duration of impact" acceptable range for the VQO from the perspective of the casual forest visitor was determined (USDA Forest Service 1974,

p. 28 through 32). The acceptable "degree of alteration" for a VQO was determined by comparing expected visual contrast with the surrounding natural landscape (USDA Forest Service 1974, p. 28). The "duration of impact" was determined from estimating the length of time a management activity is expected to be visually evident to the casual Forest visitor (USDA Forest Service 1974, p. 30). Design features were developed to reduce impacts to an acceptable level if it was determined the impacts would not allow the VQO to be met in the short-term. Design features were developed to decrease the time the disturbance would be viewed in the landscape and to assure Forest Plan compliance. If the short-term timeframe was not initially met upon implementation of an activity but it was possible to implement a design feature within that same short-term timeframe that allowed the VQO to be met in the long-term time frame then the VQO was considered met. This decision was based on the use of "should" in VMS when describing duration of impact for each VQO (USDA Forest Service 1974, p. 30, 32, 34, and 36) and (USDA Forest Service 1986, p. II/14).

In units where the proposed activity is expected to restore an undesirable visual impact to a desired visual quality, the rehabilitation goal was used (USDA Forest Service 1974, p. 28). With the rehabilitation goal, VQO compliance was determined by first projecting the final outcome of the implementation of the design feature. Then a determination was made as to whether this expected outcome would achieve the assigned VQO. If the design feature applied allowed the disturbance to be minimized to an acceptable level for the VQO within the long-term timeframe of 20 years, then compliance was achieved (USDA Forest Service 1986, p. II/14). Twenty years is used as the long-term timeframe because it could take 20 years before new vegetation fills in created openings allowing areas to blend back into the landscape. Design features were also developed to allow the VQO to be met in the shortest timeframe allowing the desired visual quality to be achieved in the case where the rehabilitation goal is used (USDA Forest Service 1974, p. 40). If design features could not be designed and implemented within the VQO "duration of impact" short-term timeframe, then the VQO would be considered not met (USDA Forest Service 1974, p. 30).

In determining design features the following were considered:

- Professional Experience
- Agriculture Handbook (AH) Numbers 434, 608, 462, 559, and 483 for technical guidance.
- Forest specialists input
- "Northern Region Scenic Resource Mitigation Menu & Design Considerations for Vegetation Treatments" dated March 12, 2009 (unpublished document)

The inventory roadless areas (IRAs) scenic attribute is analyzed in the Inventory Roadless Area Report (Valentine 2012a). This section analyzes the VQOs of these areas where management activity is proposed.

Indicators

The viewed VQO assigned through the Forest Plan within seen areas provided the primary qualitative analysis indicator when determining direct and indirect effects. Consideration of an activity's "duration of impact" and "degree of alternation" within the viewed VQO also provided qualitative analysis indicators. The degree of acceptable alteration ("degree of alteration" and "duration of impact") for each VQO was determined considering natural disturbances found in the characteristic landscape (USDA Forest Service 1974, p. 27-28). The size of a management activity is compared to the size of similar natural activities expected in the landscape. Activities mimicking natural disturbances or simulating vegetation patterns found or expected to be found in the landscape are said to be viewed similarly to their natural counterparts by the casual forest visitor. "Duration of impact is discussed in more detail in the Temporal Boundaries section of this report. Changes in the characteristic landscape attributes, when considering past, present,

and reasonably foreseeable activities (natural or manmade) within all seen areas, provided the qualitative analysis indicator when determining cumulative effects.

Viewed VQO acres within distances of sensitive areas affected by management activities were determined in order to provide additional quantitative analysis indicators for alternative comparisons (USDA Forest Service 1974, p. 7).

Spatial Boundaries

Views extending beyond the project analysis area from sensitive areas were determined. In addition, views into the project area from sensitive areas and lands of other ownership (i.e., private lands) were determined. All sensitive areas used for this analysis are listed in Table 156. When assessing direct and indirect effects, the viewed units within the seen area, as determined from the sensitive areas show on figure 88, were considered the spatial boundary. When assessing cumulative effects all viewed lands within the seen area from sensitive areas listed in table 156 (including sensitive areas listed in the table notes) were considered the spatial boundary.

Temporal Boundaries

The temporal boundary used varied from "immediate upon project completion" up to 5 years (short-term) and up to 20 years (long-term) when analyzing effects from an activity. The short-term timeframes were determined by reviewing the VQO information provided below. The criteria below was considered short term when determining if the "duration of impact" was met for each VQO upon implementation of a management activity.

- Retention – "Reduction in line, form, color, and texture contrast should be accomplished during operation or immediate upon project completion" (USDA Forest Service 1974, p. 30).
- Partial Retention – "Reduction in line, form, color and texture should be accomplished as soon after project completion as possible or at a minimum within the first year" (USDA Forest Service 1974, p. 32).
- Modification – "Reduction in line, form, color, and texture should be accomplished in the first year or at a minimum should meet existing regional guideline" (USDA Forest Service 1974, p. 34).
- Maximum Modification – "Reduction of contrast should be accomplished in five years" (USDA Forest Service 1974, p. 36).
- Rehabilitation – the VMS does not define a timeframe for duration of impact.

In addition, the following concepts were taken into consideration when compliance with both the "degree of alteration" and "duration of impact" criteria per VQO was determined:

- "Each landscape unit has its individual capacity to accept alteration without losing its inherent visual character" (USDA Forest Service 1974, p. 4).
- "Visual impact of management activities increase as the viewer's line of sight tends to become perpendicular to the slope upon which the management activity is to take place" (USDA Forest Service 1974, p. 4).
- Each objective describes a degree of acceptable alteration of the natural landscape based upon the importance of aesthetics (USDA Forest Service 1974, p. 28).
- Whether or not the disturbance from management activity is consistent with the natural disturbances viewed in the landscape is also considered when determining if a VQO was met (USDA Forest Service 1974, p. 30).

- "Generally, considerable change can take place in the positive or natural appearing elements even under Retention VQO if the change achieves desirable variety and follows the principles of landscape design, such as proper scale and arrangement of these elements" (USDA Forest Service 1980, p. 7).

Incomplete and Unavailable Information

The locations of existing and new landings were not available.

Assumptions

An entire unit was considered viewed if any portion of the unit was viewed from a sensitive area. It was assumed private property adjacent to the project area provided foreground views to the project area. The most revealing distance zone was assigned to the unit if that unit was viewed from multiple distance zones. The most restrictive VQO was assigned to a unit if more than one VQO existed for that unit. Effects to the most restrictive VQO (assigned through Forest Plan direction) from the most revealing distance zone were determined for viewed units. This allowed the greatest potential impact viewed in the landscape to be disclosed.

Design features necessary to meet the most restrictive VQO from the most revealing distance zone were developed. It was assumed a design feature that decreased viewed effects to a VQO from the most revealing distance zone would also decrease the effects viewed from other lesser revealing distance zones. If a design feature was needed to meet a VQO in a viewed unit, it was assumed the design feature would be applied across the entire unit depending on topography and shape of that unit. Existing visual condition of the landscape described in the Affected Environment section and the Affected Environment section in the vegetation section (Amell 2012) was considered in the determination of whether cumulative effects may have adverse impacts on the characteristic landscape's attributes. When determining if there would be adverse impacts upon analyzing cumulative effects it was assumed that design features would be implemented.

The rehabilitation goal was used where it was determined proposed activities would not immediately achieve the assigned VQO due to the existence of one of the following scenarios:

- A disturbance (natural or manmade) dominated the unit
- The proposed activity allowed the desired future condition defined in the Silviculture section to be achieve sooner than with no action
- The current existing condition hindered the desired future condition of the landscape to be met in the short-term

Dead trees from insect infestations were considered obtrusive elements. It was assumed a landscape with less visible dead trees is a visually desired landscape. These assumptions are based on Forest Service handbook guidance, which states natural disturbances are considered alterations to the characteristic landscape and the characteristic landscape is defined as what visually represents the basic vegetative patterns, landforms, rock formation and water forms viewed (USDA Forest Service 1980, p. 55 and USDA Forest Service 1974, p.7). This assumption differs from some public comments received on personal preferences of viewing aesthetics.

It was assumed existing and new landings may be viewed in units with proposed activities. Specific landing location information was not available. It is assumed that no catastrophic fires or additional fires would occur when analyzing effects for the no action alternative. Beetle caused mortality exists on approximately 40 percent of the existing mature lodgepole pine stands in the project area and is expected to increase.

Affected Environment

Components of the Visual Management System (VMS) used to describe the existing condition of the project area are *characteristic landscape* (vegetative patterns, landforms, rock formations, and water forms) within *distance zones* viewed from primary and secondary travel routes, use areas and water bodies (USDA Forest Service, 1974, p. 7 and p. 18). This description includes management activity (USDA Forest Service 1974, p.8). All travel routes, use areas, and water bodies listed in Appendix B of the Forest plan, identified in the *Stone Dry Vegetation Treatment NFMA Report for Scenery and Recreation September 30, 2009* (USDA Forest Service 2009), incorporated by reference, and additional areas identified by the Forest landscape architect were taken into consideration when determining the existing condition for the project area. Additional affected environment information considered in this analysis can be found in the vegetation section (Amell 2012).

Existing Condition

Character Type

"The mountains in the Columbia Rockies subregion (character type) are generally rounded and subdued where they have been severely glaciated. Valley floor elevations are about 2,000 feet above sea level and ridgetops range from about 7,000 to over 10,000 feet. Glaciers, permanent snowfields, and craggy topography are outstanding features. Vegetation is moderately varied, with some natural openings. This subregion (character type) contains sagebrush, grasslands, and ancient cedar groves. It is an area of high gradient streams and outstanding high mountain lakes. Hot springs are uncommon, but do occur. Portions of this subregion (character type) have been heavily impacted by past logging and mining practices; large portions are relatively untouched, roadless, and rugged. Natural fire processes are part of this landscape. The landscape character type of the project area is classified as Columbia Rockies" (USDA Forest Service 1980a, Visual Character Types & Variety Class Descriptions, R1 80-11, p.39).

Seen Area Identification

Figure 89 displays visual resource photo points that identify places within the project area where the photos depicted in figure 90 thru figure 99 were taken. It also shows the proposed units for alternative 2, boundaries for inventoried roadless areas and contains information for recreation.

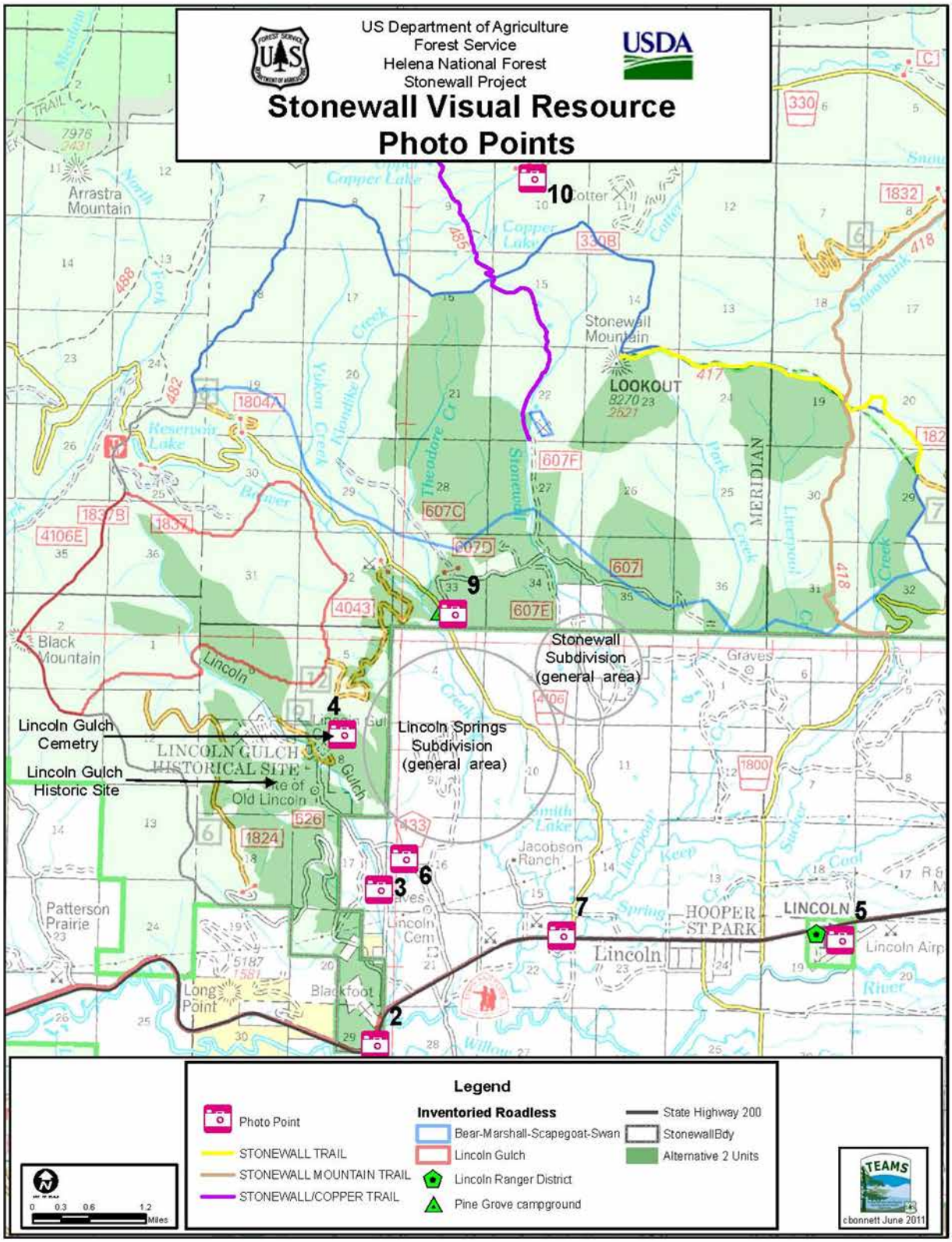

Figure 89. Stonewall Visual Resource Photo Points Map

Mortality caused by beetles exists on approximately 40 percent of the existing, mature lodgepole pine stands in the project area and is expected to increase. These beetle-killed trees, which can be viewed in figure 90, figure 92, and figure 95, negatively impact the landscape. Large portions of the project area can currently be described as a contiguous fuel-bed, with heavy accumulations of dead and down timber.

Figure 90. Photo Point 1-View looking northwest from Forest Route 1040 towards the project area (Approximately 5 miles east of Lincoln, near the Aspen Grove Campground. This is approximately 4 miles southeast of the project area, not displayed in figure 56)

Figure 91. Photo Point 2-View looking north from State Highway 200 into unit 2

Figure 92. Photo Point 3-View north down Forest Route 626

Figure 93. Photo Point 4-View northeast into the project area from Lincoln Gulch cemetery

Figure 94. Photo Point 5-View North from the Lincoln District Office. Due to topography, distance, and vegetative screening, the project area is not seen from the Lincoln District Office.

Figure 95. Photo Point 6-View northwest on County Route 433 into the project area

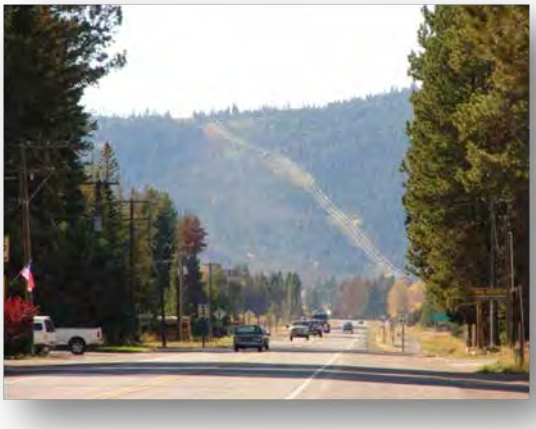

Figure 96. Photo Point 7-View west down State Highway 200 with the project area in the middleground

Figure 97. Photo Point 10-View south from Forest Route 330 towards Bear-Marshall-Scapegoat-Swan IRA. Due to topography, the project area is not seen from Forest Route 330.

Figure 98. Photo Point 8-View looking southwest from Forest road 330 of Snowbank Lake

Northeast of the project area, not displayed in figure 56. There are no views from the lake into the project units due to the surrounding topography.

Figure 99. Photo Point 9-View within Pine Grove campground

Seen areas for direct and indirect effects along with cumulative effects spatial boundaries were identified during field visits. Sensitive areas used were determine through a combination of areas listed in Management Areas R-1, R-2, areas listed in Appendix B of the Forest Plan and areas listed on page 2 and 6 of the *Stone Dry Vegetation Treatment NFMA Report for Scenery and Recreation September 30, 2009.* Additional sensitive areas given by the Forest landscape architect were also used in seen area determination. Table 156 lists the viewed distance zones into the project area determined from sensitive areas. This total seen area was used for cumulative effects purposes.

The following sensitive areas did not provide views into the Stonewall project area, but were considered for total seen area determination for cumulative effects purposes: Forest System Road 330 (Forest Plan Appendix B), Copper Creek and Aspen Grove Campgrounds (R-2 and Appendix B), Lincoln Ranger Station (Forest Plan Appendix B) figure 6, Continental Divide Trail (Forest Plan), Snowbank Lake (Forest Plan Appendix B), Indian Meadows (R-1 and Forest Plan Appendix B), Silver King Mountain (R-1 and Forest Plan Appendix B), Scapegoat Wilderness (Forest Plan), Stonewall Subdivision (USDA Forest Service 2009).

Table 156. Distance zones viewed into the project area from travel routes, use areas, and water bodies from sensitive areas

Sensitive Areas (Travel Route, Use Area, or Water Body)	Foreground Views	Middleground Views	Background Views	Management Direction
State Highway 200	X	X	N/A	Appendix B of the Forest Plan
Lincoln Gulch IRA (#1601)	X	N/A	N/A	Forest Plan
Bear-Marshal-Scapegoat-Swan IRA (#A1485)	X	N/A	N/A	Forest Plan
Lincoln Springs Subdivision	N/A	X	N/A	USDA FS, 2009
Lincoln Gulch Cemetery	X	N/A	N/A	USDA FS, 2009
Lincoln Gulch Historic Site	X	N/A	N/A	USDA FS, 2009

Sensitive Areas (Travel Route, Use Area, or Water Body)	Foreground Views	Middleground Views	Background Views	Management Direction
Pine Grove Campground	X	N/A	N/A	USDA FS, 2009
Stonewall/Copper Trail	X	N/A	N/A	USDA FS, 1974
Stonewall Trail	X	N/A	N/A	USDA FS, 1974
Stonewall Mountain Trail	X	N/A	N/A	USDA FS, 1974

Distance zone information from table 156along with topography information was used to determine seen areas and viewed units in the field. Viewed units for the proposed action are shown in figure 100 and listed in table 157. All units listed are treated as completely viewed when determining VQO acres for compliance.

Table 157. Proposed action viewed units and their VQO from travel routes, use areas, and water bodies

Travel Route, Use Area, or Water Body	Foreground View Unit/ (VQO)	Middleground Viewed Unit/(VQO)
State Highway 200	1/(R), 2/(R)	*3/(R), *5/(R), *8/(R), *10/(R), *73/(R) 39/(PR), 40/(PR), 41/(PR), 20/(PR), 44/(PR)
Lincoln Gulch IRA (#1601)	76/(PR), 77/(M)	N/A
Bear-Marshal-Scapegoat-Swan IRA (#A1485)	79/(R), 87/(R), 80/(R), 82/(R), 81/(R), 85/(R), 83/(R), 84/(R), 88/(R),	N/A
Lincoln Springs Subdivision	N/A	39/(M), 40/(M), 41/(PR), 20/(PR), 44/(PR)
Lincoln Gulch Cemetery	16/(MM), 17/(MM), 78/MM	N/A
Lincoln Gulch Historic Site	13/(M)	N/A
Pine Grove Campground	46/M	N/A
Stonewall/Copper Trail	84/(R)	N/A
Stonewall Trail	82/(R)	N/A
Stonewall Mountain Trail	82/(R), 80/(R)	N/A

Note: No units are expected to be viewed in the background that are not viewed in the foreground or middleground from the sensitive areas listed in table 3. The VQOs for units were determined using a combination of the Forest VQO map and Forest Plan information (USDA Forest Service 1986), Appendix B, p. B/2. R= retention, PR=partial retention, M=modification, MM=max modification.

*The VQO for units 3, 5, 8 10, and 73 are Retention based on the Forest VQO map which assigned a higher VQO to these areas when compared to using the matrix found in appendix B of the Forest Plan.

Environmental Consequences

Environmental effects for each alternative were considered in detail and described from the expected perspective of the casual Forest visitor (USDA Forest Service 1974, p. 30). Effects from management activities were described using dominant elements (line, form, color, and texture) viewed within distance zones (foreground, middleground, and background) from a travel route, use area, or water body (USDA Forest Service 1974, p. 7 and p. 8). The degree of acceptable alteration ("degree of alteration" and "duration of impact") for each VQO was determined considering natural disturbances found in the characteristic landscape (USDA Forest Service 1974, p. 27, and p. 28). The size of a management activity

is compared to the size of similar natural activities expected in the landscape. Activities mimicking natural disturbances or simulating vegetation patterns found or expected to be found in the landscape are said to be viewed similarly to their natural counterparts by the casual forest visitor. All previous information was used when determining acceptable duration of impact and degree of alteration for all effects sections under all alternatives. In addition the "rehabilitation goal" was used, as described in the Methodology section of the Visual Report (Bonnett 2012) based on the criteria in the VMS and direction found in the Forest Plan.

See the Stonewall Vegetation Project Visual Report (Bonnett 2012), incorporated by reference, for more detailed descriptions of effects.

Alternative 1 – No Action

There would be an increase in line, form, and color from viewing beetle infested trees as these trees lose their foliage in the short term. Effects of dead trees in the viewshed are added black lines in the landscape from the dead trees. Loss of these trees would equate to a decrease in the forest canopy followed by an increase in ground texture intermixed with the surrounding, remaining forest canopy leading to various size openings in the long-term. These effects would be noticeable in the foreground and middleground from sensitive areas by the casual forest visitor in the short and long term. Figure 90 shows dead trees in the middleground of the project seen area. Down woody material would increase as dead trees fall, increasing ground fuel density. The increase in fuel density would increase the potential for these areas to experience more intense forest fires.

There would be no vegetation treatments or fuel treatments implemented for alternative 1. There would be no construction of landings or roads built then obliterated in the project area.

Direct and Indirect Effects

There would be no direct or indirect effects for alternative 1 because no project activities are proposed.

Cumulative Effects

There would be no cumulative effects because no project activities are proposed under this alternative.

Conclusion

There are no direct or indirect effects from project activities. Effects from no action, previously described, could lead to an altered viewed landscape in the foreground and middleground views from sensitive areas. These dead trees would provide an altered landscape expected to be viewed as part of a natural disturbance by the casual forest visitor. However, dead trees could be considered undesirable elements in the landscape by some viewers. It could take 20 years or more before areas with beetle mortality fill in with new vegetation, allowing these areas to blend back into the landscape.

Visual quality objectives would be met since no management activity is proposed under this alternative and changes would be from ecological processes. The viewed vegetation patterns found in the characteristic landscape could undergo a change when effects from all infested trees viewed in the total seen area are considered. This alternative is in compliance with Forest Plan, policy, laws and regulations.

Alternative 2 – Proposed Action

The proposed action includes using both commercial and noncommercial treatments to address the purpose and need, and move the project area towards the desired condition. These actions would include: regeneration harvest, intermediate harvest, and prescribed fire. The proposed action includes using prescribed fire and treating slash in inventoried roadless areas (Bear Marshall Scapegoat Swan and

Lincoln Gulch). There would be approximately 2.6 miles of roads built then obliterated immediately following timber removal under this alternative. In addition, there would be approximately 45.6 miles of road that would be maintained for use. Commercial harvest and road work would not occur in the two inventoried roadless areas. Implementing the proposed action could include the use of chainsaws, feller bunchers, skidders, and cable logging equipment. Post treatment activities would include underburning, site preparation burning, jackpot burning, hand piling/burning, treeplanting, and monitoring of natural vegetation. Treatment descriptions Groups 1 through 8 apply to alternative 2. Treatment descriptions for each group can be found in chapter 2.

Table 158 lists activities included in the proposed action. Treatments, prescription, and logging systems are defined in the silvicultural report (Amell 2012). Viewed effects to the visual resource from proposed activities are disclosed. Effects to the viewed landscape (figure 100) were assessed to determine Forest Plan compliance. The visual quality objectives for this project include acres in retention, partial retention, modification, and max modification. The viewed units and their VQOs are listed in table 158. Table 159 shows the total VQO acres proposed for treatments for this alternative within foreground and middleground distances zones.

Project Design Features

The Stonewall Vegetation Project has been designed with features that are intended to minimize or avoid potential adverse effects while meeting project objectives. In addition to the proposed action treatments described in this section, design features would be implemented where applicable. A description of the project design features relating to scenery and other resources is displayed in table 9, chapter 2.

The specific design features listed in table 9 pertaining to scenery/visual are VIS-1 through VIS-13, This analysis is based on the implementation of all design features. Project design features apply to all action alternatives.

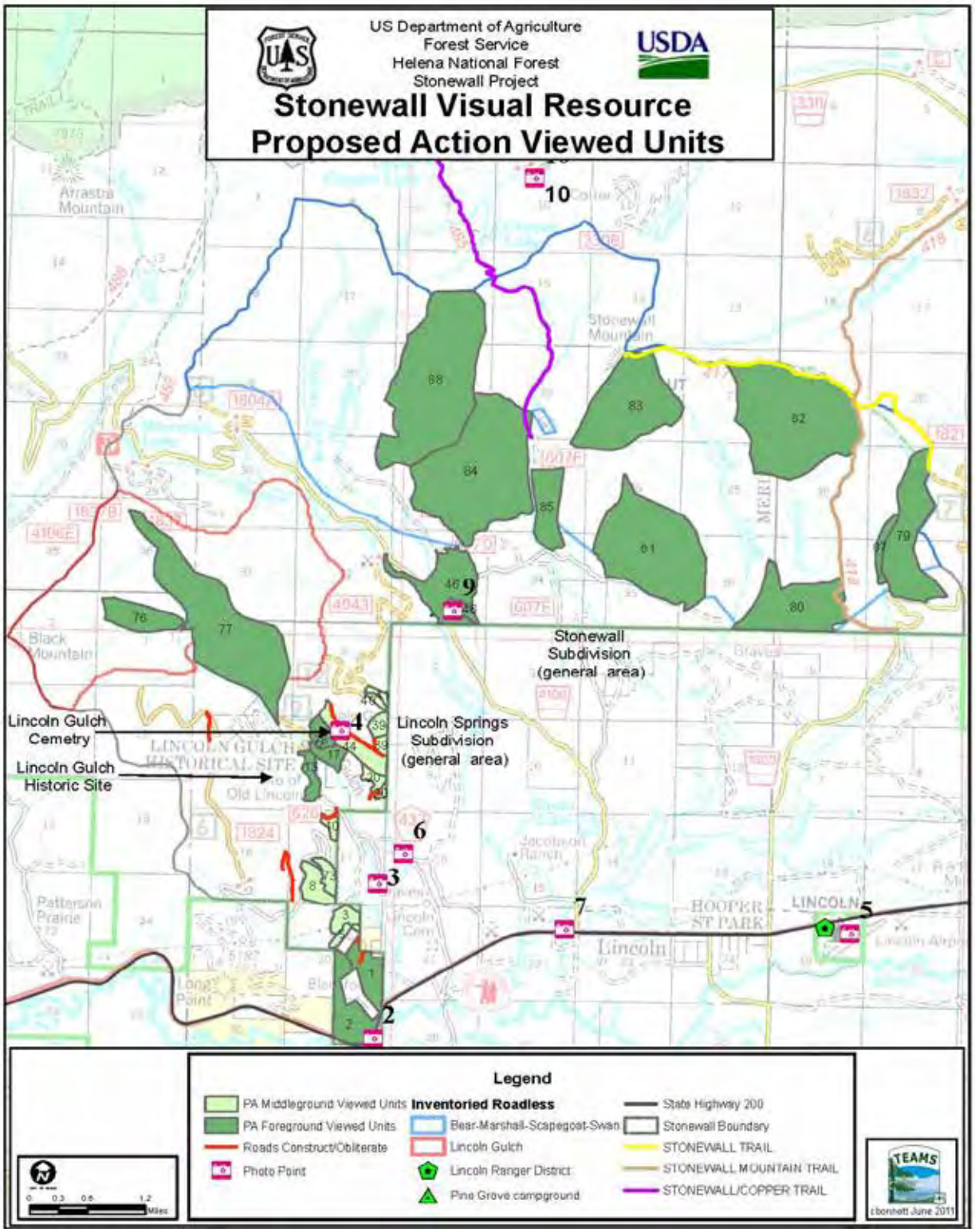

Figure 100. Stonewall visual resource proposed action viewed units

Table 158. Viewed treatment units with proposed vegetation treatment, prescriptions, logging systems, distance zone, and VQO for the alternatives 2 and 3

Treatment	Prescription	Unit	*DZ/VQO	Logging System	Alt 2 Acres	Alt 3 Acres
Intermediate Harvest	Improvement Cut, Underburn	44	MG/PR	skyline	97	
Intermediate Harvest	Improvement Cut, Underburn	46	FG/M	tractor	251	
Intermediate Harvest	Intermediate thin patches	46a	FG/M	tractor		223
Intermediate Harvest	Improvement Cut, Underburn	8	MG/R	skyline	62	62
Intermediate Harvest	Precommercial Thin, Underburn	46b	FG/M	tractor		27
Intermediate Harvest	Precommercial Thin	73	MG/R	HAND	33	33
Intermediate Harvest	Precommercial Thin, Handpiling, Burn Piles	16	FG/MM	HAND	3	3
Intermediate Harvest	Precommercial Thin, Handpiling, Burn Piles	3	MG/R	tractor	37	37
Intermediate Harvest	Sanitation, Slashing, Handpiling, Burn Piles	5	MG/R	tractor	18	18
Prescribed Fire	Low Severity Fire, Openings <5 acres	2	FG/R	HAND	146	146
Prescribed Fire	Low Severity Fire, Openings <5 acres	78	FG/MM	HAND	38	38
Prescribed Fire	Low Severity Fire, Openings <5 acres	85	FG/R	HAND	143	143
Prescribed Fire	Low-intensity and severity underburning	17a	FS/MM	HAND		38
Prescribed Fire	Low-intensity and severity underburning	20a	MG/PR	HAND		24
Prescribed Fire	Low-intensity and severity underburning	44a	MG/PR	HAND		97
Prescribed Fire	Jackpot burn or pile and burn	46a	FG/M	HAND		223
Prescribed Fire	Jackpot burn or pile and burn	80a	FG/R	HAND		326
Prescribed Fire	Low Severity Fire, Openings <10 acres	76	FG/PR	HAND	123	
Prescribed Fire	Mixed Severity Fire, Openings <20 acres	80	FG/R	HAND	326	
Prescribed Fire	Mixed Severity Fire, Openings <30 acres	77	FG/M	HAND	709	
Prescribed Fire	Mixed Severity Fire, Openings <30 acres	79	FG/R	HAND	337	337
Prescribed Fire	Mixed Severity Fire, Openings <30 acres	81	FG/R	HAND	629	
Prescribed Fire	Mixed Severity Fire, Openings <30 acres	84	FG/R	HAND	831	831
Prescribed Fire	Mixed Severity Fire, Openings <30 acres	88	FG/R	HAND	865	865
Prescribed Fire	Mixed Severity Fire, Openings <5 acres	87	FG/R	HAND	36	36
Prescribed Fire	Mixed Severity Fire, Openings <75 acres	82	FG/R	HAND	776	776

Treatment	Prescription	Unit	*DZ/VQO	Logging System	Alt 2 Acres	Alt 3 Acres
Prescribed Fire	Mixed Severity Fire, Openings <75 acres	83	FG/R	HAND	457	457
Regeneration Harvest	Clearcut with Reserves, Jackpot Burn	17	FG/MM	tractor	38	
Regeneration Harvest	Clearcut with Reserves, Underburn	10	MG/PR	tractor	18	18
Regeneration Harvest	Seedtree with Reserves, Jackpot Burn	13	FG/M	tractor	41	41
Regeneration Harvest	Seedtree with Reserves, Jackpot Burn	20	MG/PR	tractor	32	
Regeneration Harvest	Seedtree with Reserves, Underburn	39	MG/PR	skyline	42	26
Regeneration Harvest	Seedtree with Reserves, Underburn	40	MG/PR	tractor	11	11
Regeneration Harvest	Shelterwood (Group) with Reserves, Site Prep Burn	1	FG/R	tractor	96	96
Regeneration Harvest	Shelterwood (Group) with Reserves, Underburn	41	MG/PR	skyline	12	12
Grand Total					6,206	4,720

*DZ=Distance Zone, FG=Foreground, MG=Middleground, R=Retention, PR=Partial Retention, M=Modification, MM=Maximum Modification. Not all actions in a unit listed above are viewed.

Table 159. Distance zone viewed VQO acres for alternatives 2 and 3

Distance Zone*	VQO	Alt 2 Acres	Alt 3 Acres
Foreground	MM	78	78
Foreground	M	1,000	291
Foreground	PR	126	3
Foreground	R	4,634	4,004
Middleground	MM		
Middleground	M	16	
Middleground	PR	196	1898
Middleground	R	151	151

R=Retention, PR=Partial Retention, M=Modification, MM=Maximum Modification

Direct and Indirect Effects

Proposed activities in treatment units expected to be viewed are displayed in table 158. Units viewed in the background were also viewed in the middle ground and foreground. Not all activities listed under each viewed unit are expected to be viewed as described further for each activity. Viewed effects from management actions are discussed below. Acres for viewed units listed in table 158 are not repeated throughout this section. Sensitive areas are listed in table 157 and are not repeated throughout this section. The discussion that follows addresses effects from proposed activities, determines compliance, and discusses design features necessary for compliance.

Harvest Treatments

Foreground

Marked trees for retention and unit boundaries may be visible in foreground areas. No degree of alteration is expected from this activity. The duration of impact could be more than five years until the marking paint fades. Implementing VIS-10 and VIS-11 would decrease the possibility of painted trees being viewed in the landscape allowing both M and MM to be met.

Upon completion, intermediate thinning, a more open forest at the ground plane and in the mid to upper canopy is expected to be viewed throughout these units. Remaining canopy cover would be less when compared to canopy cover prior to implementation. These effects are expected to last more than 20 years but would not dominate the landscape. Thinning activities would appear similar to other areas found in the landscape that are naturally established over time. The impact from thinning is not expected to be noticeable by the casual forest visitor. Intermediate thinning activities would be considered within the degree of acceptable alteration for both M and MM.

Regeneration treatments (clear cutting, seed tree and shelterwood treatments) would create openings or more open canopy areas in the landscape. These openings and areas of open canopy are not expected to be continuous because the reserve tree technique would be utilized. Clearcut units would be less than 40 acres allowing the openings to mimic other similar size openings occurring naturally in the surrounding landscape. Creating openings could leave a wall of vegetation causing an edge effect that could be noticed by the casual forest visitor as an unnatural activity. When considering the size of the openings, the degree of alteration for MM is expected to be met. If an edge effect is created the duration of impact could last over 20 years. Implementation of design feature VIS-1 which allows the edge effect to be blended and appear natural in the landscape would allow MM to be met.

Middleground

Improvement cuts, precommercial thinning, and sanitation cuts are not expected to be viewed in the middleground from sensitive areas. No viewed effects from sensitive areas are expected upon implementation of these activities in this distance zone.

Regeneration treatments viewed in the middleground would have effects similar to the ones previously described for foreground views. However, these effects would be less visible smaller size leaving for even smaller clearcut areas. Clearcut areas would also be broken up by reserve trees. The degree of alteration would be met even in PR. Implementing design feature VIS-1 would eliminate the edge effect also allowing the duration of impact for PR to be met.

Prescribe fire (Low Severity and Mixed Severity) and Underburning

Foreground

Effects expected to be viewed in the foreground are fire line boundaries and burned ground vegetation with some small pockets of tree mortality with the low and mixed severity burn units and burned vegetation leaving some areas with little tree mortality with underburning. Fire line boundaries could add artificial lines. These boundary lines could look unnatural if straight lines and other geometric patterns are used during unit layout. The line/geometric effect could last more than a year until vegetation begins to grow and blend the unnatural lines into the landscape. The effects from the fire on the ground vegetation and tree mortality is not expected to be discernible as a management activity by the casual forest visitor when compared to effects from other natural fires found in the landscape.

When considering the line effect, the degree of alteration based on the size of the activity in these units would be met for R, MM, and PR. Implementing Vis12/Fuel2 would eliminate artificial lines allowing the duration of impact to be met for all VQOs. This design feature would allow the fire line to look more like a natural fire occurrence.

Handpiling and burning of the piles would add unnatural forms and texture to the landscape that would be viewed. These piles would be burned prior to the completion of the project allowing this effect to meet the duration of impact for M and MM.

Upon handpile and jackpot burning, small pockets of tree mortality in close proximity to the burn piles and charred branches may be viewed from the implementation of this activity. The small pockets of dead trees are not expected to dominate the landscape and can be viewed as part of a natural disturbance. This effect is considered within the degree of acceptable alteration and duration of impact for both M and MM.

Charred branches left over from the burning of piles are expected to be viewed in the landscape. Within five years new vegetation would have grown in, eliminating the possibility to view the burnt vegetation. The degree of alteration for both M and MM would be met. The duration of impact for MM would be met. The duration of impact for M would be met with the implementation of VIS-9 and S/WS/F-12.

Burn activities would temporarily add smoke into the air obstructing foreground and middleground views from sensitive areas. This effect is short term and would subside upon completion of the burning activity. At which point M and MM would be met.

Middleground

The prescribed fire is not expected be viewed in the middleground from sensitive areas. Therefore, no viewed effects are expected from prescribed fire activities for this distance zone for any unit.

After underburning is completed the effects from the activity is not expected to be viewed in the middleground due to the distance the proposed activity would be from sensitive areas and the canopy cover of these units. No viewed effects in the landscape from this activity are anticipated.

Hand piling and burning of the piles are not expected to be viewed from sensitive areas because of the existing overstory in these units, distance to the units from sensitive area, and the undulating topography of the landscape between the sensitive areas and the units. Slashing is not expected to contribute to viewed effects in the landscape.

Transportation

There would be approximately 2.6 miles of road built then obliterated immediately following timber removal under this alternative shown in figure 100. In addition, there would be approximately 45.6 miles of road that would be maintained for use under this alternative.

The road construction work associated with this alternative would not be viewed in the foreground or middleground due to the distance the proposed activity would be from sensitive areas (figure 100). Therefore, there would be no viewed effects from this activity in the landscape.

Cumulative Effects

The characteristic landscape is expected to continue to perpetuate. Management activity viewed disturbances would increase when considering all viewed units proposed for treatment. However, with the project design features the VQOs would be met. Units where dead trees would be removed would

ultimately look similar to the end result of the natural decay cycle. This alternative would decrease the length of time the dead trees are viewed in the landscape.

Compliance with Forest Plan and Other Regulations

Activities for the Stonewall Vegetation Project, when implemented with project design features and mitigation measures (chapter 2, table 9), would be in compliance with the Forest Plan for the Helena National Forest (USDA Forest Service 1984) and National and Regional policies, standards, and guidelines in the Forest Service Manuals and Handbooks and the Northern Regional Guide. See the Visuals Report (Bonnet 2012) for more details.

Alternative 3

Alternative 3 includes the same types of treatments and prescriptions as alternative 2 along with Groups 9 and 10 treatments. A complete description of each activity can be found in chapter 2. All effects to the visual resource from proposed activities are disclosed. Effects to the viewed landscape were used to determine Forest Plan compliance. The visual quality objectives for alternative 3 are retention, partial retention, modification, and maximum modification. Figure 101 displays the viewed units and their VQOs.

The viewed units and their VQOs are shown in table 158. Table 159 shows the total VQO acres proposed for treatments for this alternative within foreground and middleground distances zones.

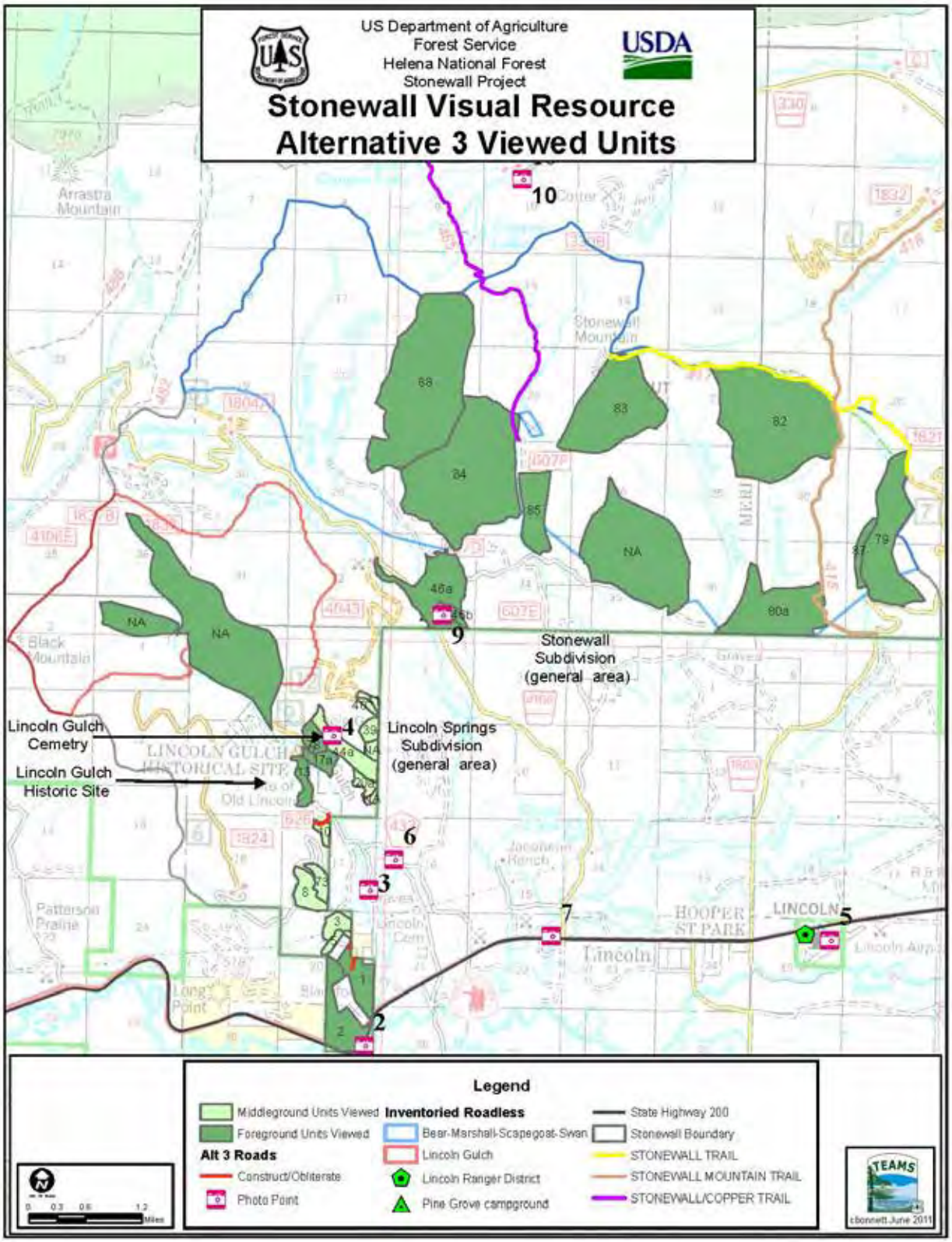

Figure 101. Stonewall visual resource alternative 3 viewed units

Direct and Indirect Effects

All units expected to be viewed and acres of proposed activities for these units are displayed in table 157. Not all activities listed under each viewed unit are expected to be viewed as described further for each activity. Viewed effects from management actions are discussed below. Acres for viewed units listed are not repeated throughout this section. Sensitive areas listed in table 156 are not repeated throughout this section. The discussion that follows addresses effects from proposed activities, determines compliance, and lists design features necessary for compliance.

Harvest Treatments

Foreground

Marked trees for retention and unit boundaries may be visible in foreground areas. No degree of alteration is expected from this activity. The duration of impact could be more than five years until the marking paint fades. Implementing VIS-10 and VIS-11 would decrease the possibility of painted trees being viewed in the landscape allowing both M and MM to be met.

Upon completion, intermediate thinning, a more open forest at the ground plane and in the mid to upper canopy is expected to be viewed throughout these units. Remaining canopy cover would be less when compared to canopy cover prior to implementation. These effects are expected to last more than 20 years but would not dominate the landscape. Thinning activities would appear similar to other areas found in the landscape that are naturally established over time. The impact from thinning is not expected to be noticeable by the casual forest visitor. Intermediate thinning activities would be considered within the degree of acceptable alteration for both M and MM. In foreground areas, when compared to alternative 2, fewer acres are proposed for intermediate thinning treatments in alternative 3.

Regeneration treatments (clear cutting, seed tree and shelterwood treatments) would create openings or more open canopy areas in the landscape. These openings and areas of open canopy are not expected to be continuous because the reserve tree technique would be utilized. Clearcut units would be less than 40 acres allowing the openings to mimic other similar size openings occurring naturally in the surrounding landscape. Creating openings could leave a wall of vegetation causing an edge effect that could be noticed by the casual forest visitor as an unnatural activity. When considering the size of the openings, the degree of alteration for MM is expected to be met. If an edge effect is created the duration of impact could last over 20 years. Implementation of design feature VIS-1 which allows the edge effect to be blended and appear natural in the landscape would allow MM to be met. In foreground areas, when compared to alternative 2, fewer acres are proposed for regeneration harvest in alternative 3.

Middleground

Improvement cuts, precommercial thinning, and sanitation cuts are not expected to be viewed in the middleground from sensitive areas. No viewed effects from sensitive areas are expected upon implementation of these activities in this distance zone. In middleground areas, when compared to alternative 2, fewer acres are proposed for improvement cut in alternative 3.

Regeneration treatments viewed in the middleground would have effects similar to the ones previously described for foreground views. However, these effects would be less visible smaller size leaving for even smaller clearcut areas. Clearcut areas would also be broken up by reserve trees. The degree of alteration would be met even in PR. Implementing design feature VIS-1 would eliminate the edge effect also allowing the duration of impact for PR to be met. In middleground areas, when compared to alternative 2, fewer acres are proposed for regeneration treatments than in alternative 3.

Prescribe fire (Low Severity and Mixed Severity) and Underburning

Foreground

Effects expected to be viewed in the foreground are fire line boundaries and burned ground vegetation with some small pockets of tree mortality with the low and mixed severity burn units and burned vegetation leaving some areas with little tree mortality with underburning. Fire line boundaries could add artificial lines. These boundary lines could look unnatural if straight lines and other geometric patterns are used during unit layout. The line/geometric effect could last more than a year until vegetation begins to grow and blend the unnatural lines into the landscape. The effects from the fire on the ground vegetation and tree mortality is not expected to be discernible as a management activity by the casual forest visitor when compared to effects from other natural fires found in the landscape.

When considering the line effect, the degree of alteration based on the size of the activity in these units would be met for R, MM, and PR. Implementing Vis12/Fuel2 would eliminate artificial lines allowing the duration of impact to be met for all VQOs. This design feature would allow the fire line to look more like a natural fire occurrence. In foreground areas, 326 acres less in the mix severity prescription in alternative 3 when compared to alternative 2.

Handpiling and burning of the piles would add unnatural forms and texture to the landscape that would be viewed. These piles would be burned prior to the completion of the project allowing this effect to meet the duration of impact for M and MM.

Upon handpile and jackpot burning, small pockets of tree mortality in close proximity to the burn piles and charred branches may be viewed from the implementation of this activity. The small pockets of dead trees are not expected to dominate the landscape and can be viewed as part of a natural disturbance. This effect is considered within the degree of acceptable alteration and duration of impact for both M and MM.

Charred branches left over from the burning of piles are expected to be viewed in the landscape. Within five years new vegetation would have grown in, eliminating the possibility to view the burnt vegetation. The degree of alteration for both M and MM would be met. The duration of impact for MM would be met. The duration of impact for M would be met with the implementation of VIS-9 and S/WS/F-12.

Burn activities would temporarily add smoke into the air obstructing foreground and middleground views from sensitive areas. This effect is short term and would subside upon completion of the burning activity. At which point M and MM would be met.

Middleground

The prescribed fire is not expected be viewed in the middleground from sensitive areas. Therefore, no viewed effects are expected from prescribed fire activities for this distance zone for any unit.

After underburning is completed the effects from the activity is not expected to be viewed in the middleground due to the distance the proposed activity would be from sensitive areas and the canopy cover of these units. No viewed effects in the landscape from this activity are anticipated.

Handpiling and burning of the piles are not expected to be viewed from sensitive areas because of the existing overstory in these units, distance to the units from sensitive area, and the undulating topography of the landscape between the sensitive areas and the units. Slashing is not expected to contribute to viewed effects in the landscape.

Proposed underburning increases in overall amount of underburning in middleground for alternative 3 when compared to alternative 2; however, alternative 3 has fewer acres proposed for jackpot burning, when compared to alternative 2.

Slashing is not expected to be viewed in any distance zone from any sensitive areas. Therefore, there would be no viewed effects from this activity in the landscape.

Transportation

There would be 0.4 miles of road constructed for use and then obliterated under this alternative. In addition, there would be approximately 43.8 miles of road that would be maintained for use under this alternative.

The road construction work associated with this alternative would not be viewed in the foreground or middleground due to the distance the proposed activity would be from sensitive areas. Therefore, there would be no viewed effects from this activity in the landscape.

Cumulative Effects

The characteristic landscape is expected to continue to perpetuate. Management activity viewed disturbances would increase when considering all viewed units proposed for treatment. However, with the project design features the VQOs would be met. Units where dead trees would be removed would ultimately look similar to the end result of the natural decay cycle. This alternative would decrease the length of time the dead trees are viewed in the landscape. Cumulative effects for this alternative are expected to be similar to alternative 2, with fewer acres impacted by alternative3.

Compliance with the Forest Plan and other Regulations

Activities for the Stonewall Vegetation Project, when implemented with project design features and mitigation measures (chapter 2, table 9), would be in compliance with the Forest Plan for the Helena National Forest (USDA Forest Service 1984) and National and Regional policies, standards, and guidelines in the Forest Service Manuals and Handbooks and the Northern Regional Guide. See the Visuals Report (Bonnet 2012) for more details.

Conclusions

The action alternatives would be in compliance with the Forest Plan and other regulations with the implementation of the visual design features. Both action alternatives would allow the VQOs to be met.

Cultural Resources

Introduction

Past human behavior and activities can be inferred through material remains observed in the present. Generally, cultural resources are the material manifestation of activities from the past but can also refer to places that are deemed sacred or significant to people in the present. They can be historical documentation, or oral evidence. These resources can be prehistoric, historic, architectural, structures, places, objects, and traditional cultural properties (Forest Service Manual (FSM) 2360.5).

The following questions are addressed to determine effects on cultural resources in the Helena National Forest:

- Are the cultural resources evaluated for eligibility for inclusion in the National Register of Historic Places (NRHP)?

- If the cultural resources are evaluated, are they eligible for inclusion in the NRHP?
- Will eligible cultural resources be damaged or adversely affected?
- Will cultural resources that are otherwise ineligible for inclusion in the NRHP, but have value determined by the forest to merit protection, be adversely affected by the proposed project.
- Will cultural resources be protected and adverse actions mitigated?

Overview of Issues

The Forest Plan requires the integration of cultural resources in project planning and forest management. Compliance inventory, evaluation of site significance and project effect, consultation with the Montana State Historic Preservation Office and Tribal Historic Preservation Offices, and implementation of mitigation treatment plans for project affected cultural resources would comply with the NHPA and its implementing regulations in 36 CFR 800, as well as Helena National Forest Plan (USDA Forest Service 1986) standards and guidelines.

Comments pertaining to disclosing the effects of project activities on cultural resources were identified from public scoping as nonsignificant (40 CFR 1501.7), and are addressed by the analyses in this section. Please refer to volume 2, appendix A of this document for a complete listing of the issues and an explanation of how the agency determined their disposition.

Ground disturbance and prescribed fire in the Historic Lincoln Townsite could result in loss of the historical integrity of this site. This is addressed with project design features to avoid adverse impacts to the known cultural resource sites.

Methodology

Effects to cultural resources are analyzed based on potential damage or adverse effects to all cultural sites within the project boundary by Helena National Forest standards. The best available science was used in preparation of this analysis. The most recent cultural GIS data for the Forest was analyzed and field work has been previously undertaken in support of this planning effort conducted in accordance with FSM 2360. Sources of information examined as part of the background research to identify previously identified cultural resources include the current Heritage GIS layers and reports documenting previous archaeological studies within the project boundary. Following the analysis described above, the consequences were analyzed as follows:

All sites were assessed for possible adverse effects or damages.

Incomplete and Unavailable Information

The above methodology assumes that all known sites in the project area have been adequately identified.

Spatial and Temporal Context for Effects Analysis

The spatial context for analysis is the extent of the current project area. The temporal context for effects analysis is two-fold. The immediate temporal context is essentially the direct effects that the current proposed project would have on cultural resources; that is, immediate changes to site condition or integrity, or even National Register status, as a direct result of project actions. The long-term temporal context is essentially the indirect effects that the current proposed project would have on cultural resources, that is, long-term changes to site condition, integrity, or National Register status resulting from changes instigated by the project actions.

Affected Environment

The prehistory and history of the upper Blackfoot River Valley and analysis area are discussed in various historical records (i.e., Beck 1989; UBVHS 1994), cultural resources overviews (i.e., Knight 1989; Scott 2001) and agency heritage compliance inventory reports (i.e., Brumley et al. 1998; Davis and Godin 2003). People have inhabited the upper Blackfoot River Valley for millennia. American Indian groups once occupied, seasonally used or traveled through this large river valley and the adjacent foothills and mountain ranges. Today, the Salish (Flathead) in particular attach great cultural significance to the ancient campsites, hunting and plant food gathering places, tool stone quarries and paint pigment sources, vision questing sites and old trails found throughout the upper Blackfoot River Valley (Godin 2003)

The Euro-American settlement of the upper Blackfoot River Valley mirrors that of Montana in general. The Lewis and Clark Expedition of 1804-1806 gave way to fur trapping and trading, then early military expeditions and railroad route explorations. A gold strike in Abe Lincoln Gulch near present day Lincoln brought permanent settlement. Nearby placer mining in Jefferson Creek Nevada Creek, and Washington Creeks attracted more people who eventually established small communities what were supported by mining, farming, ranching and logging. Early in the 20th Century, federal administration of mountain forests and surrounding lands, and increased public participation in outdoor recreation, added other dimensions to the rural life way. This natural resource and tourist oriented economy still characterizes the sparsely populated upper Blackfoot River Valley (ibid).

Existing Condition

The 36 CFR 800 regulations define an area of potential effect as:

> "…the geographic area of areas within an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking "(36 CFR 800.16(d)).

The area of potential effect for analysis is the Stonewall Vegetation Project area and treatment areas. All cultural resources located within the area of potential effect are included in the analysis. The area of potential effect for this project lies within the Lincoln Ranger District boundary of the Helena National Forest specifically in T14N, R9W, sections 5, 6, 7, 8, 17, 18, 20, and 29; T14N, R10W, section1; T15N, R8W, sections 19, 29, 30, 31 and 32; T15N, R9W, sections 16, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 31, 32, 33, 34, 35, and 36; T15N, R10W, section 36.

The Stonewall Project area is used for many recreation activities. These activities include hunting, snowmobiling, and fishing, off highway vehicle (OHV) travel, hiking, firewood, cross-country skiing, and camping. The area is busiest during the fall hunting season.

The Helena National Forest provided the most up to date GIS layers with previous cultural resource inventories and site locations. The Helena National Forest provided the previous site forms and cultural resource inventories performed within the Stonewall project area. Twenty percent of the Stonewall project area has been previously surveyed for cultural resources. There have been 23 previous surveys totaling 4,732 acres within the Stonewall project boundary. The surveys were performed for timber sales, land exchanges, mining claims, and roads projects.

The previous cultural resource inventories conducted in the Stonewall project area yielded eight known cultural resources within the areas of potential effects. These include six historic and two prehistoric cultural resource sites. According to previous cultural resource reports and site forms, two sites are

considered Eligible for the NRHP, one site is unevaluated, and five sites are considered ineligible for listing on the NRHP. See table 160 for a list of archaeological sites within the project area.

Table 160. Cultural resources within the Stonewall Vegetation project boundary

STATE NUMBER	SITE TYPE	NRHP STATUS
24LC244H/24PW62	Historic	Eligible
24LC421H	Historic	Ineligible
24LC425P	Prehistoric	*Unevaluated
24LC467H	Historic	Eligible
24LC828H	Historic	*Unevaluated
24LC840P	Prehistoric	Ineligible
24LC1114H	Historic	Unevaluated
24LC1274H	Historic	*Unevaluated
24LC1191/24PW622	Historic	*Unevaluated

*These sites have not received an official determination yet.

Alternative 1 – No Action

Under the no-action alternative, none of the proposed action activities would occur in the Stonewall Vegetation Project area.

Direct Effects and Indirect Effects

Under alternative 1, no new direct or indirect effects would occur, because no project activities are proposed. Cultural resources would continue to be vulnerable to the effects of fuel loading within the project area, increasing the risk of wildfire. Cultural resources would continue to naturally deteriorate over time. Cultural resources would continue to be threatened by natural processes (wildfire, erosion) and simply from recreational activities that bring people in contact with cultural sites.

Fire has a negative effect on cultural resources due to high temperatures, an inability to control the effects, and because resource inventories cannot be conducted in advance. Fire suppression activities such as bulldozer-created control lines, hand lines, and fire retardant drops all have the potential to destroy or damage cultural resources. In addition, wildfires cause erosion through vegetation loss resulting in resource deterioration. Vegetation loss may also inadvertently lead to increases in vandalism and looting of cultural sites. The high temperatures of wildfires cause rapid surface weathering of features and artifacts, accelerating loss.

Cumulative Effects

Cumulative effects to cultural resources are potential impacts on cultural sites from past, present, and future activities. Previous activities would have been mitigated via cultural resources inventory and documentation, and subsequent mitigation of adverse effects. Future activities would require cultural resource inventory prior to implementation and proper mitigation measures to be implemented to avoid or minimize adverse effects to sites eligible for the National Register.

Conclusions

The no-action alternative would have an undesired effect on cultural resources. Most significant of these is the increased risk of damage to cultural resources from catastrophic wildfires resulting in artifact damage, wooden structure and feature loss, and loss of site integrity through erosion.

Alternative 2 – Proposed Action

The Helena National Forest proposes to reduce an over-abundance of fuels in the project area near communities and improve the mix of vegetation composition and structure across the landscape that is diverse, resilient, and sustainable to wildfire and insects. Proposed treatments for alternative 2 includes include regeneration harvest, intermediate harvest, precommercial thinning, and prescribed fire on approximately 8,562 acres. All of these actions have the potential to adversely affect cultural resources if mitigation measures are not implemented. Positive effects of the proposed action to heritage resources include an opportunity for the Forest to monitor eligible cultural sites, a reduction in fuel load, and the management of control lines to reduce the risk of wildfire. These actions all help in protecting the cultural resources of the Helena National Forest.

Project Design Features

The Stonewall Vegetation Project has been designed with features that are intended to minimize or avoid potential adverse effects while meeting project objectives. In addition to the proposed action treatments described in this section, design features would be implemented where applicable. A description of the project design features relating to cultural resources and other resources is displayed in table 9, chapter 2.

The specific design features listed in table 9 pertaining to archaeological cultural resources are ARCH-1 and ARCH-2.

This analysis is based on the implementation of all design features. Project design features apply to all action alternatives. If project design features are followed, then it is recommended that the project be allowed to proceed as a *no adverse effect* activity.

Direct Effects and Indirect Effects

Under alternative 2 new direct effects would likely occur without mitigation measures. Direct effects to cultural resources are those that physically alter, damage, or destroy all or part of a resource; alter characteristics of the surrounding environment that contribute to the resource's significance; introduce visual or audible elements out of character with the property or that alters its setting; or resource neglect to the extent that it deteriorates or is destroyed (USDA Forest Service 2005: III-411). The proposed action has the potential to directly affect the cultural resources within the proposed project area. Several potential impacts to cultural resources were identified including: thinning projects, the construction of temporary roads, and burn treatments. Direct effects of tree thinning and road construction activities are mostly through ground disturbance caused by ground machinery disturbance, road grading, felling trees, and skidding logs or trees. Felled trees can also damage or destroy features and historic structures. Burn treatments have the potential to adversely affect cultural resources by burning historic structures and damaging or destroying artifacts and features within archaeological sites.

Indirect effects under the current proposal are related primarily to reducing the risk of wildfires in the project area. Adverse effects to cultural resources tend to be greater in wildfire situations because of high temperatures, an inability to control the effects, and because resource inventories cannot be conducted in advance (USDA Forest Service 2005: III-413). In addition, wildfires cause erosion through vegetation-cover loss, resulting in resource deterioration. Vegetation-cover loss may also inadvertently lead to increases in vandalism and looting of cultural sites. The high temperatures of wildfires cause rapid surface weathering of features and artifacts, accelerating loss.

Alternative 3

The Helena National Forest proposes to reduce an over-abundance of fuels in the project area near communities and improve the mix of vegetation composition and structure across the landscape that is

diverse, resilient, and sustainable to wildfire and insects. Proposed treatments for alternative 3 include regeneration harvest, intermediate harvest, precommercial thinning, and prescribed fire on approximately 6,562 acres. All of these actions have the potential to adversely affect cultural resources if mitigation measures are not implemented. Positive effects of the proposed action to heritage resources include an opportunity for the Forest to monitor eligible cultural sites, a reduction in fuel load, and the management of control lines to reduce the risk of wildfire. These actions all help in protecting the cultural resources of the Helena National Forest.

Design Features and Mitigation Measures

Same as alternative 2.

Direct Effects and Indirect Effects

Effects would be similar to alternative 2, with 2,000 fewer acres of potential impacts from proposed treatments.

Alternatives 2 and 3

Cumulative Effects

Cumulative effects to cultural resources are potential impacts on cultural sites from past, present, and foreseeable actions. Previous activities would have been mitigated via cultural resources inventory and documentation, and subsequent mitigation of adverse effects. Future activities may require cultural resource inventory prior to implementation and appropriate mitigation measures to be implemented to avoid or minimize adverse effects to resources.

Compliance with Forest Plan and Other Relevant Laws, Regulations, Policies and Plans

All alternatives comply with the Forest Plan standards and guidelines for cultural resources. Forest Service Policy (FSM 2361.3) requires that projects with the potential to affect cultural resources, including lands that will leave Federal agency control through sale or exchange, be surveyed for cultural resources in order to comply with 36 CFR §800 – Protection of Historic Properties, Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended; the Archaeological Resources Protection Act (ARPA) of 1979, the National Environmental Policy Act (NEPA), the Native American Graves Protection and Repatriation Act, and the American Indian Religious Freedom Act of 1978.

Other Relevant Mandatory Disclosures

As undertakings develop, the Forest is required to comply with the Section 106 process or follow protocol as established with the State Historic Preservation Office.

Conclusions

In summary, the proposed action alternatives 2 and 3 could have both negative and positive impacts on cultural resources within the project area. There would be no adverse or negative effects if the proposed project design features and mitigation measures are followed. The negative effects are the possibility of cultural resources damage from ground disturbance from the use of heavy machinery, log and tree removal, road construction, and the heat damage to resources from prescribed fires. The loss of vegetation can indirectly lead to vandalism to cultural resources because of the increased visibility. Project design features would mitigate adverse effects to cultural resources within the project area. Positive effects include the reduction of fuels that could result in fire damaged cultural resources and increased erosion of archaeological sites.

Alternatives 2 or 3 would meet the Helena National Forest management goals for cultural resources by reducing the risk of fire. Damages to cultural resources from wildfires, suppression efforts and erosion, are irreversible losses of cultural resources.

If any additional cultural resources are discovered during implementation of this project, work should cease in the area and a Forest Archaeologist would be contacted. Work in the area could only resume if mitigation measures can be determined and/or re-evaluated if necessary.

Economics

Introduction

The management of the natural resources on the Helena National Forest (HNF) has the potential to affect local economies. People and economies are an important part of the ecosystem. Use of resources and recreational visits to the National Forests generate employment and income in the surrounding communities and counties, and generate revenues returned to the Federal Treasury or used to fund additional on-the-ground activities to accomplish resource management objectives.

This section delineates the affected area, assesses potential environmental justice impacts, and outlines methods and results of analyzing the economic effects of the Stonewall Vegetation Management Project, including the project feasibility, financial efficiency, and economic impacts. Project feasibility and financial efficiency relate to the costs and revenues of doing the action. Economic impacts relate to how the action affects the local economy in the surrounding area.

Methodology

The economic measures used for this analysis are project feasibility, financial efficiency, economic impacts, and environmental justice. These measures, including methodologies, are described below.

Project Feasibility

Project feasibility is used to determine if a project is feasible, that is, will it sell, given current market conditions. The determination of feasibility relies on a residual value (stumpage = revenues - costs) feasibility analysis that uses local delivered log prices and stump to mill costs to determine if a project is feasible. The appraised stumpage rate from this analysis is compared to the base rate (revenues considered essential to cover regeneration plus minimum return to the Federal treasury). The project is considered to be feasible if the appraised stumpage rate exceeds the base rates. If the feasibility analysis indicates that the project is not feasible, the project may need to be modified. A project that is not feasible indicates an increased risk that the project may not attract bids and may not be implemented.

Financial Efficiency

Financial efficiency provides information relevant to the future financial position of the program if the project is implemented. Financial efficiency considers anticipated costs and revenues that are part of Forest Service monetary transactions. Present net value (PNV) is used as an indicator of financial efficiency and presents one tool to be used in conjunction with many other factors in the decision-making process. PNV combines benefits and costs that occur at different times and discounts them into an amount that is equivalent to all economic activity in a single year. A positive PNV indicates that the alternative, including all activities is financially efficient. Financial efficiency analysis is not intended to be a comprehensive analysis that incorporates monetary expressions of all known market and nonmarket benefits and costs. Many of the values associated with natural resource management are best handled apart from, but in conjunction with, a more limited financial efficiency framework. These nonmarket

benefits and costs associated with the project are discussed throughout the various resource sections of this document.

Costs for restoration activities are based on recent experienced costs and professional estimates. Activity costs not related to the timber sale are included in the PNV analysis, but they are not included in appraised timber value. Two PNV's are calculated, one that includes all costs associated with each alternative and one which includes only those costs that are necessary to facilitate the removal of timber.

Economic Impacts (Jobs and Labor Income)

Economic impacts are used to evaluate potential direct, indirect, and cumulative effects on the economy. Economic impacts are estimated using input-output analysis. Input-output analysis is a means of examining relationships within an economy, both between businesses and between businesses and final consumers. It captures all monetary market transactions for consumption in a given time period. The resulting mathematical representation allows one to examine the effect of a change in one or several economic activities on an entire economy, all else constant. This examination is called impact analysis. The IMPLAN modeling system (MIG 2003) allows the user to build regional economic models of one or more counties for a particular year. The model for this analysis used the 2009 IMPLAN data. IMPLAN translates changes in final demand for goods and services into resulting changes in economic effects, such as labor income and employment of the affected area's economy.

The economic impact effects are measured by estimating the direct jobs and labor income generated by (1) the processing of the timber volume from the project, and (2) Forest Service expenditures for contracted restoration activities included as part of the proposed treatments. The direct employment and labor income benefits employees and their families and, therefore, directly affects the local economy. Additional indirect and induced multiplier effects (ripple effects) are generated by the direct activities. Indirect effects are felt by the producers of materials used by the directly affected industries. Induced effects occur when employees of the directly and indirectly affected industries spend the wages they receive. Together the direct and multiplier effects comprise the total economic impacts to the local economy.

Data used to estimate the direct effects from the timber harvest and processing were provided by the University of Montana's Bureau of Business and Economic Research (BBER) (Morgan et al. 2007). This national data is broken into multi-state regions and is considered more accurate than that which is available from IMPLAN. The Northern Rockies BBER Region (Montana and Idaho) is used for this analysis. The BBER data represents the results of mill censuses that correlate production, employment, and labor income. The economic impact area for this analysis consists of Lewis & Clark, Broadwater and Powell Counties, Montana.

Potential limitations of these estimates are the time-lag in IMPLAN data and the data intensive nature of the input-output model. Significant changes in economic sectors since the latest data for IMPLAN have been adjusted using information from the University of Montana's BBER.

Environmental Justice

As stated in Executive Order 12898, it is required that all federal actions consider the potential of disproportionate effects on minority and low-income populations in the local region. The principals of environmental justice require agencies to address the equity and fairness implications associated with federal land management actions. The Council on Environmental Quality (CEQ) (1997) provides the following definitions in order to provide guidance with the compliance of environmental justice requirements:

> "Minority population: Minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis..."
>
> "Low-income population: Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports, Series P-60 on Income and Poverty. In identifying low-income populations, agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (such as migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect."

Spatial and Temporal Context for Effects Analysis

The analysis area for the efficiency analysis is the project area (figure 102). The temporal scope of the analysis is the duration of the proposed activities. The project is expected to be accomplished over a 10-year period with the harvest activity occurring primarily in the first 4 years.

Timber management activities within the project area have the potential to impact the economic conditions of local communities and counties. To estimate the potential effect on jobs and income, a zone of influence (or economic impact area) was delineated. The impact area was chosen based on commuting data suggesting a functioning economy and where the timber is likely to be processed (log flows) (Meti Corp 2010). This analysis suggested that Lewis & Clark, Powell and Broadwater Counties were the appropriate counties to include in the economic impact analysis area (figure 102).

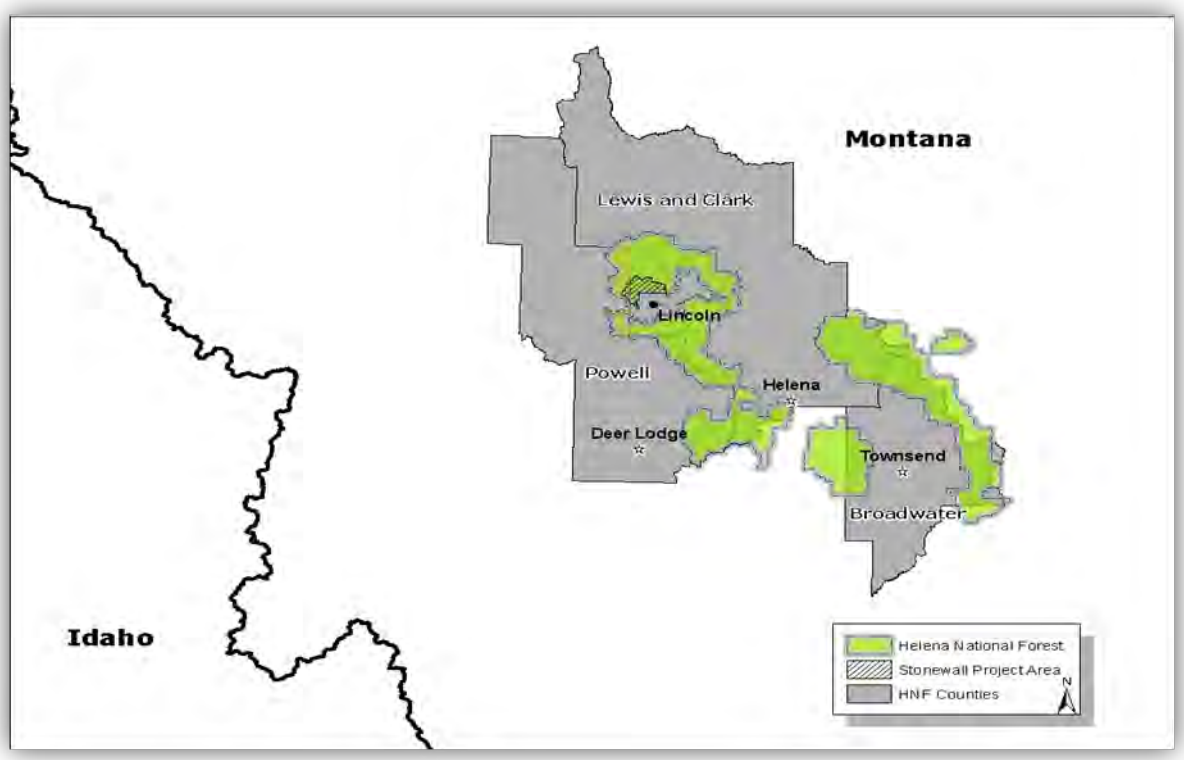

Figure 102. Economic impact area

Affected Environment

The Stonewall Vegetation Project is located on the Lincoln Ranger District of the Helena National Forest and includes portions of both Lewis & Clark and Powell Counties, Montana. Broadwater County and Powell County are likely destinations for the majority of the sawlog material as a result of the project. Since these are the three counties that would be most affected by the project in terms of social and economic effects, the Affected Environment section focuses on these three counties.

Population and Demographic Change

According to the U.S. Census Bureau, the population of Lewis & Clark County grew by 30.2 percent between 1990 and 2009. Powell County grew 6.8 percent while the population of Broadwater County grew by 44.0 percent over the same period (table 161). Population growth in both Lewis & Clark and Broadwater County outpaced the growth observed in the State and Nation. The average state density is 6.8 persons per square mile (US Census Bureau 2010). The analysis area contains one of Western Montana's least densely populated counties, Powell County, with 3.0 persons per square mile. Lewis and Clark County has a density of 18.3 persons per square mile, while Broadwater County has a density of 4.7 persons per square mile.

Table 161. Estimated Population Change 1990 to 2009

COMMUNITY	1990	2000	2009	PERCENT CHANGE
Lewis & Clark County Population	47,586	55,878	61,942	30.2 Increase
Powell County Population	6,640	7,7178	7,089	6.8 Increase
Broadwater County Population	3,328	4,366	4,793	44.0 Increase
State of Montana Population	800,204	903,293	974,989	21.8 Increase

Source: U.S. Census Bureau, 2009 Population Estimates, 2000 Census, 1990 Census

The racial composition of the population in the State of Montana and the analysis area in 2000 is shown in table 162. The overwhelming majority of the population across the state and within Lewis & Clark, Powell and Broadwater Counties is white. The total population of all races other than white was less than 10 percent at both the county and state level.

Table 162. Racial Composition of 2000 Population

	MONTANA	BROADWATER COUNTY, MT	LEWIS AND CLARK COUNTY, MT	POWELL COUNTY, MT	U.S.
Total Population	902,195	4,385	55,716	7,180	281,421,906
Hispanic or Latino (of any race)	18,081	58	843	140	35,305,818
Not Hispanic or Latino	884,114	4,327	54,873	7,040	246,116,088
White alone	807,823	4,214	52,571	6,568	194,552,774
Black or African American alone	2,534	12	104	35	33,947,837
American Indian alone	54,426	50	1,078	244	2,068,883
Asian alone	4,569	5	282	31	10,123,169
Native Hawaiian & Oth.Pacific Is.	425	3	26	0	353,509
Some other race	569	1	16	10	467,770

	MONTANA	BROADWATER COUNTY, MT	LEWIS AND CLARK COUNTY, MT	POWELL COUNTY, MT	U.S.
Two or more races	13,768	42	796	152	4,602,146
Percent of Total					
Hispanic or Latino (of any race)	2.0%	1.3%	1.5%	1.9%	12.5%
Not Hispanic or Latino	98.0%	98.7%	98.5%	98.1%	87.5%
White alone	89.5%	96.1%	94.4%	91.5%	69.1%
Black or African American alone	0.3%	0.3%	0.2%	0.5%	12.1%
American Indian alone	6.0%	1.1%	1.9%	3.4%	0.7%
Asian alone	0.5%	0.1%	0.5%	0.4%	3.6%
Native Hawaiian & Oth.Pacific Is.	0.0%	0.1%	0.0%	0.0%	0.1%
Some other race	0.1%	0.0%	0.0%	0.1%	0.2%
Two or more races	1.5%	1.0%	1.4%	2.1%	1.6%

Employment and Economic Well-Being

From 1970 to 2009, total employment for full- and part-time jobs increased by 121 percent in Broadwater County (from 1,067 to 2,354), Lewis & Clark County employment grew by 162 percent (from 17,317 to 45,758) and Powell County grew by 42 percent (from 2,576 to 3,666)(USDC 2011). The State of Montana saw an increase in total employment of 108 percent, over this same period. State employment growth was largely due to increases in service and professional sector employment (including retail trade, health and social services, transportation, utilities, finance, education, etc.). These sectors represent approximately 61 percent of employment in both counties. By contrast in the three-county impact area, the mining and fossil fuels sector decreased by 17.1 percent between 1990 and 2000.

From 1990 to 2009, average annual unemployment rates in the three counties followed similar patterns as the state and national level, falling to a low of 2.4 percent in September 2007 and rising in response to the economic downturn to a high of 6.7 percent in January 2010. The highest unemployment observed in the three counties was in Powell County, with a rate of 11.0 percent in January 2011(US Department of Labor 2011). Lewis and Clark County also peaked in January 2011 with an unemployment rate of 6.2 percent while at the same time Broadwater County checked in at 9.6 percent Lewis & Clark County has the highest rate of government labor force of the three-county region, which explains the lower unemployment rate during this period, since government employment tends to be more secure.

Per capita income is considered one of the most important measures of economic well-being. However, this measure can be misleading. Per capita income is total personal income divided by population. Because total personal income includes non-labor income sources (dividends, interest, rent and transfer payments), it is possible for per capita income to be relatively high due to the presence of retirees and people with investment income. And because per capita income is calculated using total population and not the labor force as in average earnings per job, it is possible for per capita income to be relatively low when there are a disproportionate number of children and/or elderly people in the population. From 1970 to 2009 all three counties saw increases in per capita income. Broadwater County saw the greatest increase in per capita income of the three county region with a 70 percent increase (adjusted for inflation to 2010$) from $17,752 to $30,203. Lewis & Clark County saw a 65 percent increase (adjusted for inflation to 2010$) from $23,939 to $39,407 while Powell County saw a 49 percent increase from $16,748 to $25,033.

Unlike per capita income, which is affected by nonlabor income, average earnings per job are indicators of the quality of local employment. Higher average earnings per job indicate that there are relatively more high-wage occupations. From 1970 to 2009, Lewis & Clark County saw an 11 percent increase in average earnings (adjusted for inflation to 2010$) from $38,824 to $43,140. Powell County saw a 1 percent decrease (adjusted for inflation to 2010$) from $31,501 to $31,277 while Broadwater County also experienced a 1 percent decrease (adjusted for inflation to 2010$) from $29,243 to $28,854. There are a number of reasons why average earnings per job may decline. These include: (1) more part-time or seasonal workers entering the workforce; (2) a rise in low-wage industries, such as tourism-related sectors; (3) a decline of high-wage industries, such as manufacturing; (4) more lower-paid workers entering the workforce; (5) the presence of a university with increasing enrollment of relatively low-wage students; (6) an influx of workers with low education levels that are paid less; (7) the in-migration of semi-retired workers who work part-time or seasonally; and (8) an influx of people who move to an area for quality of life rather than profit-maximizing reasons.

National and regional trends in industry sectors influence the ability of communities to adapt to changing circumstances. Employment in extractive industries such as timber and mining, as well as in ranching and agriculture, are declining in western Montana. Projections indicate continued declines in employment in these areas. The differences between today's national forest timber sale program and the program that was in place a decade or so ago has changed. However, the role that timber production from NFS lands plays in national and regional economies through logging and related activities has existed for a considerable time, and is integral to local communities and individuals directly employed by them. In Montana the sale of timber from National Forest lands has declined substantially in the last 30 years from a high of 481 million board feet in 1983 to a low of 66 million board feet in 2003, mainly due to increased litigation and changing market structures. Since the low in 2003, trends have been positive. In 2010, 185 million board feet of timber was sold from National Forest lands in Montana. On the HNF during the same period, the sale of timber has been more erratic with a high of 23 million board feet of timber sold (due to a Mountain Pine Beetle outbreak) in 2010 and a low of 1 million board feet in 1999. The most consistent period was during the 1980s decade when all years saw between 10 and 17 million board feet sold annually. See the Vegetation section for a detail of volume sold in Region One, Montana, Idaho, and the Helena National Forest for the last 30 years. Figure 103 that follows shows a chart graph displaying the same information.

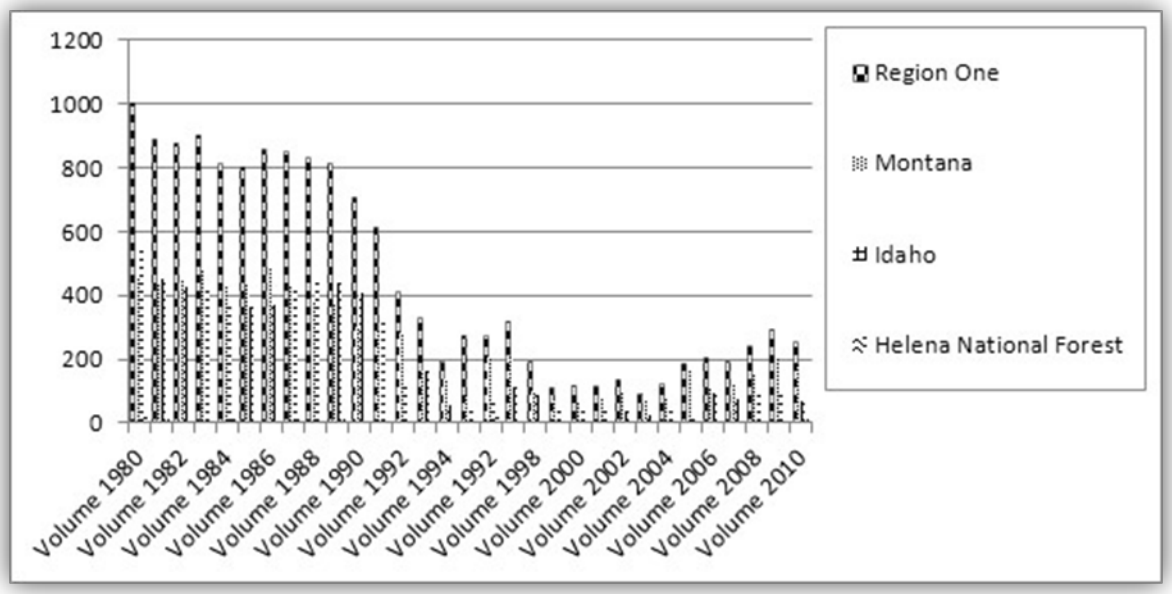

Figure 103. Volume display for R1, Montana, Idaho and HNF from 1980-2010

The Helena National Forest is a major employer and landholder in Montana's capital city and the surrounding communities. Consequently, Forest Service budget reductions and policies impact employment opportunities throughout the region. There have been changes in the forest timber sale program over the past 30 years as objectives have changed and timber harvest levels have declined. The most likely destination of timber from the Stonewall Vegetation Project is Sun Mountain Lumber in Powell County or RY Timber in Broadwater County. The percentage of manufacturing jobs (including forest products) in Powell County in 2000 was 10.7 percent and 17.3 percent in Broadwater County compared with only 3.2 percent in Lewis & Clark County, which does not have a major timber processing facility. There are several small wood processing facilities in the Lincoln Valley that may be a destination for some of the timber products associated with this project.

Alternative 1 – No Action

The no-action alternative would not harvest timber, implement BMPs on haul routes, return fire to the landscape or implement any of the proposed activities, and therefore, incurs no financial costs. Alternative 1 would produce no revenue and have no effects on jobs or income. It would also fail to meet the Helena National Forest Plan for management area T, which emphasizes timber production while protecting other resources.

Alternatives 2 and 3

Project Feasibility

The estimation of project feasibility was based on the Region 1 Sale Feasibility Model, which is a residual value timber appraisal approach. This method takes into account logging system, timber species and quality, volume removed per acre, lumber market trends, costs for slash treatment, and the cost of specified roads, temporary roads and road maintenance and results in an accurate timber appraisal and is referred to as stumpage. The appraised stumpage rate from the feasibility analysis is compared to base rates (revenues considered essential to cover regeneration plus minimum return to the federal treasury),

which in this case is the minimum rate of $3.00/CCF (hundreds of cubic feet). The appraised stumpage rate and base rates for each alternative are displayed in table 163. For each of the action alternatives, the appraised stumpage rate is greater than the base rate, indicating that each of the alternatives is feasible (highly likely to sell).

Conclusions

Alternative 2 has the highest appraised stumpage rate ($6.31/CCF) and, therefore, would likely generate the most revenue. Alternative 3 has a lower appraised stumpage rate ($3.36/CCF), which is nearing the base rate ($3.00/CCF), however it is still likely to sell given current market conditions.

Estimates of timber value are based on current fair market values of timber. Timber markets have fluctuated in the past 5 years, dropping significantly during the 2008 recession, and then rebounding slightly in subsequent years. Current markets have not returned to their pre-2008 levels; however Forest Service timber sales have continued to sell during these challenging markets. A major factor that influences the value of the timber particularly in the Stonewall Project area is the quality of the dead and dying lodgepole pine (LP). A significant percentage of the volume in this project comes from dead and dying LP, the mortality a result of the mountain pine beetle outbreak that began in 2008 and continues today. Following mortality LP retains its value as a sawlog product for a time. As the tree begins to deteriorate that value as a sawlog diminishes, however the tree may still be viable for other less valuable products. Any delay in implementation could negatively affect the feasibility of this timber and jeopardize the purpose and need of this Decision by rendering the project economically infeasible.

Table 163. Project Feasibility and Financial Efficiency Summary (2011 dollars)

CATEGORY	MEASURE	ALTERNATIVE 1 (NO ACTION)	ALTERNATIVE 2	ALTERNATIVE 3
Timber Harvest Information	Acres Harvested	0	1,969	1,074
	Volume Harvested (CCF)	0	22,022	14,299
	Base Rates ($/CCF)	$0	$3.00	$3.00
	Appraised Stumpage Rate ($/CCF)	$0	$6.31	$3.36
	Predicted High Bid ($/CCF)	$0	$11.96	$9.01
	Total Revenue (Thousands of $)	$0	$241	$119
Timber Harvest & Required Design Criteria	PNV (Thousands of $)	$0	$178	$68
Timber Harvest & All Other Planned Non-timber Activities	PNV (Thousands of $)	$0	-$1,231	-$1,096

Financial Efficiency

The financial efficiency analysis is specific to the timber harvest and restoration activities associated with the alternatives (as directed in Forest Service Manual 2400-Timber Management and guidance found in the Forest Service Handbook 2409.18). Costs for sale preparation, sale administration, regeneration, and

restoration activities are included. All costs, timing, and amounts were developed by the specialists on the project's interdisciplinary team. If exact costs were not known, the maximum of the cost range was used to produce the most conservative PNV result. The expected revenue for each alternative is the corresponding predicted high bid from the sale feasibility analysis. The predicted high bid is used for the expected revenue (rather than the appraised stumpage rate) since the predicted high bid is the best estimate of the high bid resulting from the timber sale auction. The PNV was calculated using a 4 percent real discount rate over the 10-year project lifespan (2013-2022). For more information on the values or costs, see the project file.

This analysis is not intended to be a comprehensive benefit-cost or PNV analysis that incorporates a monetary expression of all known market and nonmarket benefits and costs that are generally used when economic efficiency is the sole or primary criterion upon which a decision is made. Many of the values associated with natural resource management are best handled apart from, but in conjunction with, a more limited benefit-cost framework. An example of this is the difficulty in capturing the benefits in monetary terms of prescribed fire on wildlife habitat. These benefits are discussed qualitatively throughout the EIS document, within each resource section.

Table 163 summarizes the project feasibility and financial efficiency, including the base rates, appraised stumpage rate, predicted high bid, total revenue, and PNV for each alternative. Because all costs of the project are not related to the timber sale, two PNVs were calculated. One PNV indicates the financial efficiency of the timber sale, including all costs and revenues associated with the timber harvest and required design criteria. The required design criteria, as used here, include cost allowances for purchaser required work such as road maintenance and purchaser deposits to fund Forest Service work such as brush disposal. For a more detailed view of timber sale related costs, see the Economics project file.

The second PNV includes all costs for each action alternative, including activities that could be funded by the Forest Service, KV or potential Stewardship revenues. The costs used in the PNV calculations can be found in table 164 which displays those activity expenditures associated with each alternative, but not included in the appraisal. Sale preparation costs of $13.50/CCF, sale administration costs of $4.50 per CCF, and regeneration exam costs of $15.00 per acre are excluded from table 6. The cost of sale preparation, sale administration and regeneration exams for alternative 2 is $439,956. The cost of sale preparation, sale administration and regeneration exams for alternative 3 is $298,692.

Stewardship Opportunities

An integrated resource timber contract (IRTC) or stewardship contract as it is more commonly referred to enables the Forest Service to trade goods for services. The Forest Service exchanges timber for an equal value of environmentally beneficial work. Common types of projects included in Stewardship Contracts include weed spraying, road decommissioning, culvert replacement, precommercial thinning, slashing, etc. The starting point for the available revenue is the estimated stumpage value from the sale feasibility analysis minus an allowance for essential regeneration costs. This value is then adjusted downward by 25 percent to account for potential underrun. This stumpage value estimate is applied since it is a conservative value of the timber sale. The 25 percent adjustment provides a cushion to the available revenue estimate to account for potential factors such as the cruise volume being overestimated or degradation of dead material.

No determination has been made as to whether to use a stewardship contract to implement the Stonewall Vegetation Project. Some factors that would determine the use of a stewardship contract include the value of the timber at the time of contract, the availability of needed projects in the area and the level of degradation of the dead lodgepole pine that makes up a large percentage of the sawlog volume in the project. The estimated available revenue after the aforementioned adjustment ranges from approximately

$104,069 in alternative 2 to $36,011 in alternative 3. Both alternatives have a high likelihood of selling and producing positive revenue available for stewardship activities. Alternative 2 proposes more acres of harvest, more volume harvested, has higher potential revenue and therefore would generate greater available revenue for stewardship activities.

Conclusions

Table 163 that displays project feasibility and financial efficiency indicates that both action alternatives are financially inefficient (negative PNV) when including all activities associated with the analysis. Table 163 also indicates that both action alternatives are feasible when considering only timber harvest and the required design criteria. Alternative 2 has the highest PNV for the timber harvest and required design criteria at positive $178 thousand, and negative $1.2 million when considering all analysis activities. For alternative 3, the PNV for the timber harvest and required design criteria is positive $68 thousand, and negative $1.1 million for all decision activities. The no-action alternative has no costs or revenues associated with it.

A reduction of financial PNV in any alternative as compared to the most efficient solution is a component of the economic trade-off, or opportunity cost, of achieving that alternative. The no-action alternative would not harvest timber or take other restorative actions and, therefore, incur no costs. As indicated earlier, many of the values associated with natural resource management are nonmarket benefits. These benefits should be considered in conjunction with the financial efficiency information presented here. These nonmarket values are discussed in the various resource sections found in this document.

When evaluating trade-offs, the use of efficiency measures is one tool used by the decision maker in making the decision. Many things cannot be quantified, such as effects on wildlife and the restoration of watersheds and vegetation. The decision maker takes many factors into account in making the decision.

Table 164. Activity Expenditures by Alternative (not included in appraisal)

ACTIVITY	ALTERNATIVE 1	ALTERNATIVE 2	ALTERNATIVE 3
Sale preparation	$0	$297,297	$193,036
Sale administration	$0	$99,099	$64,345
Weed Spraying- connected to harvest	$0	$18,000	$18,000
Weed Spraying- not connected to harvest	$0	$31,600	$31,600
Weed Monitoring	$0	$3,333	$3,333
Planting	$0	$493,884	$473,688
Silvicultural exams	$0	$58,575	$43,650
Precommercial Thinning	$0	$405,256	$294,276
Noncommercial thinning/slashing	$0	$5,750	$5,750
Hand piling and burning of nonactivity fuels- Jackpot	$0	$14,600	$11,900
Post-Harvest Burn	$0	$303,875	$259,000
Prescribed burning	$0	$409,725	$296,550

Economic Impact Effects

The analysis calculated the jobs and labor income associated with the processing of the timber products harvested, and all other activities in the Decision, such as prescribed fire, noncommercial fuel reduction, post-harvest diversity planting, and precommercial thinning. Timber products harvested and the nontimber activities would have direct, indirect, and induced effects on local jobs and labor income. In

order to estimate jobs and labor income associated with timber harvest, levels were proportionately broken out by product type (

table 165). In order to estimate jobs and labor income associated with reforestation and restoration activities, expenditures for these activities were developed by the resource specialists. Only the expenditures associated with the contracted activities are included in the impact analysis.

Table 165. Proportion of Timber Harvest by Product Type

PRODUCT TYPE	ALTERNATIVE 2	ALTERNATIVE 3
Sawmills	70	70
Log Homes	5	5
Post & Poles	5	5
Pulp	20	20

Table 166 displays the direct, indirect and induced, and total estimates for employment (part and full-time) and labor income that may be attributed to each alternative. Since the expenditures occur over time, the estimated impacts of jobs and labor income would be spread out over the life of the project. It is important to note that these may not be new jobs or income, but rather jobs and income that are supported by this project. These impacts are shown both in total (over the life of the project) and on an annual basis. It is anticipated that the timber harvest would occur over a 4-year period.

Table 166. Economic Impacts (Employment and Labor Income), Total and Annual ($2011)

PROPOSED ACTIVITIES	ALTERNATIVES				
	ALTERNATIVE 2		ALTERNATIVE 3		NO ACTION
	TOTAL	ANNUAL	TOTAL	ANNUAL	
Non-timber Activities					
Part and Full Time Jobs Contributed*					
Direct	29	3	25	3	0
Indirect and Induced	8	1	7	1	0
Total	36	4	31	3	0
Labor Income Contributed ($M2011)**					
Direct	$855	$95	$737	$82	$0
Indirect and Induced	$236	$26	$204	$23	$0
Total	$1,091	$121	$941	$105	$0
Timber Harvest Activities					
Part and Full Time Jobs Contributed					
Direct	71	18	46	11	0
Indirect and Induced	63	16	41	10	0
Total	134	34	87	22	0
Labor Income Contributed ($M2011)					
Direct	$3,445	$861	$2,237	$559	$0
Indirect and Induced	$3,190	$797	$2,071	$518	$0
Total	$6,635	$1,659	$4,308	$1,077	$0

PROPOSED ACTIVITIES	ALTERNATIVES				
	ALTERNATIVE 2		ALTERNATIVE 3		NO ACTION
	TOTAL	ANNUAL	TOTAL	ANNUAL	
All Activities					
Part and Full Time Jobs Contributed					
Direct	100	21	71	14	0
Indirect and Induced	71	17	48	11	0
Total	171	38	118	25	0
Labor Income Contributed ($M2011)					
Direct	$4,301	$956	$2,974	$641	$0
Indirect and Induced	$3,425	$824	$2,275	$540	$0
Total	$7,726	$1,780	$5,249	$1,182	$0

* Employment is the total full and part-time wage, salaried, and self-employed jobs in the region.
**Labor income includes the wages, salaries and benefits of workers who are paid by employers and income paid to proprietors.

Conclusions

The no-action alternative would not change jobs or income because there are no proposed project activities associated with this alternative.

Alternative 2 proposes harvest of 22,022 hundred cubic feet (Ccf) of timber products and could result in a total of 171 jobs and labor income at $7.7 million over the life of the project. On an annual basis, this would amount to approximately 38 jobs per year over a period of 10 years. Annual effects are greatest with this alternative since it has the most timber harvest. If the harvest takes longer than anticipated, the total impacts would remain the same, but the annual contributions would be reduced. Approximately 134 direct, indirect and induced jobs and $6.6 million of labor income are associated with the proposed timber harvest activities, with the rest associated with restoration activities.

Alternative 3 proposes harvest of 14,299 Ccf of timber products could result in a total of 118 jobs and $5.2 million in total labor income over the life of the project. On an annual basis, this would amount to approximately 25 jobs per year over a period of 10 years, and $1.2 million annually in total labor income. Approximately 87 direct, indirect and induced jobs and $4.3 million of labor income would be associated with the timber harvest activities, with the rest associated with restoration activities.

Environmental Justice

According to the CEQ's Environmental Justice Guidelines for NEPA (1997), "minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis." Table 162 shows that the total share of all minority populations represented less than 10 percent of the population in the state and the analysis area in 2000. Thus, the U.S. Census data suggest minority populations within the analysis area do not meet the CEQ's Environmental Justice criterion.

Guidance from CEQ on identifying low-income populations states that "…agencies may consider as a community either a group of individuals living in geographic proximity to one another, or a set of individuals (e.g., migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposure or effect." Low-income populations are defined, based on the 2000 Census standard, as persons living below the poverty level (based on total income of $17,604 for a family

household of four). Persistent poverty status requires a county to have experienced an individual poverty rate in excess of 20 percent for several Census years. In 2000, 10.8 percent of the population in Broadwater County, 12.6 percent of the population in Powell County and 10.9 percent of the population in Lewis & Clark County were living below the poverty level. Based on these data, the characteristic of persistent poverty is not present in the analysis area.

Conclusions

Table 165 predicts more employment and labor income opportunities would be created by alternatives 2 and 3. Implementation of any of the action alternatives would not likely adversely affect minority or low-income populations. Implementation of the no-action alternative maintains the status quo and provides no additional employment or income in the economic impact area.

The Executive Order also directs agencies to consider patterns of subsistence hunting and fishing when an action proposed by an agency has the potential to affect fish or wildlife. There are no Native American Reservations or designated Native American hunting grounds located in or near the analysis area. None of the alternatives restrict or alter opportunities for subsistence hunting and fishing by Native American tribes. Tribes holding treaty rights for hunting and fishing on the Helena National Forest are included on the project mailing list and have the opportunity to provide comments on this project.

Other Disclosures

This DEIS fulfills the requirements for environmental analysis found in NEPA and in the Council on Environmental Quality implementing regulations at 40 CFR, Parts 1500-1508. NEPA at 40 CFR 1502.25(a) directs, “to the fullest extent possible, agencies shall prepare draft environmental impacts statement concurrently with and integrated with... other environmental review laws and executive orders.”

The action alternatives would be located entirely on national forest system lands. The action alternatives are not in conflict with planning objectives for County or local tribes.

Short-term Uses and Long-term Productivity

NEPA requires consideration of “the relationship between short-term uses of man’s environment and the maintenance and enhancement of long-term productivity” (40 CFR 1502.16). As declared by the Congress, this includes using all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (NEPA Section 101).

Short-term uses, and their effects, are those that occur within the first few years of project implementation. Long-term productivity refers to the capability of the land and resources to continue producing goods and services long after the project has been implemented. Under the Multiple-Use Sustained-Yield Act and the National Forest Management Act, all renewable resources are to be managed in such a way that they are available for future generations. The harvesting and use of standing timber can be considered a short-term use of a renewable resource. As a renewable resource, trees can be reestablished and grown again if the long-term productivity of the land is maintained. This long-term productivity is maintained through the application of the project design features described in chapter 2, in particular those applying to the soil and water resources.

Under alternatives 2 and 3, openings would be created in regeneration cutting units in the short term, but well-stocked vigorous stands would be established for the long term as a result of post-harvest reforestation and stand tending. Alternatives 2 and 3 would provide timber products, in decreasing yields,

to benefit consumers in the short term. With alternatives 2 and 3 harvest units there would be a short-term increase in fuel hazard in the period between harvesting and activity fuel treatment. This would be accompanied by a long-term increase in stand vigor, a reduction in fuel hazard, and a corresponding decrease in the risk of stand-replacing fire occurring within the harvest units. There would also be a 3- to 5-year increase in fuel hazard from post-harvest treatments and a corresponding increase in stand vigor as discussed in the Fire and Fuels section of this chapter.

Big game security habitat under the action alternatives would be reduced, causing short-term habitat degradation. If an action alternative is selected, a site-specific forest plan amendment would be required for Forest Plan standards 3 and 4a (FP pgs. II/17-18). The treatments would allow the development of healthy, more vigorous stands that are more sustainable for those habitat values in the long term. These effects are discussed in the Commonly Hunted Species section of this chapter.

Unavoidable Adverse Effects

Implementation of any action alternative could cause some adverse environmental effects that cannot be effectively mitigated or avoided. Unavoidable adverse effects often result from managing the land for one resource at the expense of the use or condition of other resources. Some adverse effects are short term and necessary to achieve long-term beneficial effects. Many adverse effects can be reduced, mitigated, or avoided by limiting the extent or duration of effects. The interdisciplinary procedure used to identify specific harvest units and roads was designed to eliminate or lessen the significant adverse consequences to resource protection standards of the Helena National Forest Plan. The application of project design features was intended to further limit the extent, severity, and duration of potential effects. Such measures are discussed throughout this chapter. Regardless of the use of these measures, some adverse effects would occur.

Irreversible and Irretrievable Commitments of Resources

Irreversible commitments are decisions affecting non-renewable resources such as soils, wetlands, cultural resources, or the extinction of a species. Such commitments are considered irreversible because the resource has deteriorated to the point that renewal can occur only over a long period of time or at a great expense, or because the resource has been destroyed or removed. No irreversible commitments of resources were identified.

Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as a power line right-of-way of road. These are opportunities that are forgone for the period of time that the resource can’t be used. For the action alternatives, there are irretrievable commitments of the growth of forest vegetation from the creation of new landings and new skid trails. This loss is not irreversible. Upon project completion landings, necessary for logging operations, have a low probability of maintaining long-term soil productivity. The type of vegetation growing on these sites will likely be grass and brush. The amount of landings is small and skid trails are expected to recover and are expected to show little to no adverse effects.

Required Permits

At this time it is uncertain whether this project would require a National Pollution Discharge Elimination System (NPDES) permit, due to several factors.

In Northwest Environmental Defense Center v. Brown, 640 F.3d 1063 (9th Cir. 2011) (“NEDC”), the Ninth Circuit Court of Appeals held that stormwater runoff associated with two logging roads that flows into systems of ditches, culverts, and channels before being discharged into forest streams and rivers is a point source discharge for which a National Pollutant Discharge Elimination System (NPDES) permit is

required. The Court of Appeals then remanded to the district court for further proceedings consistent with its opinion. The State of Oregon and other parties filed petitions for certiorari with the U.S. Supreme Court to review the Ninth Circuit's decision. The United States was not a party to litigation.

NEDC v. Brown involved a citizen suit; thus any available relief on remand would be limited to addressing the violation in question and is only binding on the involved parties. Because the USDA Forest Service was not a party, the Ninth Circuit's decision did not impose any affirmative duties on it. However the case has implications for federal land management agencies.

In response to NEDC v. Brown, EPA issued a formal notice on March 23, 2012 in the Federal Register (77 FR 30473) indicating its intent to expeditiously propose revisions to its Phase I stormwater regulations (40 C.F.R. §122.26) to specify that stormwater discharges from logging roads are not stormwater discharges "associated with industrial activity." The notice also states that EPA intends to further study and seek public comment on alternative approaches for addressing stormwater discharges from forest roads.

Additionally, following the Ninth Circuit's decision, Congress took legislative action suspending any potential permitting requirement imposed by the decision:

> From the date of enactment of this Act until September 30, 2012, the Administrator of the Environmental Protection Agency shall not require a permit under section 402 of the Federal Water Pollution Control Act (33 U.S.C. 1342), nor shall the Administrator directly or indirectly require any State to require a permit, for discharges of stormwater runoff from roads, the construction, use, or maintenance of which are associated with silvicultural activities.

Consolidated Appropriations Act, 2012, § 429, Pub. L. No. 112-74, 125 Stat. 786, 1046-1047 (Dec. 23, 2011).

> Thus, until September 30, 2012, no NPDES permits are required for stormwater discharges from roads associated with silvicultural activities.

Permanent legislation is also pending in both the U.S. Senate and the House of Representatives that would amend Section 402 of Clean Water Act to exempt stormwater discharges resulting from silvicultural activities from NPDES permit requirements.

Due to these factors, it is uncertain at this time whether any NPDES permitting requirements apply, or would apply in the future to stormwater discharges from logging roads. Should it be determined that an NPDES permit is required for this project, the Forest Service will comply with any applicable NPDES permitting requirements.

On March 20, 2013, the United States Supreme Court reversed the Ninth Circuit and held runoff from most logging roads is not storm water runoff related to industrial facilities and so not subject to the Clean Water Act's requirement for a NPDES permit (Decker v. NEDC). The Supreme Court gave deference to the Environmental Protection Agency's (EPA) interpretation of its own regulation, the Industrial Stormwater rule, of the Clean Water Act. In a regulation promulgated just prior to the ruling in this case, the EPA found its regulation's references to facilities, establishments, manufacturing, processing and an industrial plant mean the regulation extends only to traditional industrial buildings, such as factories and associated sites. Most logging roads are not associated with such sites unless they are directly related to raw materials storage areas and sites for the processing of raw materials, such as sawmills. The Court found deference warranted here because the EPA's interpretation of its regulation was consistent with its earlier regulations. (U.S. S. Ct.).

Roads associated with timber harvest are not considered by the EPA to produce pollutant discharges that require point-source discharge permits because they do not come from industrial sources nor do they result from manufacturing, processing, or raw materials storage areas at an industrial plant. 40 CFR §122.26(b)(14).